# **Executive Council**

## Abridged Final Report of the Seventieth Session

Geneva

20-29 June 2018



WMO-No. 1218

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# BACKGROUND INFORMATION SUPPORTING THE WORK OF THE SESSION (PART II TO THE PRESENT REPORT)

## **GENERAL SUMMARY OF THE WORK OF THE SESSION**

The WMO President, Mr D. Grimes, opened the seventieth session of the Council on 1. Wednesday, 20 June 2018 at 9.30 a.m. in the WMO headquarters building in Geneva. The President welcomed the Council and other participants. He welcomed the Second Vice-President, Professor Celeste Saulo, the first woman to be elected as a Vice-President, serving also as acting First Vice-President following the departure of Mr Rob Varley. He also acknowledged outgoing presidents of regional associations and technical commissions and the newly elected presidents. The President highlighted the wide range of weather, climate and water events shaping the actions of WMO and the key thematic areas that would be covered during the session including the areas of strategic planning, governance review, water and hydrology – with a dedicated dialogue, partnerships including with the private sector, observations and data exchange, disaster risk reduction and service delivery, climate, polar issues, capacity development and gender. The Secretary-General, Professor P. Taalas, welcomed the Council to Geneva and called members' attention to the main global challenges faced by the Organization: climate change adaptation, disaster risk reduction and water resources management, noting that the demand for WMO expertise is growing and that, for more effective delivery, a cross-cutting and holistic approach is favoured instead of a sectoral one, as well as the need for data. The Secretary-General highlighted that the governance review offers an opportunity for better addressing the needs of WMO Members, optimizing the use of resources and infrastructure, fostering a wider engagement of experts in WMO activities, adopting a holistic Earth system approach to services, observation and research, engaging the private sector in a coordinated way in WMO activities and ensuring coherence between WMO strategy and its implementation by constituent bodies, programmes and the Secretariat.

2. The agenda is provided in Appendix 1.

3. The session adopted 39 resolutions, given in Appendix 2, 66 decisions, given in Appendix 3, and 28 recommendations, given in Appendix 4.

4. The list of participants is given in Appendix 5. Out of a total of 284 participants, 78 were women, that is, 27%.

5. The Council agreed that the seventy-first session would be held at the WMO headquarters from 17 to 19 June 2019 following the Eighteenth World Meteorological Congress, which will be held from 3 to 15 June 2019. The session of the Financial Advisory Committee (FINAC) will be held the 1 and 2 June 2019.

6. The Council further tentatively scheduled the seventy-second session to be held at the WMO headquarters from 10 to 19 June 2020, preceded by FINAC on the 8 and 9 June 2020.

7. The seventieth session of the Executive Council closed at 4.54 p.m. on 29 June 2018.

## **APPENDIX 1. AGENDA**

## 1. AGENDA AND ORGANIZATIONAL MATTERS

- 1.1 Opening of the session
- 1.2 Approval of the agenda
- 1.3 Establishment of committees
- 1.4 Programme of work of the session
- 1.5 Approval of the minutes

## 2. **REPORTS**

- 2.1 Report by the President of the Organization
- 2.2 Report by the Secretary-General
- 2.3 Report of the 2018 Joint Meeting of the Presidents of Regional Associations and Technical Commissions (PRA-PTC-2018)
- 2.4 Report of the 2018 Meeting of the Presidents of Regional Associations (PRA-2018) and reports by the presidents of regional associations
- 2.5 Reports by the presidents of technical commissions

## 3. **DISASTER RISK REDUCTION, RESILIENCE AND PREVENTION**

- 3.1 WMO contribution to the implementation of the Sendai Framework for Disaster Risk Reduction
- 3.2 Global Multi-hazard Alert System (GMAS)

## 4. CLIMATE SERVICES, SUPPORT TO CLIMATE ACTION AND CLIMATE RESILIENCE

- 4.1 WMO contribution to UNFCCC and related UN processes
- 4.2 Intergovernmental Panel on Climate Change (IPCC)
- 4.3 Integrated health and urban services
- 4.4 Integrated Global Greenhouse Gas Information System (IG3IS)
- 4.5 Climate Services
- 4.6 Research and Operations Linkages in Climate Prediction

#### 5. WEATHER SERVICES, SEVICE QUALITY AND DELIVERY

- 5.1 Implementation of the WMO Strategy for Service Delivery
- 5.2 Meteorological services for aviation
- 5.3 Meteorological services for marine and coastal operations
- 5.4 Meteorological services for agriculture
- 5.5 Qualifications and competencies of personnel

## 6. HYDROLOGICAL SERVICES

### 7. OBSERVATIONS AND DATA EXCHANGE

- 7.1 WMO Integrated Global Observing System (WIGOS)
- 7.2 WMO Information System (WIS)
- 7.3 Emerging data issues
- 7.4 Implementation, evolution and design of observing systems

## 8. DATA PROCESSING, MODELLING AND FORECASTING

## 9. POLAR AND HIGH MOUNTAIN REGIONS

## 10. **RESEARCH**

- 10.1 Future WMO research
- 10.2 World Climate Research Programme (WCRP) Review

## 11. CAPACITY DEVELOPMENT

- 11.1 Education and Training
- 11.2 Voluntary Cooperation Programme

## 12. **PARTNERSHIPS**

- 12.1 Cooperation with the United Nations system
- 12.2 Public-Private Engagement
- 12.3 Decade on Ocean Science for Sustainable Development (2020–2030)
- 12.4 Agreements with international organizations
- 12.5 Development partnerships

## 13. PUBLICATIONS AND DISTRIBUTION POLICY

#### 14. **GENDER EQUALITY**

## 15. COMMUNICATION AND PUBLIC AFFAIRS

#### 16. **GOVERNANCE**

- 16.1 Oversight
- 16.2 Strategic and Operational Planning and Budget
- 16.3 Governance review
- 16.4 Preparations for Congress

#### 17. FINANCIAL, STAFF AND ADMINISTRATIVE MATTERS

- 17.1 Financial matters
- 17.2 Plan for funding liability for After-Service Health Insurance (ASHI)
- 17.3 Staff matters
- 17.4 WMO HQ building infrastructure
- 17.5 Procurement activities

## 18. GENERAL AND LEGAL MATTERS

- 18.1 International Meteorological Organization (IMO) Prize and other awards
- 18.2 Constitutional and regulatory matters
- 18.3 Designation of acting member(s) of the Executive Council

18.4 Review of subsidiary bodies and other bodies reporting to the Executive Council

## 19. SCIENTIFIC LECTURES AND DISCUSSIONS

## 20. REVIEW OF PREVIOUS RESOLUTIONS

## 21. DATE AND PLACE OF THE NEXT SESSIONS OF THE EXECUTIVE COUNCIL

22. CLOSURE OF THE SESSION

## **APPENDIX 2. RESOLUTIONS ADOPTED BY THE SESSION**

## Resolution 1 (EC-70)

## Consolidated approach to severe weather forecasting

## THE EXECUTIVE COUNCIL,

## Recalling:

- Resolution 13 (Cg-17) Report of the extraordinary session (2014) of the Commission for Basic Systems concerning the Global Data-processing and Forecasting System and emergency response activities, which included the endorsement of Recommendation 23 (CBS-Ext.(2014)) – Proposed mechanism to strengthen operational centres, built upon the lessons learned through the Severe Weather Forecasting Demonstration Project, which proposed, inter alia, to establish the Severe Weather Forecasting Programme to emphasize the need to develop sustained operational capability,
- (2) Decision 9 (EC-68) Severe Weather Forecasting Demonstration Project, which endorsed the critical elements for consolidating the Severe Weather Forecasting Demonstration Project (SWFDP) into global sustainable operational services,
- (3) That the development of SWFDP in West Africa was initiated following a technical training workshop on severe weather forecasting and public weather services held in Dakar in November 2015, and a technical planning workshop on SWFDP implementation in West Africa held in Abidjan in September 2016,

**Noting** that SWFDP, which was initiated in 2006 with the participation of just five countries in south-eastern Africa, has been expanded to cover eight subregions with involvement of over 75 developing countries, least developed countries (LDCs) and small island developing States (SIDS) in southern Africa, the South Pacific, eastern Africa, South-East Asia, the Bay of Bengal, Central Asia, West Africa and the Eastern Caribbean in Regional Associations (RAs) I, II, IV and V; and that this has resulted in escalating training requirements requiring increased resources,

**Noting also** the interest in implementing SWFDP in Oceania (RA V), South America (RA III), Central America (RA IV) and the rest of Africa (RA I),

**Noting with satisfaction** that SWFDP has been contributing to improving public safety and disaster risk reduction through the cascading forecasting process that facilitates improved forecasts and delivery of severe weather warnings by participating National Meteorological and Hydrological Services, and that its synergies with the Flash Flood Guidance System (FFGS) in southern Africa and other subregions is bringing more benefits to Members by allowing them to provide operational support for multi-hazard early warning services,

**Acknowledging** that the SWFDP regional sub-projects are mainly funded through extrabudgetary resources and that financial resource mobilization for the ongoing regional sub-projects and their synergies with other relevant projects and activities, such as FFGS, has always been challenging,

#### Considering:

- (1) The Commission for Basic Systems (CBS) Management Group decision (March 2018) to perform the overall 12-year review of SWFDP to assess benefits to participating developing countries, LDCs and SIDS in terms of the contribution of SWFDP to forecasting and early warning services, as well as to inform the future development and strategy of SWFDP, including options to oversee the project in phase IV and to report to the Eighteenth World Meteorological Congress,
- (2) That Resolution 6 (CHy-15) The Flood Forecasting Initiative and the contribution of the Commission for Hydrology to the Disaster Risk Management Programme, and Decision

17 (JCOMM-5) – Future of the Coastal Inundation Forecasting Demonstration Project, both called for independent review of the Coastal Inundation Forecasting Demonstration Project (CIFDP) to consider developing a governance structure and procedures that would transition CIFDP to a more sustainable platform for the strengthening of national multihazard early warning systems to address flooding in coastal areas (see Decisions 10–12 (EC-70) and Resolution 16 (EC-70)),

(3) The recommendation of the Flood Forecasting Initiative Advisory Group (FFI-AG) (December 2017) that the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) and the Commission for Hydrology (CHy) should conduct an independent review of CIFDP and FFGS; and that CBS should do the same for SWFDP; and that FFI-AG, through its Chairperson, will report on the reviews to Congress (see Resolution 16 (EC-70),

**Decides**, as recommended by the Executive Council Working Group on Disaster Risk Reduction:

- (1) To conduct a joint independent review of SWFDP, FFGS and CIFDP, which are disaster risk reduction supporting projects, with emphasis on how these projects have made a difference to the life of communities they serve, on their training needs and sustainability, and on the importance of a national voice for the dissemination of warning information;
- (2) That, following the review of these projects, a consolidated approach should be developed jointly by the presidents of CBS, CHy and JCOMM to ensure SWFDP, CIFDP and FFGS ensure efficient, sustainable services related to hazardous weather, water and climate;
- (3) That the result of the review and the consolidated approach should be reported to Congress by the president of CHy, Chairperson of FFI-AG;

**Requests** the Secretary General to facilitate the effective implementation of the present resolution;

**Invites** Members to contribute to the SWFDP Trust Fund to support the severe weather programme office, enabling activities and the development of new SWFDP projects to expand the programme towards global coverage.

## Resolution 2 (EC-70)

# WMO integrated approach to high-level climate-science-related policy processes

THE EXECUTIVE COUNCIL,

## Recalling:

- (1) Resolution 1 (EC-68) WMO support to the Paris Agreement,
- (2) Decision 7 (EC-69) WMO support to implementation of the Paris Agreement,

**Recognizing** that the Paris Agreement calls for "Strengthening scientific knowledge on climate, including research, systematic observation of the climate system and early warning systems, in a manner that informs climate services and supports decision-making" (Article 7, paragraph 7 (c)),

**Recognizing also** the need for ensuring global coordination of key climate-related processes such as regional and national climate forums, exchange of data and products, translating research results into operations, and developing and assembling inputs for policy-related products and services,

**Noting** that a memorandum of understanding was concluded in November 2017 between the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) and WMO encompassing the following strategic collaboration projects:

- (1) Annual reporting on concentrations of greenhouse gases in the atmosphere and the state of the global climate,
- (2) Climate services for adaptation planning and implementation,
- (3) Observation-based tools for improved national greenhouse gas emission estimates,
- (4) Regional collaboration for supporting adaptation and mitigation action,

**Noting with satisfaction** the enhanced relevance and impact of WMO involvement in the UNFCCC process, as seen most recently through the successful submissions of the WMO *Greenhouse Gas Bulletin* and the WMO Statements on the State of the Global Climate to the twenty-second and twenty-third Conferences of the Parties,

#### Noting also:

- (1) The interest expressed by the forty-seventh session of the UNFCCC Subsidiary Body for Scientific and Technological Advice in the ongoing efforts by WMO and the Global Climate Observing System (GCOS) programme to develop headline indicators of the state of the climate, as well as in the progress in implementation of GCOS and the Global Framework for Climate Services,
- (2) That the forty-eighth session of the UNFCCC Subsidiary Body for Implementation invited WMO to provide capacity-building to developing countries on the analysis of climate data and the development and application of climate-change scenarios in vulnerability and risk assessment,
- (3) That the Green Climate Fund (GCF) Secretariat, in response to a call from its Board for "Increased generation and use of climate information in decision-making" (GCF Board Decision GCF/B.07/04) and development of "Steps to enhance the climate rationale of GCFsupported activities" (GCF Board Decision GCF/B.19/06) is in advanced discussions with WMO concerning the provision of WMO expert services for the development of the climate rationale concept, methodology, and implementation approach for all GCF-funded activities (see also EC-70/INF. 12.5),
- (4) The relevance of evidence-based scientific products and information for climate investment decision making,

#### Noting further:

- The relevance of climate risk transfer schemes for managing risks of climate-related loss and damage, and the value of data generated through WMO activities for the development and implementation of such schemes,
- (2) That to realize the full potential of WMO contributions to such schemes would require further development of the technical capacities of National Meteorological and Hydrological Services (NMHSs), as well as development of business models to enhance NMHS engagement,

#### Having considered:

- (1) The emerging directions in the draft WMO Strategic and Operating Plans for the next financial period, including a focus on climate services for climate-resilient development, through the expansion and broadening of the provision of policy- and decision-making supporting climate information and services at all levels,
- (2) The relevance of WMO climate science products to UNFCCC and other high policy frameworks and processes, such as the Sustainable Development Goals, Sendai Framework for Disaster Risk Reduction, Paris Agreement "global stocktake" and Intergovernmental Panel on Climate Change (IPCC),

**Decides** to adopt an integrated approach to the provision of climate services for high-level policy processes comprising, inter alia, the following elements:

- (1) Provision of guidance on methodologies and tools to Members for the preparation of analyses of past, present and future climate as needed to assess collective progress of climate action under the Paris Agreement; and also to underpin preparation of nationally determined contributions to the Paris Agreement, adaptation communication, biennial reports under the enhanced transparency framework, national adaptation plans, and for climate-proofing of investments;
- (2) Continued integration of such analyses into WMO flagship publications such as the annual "Statement on the State of the Global Climate" and other reports on the regional state of the climate;
- Further alignment of WMO-supported climate analyses relevant to the scientific assessment of IPCC;
- (4) Sustained and systematic capacity development and technical assistance to NMHSs as needed in the above and related areas, drawing to the extent possible on extrabudgetary resources and leveraging those resources through strategic partnerships;
- (5) Engagement with partners and initiatives to explore WMO contributions to index-based climate risk transfer mechanisms;

**Requests** WMO Members, regional associations, technical commissions and programmes, including co-sponsored programmes, to collaborate and contribute to the above-mentioned activities;

**Requests** Members to provide voluntary contributions to strengthen WMO capacity for supporting climate risk transfer efforts;

Invites further dialogue between the secretariats of IPCC and UNFCCC;

**Requests** the Secretary-General:

- To continue preparations for support to high-level climate-related science-policy processes along the lines indicated above and to report back on progress to the Eighteenth World Meteorological Congress;
- (2) To further assist Members, through NMHS capacity development, to strengthen and sustain national climate system observations, and provide relevant climate information as input for submissions of their governments on national adaptation plans, nationally determined contributions and projects for climate finance;
- (3) To promote strategic partnerships, for example with relevant institutions, including the secretariat of UNFCCC and its operating entities, and international finance institutions, to enable the realization of the elements of the present resolution at global, regional and national levels;

(4) To assist Members to further engage in supporting climate risk transfer efforts, subject to the availability of dedicated funding for such support.

#### Resolution 3 (EC-70)

#### Integrated health services

THE EXECUTIVE COUNCIL,

#### **Recalling:**

- (1) Resolution 1 (Cg-Ext.(2012)) Implementation Plan of the Global Framework for Climate Services,
- (2) Resolution 47 (Cg-17) Global Atmosphere Watch Programme,
- (3) Resolution 68 (Cg-17) Establishing a WMO cross-cutting urban focus,
- (4) Decision 15 (EC-68) Implementation of the WMO cross-cutting urban focus,
- (5) Decision 62 (EC-68) Global Atmosphere Watch Implementation Plan for the period 2016–2023,

**Recognizing** that hydrometeorological and environmental phenomena affect human health outcomes in myriad ways, including through exposure to increasing temperatures, degraded air and water quality; food and nutritional insecurity; water-, food-, and vector-borne diseases; ultraviolet radiation and environmentally transported chemicals; and through high-impact events such as drought, flooding, storms, and heat and cold waves,

**Noting** the increasing importance of poor air quality and extreme heat as emerging health risks in urban areas worldwide, as well as the particular vulnerability of populations in low- and middle-income countries and small island developing States,

**Noting also** that to establish an effective mechanism and the resources necessary to deliver integrated health services there is a need to enhance the coherent approach and coordination of ongoing activities in support of Members across relevant WMO programmes and initiatives, including those activities provided through the Global Framework for Climate Services, the air quality work of the Global Atmosphere Watch Programme, the work of WMO technical commissions and regional associations, and that of other relevant programmes,

**Noting further** that the current capacity, experience and collaboration between the health and meteorological communities to develop, deliver, access and use climate and relevant environmental information remains insufficiently developed, and that some National Meteorological and Hydrological Services (NMHSs) require support from WMO to further engage with the health sector and share best practices,

**Mindful** of the need to address the following issues, as well as identify the appropriate mechanisms for their implementation:

- (1) Promotion of the alignment of relevant policies and awareness-raising of environmental, and weather-, water- and climate-related risks and solutions to protect human health,
- (2) Promotion of the generation and application of scientific evidence,

- (3) Development of appropriate technical mechanisms and partnerships to facilitate the development, delivery, access to, and use of data and tailored information products on weather, water and climate, and environmental hazards to health,
- (4) Development and dissemination of technical and normative guidance, scientific publications and tools, and other actions to support capacity development,
- (5) Monitoring of progress on the access to and use of reliable and relevant weather, climate and environmental information,

#### Decides:

- To strengthen WMO efforts for research and service delivery for global health applications through greater integration of WMO work on weather, water, climate and environment as related to health;
- (2) That WMO integrated support for improved weather-, water-, environment- and climaterelated health outcomes should be accommodated and facilitated through any new structures and processes emanating from the ongoing review of WMO governance structures;

**Requests** that, in implementing the WMO Strategy for Service Delivery, the Commission for Climatology, the Commission for Basic Systems and other relevant commissions (or their future equivalent structures) focus on strengthening capacities of NMHSs to engage with the health community to collect and share health-related data, serve the health sector through impactbased forecast health services, and provide guidance materials for use by NMHSs to improve service delivery in the area of health;

#### **Requests** the Secretary-General:

- (1) To develop, jointly with the World Health Organization (WHO), and with sufficient input from and coordination with Members and across relevant programmes of WMO, for the consideration by the Eighteenth World Meteorological Congress, a seamless and holistic five-year programme of work on climate, environment and health, including proposed mechanisms and means for implementation of integrated health services, as agreed in the Collaboration Framework on Climate, Environment and Health between WMO and WHO (May 2018);
- (2) To collaborate with WHO on the formation of a joint expert group, depending on the outcome of the governance review, that will involve experts from both organizations to enable co-design of products and services required to effectively support public health by all Members;
- (3) To support the development of capacities of NMHSs to deliver services to the health sector by providing them with guidance material on operational delivery of health-related services; and communication channels and dissemination methodologies for targeted user groups of specific health-related weather information;

#### Urges Members:

- To contribute to the development of the joint programme of work for integrated health services by sharing current capacities, expertise and experience for the provision of integrated health services;
- (2) To strengthen cooperation between the health, meteorological, hydrological and environmental communities at the national level;

**Invites** WHO and relevant stakeholders, including funding agencies, to contribute to the development and implementation of the joint programme of work, and to promote the necessary collaborations that will enable Members to fully benefit from the capacities of the WMO and health communities.

### **Resolution 4 (EC-70)**

#### Mid-term review of the Global Framework for Climate Services

#### THE EXECUTIVE COUNCIL,

#### Recalling:

- (1) Resolution 1 (Cg-Ext.(2012)) Implementation Plan of the Global Framework for Climate Services,
- (2) Resolution 2 (Cg-Ext.(2012)) Establishment of the Intergovernmental Board on Climate Services,
- (3) Resolution 2 (IBCS-1) Implementation Plan of the Global Framework for Climate Services,

### Recognizing:

- (1) That the vision of the Global Framework for Climate Services (GFCS), as formulated by the High-level Taskforce of independent advisors comprised of eminent personalities in the fields of leadership, governance, science and policy, was to establish an operational end-toend system for providing climate services and applying them in decision-making at every level of society, an undertaking that would require unprecedented collaboration across political, functional and disciplinary boundaries,
- (2) That effectiveness in realizing the vision of GFCS would require strengthened cooperation and partnerships with partner organizations and stakeholders according to their mandates,

**Noting** that, at its third session (October 2015), the Management Committee of the Intergovernmental Board on Climate Services (IBCS-MC) recommended that a review of the GFCS be conducted at the beginning of phase II of GFCS implementation (2015–2018),

#### Noting also:

- (1) That the University of Arizona was selected to conduct the review through, inter alia, wideranging consultations with all the relevant stakeholders,
- (2) That the University of Arizona had produced a mid-term review report that was considered by the fifth session of IBCS-MC (October 2017),

#### Noting further:

 That IBCS-MC had discussed the mid-term review report and responded to it by establishing two taskforces: (a) to review the governance, management and finances of GFCS; (b) to lead a strategy to enhance implementation of the priorities of GFCS; and by establishing four working groups: (a) to identify climate services standards needs; (b) to review and provide guidance to enhance the GFCS communication strategy; (c) to articulate the linkage of GFCS with major policy agendas; (d) to brainstorm and clarify the concept of the user interface platform, (2) The taskforces and working groups will prepare specific recommendations for the consideration of the sixth session of IBCS-MC in October 2018 in Rome,

**Mindful** that the Management Committee of IBCS will prepare recommendations based on the reports of the taskforces and working groups it established at its fifth session in October 2017, for the consideration of the Eighteenth World Meteorological Congress,

Endorses the mid-term review process initiated by the Management Committee of IBCS;

**Invites** IBCS-MC to take into account the ongoing WMO governance review that would be beneficial for GFCS implementation and to develop its recommendations to Congress in coordination with the Executive Council Working Group on Strategic and Operational Planning;

**Requests** the Secretary-General to facilitate exchange of information between the review of the governance, management and finances of GFCS and the WMO governance review to ensure that the two processes inform each other;

**Requests** the Chairperson of IBCS to submit specific recommendations, based on the conclusions of IBCS-MC at its sixth session and on the recommendations of the taskforces and working groups on the GFCS mid-term review findings, on further steps in the implementation of GFCS for the consideration of the Eighteenth Meteorological Congress.

## Resolution 5 (EC-70)

#### Recommendations of the Commission for Climatology at its seventeenth session

#### THE EXECUTIVE COUNCIL,

**Having considered** *Commission for Climatology: Abridged Final Report of the Seventeenth Session* (WMO-No. 1216),

**Decides** to endorse the report and to take action on the recommendations in it as follows:

(1) Recommendation 1 (CCI-17) – Review of Executive Council resolutions and decisions concerning the Commission for Climatology

Takes into account this recommendation when dealing with agenda item 20 of the present session;

(2) Recommendation 2 (CCI-17) – Strengthening the integration and coordination of WMO contributions to the provision of policy- and decision-supporting climate information and services

Approves this recommendation and takes it into account in Recommendation 3 (EC-70);

(3) **Recommendation 3 (CCI-17) – Continuation and strengthening of the work of the Commission for Climatology** 

Agrees to take into account the ongoing work and planned deliverables of the Commission for Climatology (CCI) in the ongoing WMO governance review and to ensure that their continuity is adequately incorporated into the governance review outcomes;

## (4) Recommendation 4 (CCI-17) – Climate Services Information System Technical Reference

- (a) Approves the recommendation;
- (b) Requests the Commission for Basic Systems (CBS) and other bodies relevant to Climate Services Information System (CSIS) functions and operations to support CCI efforts in the development of CSIS Technical Reference;
- (c) Requests CBS, in collaboration with CCI, to identify activities relevant to CSIS functions yet to be defined in the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485) to provide authentic and well-coordinated sources of global information to Members;
- (d) Requests the Secretary-General to support the deployment of the Climate Services Toolkit at national level, and to facilitate inputs from other climate information providers into the CSIS, including research institutions, academia, multilateral organizations and the private sector;

#### (5) **Recommendation 5 (CCI-17) – Trial phase for the international exchange of daily** climate observations

- (a) Approves the recommendation;
- (b) Urges Members to actively support the trial phase;
- (c) Requests CBS, in consultation with CCI, to assist in the operational implementation of the trial phase of the international exchange, on a monthly basis, of daily climate observations, including the provision of a handbook on reporting practices;
- (d) Requests the Secretary-General to inform Members of the details of the implementation of the proposed international exchange of daily climate observations and to explore possibilities to extend this approach to other types of observations, including marine observations, in close consultation with relevant technical commissions;

## (6) **Recommendation 6 (CCI-17) – Good practices in the use and interpretation of** climate change projections on regional and national scales

- (a) Approves the recommendation;
- Urges WMO Regional Climate Centres (RCCs) and RCC Networks to take up the highly recommended function on regional climate change projections to promote good practices;
- (c) Requests the Secretary-General to support the implementation of the guidance on good practices in all Regions;

#### (7) **Recommendation 7 (CCI-17) – Enhancing operational climate monitoring using** the WMO standard infrastructure and regulatory framework

- (a) Approves the recommendation;
- (b) Requests CBS to provide the necessary technical advice and support CCI in ensuring that WMO standard infrastructure and regulatory frameworks are used in the delivery of WMO climate data, information and products;

#### (8) **Recommendation 8 (CCI-17) – Global Seasonal Climate Update operationalization**

- (a) Approves the recommendation;
- (b) Requests CBS to support further development and operational coordination of the Global Seasonal Climate Update (GSCU) through the CBS/CCI Inter-Programme Expert Team on Operational Predictions on Sub-seasonal to Longer-time Scales;
- (c) Requests the WMO Lead Centre for Long-range Forecast Multi-model Ensembles (LC-LRFMME), jointly coordinated by the Korea Meteorological Administration and the National Oceanic and Atmospheric Administration, to integrate GSCU production and dissemination into the LC-LRFMME operational schedule;

#### (9) **Recommendation 9 (CCI-17) – Integrated capacity development process for the Climate Services Information System**

- (a) Approves the recommendation;
- (b) Requests technical commissions, especially CBS, the Commission for Hydrology, the Commission for Agricultural Meteorology and the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), and the Global Framework for Climate Services (GFCS), to actively collaborate with CCI on capacity development for CSIS implementation, including outreach;
- (c) Requests the Secretary-General to monitor climate services capacity improvements via the WMO climate services checklist, through the WMO country profile database;

#### (10) **Recommendation 10 (CCI-17) – Human resource development through** implementation of competencies for provision of climate services

- (a) Approves the recommendation;
- (b) Requests WMO Regional Training Centres (RTCs) to contribute to the development and delivery of the Basic Instructional Package for Climate Services;
- (c) Invites RCCs to coordinate their training functions with RTCs;
- (d) Requests the Secretary-General:
  - (i) To assist in twinning National Meteorological and Hydrological Services offering training programmes to support Members' requirements for developing the capacity of their technical climate staff;
  - (ii) To promote the use of blended training approaches (distance and face-to-face learning);
  - (iii) To foster international collaboration for the development of higher education programmes and technical training;
- (11) **Recommendation 11 (CCI-17) Approval of the updated version of the third** edition of the *Guide to Climatological Practices* (WMO-No. 100)

- (a) Approves the recommendation;
- (b) Requests the Secretary-General to make the updated version of the Guide available to Members and facilitate its translation into other WMO official languages;
- (c) Requests that the next updated version of the *Guide to Climatological Practices* be done in liaison with JCOMM;

#### (12) Recommendation 12 (CCI-17) – National focal points of the Climate Services Information System

- (a) Approves the recommendation;
- (b) Approves the terms of reference for national focal points of CSIS presented in the annex to the present resolution;
- (c) Urges Members to establish national focal points of CSIS and facilitate their work in meeting their terms of reference;
- (d) Requests the Secretary-General to support the provision of the necessary guidance, tools and training for the national focal points of CSIS, in close coordination with CCI and GFCS.

## Annex to Resolution 5 (EC-70)

### National focal points of the Climate Services Information System

#### **TERMS OF REFERENCE**

National focal points of the Climate Services Information System (CSIS) are closely engaged with technical aspects of climate services implementation at the national level. Their designation does not supersede other technical focal points working on other technical aspects.

Key functions include:

- (1) Facilitate the functioning of the mechanism for WMO contributions to the Global Framework for Climate Services (GFCS) and the activities including to:
  - (a) engage with partner organizations seeking to support the implementation of climate services,
  - (b) implement the activities and outputs of the country-focused results based framework for WMO contributions to the GFCS Objective 1 (Institutional, technical, financial and human resources mobilized for climate services planning, implementation and results monitoring targeting climate-sensitive national priorities),
  - (c) prepare products relevant for high-level climate-related policy processes and United Nations system joint action, such as catalogues of high-impact events for tracking associated losses and damage, preparation of National Adaptation Plans and Nationally Determined Contributions to the Paris Agreement, and National Climate Monitoring Products,
  - (d) keep under review the emerging features of the Climate Services Information System (CSIS) within the implementation of the GFCS at the national level and regularly report on the status and priority needs through updates to the checklist for climate services and WMO surveys contained in the WMO Country Profile Database,

- (e) prepare short- and long-term action plans for national level implementation of the Climate Services Information System (CSIS),
- (f) monitor capacity needs for CSIS operationalization and identify, and coordinate access to, relevant capacity development resources to address those needs, including through staff training, twinning arrangements with advanced services and expert deployments, national deployment of the Climate Services Toolkit, and engagement with Regional Climate Centres (RCCs) and Regional Climate Forums (RCFs),
- (2) Act as the primary contact point for liaising with WMO entities engaged in supporting climate services implementation at the national level – e.g. WMO and co-sponsored programmes, technical commission focal points, regional association working groups and focal points on climate and the GFCS, RCCs, and Global Producing Centres (GPCs) – and promote the alignment of the contributions of these entities towards addressing national climate services related technical priorities and needs.

#### **Resolution 6 (EC-70)**

#### WMO recognition of long-term observing stations

#### THE EXECUTIVE COUNCIL,

#### Recalling:

- (1) Decision 40 (EC-68) WMO mechanism for the recognition of long-term observing stations,
- (2) Decision 8 (EC-69) Recognition of WMO long-term observing stations,
- (3) The WMO recognition mechanism and the lists of candidate and recognized long-term observing stations (accessible by WMO regional association, information on which can be found at https://public.wmo.int/en/our-mandate/what-we-do/observations/centennial -observing-stations),

**Recognizing** that preserving long-term observing stations, including centennial stations, is a responsibility of Members' governments for sustaining irreplaceable climate heritage to serve current and future generations' needs for long-term high-quality climate records,

#### Noting with satisfaction:

- (1) That a list of 60 stations representing all WMO regional associations was approved by the Executive Council at its sixty-ninth session in 2017; that this was the introduction of the WMO recognition mechanism for long-term observing stations; and that some Members took this opportunity to celebrate the WMO recognition at local and national levels,
- (2) That Members provided additional information to reassess 26 candidate stations that had not been submitted for recognition in 2017,
- (3) That 25 Members, representing 5 regional associations, submitted 72 candidate stations in response to a second WMO call in late 2017 to nominate not more than 3 stations,
- (4) That the ad hoc advisory board for the recognition of long-term observing stations considered 98 candidate stations, among which 57 were assessed to be ready for recognition by the Executive Council at it seventieth session, while the remaining need further analysis in collaboration with Members,

**Noting also** the evaluation of the above lists of candidate stations by the ad hoc advisory board with representation from the Commission for Climatology, the Commission for Basic Systems, the Commission for Instruments and Methods of Observation and the Global Climate Observing System programme,

**Noting further** that candidate stations that have been submitted by Members and require further analysis are still under evaluation by the advisory board, either for submission for future recognition or for further feedback to Members,

**Endorses** to endorse the proposal to recognize 57 centennial observing stations as long-term observing stations as provided in the annex to the present resolution;

**Invites** Members to further strengthen their efforts to achieve sustainable high-quality long-term observations, to continue collaborating on the WMO recognition mechanism in particular and to promote it at the highest local, regional and national governmental levels, as appropriate;

**Requests** the Secretary-General to further promote the WMO recognition for long-term observing stations, to improve the practice of the recognition mechanism to allow more timely feedback to Members on the status of their nominations, and to issue another call for nomination of candidate stations in 2019.

## Annex to Resolution 6 (EC-70)

#### WMO recognition of long-term observing stations

#### Summary of advisory board review

orocco outh Africa nited Republic Tanzania mbabwe	Casablanca, 60155 Zuurbekom, 68351 Bukoba, Songea, Bulawayo Goetz, 67964	1911 1899 1893 1908
outh Africa nited Republic Tanzania mbabwe	Zuurbekom, 68351 Bukoba, Songea, Bulawayo Goetz, 67964	1899 1893 1908
nited Republic Tanzania mbabwe	Bukoba, Songea, Bulawayo Goetz, 67964	1893 1908
Tanzania mbabwe	Songea, Bulawayo Goetz, 67964	1908
mbabwe	Bulawayo Goetz, 67964	
		1897
Kazakhstan	Akkol, 35085	1909
	Aral tenizi, 35746	1884
	Mikhailovka, 29802	1907
Tajikistan	Khudjant, 38599	1866
	Murgab, 38878	1894
Thailand	Chiang Mai, 48327	1911
	Kanchana Buri, 48450	1911
	Ubon Ratchatai, 48407	1911
Uzbekistan	Fergana, 38618	1880
	Tashkent, 38457	1867
et Nam	Phu Lien, 48826	1906
	izakhstan jikistan ailand bekistan et Nam	Akkol, 35085azakhstanAral tenizi, 35746Mikhailovka, 29802jikistanKhudjant, 38599Murgab, 38878Chiang Mai, 48327kanchana Buri, 48450Ubon Ratchatai, 48407EbekistanFergana, 38618Tashkent, 38457et NamPhu Lien, 48826

#### List of centennial observing stations recommended for recognition (57 stations)

RA	Country	Station, WMO No. (where applicable)	Start of observation
	Argentina	Base Orcadas (Antarctica), 88968	1904
		Ceres, 87257	1896
		La Quiaca Observatorio, 87007	1902
111		Malargüe, 87506	1914
		Pilar Observatorio, 87349	1907
	Chile	Juan Fernandez, 85585	1901
		Central Tacubaya, 76680	1877
	Mexico	Merida Aeropuesto Intl, 76644	1898
		Zakatecas (La Bufa), 76525	1877
τv		Buffalo Bill Dam,	1905
		Purdum,	1902
	America	Saint Johnsbury,	1894
		University Experiment Station (Alaska),	1911
		· · · · · · · · · · · · · · · · · · ·	
		Graz University,	1894
	Austria	Innsbruck University,	1877
		Stift Zwettl,	1883
		Kneja, 15520	1910
	Bulgaria	Obrazcov Chflik,	1890
		Sliven, 15640	1889
	Croatia	Zagreb-Gric, 14236	1861
	Czechia	Prague-Klementinum, 11515	1775
	Finland	Helsinki, 02978	1844
		Kuusamo Airport, 02869	1909
	Iceland	Stykkisholmur,	1846
		Teigarhorn,	1881
		Moncalieri- Collegio Carlo Alberto,	1859
		Osservatorio Valerio,	1871
VI	Italy	Osservatorio Ximeniano,	1813
		Roma Collegio Romano	1787
		Urbino – Osservatorio Alessandro Serpieri,	1850
		Vigna di Valle, 16224	1910
	Latvia	Mersrags, 26324	1895
		Priekuli, 26335	1912
	Lithuania	Panevezys, 26529	1894
	Spain	Barcelona (Observatorio Fabra),	1913
	United Kingdom of Great Britain and Northern Ireland	Armagh,	1836
		Llysdinam,	1882
		Morpeth, Cockle Park,	1897
	Ukraine	Odesa, 33837	1866
		Poltava, 33506	1886
		Uman, 33587	1886

## Resolution 7 (EC-70)

#### Amendment to *Technical Regulations* (WMO-No. 49), Volume II – Meteorological Service for International Air Navigation

#### THE EXECUTIVE COUNCIL,

**Noting** that Amendment 78 to the International Standards and Recommended Practices, Meteorological Service for International Air Navigation (Annex 3 to the Convention on International Civil Aviation) was adopted by the Council of the International Civil Aviation Organization (ICAO) on 7 March 2018, with an effective date of 16 July 2018 and an applicability date of 8 November 2018, except for those provisions that contain embedded applicability dates of 7 November 2019 or 5 November 2020,

Noting also that Amendment 78 to Annex 3 to the Convention was fully coordinated with WMO,

**Noting further** the established procedures that ensure the alignment of Annex 3 to the Convention and WMO *Technical Regulations* (WMO-No. 49), Volume II,

**Approves** the amendment to WMO *Technical Regulations* (WMO-No. 49), Volume II, which ensures its necessary alignment with Amendment 78 to Annex 3 of the Convention on International Civil Aviation as provided in the annex to the present resolution;

#### **Requests** the Secretary-General:

- To arrange for the expeditious publication of the amended *Technical Regulations* (WMO-No. 49), Volume II;
- (2) To review, assisted by the president of the Commission for Aeronautical Meteorology (CAeM), and, as necessary, to publish updates to related WMO guidance material to ensure consistency with the amended *Technical Regulations*, Volume II;

**Recommends** the Secretary-General, assisted by the president of CAeM and in coordination with ICAO, to seek opportunities to improve efficiency through the elimination of duplication or redundancy between WMO and ICAO regulatory and guidance material relating to meteorological service for international air navigation.

#### Annex to Resolution 7 (EC-70)

#### Amendment to Technical Regulations (WMO-No. 49), Volume II – Meteorological Service for International Air Navigation

This amendment to WMO-No. 49, *Technical Regulations*, Volume II, Meteorological Service for International Air Navigation is to align with Amendment 78 to Annex 3 to the ICAO Convention on International Civil Aviation which was adopted by the Council of ICAO on 7 March 2018.

The following text, taken from Amendment 78 to ICAO Annex 3, serves as the basis of the amendment to WMO-No. 49, *Technical Regulations*, Volume II.

After approval by the Executive Council, WMO-No. 49, *Technical Regulations*, Volume II incorporating Amendment 78 will be published by WMO as the 2018 Edition.

Amendment to Technical Regulations (WMO-No. 49), Volume II – Meteorological Service for International Air Navigation

## **Resolution 8 (EC-70)**

#### Scientific research and development in aeronautical meteorology

THE EXECUTIVE COUNCIL,

**Recalling** Decision 44 (EC-68) – Intercommission Aviation Research Project, which, inter alia, endorsed the proposed organizing of a WMO scientific event with broad participation of research, operations and user communities, with the objective of identifying needs and planning the research activities during block 1 and block 2 of the International Civil Aviation Organization (ICAO) Global Air Navigation Plan (GANP) aviation system block upgrades (ASBU) methodology,

**Noting with satisfaction** the organization of a WMO Aeronautical Meteorology Scientific Conference in Toulouse, France, from 6 to 10 November 2017, and the availability of a conference proceedings publication (*Proceedings of the 2017 WMO Aeronautical Meteorology Scientific Conference (AeroMetSci-2017)*, AeM SERIES No. 2) and a conference website, which together provide all of the associated technical materials and outcomes of the conference,

**Having examined** the recommendations of AeroMetSci-2017 provided in the annex to the present resolution that provide a common vision for future scientific research and development activities aligned with the evolving needs and expectations of international civil aviation, together with an increased awareness of the potential impacts of climate change and variability on aviation operations now and into the future,

**Noting with interest** that a number of AeroMetSci-2017 recommendations relate to the need for quick transfer of research results into operations,

**Noting also** that aviation remains a priority customer and activity for almost all WMO Members and that significant changes are taking place in the way in which meteorological services are provided to aviation users,

#### Decides:

- (1) To endorse the AeroMetSci-2017 recommendations;
- (2) That the Commission for Aeronautical Meteorology (CAeM), Commission for Atmospheric Sciences (CAS) and Commission for Basic Systems (CBS) should develop an efficient mechanism for timely transfer of research results into operations to ensure continuous improvement of operational services to aviation;
- (3) That CAeM, in collaboration with other relevant commissions, should explore ways to efficiently transfer aeronautical meteorological information into air traffic management impacts to enable full integration in the strategic planning and pre-tactical and tactical decision-making needs of aviation users;

**Requests** the presidents of CAeM, CAS and CBS to ensure that the outcomes of AeroMetSci-2017 are well-communicated and used by the technical commissions to direct future scientific and technological advancement in support of the evolving needs of aviation;

**Requests** the presidents of the regional associations to consider how the outcomes of AeroMetSci-2017 can be used by Members to best serve the meteorological needs of aviation users at a regional or subregional level;

**Calls upon** Members to review and apply the outcomes of AeroMetSci-2017 with a view to accelerating the transition from research to operations through, in particular, community partnerships that already exist or that should be established at a national and/or multinational level involving public and private enterprise where applicable;

#### **Requests** the Secretary-General:

- To ensure that ICAO and other aviation stakeholders are kept informed of progress in respect of meteorological scientific and technological advancement consistent with the evolving GANP and ASBU methodology and the working arrangements between WMO and ICAO;
- (2) To make the necessary resources available to maintain the level of support to address Members' needs in the area of meteorological service for international air navigation, including resources to organize similar future aeronautical meteorology scientific conferences taking into consideration the evolving needs of aviation users and technological advancements, including the outcomes of the intercommission (CAeM, CAS and CBS) Aviation Research Demonstration Project.

## Annex to Resolution 8 (EC-70)

#### Recommendations and statement of the 2017 WMO Aeronautical Meteorology Scientific Conference

The following provides the outcomes, in the form of recommendations and a statement, of the 2017 WMO Aeronautical Meteorology Scientific Conference (AeroMetSci-2017) held from 6 to 10 November 2017 in Toulouse, France:

#### **Recommendation 1**

## In the context of science underpinning aeronautical meteorological (MET) observations, forecasts, advisories and warnings, the conference *recommended* that:

- Research activities demand improved access to data, especially aircraft-based observations to support validation, verification and calibration as part of a continuous improvement drive;
- (2) Research efforts should be conducted in collaboration with users to ensure their needs are addressed;
- (3) The transition from research to operations following validation should be accelerated and well communicated;
- (4) Conveying uncertainty is required to inform risk management, but remains a challenge that needs further research and guidance; and
- (5) MET hazards and their impacts on aviation should be more clearly defined and articulated.

#### **Recommendation 2**

In the context of **integration**, **use cases**, **fitness for purpose and service delivery**, the conference *recommended* that:

- Close collaboration within and across MET and air traffic management (ATM) communities should be actively encouraged as a prerequisite of impact assessment and an enabler to future global interoperability and harmonization;
- (2) Establishing ATM users' requirements should be a prerequisite for tailored, fit-for-purpose MET solutions;
- (3) MET information must be translatable into ATM impacts to enable full integration in the strategic planning, pre-tactical and tactical decision-making phases;
- (4) Probabilistic methodologies with proper verification and calibration should be applied to better convey to users where and to what extent inherent forecast uncertainties exist;
- (5) Blending MET parameters through ensemble approaches that yield a higher quality, more usable forecasts should be further pursued but with an acknowledgement of the potential masking of extremes;
- (6) Machine-learning such as artificial intelligence could be pursued to optimize MET support to ATM in the era of 'Big Data';
- (7) Design of systems for delivering harmonized MET information to pilots and other stakeholders should further consider the need for standardization and collaborative decision-making (CDM);
- (8) An increasingly automated ATM operating environment will require supporting MET educational programmes for end-users; and
- (9) The research-to-operations process for prioritized MET products and services reaching maturity should be expedited.

#### **Recommendation 3**

In the context of **climate change and variability on aviation and associated science requirements**, the conference *recommended* that:

- (1) The potential impacts of climate change and variability on aviation operations on the ground and in the air, downscaled to the local level, must be well researched and communicated;
- (2) The mitigation of extreme weather events and the adaptation to a changing climate demands a multidisciplinary effort involving both the physical and the social sciences. Furthermore, all stakeholders in meteorology and aviation must work together, including through WMO and ICAO, to build consensus on robust, sustainable global solutions;
- (3) Responding to climate variability will require a high degree of flexibility on the aviation users' side. While the incidence of high-impact extreme weather events are expected to increase, they will be infrequent relative to the norm. The foreseen continued growth of aviation worldwide in a changing climate scenario may present new challenges as demand for airspace capacity increases;
- (4) Improved availability of and access to high-quality in-situ observations of meteorological parameters, including water vapour, is a key enabler to improving climate prediction model capabilities. The preservation of such data is essential for validating and calibrating climate predictions; and

(5) A changing climate scenario may render some of today's aerodrome, airspace and airframe design and operation standards inadequate in the years or decades to come. Using past climatological records alone as an indicator of future climate at an airport, may be insufficient given the (current) rate at which the world's climate is changing (warming).

## Statement

The conference *stated* that:

- (1) There is a tremendous amount of ongoing cross-disciplinary research in the field of aeronautical meteorology (MET). This collaborative scientific excellence should be leveraged to enable the future global air traffic management (ATM) system;
- (2) The role of MET as a key enabler to aviation's vision for a globally interoperable, harmonized ATM system of the future that is safer, more efficient and more environmentally responsible will only be realized through the accelerated transition of scientific research and technological advancement into operations based on aviation users' needs, new and improved community partnerships, trust, transparency and openness; and
- (3) As the potential impacts of climate change and variability on aviation operations become better understood, the research community should continue to advance relevant science and communicate in a style that is well understood by the user.

## Resolution 9 (EC-70)

## Global and regional landscape of aeronautical meteorological service provision

THE EXECUTIVE COUNCIL,

**Recalling** Decision 42 (EC-69) – Future of aeronautical meteorological services, which, inter alia, addressed the outcomes of an "EC-69 Special Dialogue on the Future of Aeronautical Meteorological Services" and associated follow-up actions,

**Noting with satisfaction** the WMO publication of *Outcomes of the 2016–2017 Global Survey on Aeronautical Meteorological Service Provision* (Commission for Aeronautical Meteorology (CAeM), AeM SERIES No. 1), which provides detailed findings on the global and regional landscape of aeronautical meteorological service provision, as well as general findings, trends and recommendations,

**Having examined** the main findings arising from the CAeM global survey as provided in the annex to the present resolution,

**Decides** that the presidents of regional associations, in coordination with the president of CAeM, should:

- (1) Develop a mechanism by which the outcomes of the global survey, downscaled to the regional or subregional level as necessary, can be used to establish prioritized, targeted and suitably funded capacity development activities for those Members most in need of assistance with aeronautical meteorological service provision;
- (2) Undertake a review of the outcomes of the global survey from a regional perspective and assist Members in their respective Regions in the supply of regularly updated information of existing national practices to the CAeM;

**Requests** the president of CAeM to ensure that the outcomes of the global survey, including identification of Members' challenges and gaps in aeronautical meteorological service provision, are well communicated and used by CAeM to direct future priorities within the WMO Aeronautical Meteorology Programme;

**Urges** Members to analyse the outcomes of the CAeM global survey, particularly in the context of the national legal/regulatory frameworks and issues such as cost recovery; this should be done with a view to determining the implications for National Meteorological and Hydrological Services of identified trends in the provision of aeronautical meteorological services and to identifying common practices; and to supply updated information on existing national practices to CAeM by 2020 initially and at regular intervals thereafter;

**Requests** the Secretary-General to make the necessary resources available to support Members in addressing the issues identified in the CAeM global survey, in particular the challenges and gaps associated with aeronautical meteorological service provision, and the collection of regularly updated information from Members of existing national practices.

## Annex to Resolution 9 (EC-70)

## Main findings arising from the 2016–2017 Commission for Aeronautical Meteorology global survey on aeronautical meteorological service provision

#### MWO, AMO and AMS functions

One of the main focusses of the survey was on the ICAO/WMO service provision functions of meteorological watch office (MWO), aerodrome meteorological office (AMO) and aeronautical meteorological station (AMS).

Globally, there are approximately 230 MWOs and at least 600 AMOs and 1,250 AMSs serving international civil aviation.<sup>1</sup> In addition, aeronautical meteorological services are being provided to approximately 2,500 domestic airports worldwide.

There is a large variety of arrangements and conditions within and between States and Territories, as well as across regions, for the provision of aeronautical meteorological service. The maturity of aeronautical meteorological service providers (AMSP) varies significantly across the WMO Members.

In a majority (approximately 60%) of States and Territories, the MWO, AMO and AMS functions are provided by national meteorological and hydrological services (NMHS). Air traffic services (ATS) organizations are the second largest provider (between 15 and 25%) with 25% performing the MWO function, while military entities, airport authorities and commercial meteorological service providers complete the portfolio of AMSPs. The largest variety of entities providing ICAO/WMO functions is noticed for AMS service provision. In 20% of States and Territories, the AMS service provision is made up of a combination of these entities.

Twenty-five percent of Members have no responsibility to maintain a continuous meteorological watch over a flight information region and, therefore, do not have an MWO. Of those Members with responsibility to maintain a continuous meteorological watch over a flight information region (or regions), 64% of Members are responsible for one MWO, and 5% of Members for two MWOs.

In total, over 80% of States and Territories have less than five AMOs. There are three States however with more than fifty AMOs, and in total there are approximately 600 AMOs in place.

<sup>&</sup>lt;sup>1</sup> The numbers for AMO and AMS do not include the offices and stations of the 18 Members that did not respond.

While precise data on number of AMOs existing in the past is not readily available, it is considered that the number of AMOs existing today has reduced over the years as more and more AMO functions are performed from a regional or centralized location. In other words, AMO are no longer always physically located at an aerodrome.

Three quarters of Members have between one and five AMSs while 12% have between six and ten AMSs. The remainder varies between 21 and 50 AMSs. It is worthwhile to note that three Members respectively have responsibility for providing 67, 71 and 153 AMSs.

Almost 50% of Members indicated that there are plans to migrate to fully automated aerodrome observations, which is already the case for 3% of Members. Almost 40% of Members indicated that there are no plans to migrate to fully automated aerodrome observations. The differences in this regard between regional associations are significant.

The reasons for not migrating fully to automated aerodrome observations vary significantly between States and Territories and across regions and includes quality issues, lack of funding or negative business cases as well as States and Territories that opt for a hybrid approach.

In a majority (70%) of States and Territories the meteorological observational data of the AMS is made available free of charge to the NMHS. In 6% of cases a charge is involved for the NMHS and in 5% of States and Territories the observation data is not being made available to the NMHS at all. Seventeen Members (9%) indicated that there are issues regarding the sharing and provision of the meteorological observation data in their State or Territory.

#### Regulatory frameworks

The ICAO and WMO regulatory provisions are strongly reflected in the national legal/regulatory frameworks of States and Territories. In almost 80% of Members, the MWO, AMO and AMS functions are assigned through a formal designation to service providers.

The notion of 'meteorological authority' is not applied uniformly by all responding States and Territories. Many AMSPs no longer perform the role of regulator, which was a common case in the past for many NMHSs serving as AMSPs. In more than 70% of Members functional separation between regulation, service provision and oversight already exists.

Twenty-five percent of Members were of the opinion that the entity providing oversight does not possess adequate expertise in aeronautical meteorology. Several Members identified oversight deficiencies ranging from having no oversight at all to a need for more guidance and assistance.

#### Quality management systems (QMS) implementation

In a majority of States and Territories the AMSPs have fully (68%) or partially (14%) implemented QMS. This is a significant improvement compared to previous years. However, at the same time, more than 30% of Members face a regulatory risk because of lack of a QMS or only a partially implemented QMS. The main reasons for such non-compliance have been stated as lack of funding and/or human resources, or low priority given by the government.

Of the AMSPs that have fully implemented a QMS, only one in every eight are certified to the ISO 9001:2015 QMS standard. Recognizing a need to transition from ISO 9001:2008 to ISO 9001:2015 by September 2018, and in view of the lack of implementation of QMS in a number of States and Territories, it is concluded that a considerable effort is still required from Members to implement QMS and/or transition to the ISO 9001:2015 standard.

#### Competency and qualification of aeronautical meteorological personnel

WMO introduced standards for competency assessment of aeronautical meteorological personnel (applicable since 1 December 2013) and qualification standards for aeronautical meteorological forecasters (applicable on 1 December 2016). Almost 70% of States and

Territories have established a national competency programme for aeronautical meteorological personnel. The frequency of the competency (re)assessment ranges typically between 1 and 5 years.

In approximately 50% of States and Territories, the AMSPs fully comply with WMO requirements for the competency assessment for aeronautical meteorological observers and forecasters as well as the qualification standards for aeronautical meteorological forecasters. Thirty percent of Members indicate that this is in progress, 10% have not started and for 10% the situation is not known due to non-response. As such, many Members face a regulatory risk because of non-compliance with the competency assessment and qualification standards.

#### Funding mechanisms including cost recovery

In approximately 40% of States and Territories the aeronautical meteorological service provision is wholly funded by the government budget, and in 20% the service provision is fully funded via cost recovery mechanisms. For 30% of States and Territories the funding mechanism is made up of combinations of government funding, cost recovery and commercial revenues. Cost recovery for aeronautical meteorological service provision is applied in half of the States and Territories.

Cost allocation and cost recovery for the provision of aeronautical meteorological service is an issue for a number of Members. Best practices are identified as Members having a cost allocation system and a cost recovery mechanism in place. The aeronautical meteorological service provision is fully funded from either government budget or cost recovered via en-route and terminal charges. If required, a fair share of the core infrastructure costs can be allocated to the costs of the aeronautical meteorological service provision via the core cost mechanism.

#### Technical capacity/capability

Almost 90% of MWO AMSPs provide WS SIGMET in combination with or without other SIGMET types or AIRMET. For 11% of Members this is unknown, or the Members do not have an MWO responsibility, and therefore, do not issue SIGMETs. Regional differences exist as for example some regions do not provide AIRMET, and in other regions tropical cyclones do not occur and as such WC SIGMETs are not provided. One third of Members conduct cross-border coordination for SIGMET production with MWOs in neighboring FIRs.

Almost 80% of AMO AMSPs utilize NWP output and nowcasting products (fully or to some extent) in the forecasting process, including warnings, while a minority of approximately 10% of AMSPs do not.

Almost two-thirds of Members conduct forecast verification for either TAF, AIRMET, SIGMET or aerodrome warnings, and based on the response to the survey this figure is expected to go up to 80% by 2019.

At the time of the survey only around one-third of Members use aircraft based observations from AMDAR, ADS and or SSR Mode S in the aeronautical meteorological forecast production process.

#### Challenges in service provision

New or emerging challenges amongst Members include meeting emerging technological standards such as IWXXM and to fulfill ATM user needs for improved meteorological data and services.

The top 10 priority challenges indicated by Members were: migration to XML, qualification of AMF, QMS implementation/maintenance, maintenance and calibration of observing equipment, automation of aerodrome observation, meeting demands for advanced products and services, cost-recovery implementation, competency assessment, SIGMET quality, and advanced MET information and services for terminal area.

Several Members identified other challenges such as competition from other providers (private sector, commercial providers or regionalization) on aeronautical meteorological service provision. Especially in Europe there is the challenge to comply with the cost reduction targets of the Single European Sky, and at the same time comply with regulations and to contribute to increased safety and capacity by improving meteorological services for air traffic management.

#### Resolution 10 (EC-70)

#### Report of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology at its fifth session

THE EXECUTIVE COUNCIL,

**Considering** the decisions, resolutions and recommendations of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) at its fifth session, contained in *Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology: Abridged Final Report of the Fifth Session* (WMO-No. 1208) (see annex to the present resolution),

Noting Resolutions 1-9 (JCOMM-5),

#### Approves:

- Recommendation 1 (JCOMM-5) Review of relevant resolutions of the governing bodies of the World Meteorological Organization and the Intergovernmental Oceanographic Commission;
- Recommendation 15 (JCOMM-5) Update of the Manual on Sea-level Measurement and Interpretation, Volume V – Radar Gauges (IOC Manuals and Guides No. 14, Volume V; JCOMM Technical Report No. 89; 2016);

#### **Decides:**

- To amend the Manual on Marine Meteorological Services (WMO-No. 558), Volume I Global Aspects, as detailed in Recommendation 12 (JCOMM-5) – Revised Manual on Marine Meteorological Services (WMO-No. 558), Volume I – Global Aspects;
- To amend the *Guide to Marine Meteorological Services* (WMO-No. 471), as detailed in Recommendation 13 (JCOMM-5) – Revised *Guide to Marine Meteorological Services* (WMO-No. 471);

#### **Requests** the Secretary-General:

- (1) To make any subsequent purely editorial amendments, ensure editorial consistency of the relevant documents, and publish the updated Manual and Guide in four WMO official languages (English, French, Spanish and Russian);
- (2) To bring the above decisions to the attention of all concerned.

**Note:** The present resolution replaces Resolution 2 (EC-64), which is no longer in force.

#### Annex to Resolution 10 (EC-70)

#### Report of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology at its fifth session

The Abridged Final Report of The Fifth Session of The Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (WMO-No. 1208, WMO-IOC/JCOMM-5/3) is at:

#### WMO-No. 1208, 2018

A brief summary of the major outcomes of JCOMM-5 are described in EC-70/INF. 5.3(1).

#### Resolution 11 (EC-70)

#### Marine and coastal services support for WMO Members

THE EXECUTIVE COUNCIL,

**Noting** the recommendations and scenario options for WMO to strengthen marine services, as outlined in the Marine Services Assessment Report (submitted to the WMO Secretariat in March 2017 – see annex to the present resolution), which was prepared by an ad hoc working group to carry out an assessment of marine services at WMO following the request by the Seventeenth World Meteorological Congress that WMO needed to improve its role in marine services,

**Noting also** the summary recommendations for improving the roll-out of marine services to WMO Members outlined in the report (see EC-70/INF. 5.3(2) for more information),

#### Having considered:

- Decision 16 (JCOMM-5) Approval of the Services and Forecasting Systems Programme Area Vision, new structure and governance (see EC-70/INF. 5.3(1)),
- (2) Resolution 8 (JCOMM-5) Services and Forecasting Systems Programme Area,
- (3) Decision 40 (JCOMM-5) Workplan and resources for the fifth session of the Joint WMO/ IOC Technical Commission for Oceanography and Marine Meteorology, and in particular the shortfall of dedicated human and financial resources to carry out the services activities in the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) (for which Secretariat support and finance is provided by the WMO Marine Meteorology and Ocean Affairs Division),

**Recognizes** the delivery of the IMO/WMO Worldwide Met-Ocean Information and Warning Service (WWMIWS) and the formation of a Committee comprising all METAREA coordinators to coordinate and improve the service delivery in accordance with International Maritime Organization (IMO) and WMO service regulations;

**Endorses** the role of the WWMIWS Committee to coordinate a holistic approach to servicing the metocean information requirements outlined in the IMO Polar Code for vessels operating in polar waters, and to consider further alignment with service delivery programmes focused on polar areas;

**Recalling** Resolution 6 (Cg-17) – Competence requirements for marine weather forecasters,

**Considering** Resolution 5 (JCOMM-5) – Management Committee of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology, which tasked the JCOMM
Management Committee to include marine competencies in the JCOMM work activities and, through the work of the Services and Forecasting Systems Programme Area and the WWMIWS Committee (Decision 16 (JCOMM-5) – Approval of the Services and Forecasting Systems Programme Area Vision, new structure and governance, Annex 1) to create guidance material for Members to carry out marine weather competency assessments,

# Decides:

- (1) To support the request in the Marine Services Assessment Report to elevate the need for dedicated focus for improving marine services at WMO and for WMO Members;
- (2) To support the new enhanced future vision and direction of maritime safety services, and the appointment of national marine services focal points within WMO Members (as outlined in Resolution 8 (JCOMM-5)) through the provision of adequate human (Secretariat) and financial resources (as outlined in Decision 40 (JCOMM-5));

#### Requests Members:

- (1) To send nominations for the national marine services focal points, if they have not already done so;
- (2) To participate in any service delivery assessments and surveys sent by the WMO Secretariat to assess the strengths and gaps in marine services for WMO Members;
- (3) To develop competency assessment programmes for their marine weather forecasting personnel and, for Members with responsibility to issue products for WWMIWS, to ensure their forecasters are competent by 2023;
- (4) To consider providing secondments to the WMO Marine Meteorology and Ocean Affairs Division and extra financial resources to assist with strengthening marine and coastal services for Members, especially in competencies and capacity development;

**Requests** the WMO co-president of JCOMM to consult with presidents of regional associations to improve working relationships between JCOMM and regional association working groups on marine services;

**Requests** the Secretary-General to enable improved communication to Members through their national marine services focal points.

# Annex to Resolution 11 (EC-70)

# **Marine Services Assessment Report**

This report is the compilation of an assessment of marine services carried out between February and December 2016. The full report is available in EC-70/INF. 5.3(2).

# Resolution 12 (EC-70)

# **Future of the Coastal Inundation Forecasting Demonstration Project**

# THE EXECUTIVE COUNCIL,

**Considering** that the majority of the world population lives in coastal areas, many of which are vulnerable to flooding,

# Recalling:

- (1) Resolution 6 (CHy-15) The Flood Forecasting Initiative and the contribution of the Commission for Hydrology to the Disaster Risk Management Programme, which requested the president of the Commission for Hydrology (CHy), with the assistance of the appropriate members of the CHy Advisory Working Group and the Open Panel of CHy Experts, to coordinate together with the co-presidents of the Joint WMO/IOC Technical Commission on Oceanography and Marine Meteorology (JCOMM) a joint assessment of the initial phase of the Coastal Inundation Forecasting Demonstration Project (CIFDP) and, depending on the assessment results, to consider the desirability of developing a governance structure and procedures that would transition CIFDP to a more sustainable platform, for the strengthening of national multi-hazard early warning systems to address flooding in coastal areas,
- (2) Decision 17 (JCOMM-5) Future of the Coastal Inundation Forecasting Demonstration Project, which approved the collaboration of the JCOMM Management Committee with CHy, with support from the WMO Secretariat, to coordinate a joint independent assessment of CIFDP, as stipulated in Resolution 6 (CHy-15), with the objectives detailed in (1) (see EC-70/INF. 5.3(1) for more information),
- (3) Resolution 1 (EC-70) Consolidated approach to severe weather forecasting, which decided that an independent assessment should be made of the three initiatives CIFDP, the Flash Flood Guidance System (FFGS) and the Severe Weather Forecasting Demonstration Project (SWFDP),

**Noting** that the results of the proposed assessment for CIFDP, and the overall assessment for the combined CIFDP, FFGS and SWFDP activities and any recommended future governance structure arrangements will be reported to the Eighteenth World Meteorological Congress in 2019,

**Noting also** the need for the independent reviews of the initiatives CIFDP, FFGS and SWFDP to be made available to the Flood Forecasting Initiative Advisory Group (FFI-AG) to allow its members' full consideration prior to Congress (see Resolution 16 (EC-70) – Guidance on ongoing hydrology and water resources initiatives) so that, through its Chairperson, a coherent strategy can be reported for the sustainable and efficient services for the provision of flood forecasting guidance and improved multi-hazard early warning systems (MHEWS) for Members,

**Acknowledging** that the CIFDP sub-projects are mainly funded through extrabudgetary resources and that resource mobilization for the ongoing sub-projects and their sustainability and synergies with other relevant projects and activities, such as FFGS and SWFDP, has always been a challenge, both for funding and in terms of having adequate human resources for coordination,

**Endorses** the recommendations of FFI-AG (see Resolution 16 (EC-70)), including the review of CIFDP and other activities proposed, as they will improve the flood forecasting capabilities of WMO Members and thus contribute to establishing a solid foundation for MHEWS in countries;

**Requests** the Secretary-General to provide financial support for the CIFDP assessment so that it can be completed in time for the results to be considered within the overall CIFDP, FFGS and SWFDP recommendations that will be reported by the FFI-AG Chairperson to Congress.

# Resolution 13 (EC-70)

# Intergovernmental Oceanographic Commission/WMO/Permanent Commission for the South Pacific collaboration on the investigations of El Niño

THE EXECUTIVE COUNCIL,

**Recalling** Resolution 3 (EC-XLVIII) – The Joint IOC/WMO/CPPS Working Group on the Investigations of El Niño, and its terms of reference outlined in the annex to the resolution,

**Recognizing** the objectives of the Joint IOC/WMO/CPPS Working Group as set out in the annex to Resolution 3 (EC-XLVIII),

**Noting** that the Executive Council at its sixtieth session expressed its continued support for the Working Group and called for a review of its terms of reference (*Executive Council Sixtieth Session: Abridged Final Report with Resolutions* (WMO-No. 1032), 3.2.3.3),

**Noting also** that considerable time has lapsed since the last meeting of the Working Group (eleventh session) held in 2007,

**Considering** that investigations of El Niño, as well as the related information services and socioeconomic impacts, are being carried out by WMO under various programmes and activities, including those within the Commissions for Climatology (CCl) and for Basic Systems (CBS), and jointly with the Intergovernmental Oceanographic Commission (IOC) through the Joint WMO/ IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), the Global Climate Observing System (GCOS), the Global Framework for Climate Services (GFCS), the Global Ocean Observing System (GOOS), and the World Climate Research Programme (WCRP), and that these have gained momentum since 2007,

# Decides:

- That the work outlined in the terms of reference for the Working Group, particularly on collaboration with IOC and the Permanent Commission for the South Pacific (CPPS), should be updated and integrated into the relevant activities of JCOMM;
- (2) Not to keep in force Resolution 3 (EC-XLVIII);

**Requests** the co-presidents of JCOMM to liaise with CBS, CCI, GCOS, GFCS, GOOS, WCRP and any other relevant WMO and joint WMO/IOC entities contributing to knowledge and information about the El Niño phenomena and the associated capacity development activities;

**Encourages** CPPS to continue its active collaboration with WMO and IOC through JCOMM, to provide relevant contributions to the investigations on El Niño;

**Invites** IOC, as the principal secretariat in the IOC/WMO/CPPS partnership, to initiate the process to close the joint Working Group.

**Note:** The present resolution replaces Resolution 3 (EC-XLVIII), which is no longer in force.

# Resolution 14 (EC-70)

# Recommendations of the Commission for Agricultural Meteorology at its seventeenth session

# THE EXECUTIVE COUNCIL,

**Having considered** *Commission for Agricultural Meteorology: Abridged Final Report of the Seventeenth Session* (WMO-No. 1217),

**Decides** to endorse the report and to take action on the recommendations in it as follows:

# (1) **Recommendation 1 (CAgM-17) – Drought and desertification**

- (a) Approves the recommendation;
- (b) Invites Members:
  - To encourage the open sharing of agricultural, meteorological and hydrological data among national and regional ministries and organizations to improve drought-related decision-making and support the development of drought early warning systems;
  - (ii) To support the Secretary-General in the further implementation of the recommendations of United Nations Convention to Combat Desertification (UNCCD);
  - (iii) To implement as appropriate the activities of the Integrated Drought Management Programme (IDMP) with regards to the three pillars of integrated drought management: drought monitoring and early warning systems, drought vulnerability and impact assessments, and drought preparedness;
- (c) Requests the Secretary-General:
  - To continue collaboration with UNCCD and other organizations in the actions of implementation of the Drought Management Centre for Southeastern Europe and to explore the establishment of similar centres in other regions;
  - (ii) To continue collaboration with UNCCD, FAO and the United Nations Convention on Biological Diversity on the implementation of the Integrated Drought Management Programme;
  - (iii) To ensure effective coordination with WMO drought activities with regards to IDMP, the FAO Framework on Water Scarcity in Agriculture, the UNCCD Drought Initiative and the Group on Earth Observations Global Agricultural Monitoring;
- (d) Requests all relevant technical commissions, programmes and regional associations to liaise with the Commission for Agricultural Meteorology (CAgM) and IDMP experts and establish synergies with CAgM and IDMP with regards to drought monitoring and early warning systems, drought vulnerability and impact assessments, and drought preparedness especially with regards to global multi-hazard alerting systems, the Hydrological Status and Outlook System, and the cataloguing of extreme weather, water and climate events;

# (2) **Recommendation 2 (CAgM-17) – Status and progress made in agricultural** meteorology

(a) Approves the recommendation;

(b) Invites Members to ensure that their Country Profile Database (CPDB) focal points update CPDB on issues related to agricultural meteorology and drought;

# (3) **Recommendation 3 (CAgM-17) – Training and education in agricultural** meteorology

- (a) Approves the recommendation;
- (b) Requests the Secretary-General to closely liaise with WMO Regional Training Centres and specialized centres on the provision and content of education, training courses and tools in agricultural meteorology to strengthen and expand training programmes in that discipline to ensure adequate response to identified training requirements for agricultural meteorologists and understanding of the potential role of the Global Centres of Excellence in Agricultural Meteorology;

# (4) Recommendation 4 (CAgM-17) – Review of relevant resolutions of the WMO governing bodies

Takes into account this recommendation when dealing with agenda item 20 of the present session;

# (5) **Recommendation 5 (CAgM-17) – Continuation and strengthening of the work of the Commission for Agricultural Meteorology**

Agrees to take into account the ongoing work and planned deliverables of the Commission for Agricultural Meteorology in the ongoing WMO governance review to ensure their continuity is incorporated into the governance review outcomes.

# **Resolution 15 (EC-70)**

# Amendments to Technical Regulations (WMO-No. 49), Volume I, Part V

THE EXECUTIVE COUNCIL,

# Recalling:

- Resolution 4 (Cg-17) Report of the extraordinary session (2014) of the Commission for Basic Systems relevant to Technical Regulations concerning public weather services competencies,
- (2) Resolution 6 (Cg-17) Competence requirements for marine weather forecasters,
- (3) Resolution 32 (Cg-17) Report of the extraordinary session (2014) of the Commission for Basic Systems relevant to Technical Regulations concerning the Global Telecommunication System, data management and the WMO Information System,
- (4) Recommendation 10 (CCI-17) Human resource development through implementation of competencies for provision of climate services,

# Noting:

(1) The decision of the Commission for Basic Systems Management Group at its eighteenth session (Geneva, 29 March 2018) to endorse the top-level competencies for public weather services delivery and its recommendation that consideration of these should be placed on the agenda of the World Meteorological Congress,

(2) The decision of the Commission for Instruments and Methods of Observation Management Group at its fifteenth session (Geneva, 26–29 March 2018) endorsing the four sets of competencies for observations, instrumentation, calibration, and network and programme management, and requesting the WMO Secretariat to have them included in the *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8) as a new chapter on competencies and to sumit them to the Education and Training Office to be included in WMO Technical Regulations,

**Considering** that the top-level competencies, together with the entire revised public weather service delivery competency frameworks, as presented in Annex 1, have been revised to be consistent with the newly published *Guide to Competency* (WMO-No. 1205) and are designed to facilitate clear testing of competency levels among personnel engaged in work associated with the provision of public weather services,

**Endorses** the fundamental WMO competency requirements for public weather forecasters as contained in Annex 1 to the present resolution;

**Approves** the proposed amendments to *Technical Regulations* (WMO-No. 49), Volume I – General Meteorological Standards and Recommended Practices, Part V, as contained in Annex 2 to the present resolution;

**Requests** the Secretary-General to arrange for the introduction of the amendments to *Technical Regulations*, Volume I, Part V, and to make any necessary editorial modifications.

**Note:** The present resolution replaces Resolution 13 (EC-69), which is no longer in force.

# Annex 1 to Resolution 15 (EC-70)

# **Fundamental WMO competency requirements for public weather forecasters**

The competency requirements for the work of personnel engaged in operational forecasting<sup>2</sup> can be divided into five top level competencies, taking into consideration the conditions (a) to (c) below:

- (a) The nationally-defined PWS<sup>3</sup> areas of responsibility;
- (b) Meteorological and hydrological impacts on society;
- (c) Meteorological and hydrological user requirements, local procedures and priorities.

A PWS Forecaster should have successfully completed the BIP-M<sup>4</sup> (as defined in the revised WMO-No. 49, Volume I). Taking into account conditions (a) to (c) above, they should also be competent to perform the tasks defined through the five top level competencies, as follows:

- (1) Analyse and continually monitor the evolving meteorological and/or hydrological situation;
- (2) Forecast meteorological and hydrological phenomena and parameters;
- (3) Warn of hazardous meteorological and hydrological phenomena;
- (4) Communicate meteorological and hydrological information to internal and external users;

<sup>&</sup>lt;sup>2</sup> Personnel engaged in operational forecasting may work across a variety of specializations including aviation, marine and public weather services.

<sup>&</sup>lt;sup>3</sup> For the purpose of forecaster competencies the term PWS forecasters is used to describe forecasters responsible for the preparation and delivery of public weather forecasts and warnings.

<sup>&</sup>lt;sup>4</sup> BIP-M: Basic Instruction Package for Meteorologists

(5) Ensure the quality of meteorological and hydrological information and services.

Each of these top-level competencies is expanded into performance criteria that are expressed and structured in such a manner as to facilitate the clear application of an assessment procedure. The competencies are built upon a range of Enabling Skills (such as skills and knowledge in Numerical Weather Prediction) and also Transferrable Skills (workplace skills which are not exclusive to meteorology, such as problem-solving and people-management). Each toplevel competency is also associated with a range of background knowledge and skills which are essential to the discharge of the defined duties.

# 1. Analyse and continually monitor the evolving meteorological and/or hydrological situation

#### 1.1 **Competency description**

Observations and forecasts of meteorological/hydrological parameters and significant meteorological/hydrological phenomena are continuously analysed and monitored to determine the need for issuance, cancellation or amendment/update of forecasts and warnings according to documented thresholds, protocols and regulations.

#### 1.2 **Performance Criteria**

- (a) Analyse, interpret and diagnose data and information to identify meteorological/ hydrological features pertinent to the area of forecast responsibility;
- (b) Monitor meteorological/hydrological parameters and evolving significant meteorological/ hydrological phenomena and validate current forecasts and warnings based on these parameters;
- (c) Evaluate the need for amendments to forecasts and updates of warnings against documented criteria and thresholds;
- (d) Monitor information related to impacts of recent meteorological and hydrological events.

- (a) Awareness of the importance of meteorological and hydrological services, and an understanding of the effects of forecasts and warnings on users and decision makers, in particular for public safety;
- (b) An understanding of the key elements of synoptic, dynamical, and physical meteorology and core analytical/diagnostic skills at least to the level of a BIP-M;
- (c) Application of the theory, methods and practices of meteorological and/or hydrological analysis and diagnosis;
- (d) An ability to visualize/conceptualize meteorological and/or hydrological information in multiple dimensions (spatial, temporal);
- (e) An appreciation of the influence of topography, land cover, and (if relevant) bodies of water and/or snow fields on local meteorology;
- (f) Interpretation of in-situ and remote-sensed observations and data;
- (g) Understanding of the characteristics of meteorological and/or hydrological sensors and instruments;
- (h) Familiarity with the acquisition, processing and assimilation of meteorological and/or hydrological data, including quality control;

(i) Understanding of procedures, standards and technical regulations relating to observations and to forecast and warning products.

# 2. Forecast meteorological and hydrological phenomena and parameters

# 2.1 **Competency description**

Forecasts of meteorological and/or hydrological parameters and phenomena are prepared and issued in accordance with documented requirements, priorities and deadlines.

# 2.2 **Performance Criteria**

- (a) Forecast meteorological/hydrological phenomena and parameters as required, using appropriate tools and including forecast uncertainties;
- (b) Ensure that forecasts are prepared and issued in accordance with national or regional practices, relevant codes and technical regulations on content, accuracy and timeliness;
- (c) Ensure, insofar as practicable, that forecasts of meteorological/hydrological parameters and phenomena are consistent (spatially and temporally) across boundaries of the area of responsibility;
- (d) Monitor forecasts issued for other regions, and liaise with adjacent regions as required.

- (a) Core diagnostic and prognostic skills to a BIP-M level;
- (b) Knowledge of methods used in Numerical Weather Prediction (NWP) and other forecast applications;
- (c) Knowledge of the strengths, limitations and verification outputs of the NWP models used in the forecast office, and of forecast adjustments required to accommodate these;
- (d) Knowledge of statistical approaches applicable to meteorological and hydrological information;
- (e) Knowledge of probabilistic approaches to forecasting, such as those available through ensemble prediction systems;
- (f) Critical comparison of a variety of forecast models, interpretation of observational data and climatological data, and synthesis of this information to make a reasoned estimate of the most likely evolution of the weather, of alternative evolutions, and of the uncertainties associated with each;
- (g) Interpretation of model outputs at different time ranges;
- (h) Judgement in determining which observational, model, contextual and impact information is most relevant, especially in very short range forecasting;
- (i) Knowledge of the potential impacts of meteorological and hydrological events on users and their decision-making processes.

# 3. Warn of hazardous meteorological and hydrological phenomena

# 3.1 *Competency description*

Warnings are issued in a timely manner when hazardous meteorological and/or hydrological conditions are expected to occur, or when parameters are expected to reach documented threshold values or generate significant impacts, and updated or cancelled according to documented warning criteria.

# 3.2 **Performance Criteria**

- (a) Forecast hazardous meteorological/hydrological phenomena, including spatial extent, onset/cessation, duration, intensity and temporal variations;
- (b) Ensure that warnings are prepared and issued in accordance with national protocols for hazardous phenomena and their impacts;
- (c) Ensure insofar as practicable, that warnings of hazardous meteorological/hydrological phenomena are consistent (spatially and temporally) across boundaries of the area of responsibility;
- (d) Monitor warnings issued for other regions, and liaise with adjacent regions as required;
- (e) Maintain awareness of the impacts of hazardous meteorological/hydrological phenomena which are the subject of warnings and notifications.

# 3.3 Background knowledge and skills

- (a) Knowledge of the specific product preparation and dissemination systems used in the forecast office;
- (b) Knowledge and skill in using warning production tools;
- (c) Knowledge of the policies, procedures and criteria for issuing warnings;
- (d) Knowledge of the potential impacts of meteorological and hydrological events on users and their decision-making processes.

# 4. Communicate meteorological and hydrological information and potential impacts to internal and external users

# 4.1 **Competency description**

User requirements are fully understood and are addressed by communicating concise and complete forecasts and warnings in a manner that can be clearly understood by users.

# 4.2 **Performance Criteria**

- (a) Ensure that all forecast and warnings are disseminated through the authorized communication means and channels to designated user groups as specified in relevant standard operating procedures;
- (b) Explain meteorological/hydrological data and information, including uncertainties where required;
- (c) Deliver briefings and provide consultation to meet specific user needs as required.

#### 4.3 Background knowledge and skills

- Standards, procedures and dissemination methods for the presentation of forecast and warning information to the public across all relevant media, including impact information as required;
- (b) Knowledge of protocols for presenting warning information to emergency management partners, including information on likely impacts and mitigation activities if relevant;
- (c) An awareness of user's needs for, and use of, meteorological and/or hydrological information;
- (d) An awareness of the application of meteorology and hydrology to human activities and specific users.

#### 5. Ensure the quality of meteorological and hydrological information and services

#### 5.1 **Competency description**

The quality of meteorological and hydrological forecasts, warnings and related products is maintained, through the application of quality management systems processes where appropriate.

#### 5.2 **Performance Criteria**

- (a) Apply the organization's quality management system and procedures;
- (b) Validate meteorological and hydrological data, products, forecasts and warnings (timeliness, completeness, accuracy);
- (c) Assess the impacts of known error characteristics (bias, achievable accuracy of observations and sensing methods) ;
- (d) Monitor the functioning of operational systems and take contingency actions where appropriate;
- (e) Contribute to case studies and post reviews as required, including the assimilation of user feedback and impact information;
- (f) Mentor junior colleagues and provide support and advice as required.

# 5.3 Background knowledge and skills

- (a) Knowledge of standard operating procedures and also contingency procedures;
- (b) Knowledge of techniques and technology in common use in forecast offices;
- (c) Knowledge of validation and verification procedures relevant to meteorological and hydrological forecasts and warnings;
- (d) Understanding methods used in developing case studies and feedback to improve the quality of forecasts and warnings.

# Competency requirements for weather broadcasters and communicators

These competency requirements are for personnel who specialize in media work and routinely present weather information on radio or television, prepare material for weather websites and/ or social media, conduct media liaison and are active in education/outreach. They build upon,

and should be read in conjunction with the fundamental WMO competency requirements for personnel engaged in operational forecasting, although it is recognized that some people engaged in these activities may not come from a forecasting background.

The competency requirements for the work of personnel engaged in weather broadcasting and communication can be divided into four top level competencies. Taking into consideration the conditions (a) to (c) below:

- (a) The geographical areas of responsibility;
- (b) Meteorological and hydrological impacts on society;
- (c) Meteorological and hydrological user requirements, local procedures and priorities.

Weather broadcasters and communicators should be able to perform the work indicated in the top level competencies below:

- (a) Maintain awareness of the evolving meteorological and/or hydrological situation, updated forecasts and warnings, and impacts of anticipated conditions;
- (b) Assemble meteorological and hydrological information that meet user needs for communication and delivery;
- (c) Communicate meteorological and hydrological information and potential impacts via broadcast and other media;
- (d) Ensure the quality of meteorological and hydrological information and services.

Each of these top-level competencies is expanded into performance criteria that are expressed and structured in such a manner as to facilitate the clear application of assessment procedures. The competencies are built upon a range of Enabling Skills (such as skills and knowledge in Numerical Weather Prediction) and also Transferrable Skills (workplace skills which are not exclusive to meteorology, such as problem-solving and people-management). Each top-level competency is also associated with a range of background knowledge and skills which are essential to the discharge of the defined duties.

# 1. Maintain awareness of the evolving meteorological and/or hydrological situation, updated forecasts and warnings, and impacts of anticipated conditions

# 1.1 **Competency description**

Observations, forecasts, warnings and impacts of meteorological/hydrological parameters and significant meteorological/hydrological phenomena are continuously monitored to inform the content of weather broadcasts, disseminated products, briefings and other communications.

# 1.2 **Performance Criteria**

- (a) Monitor meteorological/hydrological parameters and evolving significant meteorological/ hydrological phenomena;
- (b) Monitor amendments to forecasts and updates of warnings;
- (c) Monitor information related to impacts of recent meteorological and hydrological events.

- (a) An understanding of the key elements of synoptic, dynamical, and physical meteorology;
- (b) An appreciation of the influence of topography, land cover, and (if relevant) bodies of water and/or snow fields on local meteorology;

- (c) Interpretation of in-situ and remote-sensed observations and data;
- (d) Knowledge of the routine dissemination schedule of forecasts and warnings from the meteorological service provider;
- (e) Knowledge of the thresholds and protocols associated with the issue of weather warnings by the relevant NMHSs;
- (f) Knowledge and understanding of the likely impacts on society of hazardous meteorological and hydrological phenomena.

# 2. Assemble meteorological and hydrological information that meet user needs for communication and delivery

#### 2.1 Competency description

Observations, forecasts, warnings and impacts of meteorological/hydrological parameters and significant meteorological/hydrological phenomena are assembled and synthesized into coherent narratives and products for dissemination to users.

#### 2.2 **Performance Criteria**

- (a) Articulate the weather story in a manner appropriate to the meteorological/hydrological situation, user expectations and needs;
- (b) Articulate the weather story in a manner appropriate to the communications medium employed;
- (c) Prepare graphics that visually support the communication of the meteorological/ hydrological story and situation;
- (d) Apply routine production protocols appropriate to the service provision environment.

#### 2.3 Background knowledge and skills

- (a) Knowledge of the range of users / audience who will access the weather communication;
- (b) Appreciation of the strengths and weaknesses of the communication medium employed;
- (c) Skills in oral and written language as appropriate to the communication medium employed;
- (d) Knowledge of, and skills, in the operation of the weather graphics software or other IT facilities used to prepare graphical images and IT related media for the communication of meteorological and hydrological information;
- (e) Knowledge of the function and operation of the different technological resources (PCs, servers, mixers, amplifiers, cameras etc.) commonly employed in weather broadcasting, where relevant.

# 3. Communicate meteorological and hydrological information and potential impacts via broadcast and other media.

# 3.1 **Competency description**

Observations, forecasts, warnings and impacts of meteorological/hydrological parameters and significant meteorological/hydrological phenomena are disseminated to users in a manner appropriate to the communications medium and to the needs of users.

# 3.2 **Performance Criteria**

- (a) Identify the key points in a weather story and/or high impact meteorological/hydrological hazards and develop these into a coherent narrative or presentation;
- (b) Explain and communicate the scope and limitations of forecasts and warnings, including the concept of forecast uncertainty, to users;
- (c) Present warnings of meteorological and hydrological hazards, including information on possible mitigating actions where appropriate;
- (d) Implement the "Single Authoritative Voice" concept in respect to warnings of severe weather and other public safety messages;
- (e) Create and deliver presentations on meteorological and hydrological topics to external agencies and to the public;
- (f) Deliver meteorological and hydrological information in accordance with broadcast schedules and/or other appropriate media protocols;
- (g) Develop and present new graphical representations of meteorological and hydrological information in alignment with editorial policy.

# 3.3 Background knowledge and skills

- (a) Knowledge of the likely impact of upcoming meteorological and hydrological events at different time scales, and skill in judging the relative importance of these;
- (b) Knowledge of the likely uncertainty attached to forecasts at different time scales;
- (c) Knowledge and understanding of the likely impacts on society of hazardous meteorological and hydrological phenomena;
- (d) Knowledge of the policies, procedures and criteria for issuing warnings;
- (e) Knowledge of the mitigating actions associated with the likely impacts of hazardous meteorological and hydrological phenomena;
- (f) Knowledge of the authoritative sources of meteorological, hydrological, impact and mitigating information relevant to hazardous phenomena;
- (g) Skill in the use of presentation and visualization software to support lectures, seminars and other public engagements;
- (h) Knowledge of broadcast schedules, deadlines and other appropriate media protocols.

# 4. Ensure the quality of meteorological and hydrological information and services

# 4.1 **Competency description**

The quality of meteorological and hydrological broadcasts and other communication products is maintained, by the application of approved quality management processes where appropriate.

# 4.2 **Performance Criteria**

- (a) Apply the organization's quality management system and procedures;
- (b) Apply agreed editorial policy to weather broadcasting and other meteorological and hydrological communications;

- (c) Ensure, insofar as possible, that all meteorological and hydrological information available to users is consistent, current and up-to-date;
- (d) Monitor and assess the effectiveness of the communication of meteorological and hydrological information through user-based metrics;
- (e) Develop improvements in the communication of meteorological and hydrological information based on user feedback;
- (f) Mentor junior colleagues and provide support and advice as required.

#### 4.3 Background knowledge and skills

- (a) Knowledge of standard operating procedures;
- (b) Knowledge of contingency procedures appropriate to system failure;
- (c) Knowledge of the editorial policy relevant to weather broadcasting and other meteorological and hydrological communications;
- (d) Knowledge of techniques and technology commonly used in the dissemination of meteorological and hydrological information;
- (e) Knowledge of the various user-based metrics relevant to the assessment of the effectiveness of communication of meteorological and hydrological information.

# Competency requirements for persons engaged in the development and delivery of meteorological and hydrological products and services

These competency requirements are primarily aimed at personnel who are engaged in the area of innovation, improvement, and delivery of meteorological and hydrological services and products. They should be read in conjunction with the competency requirements for personnel engaged in operational forecasting, although it is recognized that many people engaged in these aspects of work may not come from a forecasting background.

These competency requirements are divided into four top level competencies. Taking into consideration the conditions (a) to (c) below:

- (a) The nationally-defined PWS areas of responsibility;
- (b) Meteorological and hydrological impacts on society;
- (c) Meteorological and hydrological user requirements, local procedures and priorities.

Persons engaged in the development and delivery of meteorological and hydrological products and service should be competent to perform the tasks defined through the four top level competencies, as follows:

- (1) Maintain awareness of developments in technology, and science which facilitate the development and improvement of products and services to meet user requirements;
- (2) Develop applications, products and services that meet user requirements;
- (3) Develop and manage relationships with users and other stakeholders, in particular through providing documentation and delivering training on new products and services;
- (4) Ensure the quality of meteorological and hydrological information and services.

Each of these top-level competencies is expanded into performance criteria that are expressed and structured in such a manner as to facilitate the clear application of an assessment procedure. The competencies are built upon a range of Enabling Skills (such as skills and knowledge in Numerical Weather Prediction) and also Transferrable Skills (workplace skills which are not exclusive to meteorology, such as problem-solving and people-management). Each top-level competency is also associated with a range of background knowledge and skills which are essential to the discharge of the defined duties.

# 1. Maintain awareness of developments in technology and science which facilitate the development and improvement of services and products to meet user requirements.

# 1.1 *Competency description*

The needs of users for products based on meteorological and hydrological information is monitored, as are the available technologies and techniques relevant to the development of products and services and their dissemination.

# 1.2 **Performance Criteria**

- (a) Maintain awareness of users' current and future requirements for meteorological and hydrological products and services;
- (b) Maintain awareness of scientific developments supporting the development and improvement of meteorological and hydrological products and services;
- (c) Maintain awareness of developments in communication and information technologies, standards and protocols relevant to the creation and dissemination of meteorological and hydrological products and services.

# 1.3 Background knowledge and skills

- (a) An understanding of the key elements of synoptic, dynamical, and physical meteorology;
- (b) Knowledge of the range of available in-situ and remote-sensed observations and data;
- (c) Knowledge of meteorological and hydrological information available through Numerical Weather Prediction, statistical outputs and other appropriate sources, and of their potential value for users;
- (d) Knowledge of the relevant technologies available for the development of products based on meteorological and hydrological information, and their dissemination.

# 2. Develop applications, products and services that meet user requirements.

# 2.1 **Competency description**

Products and services based on meteorological and hydrological information are developed and improved in line with the needs of users and the capabilities of the available technologies and techniques.

# 2.2 **Performance Criteria**

- (a) Develop, test and implement applications and products, including relevant uncertainties, in support of user-focused services;
- (b) Develop applications for the visualization and display of meteorological and hydrological information, including forecast uncertainty;
- (c) Optimise systems used to produce and disseminate meteorological and hydrological products and services;

- (d) Implement changes to applications, products and services consequent on evolving user needs and/or changing technologies;
- (e) Document applications and products and their implementation processes to aid users and support maintenance and continuity of service.

#### 2.3 Background knowledge and skills

- (a) Knowledge of the range of users / audience who will access the meteorological and hydrological products, and of their requirements;
- (b) Knowledge of statistical methods and techniques commonly used in processing and visualizing meteorological and hydrological information;
- (c) Knowledge of the characteristics and capabilities of visualization and display systems used for meteorological and hydrological information;
- (d) Knowledge of probabilistic approaches to forecasting and representation (including especially graphical representation) of uncertainty in forecast products, such as those based on ensemble systems;
- (e) Knowledge of the characteristics and capabilities of the dissemination media employed;
- (f) Knowledge of and skill in the operation of IT facilities used to prepare graphical images for the communication of meteorological and hydrological information;
- (g) Knowledge of procedures for documenting and keeping record of software applications development.
- 3. Develop and manage relationships with users and other stakeholders, in particular through providing documentation and delivering training on new products and services.

#### 3.1 **Competency description**

Relationships with users are developed and maintained to support the ready identification of user needs and requirements and changes to these over time. Relationships with users are formalized through appropriate agreements where necessary.

# 3.2 **Performance Criteria**

- (a) Participate in the assessment of the needs of users, in collaboration with relevant experts;
- (b) Establish and maintain working relationships at operational and technical levels with users and other stakeholders;
- (c) Develop partnership agreements at operational and technical levels with users and other stakeholders;
- (d) Develop and make available adequate background documentation on new products and services;
- (e) Develop and deliver training to users and stakeholders on products and services as required.

# 3.3 Background knowledge and skills

(a) Knowledge of the methodologies for the understanding and development of user requirements;

- (b) Knowledge of the methodologies for the development of partnerships, memoranda of understanding, service level agreements etc. with users of meteorological and hydrological information and products;
- (c) Understanding of the operational systems and working priorities of relevant users;
- (d) Knowledge of the training methods and techniques appropriate to users and other stakeholders;
- (e) Understanding of the vulnerabilities of various users and how these may be impacted by meteorological and hydrological events.

# 4. Ensure the quality of meteorological and hydrological information and services

#### 4.1 **Competency description**

The quality of products and services based on meteorological and hydrological information is maintained, through the application of quality management systems processes where appropriate.

#### 4.2 **Performance Criteria**

- (a) Apply the organization's quality management system and procedures;
- (b) Support the implementation and ongoing validation of automated meteorological and hydrological products and services;
- (c) Support training in the access, use and interpretation of products and applications related to meteorological and hydrological services.

# 4.3 Background knowledge and skills

- (a) Knowledge of standard operating procedures;
- (b) Knowledge of contingency procedures appropriate to system failure;
- (c) Knowledge of techniques and technology commonly used in the dissemination of meteorological and hydrological information;
- (d) Knowledge of the various user-based metrics relevant to the accessibility and understanding of meteorological and hydrological information through products and applications;
- (e) Knowledge of procedures for documenting and keeping record of software applications development;
- (f) Knowledge of appropriate methods and techniques for user training.

# Competency requirements for pws advisors supporting disaster prevention and mitigation and other user activities

These competency requirements are for PWS advisors who work in the area of Disaster Prevention and Mitigation (DPM) and engagement with the Emergency Management (EM) community and other relevant users (such as those involved in health, transportation, energy, food safety). They build upon, and should be read in conjunction with, the fundamental WMO competency requirements for personnel engaged in operational forecasting, although it is recognized that some people engaged in liaison and outreach in EM may not come from a forecasting background. In such cases, the PWS Advisor needs to work closely with operational forecasters to develop the products and services indicated in the following sections, taking into consideration the conditions (a) to (c) below:

- (a) The nationally-defined PWS areas of responsibility;
- (b) Meteorological and hydrological impacts on society;
- (c) Meteorological and hydrological societal requirements, local procedures and priorities.

A PWS Advisor should be able to perform the work (in close association with the PWS forecaster if need be) indicated by the five top level competencies below:

- (1) Monitor continually the evolving meteorological and/or hydrological situation, updated forecasts and warnings, and impacts of anticipated conditions;
- (2) Develop and adopt procedures and services to meet user needs and facilitate impact assessments;
- (3) Develop and manage relationships with DPM users and other stakeholders;
- (4) Communicate meteorological and/or hydrological information and potential impacts to internal and external users and engage in outreach activities;
- (5) Ensure the quality of meteorological and hydrological information and services.

Each of these top-level competencies is expanded into performance criteria that are expressed and structured in such a manner as to facilitate the clear application of an assessment procedure. The competencies are built upon a range of Enabling Skills (such as skills and knowledge in Numerical Weather Prediction) and also Transferrable Skills (workplace skills which are not exclusive to meteorology, such as problem-solving and people-management). Each toplevel competency is also associated with a range of background knowledge and skills which are essential to the discharge of the defined duties.

# 1. Monitor continually the evolving meteorological and/or hydrological situation, updated forecasts and warnings, and impacts of anticipated conditions.

# 1.1 *Competency description*

Observations and forecasts of meteorological/hydrological parameters and significant meteorological/hydrological phenomena are continuously analysed and monitored, together with amendments/updates of forecasts and warnings, and assessments of the likely impacts of anticipated conditions are developed and updated as required.

# 1.2 **Performance Criteria**

- Monitor meteorological/hydrological parameters and evolving significant meteorological/ hydrological phenomena, and validate current forecast and warnings based on these parameters;
- (b) Monitor information relating to impacts of meteorological and hydrological events.

- (a) An understanding of the key elements of synoptic, dynamical, and physical meteorology and core analytical/diagnostic skills;
- (b) Application of the theory, methods and practices of meteorological and/or hydrological analysis and diagnosis;

- (c) The ability to visualize/conceptualize meteorological and/or hydrological information in multiple dimensions (spatial, temporal);
- (d) The appreciation of the influence of topography, land cover, and (if relevant) bodies of water and/or snow fields on local meteorology;
- (e) Interpretation of in-situ and remote-sensed observations and data;
- (f) Understanding of the characteristics of meteorological and hydrological sensors and instruments;
- (g) Familiarity with the acquisition, processing and assimilation of meteorological and hydrological data, including quality control;
- Understanding of procedures, standards and technical regulations regarding observations and forecast products;
- (i) Understanding of sector specific activities and vulnerabilities impacted by meteorological and hydrological events.

# 2. Develop procedures and services to meet user needs and facilitate impact assessments.

#### 2.1 **Competency description**

Procedures and services which facilitate impact assessment based on meteorological and hydrological information are developed and improved in line with the needs of users, making full use of impact modelling and other techniques where these are available

#### 2.2 **Performance Criteria**

- (a) Identify the meteorological and/or hydrological information requirements of the disaster management and civil protection community, and other users as required;
- (b) Tailor weather warning services for emergency management decision-makers and other users;
- (c) Ensure that warning dissemination schedules and related services meet the decisionmaking needs of emergency managers and other users;
- (d) Contribute to the development of very short-range forecasting and nowcasting services tailored to the emergency management community;
- (e) Contribute to the development of probabilistic forecast products tailored to the needs of disaster managers and other users;
- (f) Contribute to the development of impact-based forecast and warning products;
- (g) Apply new technology and scientific research in contributing to the development of Multi-Hazard Early Warning Systems (MHEWS).

- (a) Knowledge of meteorological and hydrological information, products and services available to support disaster management, the civil protection community and other users;
- (b) Knowledge of the methodologies for the understanding and development of user requirements;
- (c) Knowledge of risk assessments and how they apply to various sectors;

- (d) An understanding of how meteorological and hydrological risks may have an impact of various sectors as a function of vulnerability and exposure factors;
- (e) Skill in adapting usual meteorological and hydrological products and services into valueadded services for disaster management and other users;
- (f) Knowledge of the strengths and limitations of NWP models;
- (g) Knowledge of developments and innovations in Numerical Weather Prediction and how these may apply to meteorological and hydrological impact-based services.

# 3. Develop and manage relationships with DPM users and other stakeholders.

# 3.1 Competency description

Relationships with users in the Emergency Management and related communities are developed and maintained to support the ready identification of user needs and requirements and changes to these over time. Relationships with users are formalized through appropriate agreements where necessary.

# 3.2 **Performance Criteria**

- (a) Establish and maintain working relationships at strategic, operational and technical levels with the emergency management community;
- (b) Develop and implement partnership agreements at operational and technical levels with relevant agencies;
- (c) Build and maintain relationships with the media to facilitate communication of warnings and information prior to, during and after high impact meteorological and hydrological events;
- (d) Build and maintain relationships between the NMHS and relevant agencies to improve emergency planning, preparedness, and response to high impact meteorological and hydrological events, including specific urban needs where appropriate;
- (e) Contribute to the development of response advice and call-to-action statements based on the potential impact of hazards, in close coordination with relevant agencies as appropriate;
- (f) Participate in the assessment of the socioeconomic impact of meteorological and hydrological events, in collaboration with relevant experts.

- (a) Knowledge of the methodologies for the development of partnerships and memoranda of understanding;
- (b) Knowledge of meteorological and hydrological information, products and services available to support disaster management, the civil protection community and other users;
- (c) Understanding of the priorities and operational systems of relevant agencies;
- (d) Understanding of the principles of communication relating to the development of advice and statements addressing potential impacts of hazards;
- (e) Understanding of the vulnerabilities of various sectors and how these may be impacted by meteorological and hydrological events.
- 4. Communicate meteorological and hydrological information and potential impacts to internal and external users and engage in outreach activities.

# 4.1 *Competency description*

User requirements are fully understood and are addressed by communicating concise and relevant meteorological information and impact assessments in a manner that can be clearly understood by users. Preparedness of user communities is addressed through training and other outreach initiatives

# 4.2 **Performance Criteria**

- (a) Contribute to dissemination of warning information through utilization of current and emerging communication technologies;
- (b) Communicate meteorological and hydrological information to users, in particular disaster management decision-makers and media, including the scope and limitations of forecasts and warnings, the concept of forecast uncertainty, and information on potential impacts;
- (c) Contribute to the development of a communication strategy to ensure credibility of, and effective response to, warnings of high impact meteorological and hydrological events;
- (d) Promote community awareness and preparedness for high impact meteorological and hydrological events through public education and outreach.

# 4.3 Background knowledge and skills

- (a) Knowledge of protocols for presenting and communicating warning information to emergency management partners and media, including information on likely impacts and mitigation activities if relevant;
- (b) Knowledge of standards, procedures and dissemination platforms for the presentation of forecast and warning information to end users across all relevant media, including impact information as required;
- (c) Knowledge of the authoritative sources of meteorological, hydrological, impact and mitigating information relevant to hazardous phenomena;
- (d) An awareness of the application of meteorology and/or hydrology to human activities and to specific users;
- (e) An awareness of user's needs for, and use of, meteorological and/or hydrological information;
- (f) Awareness of social science research and findings relevant to the communication of warnings and impact-based meteorological and/or hydrological information;
- (g) An appreciation of the strengths and weaknesses of the communication media employed.

# 5. **Ensure the quality of information, services and procedures.**

# 5.1 *Competency description*

The quality of meteorological and hydrological forecasts, warnings, impact assessments, and related products is maintained, through the application of quality management systems processes where appropriate.

# 5.2 **Performance Criteria**

- (a) Apply the organization's quality management system and procedures;
- (b) Monitor and assess the effectiveness of warnings of high impact meteorological and hydrological events through user-based feedback;

- (c) Work with disaster management agencies and others to strengthen the role of NMHSs as the "Single Authoritative Voice" for warnings of high impact meteorological and hydrological events;
- (d) Contribute to the development of documentation and archiving systems for meteorological and hydrological hazard and impact data, including quality assurance and data management;
- (e) Collaborate with disaster management agencies and others in the development of postevents assessments of high impact meteorological and hydrological events;
- (f) Contribute to outreach and training initiatives particularly those relevant to DPM activities.

# 5.3 Background knowledge and skills

- (a) Knowledge of quality management system processes;
- (b) Knowledge of methodologies for the creation, delivery and assessment of user-feedback surveys;
- (c) Knowledge of documentation and archiving systems protocols;
- (d) Knowledge of verification processes;
- (e) Knowledge of operating and contingency procedures of NMHS and relevant agencies;
- (f) Understanding metrics and methods used in developing post assessments/case studies and verification.

# References

- Resolution 13 (EC-69) Amendment to the *Technical Regulations* (WMO-No. 49), Volume I General Meteorological Standards and Recommended Practices, Public Weather Services provisions.
- Joint Meeting of the Commission for Basic Systems Open Programme Area Group on Public Weather Service Delivery (CBS/OPAG-PWSD) Expert Teams (ETs) on Impact of Multi-Hazard Prediction And Communication (ET/IMPACT), and on Services and Products Innovation and Improvement (ET/SPII), Beijing, China, 2017.

# Annex 2 to Resolution 15 (EC-70)

# Amendments to Technical Regulations (WMO-No. 49), Volume I, Part V

# PART V. QUALIFICATIONS AND COMPETENCIES OF PERSONNEL INVOLVED IN THE PROVISION OF METEOROLOGICAL, HYDROLOGICAL AND CLIMATOLOGICAL SERVICES

# 1. QUALIFICATIONS AND COMPETENCIES

# 1.1 General

1.1.1 The qualifications and competencies required of personnel involved in the provision of <del>(operational)</del>-meteorological, hydrological, climatological and/or related services should be <del>as</del>described below, in established by Members in accordance with sections 1.2-1.5 Notes:

- 1. A specific qualification is typically acquired once and remains valid throughout a person's career.
- 2. Qualifications and competencies for personnel in additional service areas will be developed in due course and subsequently included in this chapter.

1.1.2 Members should keep records of the qualifications of all personnel involved in the provision of (operational) meteorological, hydrological, climatological and/or related services.

1.1.3 Members should decide, in light of their national circumstances, whether higher or more specific qualification requirements than those described below-in sections 1.2–1.8 should be established for certain categories of operational personnel.

1.1.4 Competency of <u>Members' personnel</u> should be demonstrated through job performance and assessed through competency assessment procedures, as appropriate.

Note: Guidance on competency <del>development and assessment</del>implementation procedures is provided in <u>Guide to</u> the Development and Implementation of Competency based Frameworksin Support of Meteorological, Hydrological and Climatological ServicesCompetency (inpreparationWMO-No. 1205).

1.1.5 Members should establish competency assessment programmes procedures for different categories of personnel; competency assessments should be repeated at regular intervals defined by the quality management practice of each Member.

1.1.6 Members should implement WMO global-level competencies y provisions for personnel taking due account of their local conditions, regulations, requirements and procedures.

Note: Top-level competencies only are included in the Technical Regulations, while more detailed second-level competencies are provided in additional guidance material, as noted. National adaptations of the WMO competencies will require careful consideration of the applicability of second-level information.

1.1.7 Members should ensure that their personnel undertake continuous professional development to maintain competence.

# 1.2 **Personnel providing aeronautical meteorological services**

# 1.2.1 *Qualifications*

<u>1.2.1.1</u> Members, taking into consideration the area and airspace of responsibility; the impact of meteorological phenomena and parameters on aviation operations; aviation user requirements; international regulations and local procedures and priorities, <u>should\_shall</u> ensure that an Aeronautical Meteorological Forecaster has successfully completed the Basic Instruction Package for Meteorologists as defined in Appendix A.

Note: This provision, which defines the required qualifications, will becomebecame a standardpractice on 1 December 2016.

<u>1.2.1.2</u> Members should decide whether their national circumstances require specific qualifications of Aeronautical Meteorological Observers.

# 1.2.2 *Competencies*

Note: See the Education & Training section at https://www.wmo.int/aemp/implementation \_areas for access to additional guidance, including second-level competency information. The competency standards for aeronautical meteorological personnel are maintained by the Commission for Aeronautical Meteorology.

# 1.2.2.1 Aeronautical Meteorological Forecaster

Members shall ensure that for the area and airspace of responsibility, given the impact of meteorological phenomena and parameters on aviation operations, and in compliance with aviation user requirements, international regulations and local procedures and priorities, an Aeronautical Meteorological Forecaster is able to:

- (a) Analyse and monitor continually the weather situation;
- (b) Forecast aeronautical meteorological phenomena and parameters;
- (c) Warn of hazardous phenomena;
- (d) Ensure the quality of meteorological information and services;
- (e) Communicate meteorological information to internal and external users.

# 1.2.2.2 Aeronautical Meteorological Observer

Members shall ensure that for the area and airspace of responsibility, given the impact of meteorological phenomena and parameters on aviation operations, and in compliance with aviation user requirements, international regulations and local procedures and priorities, an Aeronautical Meteorological Observer is able to:

- (a) Monitor continually the weather situation;
- (b) Observe and record aeronautical meteorological phenomena and parameters;
- (c) Ensure the quality of system performance and of meteorological information;
- (d) Communicate meteorological information to internal and external users.

# 1.3 **Personnel providing education and training for meteorological, hydrological and climate services**

# 1.3.1 *Qualifications*

Members should define, in light of their national circumstances, the specific qualifications required of personnel providing education and training in meteorology, hydrology and climatology.

# 1.3.2 *Competencies*

Note: See *Guidelines for Trainers in Meteorological, Hydrological and Climate Services* (WMO-No. 1114) for additional guidance, including second-level competency information. The Competency Standards for Providers of Education and Training for Meteorological, Hydrological and Climate Services (March, 2014) are maintained by the Executive Council Panel of Experts on Education and Training.

Members should ensure that institutions providing education and training for meteorological, hydrological and climate services have the personnel and resources to:

- (a) Analyse the organizational context and manage the training processes;
- (b) Identify learning needs and specify learning outcomes;
- (c) Determine a learning solution;
- (d) Design and develop learning activities and resources;

- (e) Deliver training and manage the learning event;
- (f) Assess learning and evaluate the learning process.

Note: The performance criteria and knowledge requirements that support the competencies should be customized based on the particular context of an organization.

# 1.4 **Personnel supporting the WMO Information System**

# 1.4.1 **Qualifications**

Members should define, in light of their national circumstances, the specific qualifications required of personnel supporting the WMO Information System.

# 1.4.2 *Competencies*

Note: The competency framework for personnel supporting the WMO Information System, including second-level information, can be found in the Manual on the WMO Information System (WMO-No. 1060), Appendix E, and in the Guide to the WMO Information System (WMO-No. 1061). The competency standards for WMO Information System personnel are maintained by the Commission for Basic Systems.

The provision of WIS services within a National Meteorological and Hydrological Service (NMHS) or related services might be accomplished by a variety of skilled personnel, including project managers, engineers, technicians and information technology staff. Third party organizations, such as universities, international and regional institutions and centres, private sector companies and other providers, might also supply data, products and information for the WIS service(s).

Members should ensure that institutions providing WIS services have the personnel and resources to:

- (a) Manage the physical infrastructure
- (b) Manage the operational applications
- (c) Manage the data flow
- (d) Manage data discovery
- (e) Manage interaction among WIS centres
- (f) Manage external user interactions
- (g) Manage the operational service

# 1.5 **Personnel providing climate services**

# 1.5.1 **Qualifications**

Members should define, in light of their national circumstances, the specific qualifications required of personnel providing climate services.

# 1.5.2 *Competencies*

Note: See the Guidelines for Assessment of Competencies for Provision of Climate Services (in preparation) for additional guidance, including second-level competency information. The competency standards for Climate Services provision are maintained by the Commission for Climatology. In a given institution, the list of the competencies to be met and the associated performance criteria would be determined by its infrastructural capacity. Competencies falling in the areas of quality of climate information and services as well as communication of climatological information to users are considered cross-cutting and should be met, at least at basic levels, by all institutions providing climate services.

Note: The competency framework is conditioned by:

- (a) The organizational mission and priorities, and stakeholder requirements.
- (b) The way in which internal and external personnel are engaged in the provision of climate services.
- (c) The available resources and capabilities (financial, human and technical).
- (d) National and institutional legislation, rules, organizational structure, policies and procedures.
- (e) WMO guidelines, policies and procedures for climate data and products.
- (f) The dominant weather and climate influences, and extremes experienced.
- 1.5.2.1 Competencies and associated performance criteria:

Competency 1: (a) Creating and managing climate data sets

Climate data and metadata and climate data products shall be gathered and stored in datasets, quality controlled and assessed for homogeneity. Hence staff shall:

(a) Conduct climate data preservation and rescue procedures;

(b) Assess the location and characteristics of the observation sites against the requirementsfor a climate observation reference network;

(c) Collect and store climate data and metadata in relational databases;

- (d) Apply quality control processes to climate data and resulting time series
- (e) Assess climate data homogeneity and adjust inhomogeneous time series;
- (f) Create, archive and document climate datasets;

Apply spatial and temporal interpolation to ensure data continuity.

Competency 2: (b) Deriving products from climate data

Climate data products for science and user applications are derived from different sources of climate data (such as observed and reconstructed time series, reanalysis, satellite and modelled data) applying statistics which describe their spatial and temporal characteristics. Staff should:

(a) Identify and retrieve climate data from different sources to generate climate products;

(b) Compute basic climate products, normals and averages, or anomalies defined relative to a reference period;

(c) Compute climate indices for monitoring climate change, climate variability and climate extremes;

(d) Compute sector specific climate indices and other sector oriented climate products;

(e) Apply statistical and geo-statistical analysis to monitor the spatial distribution and temporal evolution of climate;

(f) Create value added products such as graphics, maps and reports to explain climate characteristics and evolution, according to the needs of specific sectors such as health, agriculture, water, energy and disaster management.

Competency 3: (c) Creating and/or interpreting climate forecasts, climate projections and model output

Climate data, climate data products and climate model outputs are operated and used to create sub-seasonal and seasonal climate forecasts and future climate projections. Staff should:

(a) Locate, select and retrieve climate forecasts and climate model outputs generated by Regional Climate Centres, Global Producing Centres and other institutions;

(b) Create sub-seasonal, seasonal and longer-scale forecast products;

(c) Create future climate projections using climate models in a selected domain for differentscenarios and parametrization;

(d) Apply statistical and geo-statistical analysis, including downscaling, to monitor the spatial distribution and temporal evolution of model outputs;

(e) Evaluate the performance of climate model outputs and quantify the associated uncertainties;

(f) Create value-added products, such as graphics, maps and reports to communicate climate forecasts and climate model information to users.

Competency 4: (d) Ensuring the quality of climate information and services

Climate information and services should be defined and routinely updated. Best practices should be followed and/or guidelines and quality management procedures for climate information should be created and routinely maintained. Monitoring processes of climate services should be documented and used in quality control activities. Hence the institution's management should:

(a) Create and apply quality management processes and procedures for climate services;

Recruit competent personnel and organize the workforce so that it can develop and deliverclimate services;

(b) Ensure that the infrastructural capacity of the institution meets the requirements of the competency framework and that there is a strategy for sustainable capabilities;

(c) Provide training to staff so that they can fulfil their job requirements and expand their capabilities;

(d) Define and implement a catalogue of climate datasets, products and services to meet user requirements at the national/regional level;

<del>(e)</del>—

(f) Monitor the functions of climate services, including validation of data, products and services;

<del>(g)</del>—

(h) Evaluate the impacts and benefits for customers of climate services, by gathering customers' comments, suggestions and complaints;

<del>(i)</del>

(j) Make decisions for service improvement based on evaluation results;

<del>(k)</del>

(I) Build partnerships with science and service providers and end users to improve productsand service delivery.

<del>(m)</del>

Competency 5: (e) Communicating climatological information to users

Climate science, data and products should be communicated to policymakers, stakeholders and the general public. The institution's management should:

- (a) Prioritize the communication of climatological information according to social, political and economic relevance;
- (b) Establish effective communication channels with users of climate services and buildoutreach capacities, such as Regional Climate Outlook Forums;
- (c) Conduct analyses of customer needs on a regular basis and evaluate the results;
- (d) Review climate services and their communication strategy on the basis of user feedback;
- (e) Formulate and deliver, in partnership with users, specific applications to facilitate understanding and use of climate products and services;
- (f) Comply with the interfacing requirements of the GFCS and the WMO Information System.

# 1.6 **Personnel providing marine meteorological services (in preparation)**

# 1.6.1 **Qualifications**

Members should define, in light of their national circumstances, the specific qualificationsrequired of personnel providing climatemarine meteorological services. Members should ensure that a Marine Weather Forecaster has successfully completed the Basic Instruction Package for Meteorologists as defined in Appendix A.

# 1.6.2 *Competencies*

Note: See the WMO Marine Weather Forecaster Competence Standards Framework on the JCOMM website at https://www.jcomm.info/index.php?option=com\_oe&task= viewDocumentRecord&docID=13093 for additional guidance, including second-level competency information. The competency standards for Marine Weather Forecasters are maintained by the WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology.

Members should ensure that for the given area of responsibility, in consideration of the impact of meteorological phenomena, variables and parameters on marine operations, and in compliance with marine user requirements, international regulations, local procedures and priorities, a Marine Weather Forecaster is able to:

- (a) Analyse and monitor continually the marine weather situation;
- (b) Forecast marine weather phenomena, variables and parameters;
- (c) Warn of hazardous marine meteorological phenomena;
- (d) Ensure the quality of marine meteorological information and services;
- (e) Communicate marine meteorological information to internal and external users.

# 1.7 **Personnel providing public weather services**

# 1.7.1 **Qualifications**

A PWS Forecaster should have successfully completed the Basic Instructional Package for Meteorologists (BIP-M) as defined in Appendix A.

# 1.7.2 *Competencies*

Note: See EC-70/INF. 5.1 for additional guidance, including second-level competency information. The Competency Standards for Public Weather Services Delivery are maintained by the Commission for Basic Systems.

# 1.7.2.1 *Public Weather Forecaster*

Members should ensure that for the nationally-defined PWS areas of responsibility, meteorological and hydrological impacts on society, and meteorological and hydrological user requirements, local procedures and priorities, a Public Weather Forecaster is able to:

- (a) Analyse and monitor continually the evolving meteorological and/or hydrological situation;
- (b) Forecast meteorological and hydrological phenomena and parameters;
- (c) Warn of hazardous meteorological and hydrological phenomena;
- (d) Communicate meteorological and hydrological information to internal and external users; and
- (e) Ensure the quality of meteorological and hydrological information and services.

# 1.7.2.2 Public Weather broadcasters and communicators

Members should ensure that for the geographical areas of responsibility, meteorological and hydrological impacts on society, and meteorological and hydrological user requirements, local procedures and priorities, a Public Weather broadcasters and communicators is able to:

- (a) <u>Maintain awareness of the evolving meteorological and/or hydrological situation, updated</u> forecasts and warnings, and impacts of anticipated conditions;
- (b) Assemble meteorological and hydrological information that meet user needs for communication and delivery;
- (c) Communicate meteorological and hydrological information and potential impacts via broadcast and other media;
- (d) Ensure the quality of meteorological and hydrological information and services.

# 1.7.2.3 Persons engaged in the development and delivery of meteorological and hydrological products and services

Members should ensure that for the nationally-defined areas of responsibility, meteorological and hydrological impacts on society, and meteorological and hydrological user requirements, local procedures and priorities, a person engaged in the development and delivery of meteorological and hydrological products and services is able to:

- (a) Maintain awareness of developments in technology, and science which facilitate the development and improvement of products and services to meet user requirements;
- (b) Develop applications, products and services that meet user requirements;

- (c) Develop and manage relationships with users and other stakeholders, in particular through providing documentation and delivering training on new products and services;
- (d) Ensure the quality of meteorological and hydrological information and services.

# 1.7.2.4 *PWS advisor supporting disaster prevention and mitigation and other user services*

Members should ensure that for the nationally-defined PWS areas of responsibility, meteorological and hydrological impacts on society, and meteorological and hydrological societal requirements, local procedures and priorities, a PWS advisor supporting disaster prevention and mitigation and other user services is able to:

- (a) Monitor continually the evolving meteorological and/or hydrological situation, updated forecasts and warnings, and impacts of anticipated conditions;
- (b) Develop and adopt procedures and services to meet user needs and facilitate impact assessments;
- (c) Develop and manage relationships with DPM users and other stakeholders;
- (d) Communicate meteorological and/or hydrological information and potential impacts to internal and external users and engage in outreach activities
- (e) Ensure the quality of meteorological and hydrological information and services.

# 1.8 Personnel responsible for instruments, observations, and observing programmes and networks

# 1.8.1 *Qualifications*

Members should define, in light of their national circumstances, the specific qualifications required of personnel performing meteorological observations, installing, maintaining and calibrating instrumentation, and managing observing programmes and networks.

# 1.8.2 *Competencies*

Note: See the Guide to Instruments and Methods of Observation (WMO-No. 8), Volume V, Chapter 5 for additional guidance, including second-level competency information. The Competency Standards for Personnel Performing Meteorological Observations, Installing and Maintaining Instrumentation, Performing Instrument Calibrations, and Managing Observing Programmes and Networks are maintained by the Commission for Instruments and Methods of Observation, in case of the last standard, in consultation with the Commission for Basic Systems.

# 1.8.2.1 Personnel performing meteorological observations

1.8.2.1.1 Members should ensure that institutions providing meteorological observations have the personnel and resources to:

- (a) Monitor the meteorological situation;
- (b) Perform a surface observation;
- (c) Perform a balloon-borne upper air observation;
- (d) Utilize remote sensing technology in making observations;
- (e) Monitor the performance of instruments and systems;
- (f) Maintain the quality of observational information;

- (g) Maintain a safe work environment.
- 1.8.2.2 Personnel installing and maintaining instrumentation

1.8.2.2.1 Members should ensure that institutions installing and maintaining instrumentation have the personnel and resources to:

- (a) Install instruments and communications systems;
- (b) Maintain instrument and system performance;
- (c) Diagnose faults;
- (d) Repair faulty instruments and systems;
- (e) Maintain a safe work environment.
- 1.8.2.3 Personnel performing instrument calibrations

1.8.2.3.1 Members should ensure that institutions providing instrument calibration services have the personnel and resources to:

- (a) Calibrate instruments;
- (b) Check instrument performance;
- (c) Manage the laboratory work programme;
- (d) Manage the laboratory infrastructure;
- (e) Develop and maintain Standard Operating Procedures;
- (f) Manage the data and record archival#;
- (g) Maintain a safe work environment and laboratory security.

Note: \_#The meaning of the term "archival" in this context is the function of storing, keeping secure, and ensuring discoverability, accessibility and retrievability of data and information.

1.8.2.4 *Personnel managing observing programmes and networks* 

1.8.2.4.1 Members should ensure that institutions managing observing programmes and networks have the personnel and resources to:

- (a) Plan the observing programme;
- (b) Procure equipment;
- (c) Select and acquire sites;
- (d) Install network components;
- (e) Manage the network operation;
- (f) Manage the observing programme.

# Resolution 16 (EC-70)

# Guidance on ongoing hydrology and water resources initiatives

THE EXECUTIVE COUNCIL,

# Recalling:

- (1) Resolution 21 (Cg-XV) Strategy for the enhancement of cooperation between National Meteorological and National Hydrological Services for improved flood forecasting,
- (2) Resolution 15 (Cg-XVI) Establishment of an Advisory Group for the WMO Flood Forecasting Initiative,
- (3) Decision 5 (EC-69) Flood forecasting,
- (4) Decision 49 (EC-69) WMO priority actions in hydrology and water resources management,

**Recalling also** that the objective of the WMO Flood Forecasting Initiative (FFI) is to "Improve the capacity of meteorological and hydrological services to jointly deliver timely and more accurate products and services required in flood forecasting and warning and in collaborating with disaster managers, active in flood emergency preparedness and response" (cited from the Strategy and Action Plan for the Enhancement of Cooperation between National Meteorological and Hydrological Services for Improved Flood Forecasting – http://www.wmo.int/pages/prog/ hwrp/documents/FFInitiativePlan.pdf),

# Considering:

- (1) That the FFI Advisory Group (FFI-AG) at its third meeting in December 2017, as documented in its report:
  - (a) Noted the outcome of the recent independent review of the Associated Programme on Flood Management and the agreement of the Commission for Hydrology (CHy) at its fifteenth session and the Joint WMO/IOC Technical Commission on Oceanography and Marine Meteorology (JCOMM) at its fifth session to undertake an independent review of the Coastal Inundation Flood Demonstration Project (CIFDP) (see Resolution 12 (EC-70)), and, in so doing, recommended that the Commission for Basic Systems (CBS) and CHy be engaged to undertake an independent review of the Flash Flood Guidance System (FFGS) with global coverage,
  - (b) Recommended an independent review be undertaken of the Severe Weather Forecast Demonstration Project (SWFDP),
  - (c) Recommended the results of all three reviews be made available to FFI-AG to allow their full consideration prior to the Eighteenth World Meteorological Congress,
- (2) That the CBS Management Group (March 2018) decided to perform the overall review of the SWFDP (see Resolution 1 (EC-70),
- (3) That the Executive Council Working Group on Disaster Risk Reduction met in April 2018 and recommended (see Resolution 1 (EC-70)),
  - (a) An overall independent review of FFGS, CIFDP and SWFDP,
  - (b) That following the review of these projects, a consolidated approach be developed jointly by the presidents of CBS, CHy and JCOMM to ensure SWFDP, CIFDP and FFGS can provide efficient, sustainable services related to hazardous weather, water and climate,

**Acknowledging** that these projects are mainly funded through extrabudgetary resources and that resource mobilization and their sustainability have always been a challenge, both in terms of funding and in the provision of adequate human resources for coordination,

**Noting** progress made by the WMO Hydrological Status and Outlook System (HydroSOS), attained in part through two planning meetings leading to a detailed work programme that will result in a system capable of identifying cases where current and forecasted hydrological conditions could be significantly different from a normal situation, indicating the potential for drought and flood, and that these efforts will support the development of a joint report of the state of the global climate and its hydrological status,

**Noting also** progress made by the Global Hydrometry Support Facility (WMO HydroHub), aiming at improving the World Hydrological Cycle Observing System, WMO Hydrological Observing System and other hydrometry-related activities, including hydrological data-sharing, by developing sustainable and innovative approaches for efficient hydrological observations by National Meteorological and Hydrological Services and their partners,

**Endorses** the recommendations of FFI-AG mentioned above, as they will improve the flood forecasting capabilities of WMO Members and thus contribute to establishing a solid foundation for multi-hazard early warning systems in their territories;

#### Requests the president of CHy:

- To coordinate, with the presidents of CBS and JCOMM, the independent technical reviews of CIFDP, FFGS and SWFDP, including the development of a consolidated approach to ensure efficient sustainable services related to hazardous weather, climate and water, and that FFI-AG, through its Chairperson, report on the reviews to Congress;
- (2) To coordinate, with the presidents of CBS and the Commission for Climatology, as well as the WMO research community, the development and implementation of HydroSOS and the report on the state of the water resources;

#### **Requests** the Secretary-General:

- (1) To ensure that SWFDP and flood forecasting activities that include coastal inundation complement each other wherever possible;
- (2) To take the necessary steps to secure funding to undertake the independent technical reviews of CIFDP, FFGS and SWFDP together with the development of the consolidated approach of these to ensure provision of sustainable services;
- (3) To take the necessary steps to mobilize extrabudgetary resources for the development and implementation of HydroSOS and the state of the water resources report;

#### **Invites** Members:

- To express their needs and identified gaps in hydrological data collection, measuring technology, data interpretation tools and hydrological information systems that could be addressed by WMO HydroHub;
- (2) To contribute expertise and financial resources for the development and implementation of HydroSOS.

# Resolution 17 (EC-70)

# Implementation Plan of WMO Hydrological Observing System phase II

# Noting:

- (1) That WMO Hydrological Observing System (WHOS) phase II, as decided by the Commission for Hydrology (CHy) at its fifteenth session and endorsed by the Executive Council at its sixty-ninth session, aims at providing a fully WMO Information System (WIS)-compliant services-oriented framework linking hydrologic data providers and users through a hydrologic information system enabling data registration, discovery and access,
- (2) That WHOS, its operations and procedures for those centres contributing to it, are described in the *Manual on the WMO Integrated Global Observing System* (WMO-No. 1160),
- (3) That the hydrological data from WHOS need to be available to the broader WMO and partner community,
- (4) That the initial WHOS implementation plan was developed by the Advisory Working Group of the Commission of Hydrology, as requested by CHy at its fifteenth session,
- (5) That the report on the evolving role of the global hydrological data centres requested by the Seventeenth World Meteorological Congress will take into consideration WHOS requirements and governing principles,
- (6) The additional benefit that the future development of WHOS can derive from the World Water Data Initiative, now under the aegis of WMO (see Resolution 18 (EC-70)),

**Endorses** the initial Implementation Plan for WHOS phase II, the table of contents of which is included in the annex to the present resolution, including its governance and architecture, which are compliant with the WMO Integrated Global Observing System (WIGOS), WIS and the Global Data-processing and Forecasting System (GDPFS) programmes;

**Decides** that the procedures and governance for data provision from national and data collection centres, as described for National Centres and Data Collection or Production Centres in the *Manual on the WMO Information System* (WMO-No. 1060) are applicable and sufficient for authorizing WHOS centre(s) to make their data available through WIS;

**Requests** the Secretary-General to support the work of CHy in this activity and its coordination with GDPFS, WIGOS and WIS.

# Annex to Resolution 17 (EC-70)

# WHOS phase II – Initial Implementation Plan

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#### Resolution 18 (EC-70)

# Outcomes of the special dialogue on water

THE EXECUTIVE COUNCIL,

Having convened the Special Dialogue on Water on 25 June 2018,

**Noting** the outcomes of the dialogue, a summary of which is included in Annex 1, which encouraged WMO to take a stronger role in the evolving global water agenda to realize opportunities and benefits to Members,

Noting also the considerations underway as encapsulated in Recommendation 25 (EC-70),

**Urges** the president of the Commission on Hydrology (CHy) to convene an extraordinary session of CHy as soon as possible (December 2018) in Geneva to lay out the path forward with regard to the major WMO developments in hydrology and to propose the necessary organizational arrangements for the hydrological community to deliver on relevant strategic objectives defined in the WMO Strategic Plan;

**Decides** to establish an Executive Council Task Force on Water led by Mr A. Snorrason with the terms of reference given in Annex 2 to the present resolution;

Requests the Secretary-General to allocate resources and organize the session;

Invites Members to support the extraordinary session of CHy with voluntary contributions;

**Accepts** the offer of the Government of Australia to transfer the leadership of the World Water Data Initiative (WWDI), established under the High Level Panel on Water (convened by the United Nations Secretary-General and the President of the World Bank Group), to WMO, and expresses its thanks to the Government of Australia for the trust in WMO this gesture shows;

**Requests** the president of CHy to integrate WWDI into the CHy programme of work;

**Endorses** the statement of the 2018 WMO HydroConference: Prosperity through Hydrological Services (Geneva, 7–9 May);

**Requests** CHy to take a leading role, in consultation with the Commission for Basic Systems and the Commission for Atmospheric Sciences, in organizing the follow-up efforts to advance the complete hydrological value chain, in particular efforts related to operational hydrology.

# Annex 1 to Resolution 18 (EC-70)

# Summary of the debates held during the special dialogue on water

During the breakout group segment of the Special Dialogue on Water held at EC-70 on 25 June 2018, the following were the common recommendations emanating from the three groups:

- The main priorities to achieve Strategic Objective 1.3 of the WMO Strategic Plan are to support and expand with new technologies the operation of observational hydrological networks and to enhance the capacity of Members to sustain such operation;
- The promotion of and assistance to hydrological data exchange should be strengthened;
- There is a need to understand the culture of decision making, with the assistance of social science, to better define what is required in terms of hydrological services;
- The issue of optimal institutional arrangements should be approached in layers, from subnational to global. At regional level, coordination with regional entities is needed as well as an analysis of how hydrology should be addressed by existing or new WMO regional centres. At national level, it is difficult to find a one size fits all solution, but Integrated Water Resources Management is the concept to follow;
- The traditional engagement of NHSs with WMO should not be lost as a consequence of the ongoing governance changes. An effort shall be made to strengthen the representation of hydrologists in the governance of WMO;
- WMO should build on its achievements in transboundary cooperation with projects such as WHYCOS, WHOS, FFGS, HydroSoS;
- WMO should strengthen its existing partnership under the umbrella of UN-Water.

# Annex 2 to Resolution 18 (EC-70)

# **Executive Council Task Force on Water**

# **TERMS OF REFERENCE**

In order to strengthen the essential role of hydrology in WMO and its further integration into the Earth system approach, and to enhance WMO critical contribution in global water agenda, the Working Group shall develop, in coordination with EC WG SOP, recommendations to the Congress to be submitted through the President of WMO, regarding:

- (1) The unique contribution that WMO can make to the delivery of hydrological services, considering the complete value chain, in line with the WMO Strategic Plan and Operational Plan and global water agenda, based on the outcomes of the WMO HydroConference, the EC-70 Special Dialogue on Water as well as the deliberations of the extraordinary session of CHy;
- (2) Vision and strategy for the future effective and fit-for-purpose hydrological services delivery; and
- (3) Mechanisms for high-level engagement with partners and stakeholders, including UN-Water.

The Task Force on Water, chaired by Dr A. Snorrason will comprise the President of CAS, the President of CHy, two (2) EC members engaged in both hydrological and meteorological service delivery, two (2) Regional Hydrological Advisors, two (2) leading technical and service experts in hydrology and water resources appointed by the Executive Council members, in consultation with Regional Hydrological Advisors, NHSs and the President of CHy. The Task Force will work virtually to the extent possible.

# **Resolution 19 (EC-70)**

# Guide to the WMO Integrated Global Observing System (WMO-No. 1165)

THE EXECUTIVE COUNCIL,

# **Recalling:**

- Resolution 2 (EC-68) Plan for the WMO Integrated Global Observing System preoperational phase 2016–2019,
- (2) Resolution 2 (EC-69) Initial version of the Guide to the WMO Integrated Global Observing System,

- (3) Decision 30 (EC-69) Guidance on establishing Regional WMO Integrated Global Observing System Centres in pilot phase,
- (4) Decision 31 (EC-69) Indicators for monitoring progress in the WMO Integrated Global Observing System national implementation,

Acknowledging with appreciation the development of further guidance material by the Intercommission Coordination Group on the WMO Integrated Global Observing System (WIGOS), in accordance with Resolution 2 (EC-69), namely "Guidance on the national WIGOS implementation", "Guidance on WIGOS data partnerships" (the executive summary of which is provided in the annex to the present resolution), "Guidance on establishing a Regional WMO Integrated Global Observing System Centre in pilot phase" and "Technical guidelines for Regional WIGOS Centres (RWCs) on the WIGOS Data Quality Monitoring System (WDQMS) for surface-based stations of the Global Observing System (GOS)" (see http://www.wmo.int/pages/ prog/www/wigos/WGM-2018.html; and for more information http://www.wmo.int/pages/prog/ www/wigos/tools.html),

**Having considered** the draft update of the Guide proposed by the Intercommission Coordination Group on WIGOS (http://www.wmo.int/pages/prog/www/wigos/WGM-2018.html),

Decides to adopt the updated Guide with effect from 1 October 2018;

# **Requests** the Secretary-General:

- (1) To publish the updated *Guide to the WMO Integrated Global Observing System* in all WMO official languages;
- (2) To ensure the editorial consistency of the relevant documents;

**Requests** the Intercommission Coordination Group on WIGOS to further develop and enhance the Guide with additional material as it becomes available in accordance with Resolution 2 (EC-68);

## Invites Members:

- (1) To use the Guide in their implementation of the relevant Technical Regulations;
- (2) To provide feedback to the Secretary-General on how to improve subsequent versions of the Guide.

**Note:** The present resolution replaces Resolution 2 (EC-69), which is no longer in force.

# Annex to Resolution 19 (EC-70)

# **Guidance on WIGOS data partnerships**

# **Executive Summary**

The WMO Integrated Global Observing System, WIGOS, is designed to manage and coordinate the acquisition of observations of all relevant physical domains, from a diversity of surfaceand space-based observing systems, by a variety of entities. The overall aim is to provide an integrated, composite set of observations accessible to a broad user community as a basis for products and services in a wide range of operational and scientific application areas related to weather, climate, water and the atmospheric environment. The implementation of WIGOS is initially focused on the integration of existing WMO observing systems, which are predominantly, although not exclusively, operated by National Meteorological and Hydrological Services and their established partners. However, WIGOS also encourages and enables the integration of observations from other (non-NMHS) partners such as other governmental and non-governmental organizations, research institutes, volunteer networks, private sector entities, and individual citizens.

It is well known that earth system observations of potential value to the WMO community are already now being collected by such external entities, but thus far their incorporation into the WMO observing systems has been constrained by the lack of an integrating framework and by a variety of technical and regulatory barriers. WIGOS now offers the framework and tools to allow for these observations to be integrated and to more effectively contribute to national and global interests.

The purpose of this document is to provide guidance on how to integrate observations from non-NMHS sources into WIGOS. It addresses the mutual benefits of data sharing and the challenges associated with such integration. It also highlights the roles and expectations of NMHSs in encouraging and facilitating the integration process.

While primarily intended to support NMHSs in their national implementation of WIGOS, this document is relevant to both NMHS and non-NMHS audiences.

Sections 3 and 4 are intended primarily for Permanent Representatives to WMO, NMHS Directors, and Senior Managers in their roles as the national promoters and implementers of WIGOS within their Member state or territory. These sections provide the Principles and General Guidance in establishing and maintaining partnerships with operators of observing systems. These principles are also of relevance to non-NMHS organizations considering a data partnership with their NMHS.

Section 5 is intended primarily for NMHS Observing System Managers in their role as technical leads and facilitators of the national WIGOS implementation. This section provides Technical Guidance on how to integrate observational data from other sources in compliance with the Manual on WIGOS (WMO-No. 1160). This section is also of relevance to technical managers from non-NMHS organizations in order to understand the technical implications of sharing their observational data with a NMHS.

# Resolution 20 (EC-70)

# **Publication of the SATCOM Handbook**

# THE EXECUTIVE COUNCIL,

**Recalling** Resolution 31 (Cg-17) – Report of the extraordinary session (2014) of the Commission for Basic Systems relevant to centres and networks of the WMO Information System, which established the WMO–Intergovernmental Oceanographic Commission International Forum of Users of Satellite Data Telecommunication Systems (SATCOM User Forum) to facilitate access to satellite data telecommunication,

# Noting that:

- The SATCOM User Forum has developed the Satellite Data Telecommunication Handbook (SATCOM Handbook) to assist Members in procuring and using satellite data telecommunication,
- (2) The SATCOM Handbook has been presented to the Commission for Basic Systems Technical Conference, held from 26 to 29 March 2018,

# **Decides:**

- (1) To publish as a stand-alone attachment to the *Guide to the WMO Information System* (WMO-No. 1061) the SATCOM Handbook (https://wis.wmo.int/SATCOM-Handbook);
- (2) To designate the whole SATCOM Handbook as technical specifications and authorize the fast track (simple) procedure to be used to amend the it;
- (3) To amend the text of the *Guide to the WMO Information System* as indicated in the annex to the present resolution;

**Authorizes** the Secretary-General to make editorial amendments to the SATCOM Handbook and consequential editorial amendments to the *Guide to the WMO Information System*;

**Encourages** Members to refer to the SATCOM Handbook when considering the use of satellite data telecommunication.

# Annex to Resolution 20 (EC-70)

# Text to refer to the SATCOM Handbook in the *Guide to the WMO Information System* (WMO-No. 1061)

Add the following text in Part I of the WMO-No. 1061 *Guide to the WMO Information System*:

1.7.6Guidance on the use of satellite telecommunication systems is provided in the document SATCOM Handbook (WMO-No. xxx; https://wis.wmo.int/SATCOM-Handbook) that is an Attachment to this Guide.

# Resolution 21 (EC-70)

# Amendment to the Manual on the Global Telecommunication System (WMO-No. 386)

THE EXECUTIVE COUNCIL,

**Recalling** that Recommendation 18 (CBS-16) – Amendments to the *Manual on the Global Telecommunication System* (WMO-No. 386) and its attachments, Annex 2, concerning the description of connectivity of the Global Telecommunication System with the WMO Information System, was not endorsed by the Executive Council at its sixty-ninth session,

**Noting** that the Commission for Basic Systems (CBS) Management Group met on 29 March 2018 and recommended modified text following discussions during the CBS Technical Conference 2018,

**Decides** to amend the *Manual on the Global Telecommunication System* (WMO-No. 386) as specified in Annexes 1 and 2 to the present resolution;

**Authorizes** the Secretary-General to make editorial amendments to the text and diagrams in Annexes 1 and 2 to the present resolution.

# Annex 1 to Resolution 21 (EC-70)

# Amendment to the *Manual on the Global Telecommunication System* (WMO-No. 386) Regional Telecommunication Hubs of the Global Telecommunication System

# Amendments to WMO-No. 386 if the procedure to transfer RTH Tashkent to use GISC Moscow has been completed

1. Amend Part 1, Attachment I-2 by replacing the existing diagram with the following diagram (Figure 1 WIS RTH responsibility) as follows

Attachment I-2. Responsibilities in the WMO Information System for the main telecommunication network



Figure 1: WIS RTH responsibility plan

Note: data flow does not always follow the same path as the responsibilities.

2. Amend Part 1, Attachment I-3 as follows

## ATTACHMENT I-3. RESPONSIBILITIES OF REGIONAL TELECOMMUNICATION HUBS-CENTRES ON THE MAIN TELECOMMUNICATION NETWORK FOR THE TRANSMISSION OF OBSERVATIONAL DATA AND PROCESSED INFORMATION

1. RESPONSIBILITIES FOR THE COLLECTION, EXCHANGE AND DISTRIBUTION OF OBSERVATIONAL DATA OF WMCs AND RTHs LOCATED ON THE MAIN TELECOMMUNICATION NETWORK

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[Replace the table under 1. with the following table shown in Figure 2 (RTH – Areas of Responsibility)]

RTH_ Region	RTH Reference No.	RTH City (Country)	RTH's Principal GISC	RTH's Backup GISC	RTH's Area of Responsibility
1	<u>11</u>	Cairo* (Egypt)	Casablanca	Toulouse	Egypt, Sudan, Libya, adjacent sea areas
1.	<u>12</u>	Nairobi* (Kenya)	Offenbach	Moscow_/_ Tokyo	Kenya, Ethiopia, Burundi, Djibouti, Uganda, Rwanda, Somalia, La Réunion, United Republic of Tanzania, adjacent ocean areas
1	13	Lusaka (Zambia)	Pretoria	Exeter	Zambia, Zimbabwe, Malawi
1	<u>14</u>	Pretoria (South Africa)	Pretoria	Exeter	South Africa, Angola, Botswana, Lesotho, Madagascar, Malawi, Mozambique, Namibia, Eswatini, La Réunion, Zimbabwe, and the following centres via La Réunion: Antananarivo, Comoros, Mauritius, Seychelles, Amsterdam island, Kerguelen, adjacent ocean areas
1	15	Dakar* (Senegal)	Casablanca	Toulouse	Senegal, Ascension Island, Cabo Verde, Canary Islands, Cote d'Ivoire, Guinea, Guinea-Bissau, Liberia, Madeira, Mali, Mauritania, Morocco, Nigeria, Sierra Leone, St. Helena, Gambia, adjacent ocean areas
1.	16	Algiers* (Algeria)	Toulouse	Exeter	Algeria, Morocco, Lebanon, Tunisia, adjacent sea areas
1.	17	Brazzaville (Congo)	Casablanca	Toulouse	Congo, Cameroon, Central African Republic, Gabon, Equatorial Guinea, São Tomé and Príncipe, Democratic Republic of the Congo, adjacent ocean areas
1	18	Niamey (Niger)	Casablanca	Toulouse	Benin, Burkina Faso, Chad, Ghana, Niger, Nigeria, Togo
2	21	Tehran (Islamic Republic of Iran)	Tehran	TBD	Iran (Islamic Republic of), Iraq, Pakistan, Yemen, other territories in the Arabian Peninsula, adjacent sea and ocean areas
2	22	Tashkent (Uzbekistan)	Moscow	TBD	Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan
2	23	Novosibirsk (Russian Federation)	Moscow	Offenbach / Toulouse	Mongolia, Russian Federation (in Region II)
2	24	Khabarovsk (Russian Federation)	Moscow	Offenbach / Toulouse	Democratic People's Republic of Korea, Russian Federation (in Region II), adjacent sea and ocean areas

RTH Region	RTH Reference No.	RTH City (Country)	RTH's Principal GISC	RTH's Backup GISC	RTH's Area of Responsibility
2	25	Tokyo* (Japan)	Tokyo	Beijing / Offenbach / Melbourne	Hong Kong (China), Japan, Macao (China), Republic of Korea, adjacent sea and the Pacific Ocean areas
2	26	Bangkok (Thailand)	Tokyo	Beijing / Offenbach / Melbourne	Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, Viet Nam, adjacent sea and ocean areas
2	27	<u>New Delhi* (India)</u>	New Delhi	TBD	Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, Pakistan, Sri Lanka, adjacent sea and ocean areas
2	28	Beijing* (China)	Beijing	Tokyo	China, Democratic People's Republic of Korea, Viet Nam, adjacent sea and ocean areas
2	29	Jeddah* (Saudi Arabia)	Jeddah	TBD	Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, Yemen, other territories in the Arabian Peninsula, adjacent sea and ocean areas
3	31	Brasilia* (Brazil)	Brasilia	Washington / Pretoria	Brazil, Colombia, Ecuador, French Guyana, Guyana, Suriname, Venezuela (Bolivarian Republic of), ships' and aircraft reports
3	32	Buenos Aires* (Argentina)	Brasilia	Washington / Pretoria	Argentina, Bolivia (Plurinational State of), Chile, Paraguay, Peru, Uruguay, ships' and aircraft reports
3	33	Maracay_ (Venezuela)	Brasilia	Washington / Pretoria	Colombia, Ecuador, French Guyana, Guyana, Suriname, Venezuela (Bolivarian Republic of), ships' and aircraft reports
4	41	Washington* (United States of America)	Washington	Brasilia	Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, British Caribbean Territories, Canada, Cayman Islands, Colombia, Costa Rica, Cuba, Curaçao and Sint Maarten, Dominica, Dominican Republic, El Salvador, Grenada, Guatemala, Haiti, Honduras, Jamaica, Mexico, Monserrat, Nevis, Nicaragua, Panama, Saint Kitts, Saint Lucia, Trinidad and Tobago, United States of America

RTH Region	RTH Reference No.	RTH City (Country) (*=RTH/MTN)	RTH's Principal GISC	RTH's Backup GISC	RTH's Area of Responsibility
5	51	Melbourne*_ (Australia)	Melbourne	Tokyo / Seoul	Australia and outlying islands, Brunei Darussalam, Federated States of Micronesia, Fiji, French Polynesia, Indonesia, Kiribati, Malaysia, New Caledonia, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Timor-Leste, Tonga, Tuvalu, Vanuatu, Wallis and Futuna
5	52	Wellington (New Zealand)	Melbourne	Tokyo / Seoul	New Zealand and outlying islands, Cook Islands, Niue, Pitcairn, Tokelau
6	<u>61</u>	Exeter* (United Kingdom of Great Britain and Northern Ireland)	Exeter	Toulouse	Gibraltar, Greenland, Iceland, Ireland, Netherlands, United Kingdom, ocean weather stations (OWS)
6	62	Norrköping (Sweden)	Offenbach	Moscow / Tokyo	Denmark, Estonia, Finland, Latvia, Lithuania, Norway, Sweden
6	63	Toulouse* (France)	Toulouse	Exeter	Belgium, France, Luxembourg, Monaco, Portugal, Spain
6	64	Offenbach*_ (Germany)	Offenbach	Moscow / Tokyo	Germany, Jordan, Israel, Switzerland
6	<u>65</u>	Moscow* (Russian Federation)	Moscow	Offenbach /_ Toulouse	Armenia, Azerbaijan, Belarus, Georgia, Republic of Moldova, Russian Federation (in Region VI), Ukraine
6	66	Rome (Italy)	Offenbach	Moscow / Tokyo	Greece, Italy, Lebanon, Malta, Turkey
6	67	Prague* (Czechia)	Offenbach	Moscow / Tokyo	Czechia, Poland
6	68	Vienna (Austria)	Offenbach	Moscow / Tokyo	Austria, Croatia, Hungary, Slovakia, Slovenia
6	<u>69</u>	Sofia <u>* (Bulgaria)</u>	Offenbach	Moscow / Tokyo	Albania, Bosnia and Herzegovina, Bulgaria, Cyprus, Montenegro, Romania, Serbia, Syrian Arab Republic, the former Yugoslav Republic of Macedonia

# Figure 2 RTH – Areas of Responsibility (\* denotes RTH on the MTN)

# Annex 2 to Resolution 21 (EC-70)

# Amendment to the specification of the functional responsibilities of Regional Telecommunication Hubs of the Global Telecommunication System in the *Manual on the Global Telecommunication System* (WMO-No. 386)

Amend WMO-No. 386 Manual on the Global Telecommunication System as follows.

1. Amend Part 1, Section 1, paragraph 1.1 as follows:

1.1 Functions

The functions of the Global Telecommunication System (GTS) as a key component within the WMO Information System (WIS) shall be to facilitate the flow of data and processed products to meet the WWW requirements in a timely, reliable and cost-effective way, ensuring that all Members have access to data and products in accordance with approved procedures and within the limits of the agreed WWW system.

Note: It also gives telecommunication support to other programmes as a part of WIS and as decided by the WMO Congress or the Executive Council, within the limits of its primary objectives.

2. Amend Part 1, Section 1, paragraph 1.2.1 as follows

1.2.1 The Global Telecommunication System shall be so organized as to accommodate the volume of meteorological information and its transmission within the required time limits as the core network of WIS and to meet the needs of World, Regional Specialized and National Meteorological Centres, resulting from the implementation of the WWW.

Insert note after paragraph 1.2.2(c) to read

1.2.2 The GTS shall be organized on a three-level basis, namely:

... (c) The national telecommunication networks.

Note: The components of the MTN connecting the WIS Global Information System Centres is also referred to as the WIS Core Network (See the *Manual on the WMO Information System* WMO-No. 1060).

3. Amend Part 1, Section 3 as follows

# 3. FUNCTIONS AND CHARACTERISTICS OF THE NETWORKS OF THE GLOBAL TELECOMMUNICATION SYSTEM

3.1 The Main Telecommunication Network (MTN)

3.1.1 The MTN shall be an integrated system of circuits linking together the GISCs on the WIS Core Network-WMCs and designated RTHs. The circuits which directly link WMCs and/or RTHs situated on the MTN may, at the request of Members concerned, be designated as circuits of the MTN.

Note: The names of these centres, together with a diagram indicating the configuration of the MTN, are given in Attachment I-2.

3.1.2 The MTN shall be designed in such a way that the traffic originating from each centre (WMC, designated RTH) will be routed selectively towards the addressee centre(s). Each centre on the MTN shall ensure selective relay of the traffic which it receives towards the circuit(s) which it serves.

3.1.3 The MTN shall have the function of providing an efficient, reliable communication service between the designated centres, in order to ensure:

- (a) Rapid and reliable exchange of observational data required to meet the GDPFS requirements;
- (b) Exchange of processed information between the WMCs, including data received from meteorological satellites;
- (c) Transmission of processed information produced by the WMCs, to meet the requirements of RSMCs and NMCs;
- (d) Transmission of other observational data and processed information required for interregional exchange.

Note: Responsibilities of <u>RTHs</u>, including those centres located on the MTN, for the transmission of observational data and processed information are given in Attachment I-3.

# Resolution 22 (EC-70)

# Amendment to the Manual on the WMO Information System (WMO-No. 1060)

THE EXECUTIVE COUNCIL,

# **Recalling** that:

- (1) Appendix B of the *Manual on the WMO Information System* (WMO-No. 1060) records those centres that are approved WMO Information System (WIS) centres,
- (2) The Executive Council reviews Appendix B taking into consideration the recommendations of the Commission for Basic Systems (CBS) on the compliance of WIS centres with the technical specifications defined in Part IV of the Manual,

**Noting** that CBS had assessed compliance with WIS requirements of proposed WIS centres and had assessed those listed in the annex to the present resolution as conforming to the requirements,

**Decides** to amend the *Manual on the WMO Information System* as specified in the annex to the present resolution;

**Authorizes** the Secretary-General to make editorial amendments to the text of the annex to the present resolution.

# Annex to Resolution 22 (EC-70)

# Inclusion of WIS Centres in the *Manual on the WMO Information System* (WMO-No. 1060)

Add the following rows to table 2 in Appendix B to WMO-No. 1060 *Manual on the WMO Information System* in the appropriate position taking into account alphabetic order of the first two columns.

WMO Member or contributing organization	Centre name	Centre location region/city	Function	Technical commission/ programme	GISC
France	Copernicus Regional Air Quality Data Centre	VI Toulouse	Copernicus Regional Air Quality Data Centre	<u>RA VI</u>	Toulouse
Singapore	ASEAN Specialized Meteorological Centre (ASMC)	V Singapore	Regional monitoring and alerting of transboundary smoke haze	CBS	Melbourne

**Table 2: Data Collection or Production Centres** 

Modify the entries for Kazakhstan and Uzbekistan in table 3 in Appendix B to WMO-No. 1060 *Manual on the WMO Information System* by editing the current row and introducing a second row as shown below. Deleted text is indicated using red strikeout and added text using green\_ dashed underline.

Member or or organization	Centre name	GTS function		Centre Region location	Principal GISC	Constituent body
Kazakhstan	<del>Kazhydromet</del> National Meteorological and Hydrological Service (Almaty)	NMC	II	Almaty	Moscow	CBS
Kazakhstan	National Meteorological and Hydrological Service (Astana)	NMC	II	Astana	Moscow	CBS
Uzbekistan	Uzhydromet	NMC	II	Tashkent	<del>Seoul</del> Moscow	CBS

**Table 3: National Centres** 

# Resolution 23 (EC-70)

## WMO Information System 2.0

## THE EXECUTIVE COUNCIL,

## Recalling that:

- The future WMO Information System (WIS) was first envisaged by the Commission for Basic Systems (CBS) in 1992, the concept adopted by the Fourteenth World Meteorological Congress (2003) and approved by Resolution 2 (Cg-XV) – World Weather Watch Programme for 2008–2011,
- (2) The first operational Global Information System Centres (GISCs) began in 2012,

**Noting** that WIS development, in addition to creating the new functionalities of discovery and access, was conceived to be an evolution of the Global Telecommunication System (GTS),

# Noting also that:

 The current architecture of WIS was developed almost 12 years ago, and that there are many new technologies, architecture designs and industry solutions that were not available at the time it was developed initially,

- (2) Members have made considerable progress in moving from a telecommunications architecture to data-centric infrastructure built on GISCs,
- (3) Some Members are keen to ensure that WIS 2.0 is developed without such restrictions, making full use of the new information technology and the public-private partnerships environment and practices that are available to achieve the requirements of Members for the full cycle of information management, building on the investments of Members in the initial development and roll-out of WIS,

**Requests** CBS, in collaboration with the private sector and involving those Members that currently operate GISCs, to analyze the data-exchange needs for WIS to provide reliable data access to all users considering the availability of new technologies, architectures and communication techniques, including cloud-based solutions, web services, application programming interfaces, modern messaging protocols, and the like, and to study how they would support or contribute to the evolution to WIS 2.0, and report back;

Requests the Secretary-General to provide the resources to support this work;

**Urges** Members to provide resources for development of potential solutions and feasibility studies.

# **Resolution 24 (EC-70)**

# Provision of high-resolution radiosonde data on the WMO Global Telecommunication System

THE EXECUTIVE COUNCIL,

**Recalling** Resolution 40 (Cg-XII) – WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities, which adopts the practice that "Members shall provide on a free and unrestricted basis essential data and products which are necessary for the provision of services in support of the protection of life and property and the well-being of all nations, particularly those basic data and products, as, at a minimum, described in Annex 1 to this resolution, required to describe and forecast accurately weather and climate, and support WMO Programmes", and that Annex 1 – Data and products to be exchanged without charge and with no condition on use, includes "All available data from upper air sounding networks",

**Recalling also** WMO Integrated Global Observing System (WIGOS) Observing Network Design Principle No. 9, which states observing networks should be designed and should evolve in such a way as to ensure that the observations are made available to other WMO Members at space and time resolutions, and with a timeliness that meet the needs of regional and global applications,

**Recalling further** Resolution 10 (EC-65) – Report of the fifteenth session of the Commission for Basic Systems relevant to integrated observing systems, approving Recommendation 6 (CBS-15) – Implementation Plan for the Evolution of Global Observing Systems, responding to the vision for the Global Observing System in 2025 and the needs of WIGOS,

**Noting** that the Implementation Plan for the Evolution of Global Observing Systems includes action G14, which requests Members to "Ensure a timely distribution of radiosonde measurements at high vertical resolution, together with position and time information for each datum, and other associated metadata",

**Noting also** that the Commission for Basic Systems (CBS) had developed and approved procedures for the transition from the provision of radiosonde data in traditional alphanumeric codes to their provision in high-resolution BUFR,

**Mindful** that, while some Members have complied with this agreed action and are already providing high-resolution radiosonde data on the Global Telecommunication System, it is estimated that 69% of radiosonde stations are not yet providing these data (see EC-70/INF. 7.4(1) for further information supporting the present resolution),

**Having been informed** that, even with the currently limited provision of high-resolution radiosonde data, numerical weather prediction applications have measured a significant positive impact in forecast skill from the availability and use of these data, and experts expect that this improvement will be extended and increased through wider availability of such data,

**Decides** to urge Members to increase their efforts to implement the required systems and procedures to enable the provision of high-resolution radiosonde data from their radiosonde stations in compliance with related CBS procedures and practices;

**Encourages** Members to increase the number of radiosonde launches per day;

**Encourages** regional associations and technical commissions, where needed and where possible, to provide technical advice and develop collaborative solutions to assist Members with this process.

# **Resolution 25 (EC-70)**

# Changes to ship masking schemes

# THE EXECUTIVE COUNCIL,

**Recalling** Resolution 27 (EC-LIX) – Ship owners' and masters' concerns with regard to VOS data exchange,

**Noting** *Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology: Abridged Final Report of the Fifth Session* (WMO-No. 1208), including Recommendation 8 (JCOMM-5) – Changes to ship masking schemes, and Decision 32 (JCOMM-5) – Ship Observations Team identifier scheme,

# Noting also that:

- (1) Security issues (piracy) as initial driver for the implementation of ship identifier masking schemes are less important today,
- (2) Progress with the satellite Automatic Identification System now allows for even global and continuous ship tracking on public websites,

**Mindful** that the use of current ship identifier masking schemes such as "SHIP" does not facilitate quality monitoring of ship data, and is, de facto, limiting access to VOS data to some users,

**Having considered** the new Ship Observations Team identification scheme (SOT ID) approved by the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) through Decision 32 (JCOMM-5),

**Mindful also** that some Members (such as Japan) have yet to negotiate the transition from ship identifier masking to the new SOT ID with national authorities,

**Having been informed** of the rationale for Decision 32 (JCOMM-5) as detailed in Recommendation 8 (JCOMM-5),

Decides no longer to keep in force Resolution 27 (EC-LIX);

**Requests** Members to discontinue using existing ship identifier masking and encode/decode schemes, and to use the new proposed SOT ID instead;

**Requests** JCOMM to prepare a transition plan with instructions on timing and procedure to move to the new SOT ID.

**Note:** The present resolution replaces Resolution 27 (EC-LIX), which is no longer in force.

# **Resolution 26 (EC-70)**

# Amendments to the Manual on the Global Data-processing and Forecasting System (WMO-No. 485)

# THE EXECUTIVE COUNCIL,

### Considering:

- (1) WMO circular letter reference WDS-DPFS/Revised Manual on GDPFS-2017, dated 16 January 2017, with actions required:
  - (a) "WMO Members currently hosting a WMC and/or RSMC to confirm the mapping of their centres onto the new designations",
  - (b) "WMO Members, who have expressed interest to have their centres designated at the time of the CBS-16 session, to complete the designation process",
  - (c) "All WMO Members that fulfil the criteria/functions described in the revised *Manual on the GDPFS* (WMO-No. 485) to submit their candidature for designation",
- (2) Resolution 6 (Cg-XVI) Revised Manual on the Global Data-processing and Forecasting System (WMO-No. 485), in which the World Meteorological Congress agreed that the revised Manual is the single source of technical regulations for all operational dataprocessing and forecasting systems operated by WMO Members, including its designated centres,
- (3) Resolution 18 (EC-69) Revised Manual on the Global Data-processing and Forecasting System (WMO-No. 485), which approved the publication of the revised Manual, including the addition of new types of centres – the Manual was effectively published on 16 February 2018,
- (4) The transition arrangements, in particular that existing Regional Specialized Meteorological Centres (RSMCs), once they have mapped themselves onto new types of centres, will retain their status until the Eighteenth World Meteorological Congress in 2019; and, to retain their status after Eighteenth Congress, they will need to have demonstrated compliance by the time of the Eighteenth Congress (see Recommendation 3 (CBS-Ext. (2014) annex, endorsed by Resolution 12 (Cg-17),
- (5) The plan to audit the centres for full compliance in advance of the Eighteenth World Meteorological Congress, following the procedures that will be developed by the Implementation Coordination Team on the Data-processing and Forecasting System Task Team on Audit,

**Recalling** the standard procedure for amending WMO Manuals that are the responsibility of the Commission for Basic Systems, as defined in the General Provisions,

# Having examined:

- (1) Recommendations of the Commission for Basic Systems (CBS) Management Group at its eighteenth session (March 2018):
  - (a) For the formal designation of Offenbach (Germany) as a World Meteorological Centre,
  - (b) For the formal designation of new RSMCs and their inclusion in Part III of the *Manual* on the Global Data-processing and Forecasting System:
    - (i) For nowcasting: Hong Kong Observatory, Hong Kong, China,
    - (ii) For severe weather forecasting: Wellington (New Zealand) and Pretoria (South Africa),
    - (iii) For nuclear and non-nuclear emergency response: Offenbach (Germany) and Toulouse (France), respectively,
  - (c) For formal designation of the following new Global Producing Centres for Annual to Decadal Climate Prediction: Offenbach, Barcelona Computing Centre (Spain), Montreal (Canada) and Exeter (United Kingdom of Great Britain and Northern Ireland),
  - (d) For the endorsement of the outlines of the *Guide to the Global Data-processing and Forecasting System* (WMO-No. 305), as per Annex 1 to the present resolution, to ensure the necessary alignment with and provide further guidance to Members for the implementation of the revised *Manual on the Global Data-processing and Forecasting System*,
  - (e) To amend Appendix 2.2.18 of the Manual on the Global Data-processing and Forecasting System – "Access to Global Producing Centres data and visualization products held by the Lead Centre(s) for Long-range Forecast Multi-model Ensembles (LC-LRFMME)" as per Annex 2 to the present resolution, to reflect the agreement by the Global Producing Centres for Long-range Forecasts to remove the password requirement for accessing their graphical products from the LC-LRFMME website,
  - (f) To amend Appendix 2.2.34 of the Manual on the Global Data-processing and Forecasting System – "Standardized verification of deterministic numerical weather prediction products"- to include, as per Annex 3 to the present resolution, a few parameters and information related to scores which were missed during the edition of the Manual,
- (2) Recommendation 14 (JCOMM-5) Criteria for, and designation of, marine-related GDPFS Centres, (see EC-70 INF. 8(1)) which:
  - (a) Defines the designation criteria for RSMCs for marine meteorological services and marine environmental emergencies, as per Annex 4 to the present resolution, for inclusion in the *Manual on the Global Data-processing and Forecasting System*,
  - (b) Recommends the formal designation of all METAREA Issuing Services and Preparatory Services as RSMCs for marine meteorological services and contributing centres and inclusion in Part III of the *Manual on the Global Data-processing and Forecasting System*,
  - (c) Recommends for formal designation the following centres as RSMCs for numerical ocean wave prediction and inclusion in Part III of the *Manual on the Global Dataprocessing and Forecasting System*: Montreal (Canadian Meteorological Centre); Toulouse (Météo-France) and Tokyo (Japan Meteorological Agency),

**Approves** the above recommendations of the CBS Management Group and the Joint WMO/ IOC Technical Commission on Oceanography and Marine Meteorology (JCOMM) (as indicated in Annex 5 to the present resolution);

**Notes with appreciation** the significant progress that has been made towards the completion of the designation process by interested Members, as defined in the revised *Manual on the Global Data-processing and Forecasting System*;

**Invites** Members who have not completed their mapping onto the new types of centres and those who have completed it but have not yet demonstrated compliance, to take action as soon as possible to complete the process for demonstrating compliance to retain their status according to the new designations beyond the Eighteenth World Meteorological Congress;

**Requests** CBS to accelerate the development of the *Guide to the Global Data-processing and Forecasting System* to facilitate the use of the revised Manual and to submit the Guide to the Eighteenth World Meteorological Congress for approval;

**Authorizes** the Secretary-General, in consultation with the presidents of CBS and JCOMM, to make any editorial amendments to the revised Manual.

# Annex 1 to Resolution 26 (EC-70)

# Draft table of contents of revision of the *Guide to the Global Data-processing and Forecasting System* (WMO-No. 305)

# PART 1. ORGANIZATION AND RESPONSIBILITIES

- 1.1 The vision of the GDPFS (*Note: this section will seek to capture the articulated vision of the seamless GDPFS from relevant discussions and documents, in a way that assists the promotion of the GDPFS to the wider community*)
- 1.2 Guiding principles of the GDPFS (*Note: the section will articulate foundational principles of the GDPFS that are not necessarily explained in the Manual to those less familiar with the GDPFS*)
- 1.3 Organization of the GDPFS
- 1.4 Compliance with required GDPFS functions
- 1.5 Summary of required or recommended competencies for undertaking GDPFS functions
- 1.6 Alignment with related WIS functions
- 1.7 Alignment with related WIGOS functions
- 1.8 Interaction among GDPFS centres
- 1.9 Implementation of GDPFS, including interactions among technical commissions and programmes
- 1.10 Summary of relevant Guidelines (further detail to be given in Part IV).

# PART 2. ACTIVITIES SUPPORTED BY THE GDPFS

2.1 General (Note: this section will expand on the concise functional descriptions given in the Manual but to the extent possible without repeating Manual text. The language will still be kept simple and concise to ensure ease of translation)

- 2.2 Functional architecture of GDPFS
- 2.3 Roles in and review of activities supported by the GDPFS
  - 2.3.1 General purpose activities
  - 2.3.2 Specialized activities
  - 2.3.3 Non-real time coordination activities
- 2.4 Functional requirements of a GDPFS centre (*Note: this includes 24/7, connection to WIS, back-up procedures, etc.*)

# PART 3. DESIGNATION PROCEDURES FOR GDPFS CENTRES

- 3.1 General
- 3.2 Procedure for a World Meteorological Centre (*Note: To include background, a service offer by a Member for potential WMC, demonstration of capabilities, designated WMCs*)
- 3.3 Procedure for a Regional Specialized Meteorological Centre (*Note: To include background, service offer by a Member for potential RSMC, demonstration of capabilities, designated RSMCs*)
- 3.4 Rolling review of GDPFS centres (*Note: references to detailed procedures will appear in Part IV*)

# PART 4. GUIDELINES AND FURTHER READING

- 4.1 General
- 4.2 WMO Guidance (Note: this section will draw the reader's attention to other WMO guidance essential for understanding the seamless GDPFS within the context of the greater whole, including relevant Guides and Guidance notes already extant and as they are further developed. Subjects covered might include quality control of incoming observations, data collection and product dissemination, including standards and specifications, procedures and formats for the exchange of data and products aligned with WIS technical specifications, data-processing, including long-term storage of data and products, verification, the audit process, training, and reporting.)
- 4.3 Other references

# Annex 2 to Resolution 26 (EC-70)

# Amendment of Appendix 2.2.18 – Access to Global Producing Centre data and visualization products held by the Lead Centre(s) for Long-range Forecast Multimodel Ensembles

- (a) Access to GPC data graphical products from the Lead Centre(s) for LRFMME websites will be password protected.
- (b) Digital GPC data will be redistributed only in cases where the GPC data policy allows it. In other cases, requests for GPC output should be referred to the relevant GPC.

. . .

# Annex 3 to Resolution 26 (EC-70)

# Amendment to Appendix 2.2.34 – Standardized verification of deterministic numerical weather prediction products – Section 5.1 and 5.7 (pp 90 & 92) of the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485)

# 5.1 **Parameters**

Extra-tropics:

- Mandatory:
  - MSLP (verification against analysis only);
  - Geopotential height at 850, 500 and 250 hPa;
  - Temperature at 850, 500 and 250 hPa;
  - Wind at 925, 850, 700, 500 and 250 hPa.
- Additional recommended:
  - Geopotential height, temperature, wind at 100 hPa;
  - Relative humidity at 850 and 700 hPa.

# Tropics:

- Mandatory:
  - Geopotential height at 850 and 250 hPa;
  - Temperature at 850 and 250 hPa;
  - Wind at 850 and 250 hPa.
- Additional recommended:
  - Relative humidity at 850 and 700 hPa.

# 5.7 **Scores**

The following scores are to be calculated for all parameters against both analysis and (except mean sea-level pressure) observation.

# Wind

- Mandatory
  - rms vector wind error
  - mean error of wind speed

# Other parameters:

- Mandatory
  - Mean error
  - Root mean square (rms) error
  - Correlation coefficient between forecast and analysis anomalies (not required for obs)
  - S1 score (only for MSLP and only against analysis)

# - Additional recommended

- mean absolute error
- rms forecast and analysis anomalies (not required for observations)
- standard deviation of forecast and analysis fields (not required for observations)

# Annex 4 to Resolution 26 (EC-70)

# Amendment to the Manual on the Global Data-processing and Forecasting System (WMO-No. 485) concerning criteria for designation of marine meteorological services and marine environmental emergencies

# 2.2.2.X. Marine Meteorological Services

Notes:

- 1. Operations, including practices, procedures and specifications are described in the *Manual* on *Marine Meteorological Services* (WMO-No. 558);
- 2. This activity includes a network of National Meteorological Services.

2.2.2.X.1 National Meteorological Centres (including the Preparatory Services, which are contributing centres) conducting marine meteorological services shall:

- (a) Issue forecasts of marine environmental conditions for coastal and offshore areas;
- (b) Issue warnings of marine meteorological hazards for coastal and offshore areas;
- (c) Coordinate with national agencies responsible for marine matters, including for disaster risk reduction, and search and rescue.

2.2.2.X.2 Members holding METAREA responsibility under the WMO/IMO Worldwide Met-Ocean Information and Warning Service (WWMIWS), shall provide the following services in compliance with the Joint IMO/IHO/WMO Manual on Maritime Safety Information:

- (a) Issue forecasts of marine environmental conditions for the high seas;
- (b) Issue warnings of marine meteorological hazards for the high seas;
- (c) Organize the broadcast of marine forecasts and warnings on broadcast systems compliant with the Global Maritime Distress and Safety System (GMDSS);
- (d) Undertake the METAREA Coordinator responsibilities.

Note: The bodies in charge of managing the information contained in the Manual related to marine meteorological services are specified in the Table below.

Responsibility				
Changes to activity specification				
To be proposed by:	JCOMM/WWMIWS			
To be approved by:	ЈСОММ	CBS		
To be decided by:	EC/Congress			
Centres designation				
To be approved by: JCOMM CBS				

To be decided by:	EC/Congress		
	Complianc	е	
To be monitored by:	JCOMM/WWMIWS		
To be reported to:	CBS	JCOMM	

# 2.2.2.X. Marine Environmental Emergencies

Notes:

- 1. Operations, including practices, procedures and specifications are described in the Manual on Marine Meteorological Services (WMO-No. 558);
- 2. Functions and responsibilities to be defined by the JCOMM/ET-MEER during the intersessional period;
- 3. The bodies in charge of managing the information contained in the Manual related to marine environmental emergencies are specified in the Table below.

Responsibility					
	Changes to activity s	pecification			
To be proposed by:	JCOMM/ET-MEER				
To be approved by:	ЈСОММ	CBS			
To be decided by:	EC/Congress				
	Centres designation				
To be approved by:	JCOMM	CBS			
To be decided by:	EC/Congress				
Compliance					
To be monitored by:	JCOMM/ET-MEER				
To be reported to:	CBS	JCOMM			

# Annex 5 to Resolution 26 (EC-70)

# Designation of centres and inclusion in Part III of the *Manual on the Global Data*processing and Forecasting System (WMO-No. 485)

1. The World Meteorological Centres are located at:

. . .

- WMC Offenbach
- 2. The Regional Specialized Meteorological Centres with geographical specialization are located at:

. . .

3. General purpose activities

Provision of global deterministic numerical weather prediction:

• • •

RSMC Offenbach

Provision of limited area deterministic weather prediction:

. . .

Provision of global ensemble numerical weather prediction:

. . .

RSMC Offenbach

Provision of limited area ensemble numerical prediction:

. . .

Provision of Nowcasting

• • •

RSMC Hong-Kong

Global Producing Centres for long-range prediction:

. . .

Global Producing Centres for Annual to Decadal Climate Prediction

- GPC Exeter
- GPC Barcelona
- GPC Montreal
- GPC Offenbach
- 4. The Regional Specialized Meteorological Centres for specialized activities are the following: Tropical cyclone forecasting, including marine-related hazards:

. . .

Provision of atmospheric sandstorm and dust storm forecasts:

. . .

Provision of atmospheric transport and dispersion modelling (for environmental emergency response and/or backtracking) – Nuclear :

. . .

RSMC Offenbach

Provision of atmospheric transport and dispersion modelling (for environmental emergency response) – Non-Nuclear;

- RSMC Offenbach
- RSMC Toulouse

Provision of Severe Weather Forecasting

- RSMC Pretoria
- RSMC Wellington

Provision of marine meteorological services

RSMC Exeter	RSMC Melbourne
RSMC Toulouse	RSMC Tokyo
RSMC Athens	RSMC Beijing
RSMC Washington DC	RSMC St Petersburg
RSMC Miami	RSMC Vladivostok
RSMC Niteroi	RSMC Wellington
RSMC Buenos Aires	RSMC Valparaiso
RSMC Pretoria	RSMC Callao
RSMC New Delhi	RSMC Tromsø

RSMC Vacoas	<b>RSMC Edmonton</b>
RSMC Karachi	RSMC Winnipeg
RSMC La Réunion	RSMC Ottawa

Provision of numerical ocean wave prediction

- RSMC Montreal
- RSMC Toulouse
- RSMC Tokyo

Regional climate prediction and monitoring:

. . .

5. The Regional Specialized Meteorological Centres for non-real-time coordination activities:

. . .

- Lead Centre for coordination of wave forecast verification
- ECMWF

## **Resolution 27 (EC-70)**

# Terms of reference of the Executive Council Panel of Experts on Polar and Highmountain Observations, Research and Services

#### THE EXECUTIVE COUNCIL,

# Noting:

- (1) Resolution 16 (EC-69) Executive Council Panel of Experts on Polar and High-mountain Observations, Research and Services,
- (2) Decision 45 (EC-69) Development and implementation of the Global Cryosphere Watch,
- (3) Decision 46 (EC-69) Development and implementation of the Arctic Polar Regional Climate Centre Network and of Polar Regional Outlook Forums,
- (4) Decision 48 (EC-69) Polar and high-mountain regions priority activity,
- (5) The report of the Executive Council Panel of Experts on Polar and High-mountain Observations, Research and Services (EC-PHORS) at its eighth session (Levi, Finland, 21–23 March 2018), with proposed changes to the terms of reference of EC-PHORS,
- (6) Basic Documents No. 1 (WMO-No. 15),

#### Considering:

- (1) That considerations expressed under Resolution 16 (EC-69) remain valid,
- (2) That the polar regions, in particular the Arctic, are experiencing an increase in human presence and activities, requiring new or enhanced services linked to weather, climate, water and related environmental matters,
- (3) The role of the oceans with regard to changes in the polar regions,

(4) That the Year of Polar Prediction (YOPP) is a good example of an international initiative that is bringing the polar research, services and operations communities together,

# Recognizing:

- That in 2017 WMO received observer status to the Arctic Council, and has for several years been an active invited expert to the Antarctic Treaty and Committee for Environmental Protection,
- (2) The recent high-level engagement of WMO with the Arctic Council and its working groups, in particular during the Senior Arctic Officials meeting (Levi, Finland, 22 and 23 March 2018) and meetings of the Arctic Council working groups, including the Arctic Contaminants Action Programme, the Arctic Monitoring and Assessment Programme and the Protection of the Arctic Marine Environment,
- (3) The contribution of WMO to the Sustained Arctic Observing Networks,
- (4) That the Arctic Council at its tenth Ministerial Meeting (Fairbanks, Alaska, United States of America, 11 May 2017) announced the "Agreement on Enhancing International Arctic Scientific Cooperation, the third legally binding agreement negotiated under the auspices of the Arctic Council, which will help increase effectiveness and efficiency in the development of scientific knowledge about the region as well as strengthen scientific cooperation in the Arctic region, and encourage its implementation by all parties following its entry into force" (paragraph 33 of the Fairbanks Declaration 2017),
- (5) That EC-PHORS at its seventh and eighth sessions recognized the need to improve the gender balance in the membership of EC-PHORS and the Global Cryosphere Watch (GCW),
- (6) The excellent contribution of Finland to WMO in promoting meteorological cooperation as one of the four priority areas during its period as Chair of the Arctic Council, and the hosting by Finland of the Arctic Meteorology Summit on 20 March 2018 at the side of the Senior Arctic Officials meeting,

**Decides** to amend the terms of reference of EC-PHORS with those proposed by EC-PHORS at its eighth session, given in the annex to the present resolution;

## Invites Members:

- (1) To take into account the importance of the gender-balance policy with regard to nominating experts in EC-PHORS and GCW working structures;
- (2) To ensure that YOPP observation and numerical weather prediction data continue to be available for research and model verification purposes for up to 10 years after the YOPP core phase has completed; this period is required to ensure that full value can be obtained from the investment in developing and collecting the data (see EC-70/INF. 9 for detailed information);

## **Requests** the Secretary-General:

- To formally invite the Arctic Council Arctic Monitoring and Assessment Programme, the International Arctic Science Committee, the Scientific Committee on Antarctic Research, and the Intergovernmental Oceanographic Commission of UNESCO to participate in EC-PHORS as members;
- (2) To provide the necessary support to activities and sessions of the Panel, including the GCW working structure, and liaise with relevant international organizations, programmes and bodies;

(3) To engage the Polar Regional Climate Centres, Regional Specialized Meteorological Centres, GCW and groups undertaking operational observation network design to participate in the consolidation phase of YOPP to ensure seamless transition to operations.

**Note:** The present resolution replaces Resolution 16 (EC-69), which is no longer in force.

# Annex to Resolution 27 (EC-70)

# Terms of reference of the Executive Council Panel of Experts on Polar and Highmountain Observations, Research and Services

[Note from Secretariat: Below are changes to the Terms of Reference of EC-PHORS compared to those from Resolution 16 (EC-69). Editorial changes do not appear in track changes for better readability]

The Executive Council Panel of Experts on Polar and High-mountain Observations, Research and Services (EC-PHORS) shall be composed of members nominated by the Permanent Representatives of Members, including Parties to <u>the Arctic Council (e.g. indigenous interest</u>), the Antarctic Treaty, and participants from other organizations that have active meteorological, hydrological, oceanographic or cryospheric programmes, in particular in the polar <u>and high-</u> <u>mountain</u> regions.

Observers from other groups may be invited to attend meetings of the Panel.

The Panel is authorized to establish subgroups and task teams as and when required, including in particular an Antarctic Task Team, a High-mountain Task Team, a Polar Space Task Group, a GCW Steering Group.

The Panel shall:

- (1) Operate under the general terms of reference of Regional Associations with regard to the WMO activities in Antarctica as spelled out in Annex II of Basic documents No. 1 (WMO-No. 15);
- (2) Continue advancing the following five key initiatives under the WMO polar and highmountain regions priority activity: (a) AntON; (b) the polar Regional Climate Centres and polar Regional Outlook Forums; (c) GCW; (d) high-mountain region activities; and (e) GIPPS, including the Polar Prediction Project, and YOPP, as well as relevant research activities under the World Climate Research Programme;
- (3) Emphasise, compile and maintain information on the socioeconomic benefits and costbenefit aspects of WMO polar and high-mountain region activities in particular through outreach activities and by attracting expertise in this field, and engaging and aligning with existing mechanisms, such as the Societal and Economic Research and Applications subcommittee of the Polar Prediction Project and the CBS-OPAG/PWSD;
- (4) Explore mechanisms to actively engage early career scientists in the delivery of results, including in collaboration with Association of Polar Early Career Scientists (APECS).

The Panel will undertake:

# For Polar Regions:

(a) To develop and promote an integrated approach to understanding the global impact of changes in polar regions so that the required services may be provided to users and governments may be advised on aspects of adaptation;

- (b) To ensure that operational and research observing networks in polar regions (including AntON) are integrated within the framework of WIGOS and WIS and are enhanced to include cryosphere-related variables;
- (c) To engage in a concerted effort to involve Members, technical commissions and regional associations, as well as relevant research and international organizations and bodies, in improving predictive capability in polar regions on timescales from hours to centuries;
- (d) To coordinate WMO interests with other international organizations focused on polar science and observations, and to work collaboratively as appropriate;
- (e) Where other initiatives are identified as aligned with the WMO goals, to engage and assess their validity and make recommendations to the Executive Council for further consideration;
- (f) To oversee and guide the development and implementation of GCW in collaboration with technical commissions, regional associations and relevant WMO and international programmes, organizations, institutions and bodies;
- (g) To oversee and guide the Polar Space Task Group, which provides coordination across space agencies to facilitate acquisition and distribution of fundamental satellite datasets, and to contribute to or support development of specific derived products for cryospheric scientific research and applications;
- (h) To guide the development of GIPPS in collaboration with technical commissions, regional associations and relevant international programmes, organizations and bodies;
- (i) To provide WMO participation in the implementation of the Arctic Council Agreement on enhancing international Arctic scientific cooperation;
- (j) To facilitate the acquisition, exchange and archiving of observational data from polar regions in compliance with WIGOS requirements related to instruments, data exchange and the WMO Quality Management Framework to underpin the provision of services required for the polar regions;
- (k) To provide a forum for discussion of relevant scientific issues and make recommendations on meteorological, hydrological, oceanographic and cryospheric research and operations related to the polar regions;
- (I) To provide regular input on issues related to polar meteorology, hydrology, oceanography and the cryosphere to support the activities of relevant groups or bodies, such as the World Climate Programme, which includes the Global Climate Observing System (GCOS), the World Climate Research Programme and the World Climate Services Programme; Global Atmosphere Watch; the World Weather Research Programme; the Global Framework for Climate Services; and technical commissions, regional associations and programmes;
- (m) To ensure close collaboration with and contribute to other international organizations, committees and programmes concerned, such as the Antarctic Treaty Consultative Meeting, the Arctic Council, the Scientific Committee on Antarctic Research, the International Arctic Science Committee, the International Association of Cryospheric Sciences and other relevant associations of the International Union of Geodesy and Geophysics, the Council of Managers of National Antarctic Programmes, the Forum of Arctic Research Operators, the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO), and the International Hydrological Programme of UNESCO.

# For the Antarctic:

The Panel should cooperate, as appropriate, with other relevant international and regional entities:

- (a) To promote the implementation of the resolutions of Congress and the Executive Council in the area from 60°S to 90°S;
- (b) To coordinate programmes of surface and upper-air meteorological observations in the Antarctic, working with relevant international scientific organizations, and liaise with regional associations in relation to sub-Antarctic observations;
- (c) To coordinate the design of AntON, comprising surface and upper-air stations, including the GCOS Surface Network, GCOS Upper-air Network, Global Atmosphere Watch and other relevant observing components;
- (d) To coordinate standardization of observing, coding, data exchange and data management practices applied to the Antarctic;
- (e) To propose recommendations to the Parties of the Antarctic Treaty System and Members of the Committee for Environmental Protection of the Antarctic Treaty.

# For the Arctic:

- (a) To promote WMO engagement with the Arctic Council and its Working Groups, in particular for providing appropriate observations and Earth system modelling frameworks in the Arctic region, supporting climate resilience and adaptation policies, advancing hydrology and water resources services, and understanding changes in the oceans;
- (b) While appropriate functions are covered by the respective regional associations, the Panel may liaise with them in defining components of Arctic observing systems and services;
- (c) To guide, in collaboration with the Commission for Hydrology, the further development of the Arctic Hydrological Cycle Observing System project;
- (d) To hold a third YOPP Special Observing Period (SOP) for the Arctic in the period February 2020 to March 2020, taking into account lessons learned from first YOPP SOP, to complement the MOSAiC (Multidisciplinary drifting Observatory for the Study of Arctic Climate) project and benefit from the extensive observations during Arctic winter.

# For the High-Mountain regions:

- (a) To contribute to the work of regional associations, technical commissions and programmes in defining appropriate components of hydrometeorological and cryospheric observing systems and services in high mountain regions,
- (b) To develop a strategy on WMO high mountain regions focused activities, including by considering an initiative similar to YOPP for the next financial period to be submitted to Congress at its eighteenth Session for its consideration.

# Resolution 28 (EC-70)

# WMO as an observer with the Arctic Council

THE EXECUTIVE COUNCIL,

# Noting with satisfaction:

- (1) That in 2017 WMO was granted observer status at the Arctic Council,
- (2) That the Arctic Council has recognized the Arctic meteorological cooperation as one of its priorities,

**Recalling** that WMO has already taken an active leadership role on Arctic matters through its existing working programmes and projects, such as the Global Atmosphere Watch, Global Cryosphere Watch, Executive Council Panel of Experts on Polar and High-mountain Observations, Research and Services (EC-PHORS) framework and Polar Prediction Project, and by establishing the Arctic Regional Climate Centre network and the Polar Arctic Climate Outlook Forum, among others,

Endorses the long-term engagement of WMO with the Arctic Council and its programmes;

**Invites** EC PHORS, technical commissions and regional associations to collaborate with the Arctic Council and its working groups in support of policy decisions on Arctic matters, to achieve well-maintained and sustained observing networks for monitoring changes in the climate, weather, cryosphere and water resources; for enhancing the broad sharing of data and information; for addressing the needs of different stakeholders, including different disciplines of science; and for the development of safety- and sustainability-related services;

Invites Members to actively contribute to the implementation of this resolution;

**Requests** the Secretary General to ensure sustained engagement with the relevant Arctic Council programmes, within the existing resources.

# Resolution 29 (EC-70)

# **Global Cryosphere Watch Surface Observing Network**

THE EXECUTIVE COUNCIL,

# **Recalling:**

- Resolution 43 (Cg-17) Global Cryosphere Watch, that decided to mainstream and implement the Global Cryosphere Watch (GCW) in WMO programmes as a cross-cutting activity,
- (2) Decision 50 (EC-68) Development of the Global Cryosphere Watch,
- (3) Decision 45 (EC-69) Development and implementation of the Global Cryosphere Watch,
- (4) Resolution 16 (EC-69) Executive Council Panel of Experts on Polar and High-mountain Observations, Research and Services,

# Noting:

- The recommendations of the report of the Panel of Experts of the Polar and High-mountain Observations, Research, and Services (EC-PHORS) at its eighth session (Levi, Finland, 21–23 March 2018) (see EC-70/INF. 9),
- (2) The provisions of Technical Regulations (WMO-No. 49), Vol I, Part I,

# Noting also:

- (1) The importance of monitoring the cryosphere for improving the understanding of the global climate, of the hydrological system, and of sea-level changes, as well as for impact assessments and for Earth system modelling,
- (2) The continuous need for long and more reliable historical cryosphere data from in situ measurements,

**Noting further** that the success of GCW depends on the full and sustained integration and observation-sharing from both National Meteorological and Hydrological Services (NMHSs) and non-NMHS sources,

# Noting with satisfaction:

- (1) That GCW has been successful in engaging both NMHSs and non-NMHS organizations, academia, and independent research and operational organizations, on achieving the consistent in situ observation of all components of the cryosphere (snow, glaciers, permafrost, sea ice, ice sheets, lake and river ice, and icebergs),
- (2) The progress made in expanding the interoperability of the GCW Data Portal with major data centres and the data centres of CryoNet and the GCW contributing stations,
- (3) The progress made on the development of regional snow trackers, providing quick assessments of the current state of the cryosphere,

## Decides:

- That the name "Global Cryosphere Watch Surface Observing Network" is to be used for the surface observing component of GCW, being composed of CryoNet, contributing stations, and stations of GCW-affiliated networks;
- (2) That the stations listed in the annex to the present resolution constitute the GCW Surface Observing Network;

**Requests** EC-PHORS to further update the Implementation Plan of GCW, in coordination with technical commissions, regional associations and partner organizations, focusing on those aspects that will ensure that GCW becomes operational as an end-to-end, cross-cutting programme during the eighteen financial period;

**Requests** the technical commissions, in particular the Commission for Basic Systems, Commission for Climatology, Commission for Hydrology, Commission for Instruments and Methods of Observation and Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology, to collaborate with the GCW Steering Group in developing technical standards and guidelines, enabling the sustainable observation of the cryosphere and the exchange of cryosphere data;

**Requests** the regional associations to collaborate with the GCW Steering Group and to encourage Members to participate in, and contribute to GCW activities;

# Urges Members:

- (1) To secure full implementation of the network of stations set forth in the annex to the present resolution, as a component of the WMO Integrated Global Observing System (WIGOS), including by allocating WIGOS IDs;
- (2) To record these stations in the Observing System Capability Analysis and Review Tool (OSCAR)/Surface, to associate these stations with the GCW Surface Observing Network, and to assist the organizations responsible for these stations, through their OSCAR and WIGOS focal points;
- (3) To maintain, and, where possible, enhance the observing programmes at these stations with additional cryosphere observations;
- (4) To further develop the observing component of GCW, as part WIGOS, especially in datasparse regions, in support of application areas relying on cryosphere information;
- (5) To comply with the procedures and the data collection standards, as laid down in *Technical Regulations* (WMO-No. 49), Volume I, *Manual on the WMO Integrated Global Observing System* (WMO No. 1160), *Manual on Codes* (WMO-No. 306) and *Manual on the Global Telecommunication System* (WMO-No. 386) by providing the data in real time, where required, and as far as practicable;
- (6) To make historic research and routine observational data available to the GCW Data Portal or other appropriate data collection or production centres, and to archive them for climate purposes;
- (7) To ensure that GCW stations within their territory are monitored as a part of the WIGOS Data Quality Management System framework, and that feedback is given when monitoring systems detect problems with data or their transmission;
- (8) That priority should be given to the development of a strategy to integrate stations operated by organizations other than NMHSs;
- (9) To contribute with human and financial resources to help support the further implementation of GCW;

**Invites** partners to collaborate with WMO on sustaining and evolving the GCW Surface Observing Network;

# **Requests** the Secretary-General:

- (1) To take all necessary actions, within available budgetary resources, for the implementation of GCW and its observing network as a component of WIGOS;
- (2) To take the necessary actions to develop and maintain WMO collaboration in matters of cryosphere, through GCW, with relevant organizations, agencies, groups and institutions, such as the United Nations Educational, Scientific and Cultural Organization, the International Union of Geodesy and Geophysics, the European Union and the Group on Earth Observations.

# Annex to Resolution 29 (EC-70)

# **Global Cryosphere Watch Surface Observing Network**

# 1. CryoNet Stations

No.	Station name	GCW Submission ID	Member Country of the organization operating the station	Geographical location of station	WMO ID
1	Dome C Concordia air – snow observatory	109	France; Italy	Antarctica	pending
2	Adelie Land	42	France	Antarctica	pending
3	Base Belgrano II	25	Argentina	Antarctica	89034
4	Base Esperanza	30	Argentina	Antarctica	88963
5	Base Jubany (Carlini)	31	Argentina	Antarctica	89053
6	Base Marambio	32	Argentina	Antarctica	89055
7	Base Orcadas	33	Argentina	Antarctica	88968
8	Base San Martin	34	Argentina	Antarctica	89066
9	Davis main AFIN station	96	Australia	Antarctica	89571
10	Dome-C Surface-Snow-Meteo	114	Italy	Antarctica	pending
11	Halley	197	United Kingdom	Antarctica	89022
12	Juan Carlos I	122	Spain	Antarctica	89064
13	Rothera	192	United Kingdom	Antarctica	89062
14	Syowa	63	Japan	Antarctica	89532
15	Aonikenk	54	Argentina	Argentina	pending
16	AWS Pasterze	136	Austria	Austria	pending
17	AWS-Kleinfleisskees	141	Austria	Austria	pending
18	Goldbergkees	133	Austria	Austria	pending
19	Jamtalferner	148	Austria	Austria	pending
20	Kleinfleisskees	134	Austria	Austria	pending
21	Pasterze	136	Austria	Austria	pending
22	Sonnblick Observatory	138	Austria	Austria	11146
23	Zongo Glacier	23	France; Plurinational State of Bolivia	Plurinational State of Bolivia	pending
24	Bjelasnica	107	Bosnia and Herzegovina	Bosnia and Herzegovina	14652
25	Ivan Sedlo	108	Bosnia and Herzegovina	Bosnia and Herzegovina	14650
26	ALERT CLIMATE	184	Canada	Canada	71355
27	Bow Hut	204	Canada	Canada	pending
28	CAMBRIDGE BAY GSN	185	Canada	Canada	71288
29	CHURCHILL CLIMATE	186	Canada	Canada	71696
30	Eureka (MSC)	18	Canada	Canada	71913
31	NEIGE-FM	191	Canada	Canada	71212
32	INUVIK CLIMATE	187	Canada	Canada	71364
33	IQALUIT CLIMATE	188	Canada	Canada	71321
34	Peyto Lower Ice	203	Canada	Canada	pending
35	Kluane Lake Research Station (KLRS)	93	Canada	Canada	pending
36	Peyto Main	202	Canada	Canada	pending

No.	Station name	GCW Submission ID	Member Country of the organization operating the station	Geographical location of station	WMO ID
37	Peyto Outlet New	206	Canada	Canada	pending
38	RESOLUTE CS	190	Canada	Canada	71018
39	Valle Nevado	68	Chile	Chile	pending
40	Haxilegen Galcier No. 51 station	179	China	China	pending
41	Jimunai station	180	China	China	pending
42	Laohugou station	174	China	China	pending
43	Miaoergou Ice Cap Station	177	China	China	pending
44	Muz Taw glacier station	181	China	China	pending
45	Qilian	16	China	China	pending
46	Suli station	175	China	China	pending
47	Tanggula	49	China	China	pending
48	Urumqi Glacier No.1 station	176	China	China	pending
49	Xidatan	48	China	China	pending
50	Glaciar Conejeras	43	Colombia	Colombia	pending
51	Anogia-Psiloritis	210	Greece	Crete/Greece	pending
52	Chania-White Mountains	209	Greece	Crete/Greece	pending
53	Antisana 15 alfa	21	Ecuador	Ecuador	pending
54	Pallas-Kenttarova	131	Finland	Finland	5824
55	Sodankyla Intensive Observation Area (IOA)	126	Finland	Finland	pending
56	Sodankyla Sounding Station	128	Finland	Finland	2836
57	Argentiere Glacier	45	France	France	pending
58	Col de Lac Blanc	117	France	France	pending
59	Col de Porte	70	France	France	pending
60	Saint-Sorlin Glacier	44	France	France	pending
61	A.P. Olsen Ice Cap	168	Denmark	Greenland	pending
62	PROMICE KAN_L	159	Denmark	Greenland	pending
63	PROMICE KAN_M	160	Denmark	Greenland	pending
64	PROMICE KAN_U	161	Denmark	Greenland	pending
65	PROMICE KPC_L	166	Denmark	Greenland	pending
66	PROMICE KPC_U	167	Denmark	Greenland	pending
67	PROMICE NUK_L	158	Denmark	Greenland	pending
68	PROMICE QAS_L	156	Denmark	Greenland	pending
69	PROMICE QAS_U	157	Denmark	Greenland	pending
70	PROMICE SCO_L	151	Denmark	Greenland	pending
71	PROMICE SCO_U	152	Denmark	Greenland	pending
72	PROMICE TAS_A	155	Denmark	Greenland	pending
73	PROMICE TAS_L	153	Denmark	Greenland	pending
74	PROMICE THU_L	164	Denmark	Greenland	pending
75	PROMICE THU_U	165	Denmark	Greenland	pending
76	PROMICE UPE_L	162	Denmark	Greenland	pending
77	PROMICE UPE_U	163	Denmark	Greenland	pending
78	SIGMA-A	62	Japan	Greenland	pending
79	SIGMA-B	61	Japan	Greenland	pending
80	Hofsjökull Ice Cap	149	Iceland	Iceland	pending
81	Hveravellir	150	Iceland	Iceland	4156

No.	Station name	GCW Submission ID	Member Country of the organization operating the station	Geographical location of station	WMO ID
82	AWS1 FORNI	67	Italy	Italy	pending
83	Snow and Ice Research Center, NIED	201	Japan	Japan	pending
84	Tavanbogd	91	Mongolia	Mongolia	pending
85	Mera	95	Nepal; France	Nepal	pending
86	Hellstugubreen	170	Norway	Norway	pending
87	Langfjordjøkelen	193	Norway	Norway	pending
88	Dammay, Bagrot AWS (Chira glacier)	115	Pakistan	Pakistan	pending
89	Khama Bagrot AWS(Hinarchi Glacier)	120	Pakistan	Pakistan	pending
90	Quelccaya Ice Cap	35	United States	Peru	pending
91	Ice Base Cape Baranova	51	Russian Federation	Russian Federation	20094
92	Tiksi	50	Russian Federation	Russian Federation	21824
93	Spasskaya Pad (Yakutsk)	66	Japan	Russian Federation	pending
94	Formigal-Sarrios	72	Spain	Spain	pending
95	Davos Laret (LAR)	194	Switzerland	Switzerland	pending
96	Davos SLF (SLF)	77	Switzerland	Switzerland	pending
97	Davos SwissMetNet AWS (DAV)	98	Switzerland	Switzerland	0- 20000- 0-06784
98	Dischma Chaiseren (DMAC)	195	Switzerland	Switzerland	pending
99	Dischma Dürrboden (DMAD)	196	Switzerland	Switzerland	pending
100	Fluela permafrost station (FLU)	39	Switzerland	Switzerland	pending
101	IMIS Parsenn 2 automatic station (PAR2)	99	Switzerland	Switzerland	pending
102	Stillberg station (STILL)	79	Switzerland	Switzerland	pending
103	Weissfluhjoch Versuchsfeld (WFJV)	74	Switzerland	Switzerland	pending
104	Kilimanjaro Northern Icefield	200	United States	United Republic of Tanzania	pending
105	Barrow Baseline Observatory	55	United States	United States	70026-0

# 2. GCW Contributing Stations

No.	Station name	GCW Submission ID	Member Country of the organization operating the station	<i>Geographical</i> location of station	WMO ID
1	Dome C GLACIOCLIM SAMBA stakes network north	110	France	Antarctica	pending
2	Dome C GLACIOCLIM SAMBA stakes network south	111	France	Antarctica	pending
3	Traub Glacier ( Quito )	22	Ecuador	Antarctica	pending
4	ARA Almirante Irizar	29	Argentina	Antarctica, Southern Ocean	LOAI
5	ARA Canal de Beagle	28	Argentina	Antarctica, Southern Ocean	LOCB
6	ARA Puerto Deseado	27	Argentina	Antarctica, Southern Ocean	LOPD

No.	Station name	GCW Submission ID	Member Country of the organization operating the station	<i>Geographical</i> location of station	WMO ID
7	ARA Suboficial Castillo	26	Argentina	Antarctica, Southern Ocean	LOCS
8	Morenas Coloradas Rockglacier	24	Argentina	Argentina	pending
9	Vuriloches	53	Argentina	Argentina	pending
10	AWS Fraganter Scharte	140	Austria	Austria	pending
11	Kolm Saigurn	135	Austria	Austria	pending
12	Wintergasse	139	Austria	Austria	pending
13	Wurtenkees	137	Austria	Austria	pending
14	Peyto Middle Ice	207	Canada	Canada	pending
15	Peyto Upper Ice	208	Canada	Canada	pending
16	Mocho-Choshuenco Volcano	69	Chile	Chile	pending
17	Fuyun station	183	China	China	pending
18	Kanas station	182	China	China	pending
19	Lower Station	172	China	China	pending
20	Middle Station	173	China	China	pending
21	Qingbingtan 72 Glacier station	172	China	China	pending
22	Terminus Station	171	China	China	pending
23	Sodankyla Lake Orajarvi	129	Finland	Finland	pending
24	Sodankyla Peatland	130	Finland	Finland	pending
25	Col	147	France	France	pending
26	Dome	119	France	France	pending
27	Gebroulaz Glacier	47	France	France	pending
28	La Muzelle	118	France	France	pending
29	Mer de Glace Glacier	46	France	France	pending
30	PROMICE TAS_U	154	Denmark	Greenland	pending
31	Zackenberg Research Station	169	Denmark	Greenland	pending
32	Filefjell/Kyrkjestølane	199	Norway	Norway	pending
33	Rabben Station in Ny-Alesund (closed)	19	Japan	Norway/ Svalbard	1007
34	Angel Orus	127	Spain	Spain	pending
35	Bachimana	125	Spain	Spain	pending
36	Goriz	121	Spain	Spain	pending
37	LLauset	124	Spain	Spain	pending
38	Renclusa	123	Spain	Spain	pending
39	Bueschalp observer station (5DB)	78	Switzerland	Switzerland	pending
40	Klosters Kraftwerk observer station (5KK)	105	Switzerland	Switzerland	pending
41	Klosters RhB observer station (5KR)	104	Switzerland	Switzerland	pending
42	Matta Frauenkirch observer station (5MA)	103	Switzerland	Switzerland	pending
43	NIME station Dischma (DMA)	143	Switzerland	Switzerland	pending
44	NIME station Monstein (MST)	144	Switzerland	Switzerland	pending
45	Scaletta Glacier (SCAL)	145	Switzerland	Switzerland	pending
46	Silvretta Glacier (SILV)	81	Switzerland	Switzerland	pending
47	Verstancla Glacier (VERST)	146	Switzerland	Switzerland	pending

No.	Station name	GCW Submission ID	Member Country of the organization operating the station	Geographical location of station	WMO ID
48	Weissfluhjoch SwissMetNet AWS (WFJ)	75	Switzerland	Switzerland	0-20000- 0-06780

# Resolution 30 (EC-70)

# The 2018 review of the World Climate Research Programme

THE EXECUTIVE COUNCIL,

**Recalling** that the World Climate Research Programme (WCRP) was established in 1980 under the joint sponsorship of the International Council for Science (ICSU) and WMO; that in 1993 the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization also became a sponsor, and that the joint agreement signed between the three co-sponsors in 1993 provides the definition of the WCRP financial, governance and institutional arrangements that enable the international planning and coordination of the Programme,

**Appreciating** the review of WCRP conducted by a review panel established by co-sponsors and concluded in early 2018,

**Recognizing** that since its inception, the key strength of WCRP has been its focus on cuttingedge physical climate science where international coordination enables scientific advances that would not happen otherwise,

**Recognizing also** that WCRP and other WMO research programmes under the Commission for Atmospheric Sciences (CAS) (the World Weather Research Programme (WWRP) and Global Atmosphere Watch (GAW)) draw on the capabilities of a large science community beyond the National Meteorological and Hydrological Services (NMHSs), and that those capabilities are fundamental for advancing the WMO strategy for service delivery,

**Noting** that research needs to be better integrated and more closely coordinated across weather, climate, water and related environmental domains to provide the necessary scientific and technical advances needed to address the growing need for targeted and societally relevant services and to create an attractive environment in which NMHSs, academic institutions, the private sector and end users can engage in research to their mutual benefit,

**Noting also** that the transition process in WMO constituent bodies will create opportunities for developing a broader umbrella for Earth system sciences across technical commissions and WMO and co-sponsored research programmes,

**Having examined** the outcome of the review and also the report by the review panel Chairperson, Ms Julia Slingo, including recommendations on the future WCRP strategy, structure, governance, operations, financing and partnerships, in order to effectively deliver WCRP to meet the evolving needs for climate science in support of policy and services,

**Mindful** of the role of the WCRP Joint Scientific Committee to provide science leadership, to develop the science strategy and oversee its implementation, and to build a strong community of international scientists to work on grand challenge problems that require international coordination,

**Appreciating also** the progress that has been made on developing the WCRP strategy and making it available for a broad community consultation,

**Appreciating further** that the president of CAS and the scientific leadership of GAW, WCRP and WWRP have already initiated a consultation process to strengthen their strategic partnerships and initiate co-design of relevant research programmes,

**Endorses** the recommendations of the review provided in the annex to the present resolution;

**Urges** the Chairperson of the WCRP Joint Scientific Committee to give strong consideration to recommendations 1, 3, 5, 7 and 8 in the future strategic and implementation plans of WCRP, working closely with WWRP, GAW, the Global Climate Observing System, the Global Framework for Climate Services as well as Future Earth;

**Requests** the Second Vice-President of WMO, with support from the Secretary-General:

- (1) To facilitate the consultation with the officers of WCRP co-sponsors ICSU and IOC in preparation for the approval by the Executive Council of the new WCRP Science Strategy and Implementation Plan, taking note of review recommendations 2, 4 and 6 directed towards the governance, support and financing of WCRP, with guidance from the WCRP Joint Scientific Committee;
- (2) To consult with the officers of WCRP co-sponsors ICSU and IOC on the most effective mechanisms for the governance of WCRP;

**Requests** the Secretary-General, together with the executive heads of other WCRP cosponsors, to actively engage in resource mobilization initiatives to support the Programme;

**Calls upon** Members to actively support WCRP activities and promote the WCRP role at a national level as the primary global climate research coordination programme.

# Annex to Resolution 30 (EC-70)

# **Recommendations of the review of the World Climate Research Programme**

The full report of the 2018 WCRP Review with executive summary and recommendations is available at EC-70/INF. 10.2.

# **Recommendation 1: Science Strategy**

A new 10-year WCRP science strategy and related 5-year implementation plan must be developed as soon as possible in discussion with the sponsors and with wide consultation and community buy-in.

# Recommendation 2: Governance and the Memorandum of Understanding (MoU)

The Review Panel recommends that a formal high-level Governing Board for WCRP be established to enable more effective engagement with the co-sponsors and enable them to fulfil their responsibilities for the programme. A new MoU should be put in place to reflect changes in governance, operations and structure.

# **Recommendation 3: Scientific Leadership**

The Review Panel recommends that the Joint Scientific Committee (JSC) should be reinvigorated to focus on providing science leadership, setting the science strategy and overseeing its implementation, including establishing partnerships, and building a strong community of international scientists to work on grand challenge research problems that require international coordination.

# **Recommendation 4: Operations**

The Review Panel recommends that additional clarity be provided in the terms of reference, structure and functions of the Joint Planning Staff (JPS) and the Director of the WCRP, to ensure that the JPS works effectively with the JSC to support its scientific activities, to facilitate international engagement and partnerships, and to manage WCRP resources.

# **Recommendation 5: Structure**

The JSC, in consultation with the newly created Governing Board, should work with the science community to establish a new structure for the WCRP research effort that best serves its new strategy and involves a simplified set of delivery mechanisms.

# **Recommendation 6: Financing**

In light of the importance to society of the goals of WCRP and the precarious level of current financial support for the programme, the co-sponsors should redouble their efforts to support WCRP financially at a higher level of enabling funding so that it can operate more effectively.

# **Recommendation 7: Science to service**

WCRP should take action to ensure its knowledge is brought to the service of society, especially in supporting the development of climate services.

# **Recommendation 8: Partnership**

WCRP should seek to develop strategic and strong partnerships with other WMO research programmes (specifically WWRP and GAW), GCOS, and Future Earth.

# Resolution 31 (EC-70)

# Education and training

THE EXECUTIVE COUNCIL,

# **Recalling:**

- (1) Resolution 51 (Cg-17) Education and Training Programme, on the guiding principles of the Programme,
- (2) Resolution 52 (Cg-17) Recognition and reconfirmation of WMO Regional Training Centres,
- (3) Resolution 8 (EC-68) Amendments to Technical Regulations (WMO-No. 49), Volume I,
- (4) Decision 64 (EC-68) Reconfirmation of the Institute of Biometeorology (Florance, Italy) as WMO Regional Training Centre,
- (5) Decision 56 (EC-69) WMO Regional Training Centres,

**Taking note** of the request of the Permanent Representative of Spain on designation of the Agencia Estatal de Meteorología (AEMET) as a WMO Regional Training Center (RTC) in Spain,

**Having considered** the recommendations of the Executive Council Panel of Experts on Education and Training (EC-PEET) to designate AEMET as an RTC (see EC-70/INF. 11.1),
**Taking note also** of the request of the Permanent Representative of Argentina on the designation of the Facultad de Ingeniería y Ciencias Hídricas (FICH) of the Universidad Nacional del Litoral (UNL) as a component of the WMO RTC in Argentina; and that of the Permanent Representive of Peru on the designation of the Servicio Nacional de Meteorología e Hidrología (SENAMHI) as a component of the WMO RTC in Peru,

**Having also considered** the recommendations of the president of Regional Association III and of EC-PEET,

## Decides:

- (1) To designate AEMET as an RTC in Spain;
- (2) To designate FICH of UNL as the third component of the RTC in Argentina;
- (3) To designate SENAMHI as the second component of the RTC in Peru;
- (4) To reconfirm the RTC in Algeria based on the recommendation made by EC-PEET;
- (5) To extend the reconfirmation of the RTCs in Indonesia, Israel, Italy, Kenya, Madagascar, Nigeria, Peru, Philippines, Russian Federation, South Africa and Turkey as RTCs until subsequent Executive Council decisions following the conclusions of ongoing or future external reviews by EC-PEET.

## Resolution 32 (EC-70)

#### Review plan for the Basic Instructional Package for Meteorologists and the Basic Instructional Package for Meteorological Technicians

## THE EXECUTIVE COUNCIL,

**Recalling** Resolution 32 (Cg-XVI) – Definition of a meteorologist and meteorological technician, calling for a replacement of *Guidelines for the Education and Training of Personnel in Meteorology and Operational Hydrology* (WMO-No. 258), Volume I – Meteorology; and the subsequent publication of *Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology* (WMO-No. 1083), Volume I – Meteorology, in 2015,

**Noting** the recommendations from the Thirteenth WMO Symposium on Education and Training (SYMET-13) (29 October–1 November 2017) and the recommendation of the Executive Council Panel of Experts on Education and Training (EC-PEET) to begin a review process of the current Basic Instructional Package for Meteorologists (BIP-M) and for Basic Instructional Package for Meteorologists (BIP-M) and for Basic Instructional Package for Meteorologists (BIP-M) (see EC-70/INF. 11.1),

**Requests** the Secretary-General, working with EC-PEET, to review BIP-M and BIP-MT, with particular attention to scientific advancements, skills required for identifying and communicating user impacts, utilization of upstream seamless data and products, management development, and socioeconomic and other relevant societal issues.

## Resolution 33 (EC-70)

## **Public-private engagement**

THE EXECUTIVE COUNCIL,

#### **Recalling:**

- Decision 73 (EC-68) Cooperation between the public and private sectors for the benefit of society,
- (2) Decision 61 (EC-69) Public–private engagement: A road map to the Eighteenth World Meteorological Congress,

**Acknowledging** recent events and developments involving discussions on public–private engagement (PPE) and the global weather enterprise (GWE),

**Expresses support** to the allocation of additional resources by the Secretary-General to ensure timely follow-up on the agreed roadmap and to facilitate a constructive dialogue with stakeholders from the private sector;

**Endorses** the Policy Framework for Public–Private Engagement, presented in the annex to the present resolution, as a guiding document for Members pursuing cooperation with non-State entities aimed, inter alia, at supporting the United Nations Sustainable Development Agenda 2030, the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction;

**Acknowledges** the establishment of a Global Weather Enterprise Forum supported by WMO, the Global Facility for Disaster Reduction and Recovery of the World Bank, and the Association of the Hydro-Meteorological Equipment Industry (HMEI), as a consultative platform among various stakeholders in the public, private and academic sectors, to steer the dialogue between the sectors, consider necessary coordinated actions to address the growth of GWE, and derive recommendations for consideration by relevant bodies, including WMO;

**Agrees** that there is urgent need for thorough preparation of a high-level policy on GWE and PPE for consideration by the Eighteenth World Meteorological Congress, in order to update existing policy and guidance documents, including the Geneva Declaration of the Thirteenth World Meteorological Congress (1999) and Annexes 2 and 3 to Resolution 40 (Cg-XII);

**Also agrees** that the activities related to GWE and PPE should be closely coordinated with the efforts for new partnerships with development finance institutions, with a strong focus on developing sustainable business models and PPE to achieve the strategic objective of closing the capacity gap between developed and developing countries;

**Requests** presidents of regional associations and technical commissions:

- (1) To assist in awareness, communication and outreach activities related to GWE and PPE, and sessions of regional associations and technical commissions;
- (2) To invite broad participation of experts from the private sector to the technical commission sessions, and technical or regional conferences to ensure the views of these sectors are considered;

#### **Requests** the Secretary-General:

 In view of the ongoing dialogue with the private sector, to provide regular policy briefs to the Executive Council and to Members on PPE, including lessons learnt and recommended national practices; (2) To continue to allocate resources to support engagement in the ongoing activities related to GWE and PPE through existing or new working mechanisms with relevant partner organizations.

#### Annex to Resolution 33 (EC-70)

#### **Policy Framework for Public-Private Engagement**

#### 1. INTRODUCTION

#### 1.1 Global factors

WMO, as a United Nations organization, is driven by the Global UN agenda. Today, it is based on the 2030 Agenda for Sustainable Development adopted in 2015 with its 17 Sustainable Development Goals (SDG). The achievement of the 2030 SDGs will require different sectors and actors working together in an integrated manner by pooling financial resources, knowledge and expertise. The new development era with 17 intertwined SDGs and 169 associated targets as a blue print for achieving the sustainable 'Future We Want', cross sectorial and innovative multistakeholder partnerships will play a crucial role for meeting the targets by the year 2030.

Sustainable Development Goal 17, which reads "Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development", recognizes multi-stakeholder partnerships as important vehicles for mobilizing and sharing knowledge, expertise technologies and financial resources to support the achievement of the SDGs in all countries, particularly developing countries. Goal 17 further seeks to encourage effective partnerships between public, private and academic sectors, as well as civil society, building on the experience and resourcing strategies of partnerships.

The majority of United Nations organizations have adapted, or are in the process of adapting, their respective strategies and/or policies to reflect the 2030 Agenda.

#### 1.2 WMO context

WMO Congress defined 'partnership' as working with international agencies, other organizations, academia, the media and the private sector to improve the range, quality and delivery of critical environmental information and services. WMO partnerships, some of which were formed decades ago, are in concert with the rolling WMO Strategic Plan which maintains a strategic objective 'Strengthened Partnerships' with the realization that new and strengthened partnerships and cooperation activities are needed to improve NMHSs' performance in delivering services and to demonstrate the value of WMO contributions within the United Nations system, relevant regional organizations, international conventions and national strategies.

An important milestone in the WMO history of partnerships with non-State entities was the adoption by the Twelfth World Meteorological Congress (1995) of a policy on, and a new practice for, the international exchange of meteorological data and products (Resolution 40 (Cg-XII)). An annex to Resolution 40 provided "Guidelines for relations between National Meteorological or Hydrometeorological Services and the commercial sector". It was clearly stated in these guidelines that the purpose was "to further improve the relationship between NMSs and the commercial sector. The development of the exchange of meteorological and related information depends greatly upon sound, fair, transparent, and stable relations between these two sectors."

The WMO World Weather Open Science Conference (WWOSC) held in Montreal, August 2014, put a special focus on the need for a broad dialogue between the public and private sectors, with a strong engagement of academia and other relevant entities, such as learned societies, to respond to the changing landscape of the weather, climate and hydrological science and services, which could be best described as a Global Weather Enterprise. The outcomes of

the WWOSC discussions encouraged the conduct of a series of multi-stakeholder follow-up dialogues supported by the WMO and partner organizations, such as the Global Facility for Disaster Reduction and Recovery (GFDRR) of the World Bank Group and the Association of Hydro-Meteorological Equipment Industry (HMEI).

The Seventeenth World Meteorological Congress (Cg-17 (2015)) gave a new perspective to partnerships by acknowledging the growing involvement of entities which can be identified as belonging to the "private sector" (private companies, citizen's associations, bloggers, etc.) in weather, climate, water and related environmental matters. These private sector entities have been active to a varying extent in the full value chain of activities, starting with observations; extending to data acquisition tools and technologies, information generation and processing technologies; and culminating in product dissemination and services. Congress thus recognized this part of the private sector as a set of stakeholders in end-to-end service delivery supporting the WMO vision, mandate and objectives. Congress highlighted the different, and at times, complementary roles and responsibilities of NMHSs, academic institutions, research and technological agencies, and the private sector. It was felt that closer interactions between the public and private sectors would stimulate innovation and facilitate cross-fertilization, ultimately benefitting the society. Congress noted that WMO had a unique opportunity to initiate such an interaction and emphasized that inaction may limit the benefits to be derived for the users. On the other hand, such activities could also lead to proliferation of weather and climate information of various nature and quality which could challenge the NMHSs mandate to disseminate authoritative weather information and warnings to the public and disaster management authorities as well as the rest of the enterprise in delivering on their missions. It was also recognized that the private sector initiatives do increase the availability of weather services for the citizens; it was of paramount concern to ensure the sustainability of NMHSs over time.

Acknowledging the challenges, Cg-17 recognized that WMO guidance on engagement with the private sector would help NMHSs to keep pace with the activities at the national and international levels and enhance efficiency and service delivery, including in support of the development of observational and communication infrastructures at the local and regional level.

Following the directives given by the Cg-17, several activities have been undertaken with the aim to build awareness and improve the understanding between the public, private and academic sectors. The 68th Session of WMO Executive Council (2016) held for the first time a Special Dialogue on the "complementary and cooperative contributions of public and private sector institutions to meteorology and hydrology". In 2017, EC-69 adopted "A Roadmap to the Eighteenth World Meteorological Congress on the Public-Private Engagement (PPE)". A key element of this Roadmap is the development of a WMO Policy Framework on PPE which would assist Members and stakeholders from all sectors by providing a set of guiding principles and highlighting the challenges and opportunities that need to be addressed in order to harness the potential benefits from working together for the benefit of society.

## 2. OBJECTIVES OF THE POLICY FRAMEWORK

The Policy Framework for Public-Private Engagement guides global, regional and national action by the World Meteorological Organization and its Members to promote active engagement between the public, private and academic sectors, and all stakeholders to successfully manage and participate in the Global Weather Enterprise. It outlines principles and guidelines aimed at maximizing the benefits of an inclusive weather-enterprise approach.

Developed in line with Resolution 67 (Cg-17) and Decisions 73 (EC-68) and 61 (EC-69), the Policy Framework outlines:

- (a) The current potential for public-private engagement in the context of the Global Weather Enterprise;
- (b) Principles for public-private sector engagement based on the "Key Issues to be addressed in developing policies and principles for engagement" (Annex 2 to Decision 73 (EC-68));

- (c) Evolving roles at stakeholders at global regional and national levels;
- (d) Options for guiding public-private partnerships and directions for development of WMO guidance to Members.

This framework is intended to serve as a first step in ongoing work to address these issues and shape a robust way forward in a changing environment. It aims to build understanding and enhance cooperation among stakeholders to sustain and expand the weather enterprise and to maximize its benefits to society in the short- and long-term. The framework seeks to strengthen and enhance opportunities for Members, their NMHSs and the private sector, on the basis of ethical behaviour to ensure a level playing field, enable efficiency and innovation, and utilize an inclusive approach to funding fundamental infrastructure and research.

The framework supports and builds upon the WMO Convention, existing policies and related regulations and guidance. The Convention has ensured the world's nations do cooperate to create and sustain an international system to observe and predict weather, climate and water; provide reliable information and services to support effective decision-making; reduce the loss of life and property; further sustainable development; and preserve the environment and the global climate for present and future generations of humankind.

## 3. PUBLIC-PRIVATE ENGAGEMENT IN THE GLOBAL WEATHER ENTERPRISE

The need for a WMO Policy Framework on PPE stems from the realization of a new landscape in all business areas covered by the WMO Convention, which form the value chain of the weather, climate and hydrological services.



The flow of activities along this value chain and the interconnections between its modules need to be further analysed in the context of the Global Weather Enterprise. This would allow to identify potential for gaining efficiency and improving quality through partnership arrangements with the participation from all sectors, in particular, partnerships that will enable bridging existing gaps in capacity and access to essential information and products in the developing part of the world.

## 3.1 Historic perspective

An enterprise notion and multi-stakeholder approach could be traced back deeply in the roots of the WMO and its preceding international cooperation initiatives. It is seen in one of the first meeting invitations send to the international meteorological communities:

"We venture by the present circular to invite the heads of Meteorological Institutes, the Meteorological and other Learned Societies, as well as private scientific men and practical observers in the domain of Meteorology, to this consultative meeting, which is to be held in Leipzig ..."

## From the invitation letter to the Meteorological Conference at Leipzig,<sup>5</sup> August 1872

The weather enterprise of the 20th century was primarily based on public sector investments. WMO Member States collectively built a global infrastructure under a globally coordinated World Weather Watch (WWW) Programme, composed by three global systems – the Global Observing System (GOS), the Global Telecommunication System (GTS) and the Global Data Processing and Forecasting System (GDPFS). WWW has been realized and made operational on a 365/24/7 basis through an agreed set of global standards for observations, data processing and service delivery which ensured the needed harmonization and interoperability. A number of global and regional centres hosted by NMSs formed the backbone of the communication and numerical modelling needed for the forecasting of the main atmospheric variables. States cooperated, coordinated and collectively invested in building the expensive satellite segment of the Global Observing System.

While the WWW was a predominantly a public sector endeavour, it would not have been successful without an essential scientific and technological support from the academia and the private industry. At that stage, the participation of the private sector in the service delivery was generally limited with the exception of several countries, where private companies have become prominent mostly in the provision of weather services to media outlets.

Significant changes in the weather enterprise structure started happening during the last 10– 15 years. While this change is evident across the globe its manifestations vary greatly by region and country. Five primary factors are influencing change:

- (a) Scientific and technological innovation;
- (b) Growing demand for meteorological, climatological, hydrological, marine and related environmental products and services from commercial interests, the general public and government sector;
- (c) Global action for adaptation to climate change and the United Nations Sustainable Development Goals;
- (d) Public-sector institutional and resource constraints;
- (e) Private-sector increased involvement and investment, consolidation and globalization.

These factors shape the processes within the global weather enterprise with a pronounced trend of accelerating growth in terms of stakeholder participation and financial turnover. Amidst this change, it remains in the interest of all parties to have a robust national and global meteorological and hydrological infrastructure, as this forms the information backbone of the global weather enterprise. This requires all countries to reaffirm their commitments and acceptance to their responsibilities in funding and operating national observing networks and communication means, adherence to respective standards and procedures necessary to sustain a global sharing of requisite and quality assured. Substantial internationally coordinated scientific and research effort underpins the operational systems and ensures their evolution with uptake of innovation, as well as continuous human capacity-building through education and training.

From being mostly engaged in manufacturing equipment and providing media services, recently, the private sector involvement has been rapidly growing in all aspects of meteorological and hydrological services, including a number of companies building `end-to-end' capability with regional and global coverage. Such a growth is substantially expanding both opportunities and challenges for all players, including the NMHSs.

<sup>&</sup>lt;sup>5</sup> Leipzig Conference (1872) prepared the way for holding, in Vienna in 1873, the First International Meteorological Congress, which established the International Meteorological Organization (IMO), the predecessor of the WMO.

#### 3.2 Evolving roles

The impact of these changes on the current institutional arrangements widely accepted by WMO Members for the collection, processing, and exchange of meteorological, hydrological, climatological and other environmental data, as well as for the generation and provision of respective information and services, could be far-reaching. The potential exists to improve the efficacy and reach of warnings, forecasts and other services within societies around the world. At the same time, concerns have been raised that these changes might erode the core observational assets usually managed by NMHSs, as well as their status, funding and modes of operation. Such erosion could impact sustained long-term, national observing capabilities, and thereby harm national and global climate monitoring. There could be risks to the role of NMHSs as the single national authoritative voice for severe weather warnings and other core governmental purposes, all of which could have negative impacts on end users and other stakeholders of the weather enterprise. There are numerous case studies and practices present in various parts of the community today and examples from other sectors that can inform best practices for effective PPE to mitigate these risks.

Within the weather enterprise, national, regional and international institutions and business models vary greatly. All stakeholders, however, contribute to the core mission of the enterprise to help protect life and property, to help foster economic growth, and to improve quality of life. Government, private sector, academia and civil society all play important roles. By its Convention, WMO plays a key role in understanding and facilitating the contributions of Member countries and their weather enterprise stakeholders.

Historically, the public sector has led funding and development of the backbone infrastructure of the weather enterprise. The development of observational networks and provision of weather, climate and hydrological services have been considered as national governments obligations as "public goods".<sup>6</sup> Recently, technological changes and changes in users' requirements have provided new opportunities for the private sector to contribute to the provision of those services in support of public interest as well as to meet specific stakeholder needs.

In the case of weather services, one of its distinguishing characteristics is its dependence on observational data from around the globe. No one nation could provide even basic services to its citizens without continuous, real-time access to such data internationally. While investments in obtaining these observations are made at the national level, the collective benefits only accrue if: (i) a sufficiently large number of nations decide to make these investments; and (ii) these nations share the resulting data with each other. Members have invested in public sector institutions because weather, climate and hydrological services have proved essential to the safety and security of their citizens; a fundamental role of government. These factors should still be true even in the case of both public and private sectors contributing to collection of data.

At the same time, the private sector is also a valued contributor in well-being of nations and has been active in the weather enterprise for decades across all elements of the value chain. It serves a number of very important roles, including as a source of investment, a driver of technological development and innovation, a partner in service development and delivery, and an engine for economic growth and employment.

#### 4. **PRINCIPLES OF ENGAGEMENT**

A major role of the Policy Framework is to establish a set of basic principles to provide directions, express responsibilities and goals. The PPE policy framework steps on the core values and goals of the WMO as an organization, and serves two main tasks: to guide an

<sup>&</sup>lt;sup>6</sup> Public goods, in economic terms, are those that exhibit the following two characteristics: Non-rivalry of consumption – one person's consumption does not reduce the amount available to others; and Non-excludability – it is impossible or extremely expensive to exclude from benefit a person or organization that refuses to contribute to the cost. These two characteristics mean that even in free-market economies, market processes do not provide them, or do not provide them at socially optimal levels.

effective engagement of the public, private and academic sectors in the GWE, and to guide Members' intentions and efforts in expanding the public-private-academic partnerships for ensuring better service to their governments, business and citizens.

These principles will provide a framework to facilitate the formulation and implementation of partnerships between the WMO and the business sector, respectively, between the NMHS and private sector at country level, while safeguarding the integrity, impartiality and independence of the WMO and preventing and mitigating potential risks of adverse impacts on core mandates and services.

## 4.1 'People First' principle

Recognizing the core mandate of supporting local-to-global decisions related to saving life, property and economic productivity, by providing essential, meteorological, climatological, hydrological and environmental information, WMO adheres to the "People First"<sup>7</sup> approach to public-private engagement and partnerships promoted by the UN Economic Commission for Europe (UNECE) and widely accepted as a vehicle to achieve the UN SDGs.

'People-first' principle sets out a clear statement that out of all the stakeholders, 'people' should be the priority and main beneficiary. The focus of PPE and PPPs in the context of the GWE should be on improving the safety and quality of life of communities, particularly those that are fighting poverty. GWE partnerships should provide increased access to essential, affordable and fit-for-purpose products and services for all, thus contributing to resolve vulnerabilities and sensitivities to weather and climate impacts, which in turn would strengthen the enterprise by creating new demand and opportunities for weather, climate and hydrological services.

WMO contributes to this 'People-first' principle with its programmes supporting meteorological and hydrological service providers including NMHSs with free and open available data and products.

## 4.2 WMO Guidelines on commercial relations

Commercial weather activities have been growing in the last two decades of the 20th century. WMO had the challenge to find a solution to crucial issues facing WMO and the world meteorological community: how to maintain and improve the free exchange of meteorological data and products whilst safeguarding the economic concerns of Members and the development of their national Meteorological Services.

In response to this, Congress adopted a policy showing that WMO was committing itself to broadening and enhancing the free and unrestricted international exchange of meteorological and related data and products. This policy, known as Resolution 40 (Cg-XII), provided also "guidelines for relations between national meteorological or hydrometeorological services (NMSs) and the commercial sector" (Annex 3 to Resolution 40 (Cg-XII), with the understanding that the development of the exchange of meteorological and related information depends greatly upon sound, fair, transparent, and stable relations between the public and 'commercial'<sup>8</sup> sectors. While dating back to more than 20 years now, most of the generic guidance on the relations between the non-commercial (or non-for-profit) entities and commercial entities, co-existing in the data and service delivery domains, remain valid in their attempt to 'urge' the sectors 'to recognize the interdependence and mutual benefit possible from cooperative interaction. However, it has also been recognized that adoption and application of these guidelines is highly variable.

## 4.3 Mutual benefit

A successful GWE builds on both public sector and private sector contributions, and each sector contributes to the success of the other. While the public sector is more likely to invest in long-

<sup>&</sup>lt;sup>7</sup> Promoting People first Public-Private Partnerships (PPPs) for the UN SDGs, UNECE, July 2016

<sup>&</sup>lt;sup>8</sup> Resolution 40 uses the term 'commercial sector' with the understanding that the guidelines apply to the commercial sector engaged in meteorological activities, which includes government organizations engaged in commercial meteorological activities.

term programmes and underpinning core infrastructure, such as that required to deliver the sustained, high quality climate record, the private sector can be more responsive to selected investment in data gaps to meet special needs and application of emerging technologies. The public sector's deep understanding and trusted connection with its user community is critical to assured community safety through responsiveness to authoritative warnings, while the capacity and technological agility of the private sector can present opportunities to meet novel and emerging service needs. The WMO offers a strong foundation of science, data and global standards which can inform and influence the development of these services and offer assurance to end-users regarding their quality. The private sector depends on the essential scientific and observational underpinning provided by the public sector and can be powerful advocates for sustained government investment in core public infrastructure and capability.

Recognizing the key importance of data availability for all sectors of the GWE, a commonly developed and agreed framework to promote fair and equitable exchange of data and products will be essential for a successful cooperation on all matters concerning the GWE and will contribute to the full realization of its potential. Such a framework would be equally applicable to both private and public sector. It will be particularly important for life-saving missions, like disaster risk reduction, and for improving the access to critical information in the least developed countries, to establish sustainable and affordable conditions for access to data from the private sector.

## 4.4 Towards a new set of principles for public-private engagement

In moving forward, public-private engagement activities should be guided and informed by the following set of principles, which are derived from the UN Global Compact<sup>9</sup> as well as from guidance given by the Executive Council (Decision 73 (EC-68) refers).

## A. Advancing the over-arching goals articulated in the WMO Convention, namely:

- (a) Protection of life and property;
- (b) Safeguarding the environment;
- (c) Contributing to sustainable development;
- (d) Promoting long-term observation, collection and sharing of meteorological, hydrological and climatological data, including related environmental data;
- (e) Promotion of endogenous capacity-building;
- (f) Meeting international commitments;
- (g) Contributing to international cooperation.

**B. Shared value**: Engagement between the public, private and academia sectors should create shared value and seek "win-win" situations whereby both public entities and businesses can recognize the opportunities for innovation and growth, based on science, in meeting society's needs. Creating shared value can be done by leveraging private-sector expertise and supporting technology transfer, by promoting free and unrestricted data sharing based on national circumstances with intellectual property rights duly respected, and by accelerating uptake of research and technological developments into operations and stimulating the generation of new services, translation and dissemination of valuable knowledge, and by investing in local research and developing human capacity through training, thereby supporting the sustainability of the global weather enterprise.

**C. Sustainability**: Public, private and academic sectors should seek opportunities for engagement where they can provide leadership on matters critical to sustainability of the weather enterprise and where joint action is needed to gain efficiencies and better serve society. The three sectors should seek to identify opportunities to assume complementary roles, minimizing overlap or competition where this would lead to inefficiencies or be detrimental to the sustainability of the weather enterprise.

<sup>&</sup>lt;sup>9</sup> https://www.unglobalcompact.org/about.

D. **Advancing together**: The rapid development of science and technology carries the risk of widening the gap between the developed and developing countries; the availability of global service providers might lead to marginalization of national agencies if not up to required service quality requirements. At the same time, there is also an opportunity for developing countries to leapfrog ahead with the smart adoption of innovative solutions in implementing those activities WMO defines as the key role of NMHSs, i.e., providing the core observing infrastructure and authoritative voice in public safety related services that must be recognized and maintained. At the same time, a new approach to a better engagement with private and academic sectors as well as to investment policies, both national and through development financing, should be promoted to support and enhance the provision of high quality products and services to users in all countries based on need. This will include efforts to help bridge existing gaps and develop capacity of developing countries, LDCs and SIDS, through public-private-academia-donors partnerships for sustainable development projects. A key principle to be maintained is that all countries, no matter what their state of development, should have the possibility and be helped to advance.

Level playing field: Both public and private sectors have much to offer to advance Ε. collective objectives in support of the public goods and specific stakeholder needs. As such, public and private sector communities should both have the opportunity to propose cooperative arrangements or other forms of engagement which will facilitate working together, when appropriate. Weather, climate and hydrological services offered by both public and private sectors should be provided with an assured level of quality. WMO and Member governmental agencies can engage with the private sector for the purposes of development and provision of products and services that explicitly support and accelerate achievement of the goals of WMO and those of Member governments. However, to the extent reasonable, engagement should not provide exclusivity or imply endorsement or preference of a particular privatesector entity or its products or services. Moreover, over the past decade, the private sector has invested in various aspects of the weather enterprise, including in observational networks and dissemination mechanisms. This creates a unique opportunity for two-way collaboration and sharing, including of data and expertise, to facilitate the attainment of common objectives and extract maximum benefit from the value chain for all involved. In the interest of a commonly supported level playing field, exclusivity of data ownership existing on both the public and private side of activities of data gathering and dissemination should be avoided.

With due regard to national legislation, members should ensure that access to commercial data with use restrictions is treated equally between private arms of NMHSs and private sector companies. All enterprise stakeholders, including NMHSs, should comply with relevant national legislation and policy with respect to both data provision and the avoidance of anti-competitive behaviour. Where an NMHS operates both public and private arms, these should be treated as distinct entities when engaging in activities including: the exchange of data and products (including computer model output); and the provision of services (including consultancy services). Furthermore, where an NMHS with a private arm receives or generates data or products that it does not completely distribute on a full and unrestricted basis under resolutions 25, 40 or 60 to commercial users, the commercial activities of the NMHS should receive equivalent treatment as commercial users.

**F. Integrity**: WMO and the public agencies established by its Members should seek to engage in mutually beneficial relationships and partnerships with academia and the private sector so as to benefit society. The integrity of the WMO and the agencies established by its Members, as well as their credibility, independence and impartiality should be maintained in the engagement.

**G. Sovereignty**: The prerogative of WMO Members in how weather, climate and hydrological services are to be arranged and provided within their sovereign nations should be respected. This includes national or regional policies for making public data and products available on an open and free principle.

**H. Transparency**: Engagement with the private sector should be transparent. Information on the nature and scope of major arrangements should be available to the concerned entities and to the public at large.

## 5. GLOBAL, REGIONAL AND NATIONAL ROLES

Promoting better public-private engagement would require ongoing consultation and action at global, regional and national levels. This will include defining respective roles of WMO constituencies in their interaction with other stakeholders of the weather enterprise.

## 5.1 **Global level – The World Meteorological Organization**

The World Meteorological Organization facilitates worldwide activity and cooperation around weather, climate and water for the benefit of all nations and humankind overall. The WMO role supporting effective public-private engagement includes:

Modernized and clearly articulated standards and recommended practices. WMO Α. is a recognized standard-setting organization and its standards and recommended practices are developed to enable a unified global data exchange in the weather, climate, water and environment areas; a highly harmonized data processing and forecasting; as well as, provision of services with an acceptable level of quality and standard to specific economic sectors and the public. Standards are constantly developing based on both evolving requirements and evolving technology. WMO, throughout its existence (and before that time, the International Meteorological Organization (IMO)) managed to mobilize a global community of expertise to support the development, validation and promulgation of standard and recommended practices, which, once approved by the Congress, provided the needed level of standardization, interoperability and investment-sharing that led to the today's highly successful Global Weather Enterprise. With the understanding that these regulations shall be respected by all providers in all Member countries, WMO should in the future engage more experts from the private sector and academia, including through sector's professional associations like the HMEI and other relevant international bodies, in the standard-setting process for a shared ownership of these standards. As WMO work in standards and practices setting expands to consider PPE, care should be taken in not prescribing specific solutions but rather should focus on desired outcomes and performance. WMO should also enhance its role to help ensure quality in data and services. In particular, compliance with standards should be promoted in all enterprise sectors and supported by agreed verification and validation measures.

**B.** Encouraging free and unrestricted exchange of data. Governments who signed the WMO Convention have committed to following its regulations, including standards and practices related to the collection and sharing of data and products between stakeholders to support the global infrastructure as outlined in Resolutions 25 (Cg-XIII), 40 (Cg-XII) and 60 (Cg-17) and relevant technical regulations. WMO will develop and adapt guidance for NMHSs and other stakeholders as needed on free and unrestricted exchange of data as it applies to the current environment, in which private-sector entities may assume larger roles in data provision.

**C. Facilitating dialogue between all stakeholders**. WMO should, together with its Members, formulate strategies to better communicate the value of public meteorological and hydrological services. Furthermore, WMO has proactively set up and participated in the ongoing global dialogue between public, private and academia stakeholders, engaging players and tracking developments and trends. Over time, and giving due consideration to existing forums, it should lead development of formal mechanisms to support regular, ongoing dialogue with private and academic sectors along all parts of the value chain. Such mechanisms should provide a platform for exploration and resolution of issues and should seek to offer the members of the enterprise more parity in order to foster a spirit of cooperation and partnership. The governance structures and experience of other international organizations may provide useful models. WMO technical commissions should actively seek to better engage available expertise not only from the public sector, but also from academia and private sector. Such an all-inclusive approach will require innovation in the way the technical bodies conduct their business engaging efficient use of modern communication and collaboration technology.

**D.** Investigate emerging issues as well as new roles, and implementing such roles as appropriate. As the weather enterprise evolves, WMO should monitor issues emerging around public- private engagement that could significantly affect either its Members or the sustainability of the global weather enterprise. Among those issues, it should investigate

the feasibility and desirability of taking on new roles to help ensure quality in data and services. For example, in an increasingly crowded marketplace, there is a pressing need for an international authority to objectively validate the quality of the provided information and services, thus helping users in their selection of providers based on quality assurance. WMO programmes and expert bodies have been engaged in the development and implementation of verification methodologies, inter-comparison campaigns and quality management guidance. Verification of forecasts of different providers from both private and public sectors has also been done by independent third parties. In the future, such quality assurance activities should be better coordinated and criteria should be developed with the participation of the three enterprise sectors in order to distinguish between a "good service" and a "bad service". The WMO Secretariat also needs to continue to expand dedicated expertise in "meteorology as a business".

## 5.2 Regional level – regional associations

WMO regional associations interface with their Members, liaise with other stakeholders, designate and support regional centres for delivery of regional services to Members. To support engagement with private sector and other stakeholders, regional associations are urged to take on roles including:

**A. Gathering and disseminating information and guidance**. Regional associations are urged to facilitate change management and advocate for inclusive consultations, including knowledge and experience sharing, in order to enable Members to learn from each other and provide support as needed for effective public-private engagement. Knowledge can be shared globally through the WMO Secretariat to regional and national levels, as well as directly by regional associations with Members and other stakeholders.

**B. Raising awareness and capacity-building to Members**. Regional associations are urged to provide capacity-building training to agency staff and leadership in practices needed for effective promotion of the value of weather services as well as public-private engagement. Such a capacity-building should highlight the need for public-private-academia partnerships in the light of the UN SDGs and should come with practical examples of good national practices.

**C. Exploring further cooperation in service provision at regional and subregional level**. The regional associations should take a lead in informing their Members of the ongoing development of the Global Weather Enterprise and its expected growth. A key element to be well understood and exploited is the increasing internationalization of the service delivery. Modern technology allows for a global and regional provision of data and information services which in the past were provided exclusively by national entities. Such a trend poses both opportunities and risks, which regional associations should address to help their members adapt to this new environment. In particular, regional associations should study and promote examples of regionalization of certain services through bilateral or multilateral cooperation between Members which improve competitiveness of services and reduce their costs. Such subregional and regional approach should again not be limited to the public sector, but to explore achieving more efficiency through public-private cross-border engagement without compromising national mandates or quality requirements.

## 5.3 National level – Members and NMHSs

Given the increasing participation of the private sector, Members and their designated agencies such as NMHSs are urged to take action to maintain and improve agency engagement with the private sector to strengthen the weather enterprise with the aim of maximizing benefits to the Members in the short- and long-term. Effective engagement also offers opportunities to strengthen NMHSs and all entities involved in the weather enterprise. Roles include:

**A.** Fostering structured dialogue with the private sector. Members and their designated agencies such as NMHSs are urged to reach out proactively to set up structured dialogue between public, private and academic sector stakeholders on issues of common interest.

Regular dialogue would be more effective to improve mutual understanding and foster relationships. In this, Members and NMHSs may benefit from recognizing the opportunities where national objectives converge with those of the private sector.

**B.** Encouraging appropriate legislation, business models, performing change management and building on core strengths. In an environment where private sector engagement in meteorological and hydrological services is likely to continue in the decades ahead, NMHSs should strongly consider building expertise, to develop their research and development capability, and to continuously enhance the quality and dissemination of their products and services to allow them to thrive in an increasingly competitive environment. They may also wish to undertake initiatives in order to understand and adapt to ongoing changes in their business models, including potential initiatives involving national legislation to enable effective public-private engagement to leverage resources and build upon the strengths of the sectors. Recognizing the increasing stress on the public budget in many States, which in turn puts a lot of stress on the NMHSs ability to maintain and develop their infrastructure and service capacity, national legislation enabling effective and equitable public-private engagement, creating 'win-win' solutions to serve better the society and strengthening the authoritative role of NMHSs, may be appropriate.

**C. Promoting uptake of WMO standards and guidance**. On an ongoing basis, Members' governments are urged to ensure that all national players providing meteorological or hydrological functions comply with WMO technical regulations (standards and recommended practices, procedures and specifications) that are designed to ensure global standardization and quality of data and products. WMO will also issue guidance for effective engagement between public and private actors in the weather enterprise and to provide some 'rules of engagement' for Members and other stakeholders. Members also are urged to promote awareness of and compliance with these standards and guidance among other stakeholders.

**D.** Fostering partnerships between public and civil society entities. In an evolving world, with societal vulnerabilities to weather and climate risks growing, designated Member agencies such as NMHSs are strongly encouraged to consider the needs and resources of public sector and civil society weather, climate, hydrological, marine and other related service consumers, and where opportunities exist to improve services for vulnerable end users, to seek to provide data and other information at cost-recovery rates or less.

**E. Exploring new partnerships at national and cross-border nature**. In anticipation of a growing diversity in a multi-stakeholder weather, climate and hydrological service provision landscape, partnerships between national agencies or multi-national service delivery models through bi-lateral or multilateral agreements for certain services, should be encouraged. Such models would leverage resources, improve efficiency and allow consistent and seamless services across national borders.

## 6. PUBLIC-PRIVATE ENGAGEMENT FOR CAPACITY DEVELOPMENT

The UN sustainable development agenda 2030 makes a call to join-up efforts to better serve countries, and it creates a sense of urgency for country level action. Most of the Sustainable Development Goals (SDGs) are linked to weather-, climate- and water-sensitive areas. Achieving them requires the multi-stakeholder public-private-academic Global Weather Enterprise (GWE) to develop and expand its capability to help reduce the vulnerability of societies to weather and climate extremes. The goals set by the 2030 Agenda, the Sendai Framework and the Paris Agreement is mobilizing an increasing amount of investments, which effectiveness will highly depend on the quality of weather, climate and hydrological information supporting those investments.

While demands for information and service provision are increasing exponentially, many national meteorological and hydrometeorological services (NMHSs) in developing countries are confronted with major performance challenges. Closing this capacity gap requires scaling up collaboration and leveraging of WMO expertise and knowledge through strategic partnerships for increased impact.

Capacity development actions to ensure production of and access to high-quality weather, hydrological and climate information needed for sustainable development, will require a concerted effort of all GWE stakeholders, but also a mobilization of significant financial resources. This challenging task brings the development finance institutions (DVI) as another important partner in the GWE. The growing flow of resources for building the capacity of hydrometeorological services including from the Green Climate Fund (GCF), Multilateral Development Banks, and bilateral partners require a more systematic and complementary approach for sustainable investments. Efforts need to focus not only on "more" but also "better" investments to increase capacity and relevance of NMHSs as key players for a country's sustainable development

The GWE has a major role in developing business models to ensure the best use of the significant donor funds for raising the capacity of the developing countries in a sustainable manner. The interlinkages and interdependencies between the developing and developed world substantiate two main business cases for the enterprise: the business case of a sustainable global infrastructure to run global services, and the business case of enabling developing countries to develop local capacity and benefit from the global services available. A component of the capacity supporting local capabilities throughout the WMO community is currently and will continue to be, tied to the ability of the growing private sector to create jobs, especially as the government sector shrinks in the face of contracting budgets. In this regard, a focus on the growth of the local workforce with expertise in the IT and science-to-service advancements will go hand-in-hand in the development and growth of local capabilities within the private sector that will be required to sustain the capacity development envisioned for all Members.

Development projects with public-private engagement have a potential to provide sustainable solutions for modernizing national infrastructure and enhancing the access to and the quality of the requisite services needed by the national economy and citizens. To enable such partnerships, it is necessary for both public and private sector stakeholders to build mutual trust, respect a code of ethics and strive to establish long-lasting engagement. Business models based on leveraging of the resources, cost- and revenue-sharing, should be further developed and promoted. The academic sector has also its important role in such partnerships by bringing innovation and training and education opportunities.

At international level, WMO should work closely with the development financing institutions in designing projects that are based on prioritized national needs following the 'people first' principle, financially viable to ensure sustainability, and reinforcing the capability of the developing countries to be part of the international exchange of data and products through the WMO global systems.

## APPENDIX

## **GLOSSARY OF TERMS**

Note: The definition of terms related to public-private engagement is a work in progress. Thus, the definitions of terms below should be seen as related to the context of this Policy Framework and not as universally applicable.

**Academic Sector** means public or private higher education establishments awarding academic degrees, public or private non-profit research institutes whose primary mission is to pursue research. (definition used by the European Commission)

**Private sector (business sector)**: Either for-profit, and commercial enterprises or businesses; or business associations and coalitions (cross-industry, multi-issue groups; cross industry, issue-specific initiatives; industry-focused initiative); including but not limited to corporate philanthropic foundations".

**Public-private engagement**: Engagement by NMHSs (and/or other public agents) with the private sector in various modes in the production and delivery of weather, climate, hydrological, marine and related environmental information and services while respecting the public interest and the mandates of NMHSs and keeping in mind budgetary constraints.

**Public-private partnerships** are voluntary and collaborative relationships among various actors in both public (State) and private (non-State) sectors, in which all participants agree to work together to achieve a common goal or undertake specific tasks. Partnerships may serve various purposes, including advancing a cause, to implement normative standards or codes of conduct, or to share and coordinate resources and expertise. They may consist of a specific single activity, or may evolve into a set of actions or even an enduring alliance, building consensus and ownership with each collaborating organization and its stakeholders. While they vary considerably, such partnerships are typically established as structured cooperative efforts with a sharing of responsibilities as well as expertise, resources and other benefits.

**Weather Enterprise**: A name used to describe the multitude of systems and entities participating in the production and provision of meteorological, climatological, hydrological, marine and related environmental information and services. For brevity, the name only refers to "weather"; however, the enterprise encompasses all business areas of WMO, including weather, climate and water; and all core activities – observations, modelling, data-processing and forecasting, and other services and related research. The weather enterprise includes public-sector entities (NMHSs and other governmental agencies), private-sector entities (such as equipment manufacturers, service-provider companies and private media companies) and academia, as well as civil society (community-based entities, NGOs, national meteorological societies, scientific associations, etc.). The weather enterprise has global, regional, national and local dimensions.

**Global Weather Enterprise** is the global dimension of the multi-national multi-stakeholder weather enterprise encompassing all contributors to the Earth system monitoring, prediction and service provision from public, private and academic sectors, as well as learned or civil society entities.

**Data and services**: The terms data and services are understood as complementary and often overlapping. Their use and definition is expected to develop over time.

## Resolution 34 (EC-70)

#### WMO Code of Conduct for officers of the Organization and members of the Executive Council including its committees and for delegates at constituent body meetings

THE EXECUTIVE COUNCIL,

**Noting** the exchange of correspondence between the external auditor and the President of WMO in 2017 and 2018 related to the reputation of WMO,

**Noting also** that the President requested the Secretary-General to prepare a draft code of conduct for officers of the Organization and members of the Executive Council, including its committees and for delegates at constituent body meetings,

**Endorses** the Code of Conduct for officers of the Organization and members of the Executive Council including its committees and for delegates at constituent body meetings, as provided in the annex to the present resolution;

**Decides** to consider amendments to the Code of Conduct, with special emphasis on paragraphs 2.3, 2.4 and 2.5, at the seventy-first session of the Executive Council;

**Requests** the Executive Council Working Group on Strategic and Operational Planning to review and propose amendments to the Code of Conduct as may be required to the Executive Council at its seventy-first session.

## Annex to Resolution 34 (EC-70)

## WMO Code of Conduct for officers of the Organization and members of the Executive Council including its committees and for delegates at constituent body meetings

## 1. Purpose and Scope

1.1 The purpose of this Code of Conduct (the "Code") is to reflect the utmost commitment of the World Meteorological Organization (the "Organization") to the highest standards of ethical behaviour.

1.2 The Organization recognizes that the legitimacy and credibility of its work depends on public trust and confidence in the institution. This may be negatively impacted by the individual behaviour of those serving the Organization and supporting its work.

1.3 The Officers of the Organization (the "Officers") and the Executive Council ("EC") and delegates at constituent body meetings play a critical role in safeguarding and maintaining the image and reputation of the Organization. Accordingly, Officers, members of EC,<sup>1</sup> as well as members and alternate members of the EC Committees established by EC (collectively, "EC and Committee members") and delegates at constituent body meetings are expected to reflect the highest the standards of conduct. This includes observing the present Code.<sup>2</sup>

1.4 Breaches of this Code shall be brought to the attention of the President, who will decide how to proceed in the best interests of the Organization. Actions in this regard may include but are not limited to bringing the matter to the attention of the relevant Member State.

## 2. Safeguarding the Image and Reputation of the Organization

2.1 Bearing in mind the potential impact of their individual behaviour on the work of the Organization, Officers, EC and Committee members and delegates at constituent body meetings should refrain from engaging in any activity that may negatively affect the image and reputation of the Organization.

2.2 Due regard for the potential impact on the image and reputation of the Organization means also taking into consideration public perceptions. Questions raised in a public forum regarding ethical behaviour of EC and Committee members and delegates at constituent body meetings may have an immediate effect of jeopardizing the Organization interest(s). These situations – which may, for example, arise in the context of alleged criminal behaviour, or in disputes or complaints of a public nature – must be handled with care, respecting individual rights while also recognizing the need to prioritize the interests of the Organization.

2.3 Where individual circumstances arise with a reasonable likelihood of negatively affecting the image and reputation of the Organization, the relevant Officer, EC or Committee member or delegate shall immediately inform the President in writing. Officers, EC and Committee members or delegates should bring such matters to the attention of the President as soon as possible, preferably well before the matter becomes a question of public discussion.

2.4 After consulting with the President, EC and/or the respective Committee, as relevant, delegates, Officers, EC members or Committee members shall either: (a) voluntarily step down from the Office of President or Vice-Presidents of the Organization, EC or the Committee; or (b) shall refrain from any participation in constituent body sessions, EC or the relevant Committee until the circumstances are resolved. The WMO President shall decide whether he/ she considers the circumstances resolved to his/her satisfaction. If the matter relates to an Officer or an EC/Committee member and is not deemed resolved by the next EC meeting, or within 1 (one) year from the date that it was reported to the President (whichever is later), the Officer, EC or the Committee member shall definitively step down and the usual procedure for election/designation of a new Officer, EC and Committee member shall be launched.

2.5 Where actual circumstances have not yet arisen but it is reasonably foreseeable that they will, the delegate, Officer, EC or Committee member shall inform the President, who will decide how to proceed.

## 3. **Conflicts of interest of Officers, EC/Committee members**

3.1 In carrying out their WMO duties, Officers, EC members or Committee members shall avoid any situation that poses an actual, or the potential for, or the appearance of a conflict between their personal interests and the performance of their official duties.

3.2 An actual, potential or apparent conflict of interest arises when personal interests of an Officer, an EC member or a Committee member interfere or may be perceived as interfering in any way with the performance of his/her official duties.

3.3 An actual conflict of interest involves a conflict between official duties of an Officer, EC member or Committee member as part of the EC or a Committee and his/her individual interests that could improperly influence the performance of those official duties. Such a conflict of interest may arise when an Officer, an EC member or a Committee member takes actions or has interests that make it difficult to perform his/her work objectively and effectively, or when an Officer, an EC member or a Committee member takes actions that intentionally result in improper benefits for that an EC member or a Committee member, his/her immediate family members or other persons or entities.

3.4 A potential or apparent conflict of interest arises when it could reasonably be perceived that an Officer, an EC member or a Committee member personal interests could improperly influence the performance of his/her official duties, even if this is not, in fact, the case.

3.5 In order to avoid such circumstances, Officers, EC members or Committee members shall not take any action that might result in, or create the potential for, or the appearance of:

- (a) Giving unwarranted preferential or prejudicial treatment to any organization or person; or
- (b) Impeding the efficiency of the decision-making processes in EC or the relevant Committee; or
- (c) Losing independence or impartiality of action; or

(d) Affecting adversely the confidence of Member States or the public in the integrity of WMO.

3.6 An Officer, an EC member or a Committee member having an actual, potential or apparent conflict of interest concerning a deliberation or a decision to be taken by EC shall declare it to the President prior to the relevant session. For Officers and EC members, as a matter of good practice, the Officer and EC or Committee member should report the matter to the government of the Member State of which he/she is a national. In addition, he/she shall not communicate with other EC or Committee members regarding the decision or deliberation, shall not participate in the discussion of such item in EC or in the relevant Committee, and shall abstain from voting on such decision. Any such declaration concerning a recusal shall be recorded in the minutes of the session as follows: "[NAME] recused himself/herself from consideration of this item."

3.7 An Officer, an EC member or a Committee member having a conflict of interest concerning a decision of EC or the relevant Committee to be adopted by written or tacit procedure shall abstain from communicating with other EC or Committee members about the decision and shall abstain from voting on such decision. He/she may ask, in writing, the President that his/her abstention on grounds of conflict of interest be recorded.

## 4. Independence of Officers, EC/Committee members

As provided under Article 6 of the WMO Convention, in the performance of their duties, Officers and EC members act as representatives of the Organization, not as representatives of particular Member States. EC members, as well as members of the EC Committees are expected to respect the principle of independence while carrying out their duties.

## 5. Acceptance of gifts

Delegates, Officers, EC members or Committee members shall exercise tact and judgement in relation to the acceptance of gifts,<sup>3</sup> favours or entertainment from persons having dealings with WMO in order to protect WMO from any appearance of impropriety or of improper influence on the performance of their official duties.

## Resolution 35 (EC-70)

## WMO Executive Council structures

THE EXECUTIVE COUNCIL,

## **Recalling:**

- (1) Decision 84 (EC-68) Governance review,
- (2) Decision 68 (EC-69) WMO constituent body reform,

**Having considered** the recommendations of the Executive Council Working Group on Strategic and Operational Planning concerning the WMO constituent body reform,

**Emphasizing** the essential role of the Executive Council as the executive body of the Organization, responsible for the coordination of programmes of the Organization and for the utilization of its budgetary resources in accordance with the decisions of the World Meteorological Congress,

**Recalling** the primary functions of the Executive Council set out in Article 14 of the Convention of the World Meteorological Organization,

**Considering** that the discharge of such primary functions requires the Executive Council, inter alia:

- (1) To lead the development of the WMO Strategic Plan and provide recommendations to Congress on overall policy aspects, including the establishment of partnerships,
- (2) To support and supervise regional associations and technical commissions in the implementation of their decisions and resolutions and in the preparation of their operating plans,

<sup>&</sup>lt;sup>1</sup> Including the President, the three Vice-Presidents, the ex officio members, and the elected/acting members.

<sup>&</sup>lt;sup>2</sup> Staff members serving in the Secretariat have pledged their commitment to ethical behaviour through the WMO Code of Ethics.

<sup>&</sup>lt;sup>3</sup> Gifts include any tangible goods or services, honour, decoration, remuneration, favours or economic benefits.

- (3) To provide advice to Congress on scientific and technical matters and emerging issues, including those that entail the engagement of expert communities beyond the WMO mandate,
- (4) To provide recommendations to Congress concerning programme and budget estimates, financial matters and compliance with the legal framework of the Organization,

## **Decides:**

- (1) To establish the following standing bodies reporting to the Executive Council, with the terms of reference as given in the annex to the present resolution:
  - (a) Policy Advisory Committee (PAC);
  - (b) Technical Coordination Committee (TCC);
- (2) To confirm the following bodies reporting to the Executive Council:
  - (a) WMO Staff Pension Committee, established by Resolution 30 (EC-XXI), as amended by Resolution 21 (EC-XXXV);
  - (b) WMO Audit Committee, with the terms of reference provided by Resolution 8 (EC-LXIII);
  - (c) Financial Advisory Committee, with the terms of reference provided by Resolution 39 (Cg-XV), reporting to Congress and the Executive Council;
- (3) To recommend to Congress the establishment of the Science Advisory Panel, reporting to Congress and the Executive Council, with the terms of reference as formulated in Recommendation 25 (EC-70) Annex 4;
- (4) That the need for, and the functions of, other bodies reporting to the Executive Council shall be reconsidered in light of the establishment of PAC and TCC;
- (5) To continue consideration of the matter of the number and distribution of seats of the Executive Council, referred to the Council by Congress, in the next financial period 2020–2023;
- (6) To defer the implementation of point (1) in this decision regarding the PAC and the TCC to the Executive Council at its seventy-first session.

## Annex to Resolution 35 (EC-70)

## Policy, scientific and technical advisory bodies reporting to the Executive Council

## A. Policy Advisory Committee

## Mandate

The Policy Advisory Committee (PAC) shall advise the Executive Council on any matters concerning the strategy and policy of the Organization submitted to it by the Executive Council, with a particular focus on:

(1) Maintaining awareness of global trends and external drivers that affect Members and the long-term vision-setting of the Organization,

- (2) Improving and aligning the Organization-wide strategic, operational and budget planning process, including monitoring of implementation of the Strategic Plan,
- (3) Keeping under review WMO policies and practices for the exchange of meteorological, hydrological and climatological and related data and products,
- (4) Optimizing WMO governance and programme structures, processes and practices to ensure the effective and efficient use of resources through a more strategic focus and within a quality management framework,
- (5) Addressing and keeping under review the evolution of the role and operation of National Meteorological and Hydrological Services,
- (6) Streamlining WMO scientific and technical programmes to ensure their relevance to the Strategic and Operating Plans and effectiveness,
- (7) Guiding the engagement of the Organization in partnerships with other UN and international organizations, the academia and the private sector,
- (8) Mainstreaming and advancing gender equality across the Organization, especially in governance and decision-making.

#### Membership

The Committee shall be composed of:

- (a) The presidents of the regional associations,
- (b) Eight Members of the Executive Council appointed by the Council upon proposal by the President noting the need for the expertise in the focus areas of the mandate of the Committee and taking into consideration regional representation and gender equality factors,
- (c) The chairs of the Scientific Advisory Panel and the Technical Coordination Committee as ex officio members.

#### Working procedures

The Committee shall be chaired by the WMO President or one of the Vice-Presidents.

The Committee shall normally meet once per year prior to a session of Executive Council.

The chair of the Committee may invite experts and/or representatives from partner organizations to attend meetings of the Committee as observers.

At meetings of the Committee, the members may be assisted by advisors.

The Committee may establish time-bound substructures as needed for the discharge of specific tasks during an intersessional period.

#### **B. Technical Coordination Committee**

#### Mandate

The Technical Coordination Committee (TCC) shall act as a two-way interface between the Executive Council and the technical bodies of the Organizations: technical commissions, the Research Board, and other relevant bodies. It shall ensure the coordination between these bodies and shall provide the necessary analytical information to inform EC decisions on

technical matters. The TCC shall oversee the level of coordination between the technical bodies and the regional associations to ensure that the technical work of the Organization is properly guided by the needs and priorities identified by Members.

The committee shall report to the Executive Council on the following issues:

- (1) Progress in developing further the WMO technical regulatory framework in a consistent manner by all technical bodies involved;
- (2) Status of compliance with technical regulations of the WMO Members, including advice on identified barriers to compliance and ways to address them to resolve deficiencies;
- (3) Impact and risk assessment of new standards and technology on the systems operated by Members, including financial and human resources impact;
- (4) Evolving user needs for information and services and alignment of the plans of the WMO technical bodies to meet those needs;
- (5) Collaboration and coordination between the technical bodies and regional associations to ensure that regional priorities and requirements are considered into the technical bodies' planning;
- (6) Collaboration among the technical commissions, the Research Board and any other bodies established by Congress or Executive Council required to facilitate the transition of research to operations through co-design, operational testing and feed-back from operational community;
- (7) Issues of common concerns of regional associations, technical commissions, the Research Board and any other bodies established by Congress or Executive Council affecting the progress of implementation of the Strategic and Operating Plans;
- (8) Coordination with other bodies, such as SAP and PAC and any other issues that might be referred to by the Executive Council.

## Membership

The Committee shall be composed of:

- (a) The presidents and vice-presidents of the technical commissions,
- (b) The presidents of regional associations,
- (c) The chair and vice-chair of the Research Board,
- (d) The chairs of any other bodies established by Congress or Executive Council,
- (e) The chairs of other WMO sponsored and co-sponsored technical bodies identified by the President.

#### Working procedures

The Committee shall be chaired by a WMO Vice-President.

The Committee shall meet in principle once per year prior to a session of Executive Council.

The chair of the Committee may invite experts and/or representatives from other partner organizations to attend meetings of the Committee as observers.

At meetings of the Committee, the members may be assisted by advisors.

The Committee may establish time-bound substructures for the discharge of specific tasks during an intersessional period. Such temporary substructures shall be discontinued at the end of every intersessional period.

## Resolution 36 (EC-70)

## WMO Constituent Bodies Reform Transition Plan and Communication Strategy

THE EXECUTIVE COUNCIL,

**Recalling** Decision 68 (EC-69) – WMO constituent body reform, which:

- (1) Agreed that "the change should be implemented through a phased approach ensuring smooth and effective transformation of different kinds of WMO constituent bodies",
- (2) Requested the Working Group on Strategic and Operating Planning to:
  - (4) Prepare a communication strategy, including consultations with Members and relevant external constituencies, such as IOC/UNESCO, FAO, ICAO;
  - (6) Elaborate the transition and change management processes,

**Recognizing** the key importance of having a transition plan that establishes the goals, priorities and strategies to be in place for a successful transition, together with a clear schedule for the different phases of the transition process and related change and risk management,

**Having considered** the recommendations of the Working Group on Strategic and Operating Planning concerning the transition process and communication strategy,

**Adopts** the proposed WMO Constituent Bodies Reform Transition Plan (hereafter referred as the Transition Plan) presented in Annex 1 to the present resolution, and the related Communication Strategy presented in Annex 2 to the present resolution, with the understanding that they will be living documents that will be kept under continuous review and updated as necessary to meet the established targets and milestones;

**Establishes** an Executive Council WMO Constituent Bodies Reform Task Force (CBR-TF) with composition and terms of reference as shown in Annex 3 to the present resolution, tasked to support and guide the further development and implementation of the Transition Plan;

**Requests** the Chairperson of CBR-TF to initiate the work of the Task Force as soon as possible and to establish a timeline for carrying out its tasks, aligned with the timeline of the Transition Plan;

**Requests** presidents of regional associations and technical commissions to facilitate the implementation of the Transition Plan and the Communication Strategy through coordinated awareness-raising actions in their respective Regions and commissions, including through the agendas of the forthcoming regional association or technical commission sessions before the Eighteenth World Meteorological Congress;

**Requests** the presidents of technical commissions to coordinate closely with CBR-TF to ensure the continuity of activities included in the work programme of the current technical commission, as well to provide technical advice and implementation assistance to Members during the transition period; **Requests** the Secretary-General, in coordination with CBR-TF:

- To continue development of the Transition Plan before the Eighteenth Congress, using recognized project management processes and tools, and ensuring an appropriate approach to balance speed of progress against the associated risks, and ensure the early, sustainable implementation of high priority activities;
- (2) To manage the transition process, engage main stakeholders, synchronize the Transition Plan with the conjoint change management, communication and risk mitigation processes;
- (3) To work closely with the presidents of technical commissions and of regional associations, and other groups as necessary, to ensure that transition and communication activities are planned and conducted in a scheduled and harmonized way;
- (4) To arrange relevant activities and allocate resources to support the work of CBR-TF and ensure the implementation of the communication and outreach actions envisaged in the Communication Strategy, including:
  - (a) Conduct of meetings of CBR-TF;
  - (b) Web space for communication and outreach dedicated to the WMO constituent bodies reform;
  - (c) Preparation and publication of awareness-raising materials on the WMO constituent bodies reform.

## Annex 1 to Resolution 36 (EC-70)

#### WMO Constituent Bodies Reform Transition Plan (draft v02, 14 May 2018)

## 1. Introduction

During the last ten years a number of UN agencies have undertaken a review, realignment and reform process. There are several major drivers for this but they all could be summarized as alignment with 21st century realities, priorities and dynamics.

The WMO Constituent Bodies Reform (WMO CBR) has been carried out in accordance with the directions given by Cg-17 (2015) and the following EC sessions in 2016 and 2017. The scale of the discussed changes to the constituent bodies is unprecedented in the history of the WMO. The EC Working Group on Strategic and Operational Planning (WG-SOP) has been given the task to discuss, plan and design the reform elements and process, and to develop coordinated mature proposals for the structural changes, related working mechanisms and transition processes to be considered by the Cg-18 in June 2019.

As an interim step, Decision 68 (EC-69) tasked the WG-SOP with support from the Secretariat to develop, for consideration by EC-70, a set of recommendations for Cg-18, which address the key issues identified in the proposal for the WMO CBR, including the transition and change management processes.

The reform will affect the structure of the organization, its strategy and priorities, its work programmes realignment, its processes and finally the Secretariat. It is also a cultural change. Thus, the success of the reform depends to a large extent on a well elaborated change management process and scheduled transition. Communication with Members, partner

organizations and users to explain the rationale, expected improvements and benefits of the reform and to receive feedback during the process is another key to success of the planned restructuring and realignment.

## 2. **Objective**

The Transition Plan describes how the changes of the structure will be implemented. The objective is to ensure a scheduled approach and to assign governing and reporting functions along the process. It focuses on changes that are anticipated, planned ahead of time.

The Transition Plan is based on decisions/resolutions of the EC-70 (June 2018) (Resolution 36 (EC-70). A revision is envisaged based on decisions by extraordinary session of the Commission for Hydrology (CHy-Ext.) in December 2018, and Cg-18 (June 2019) to ensure timely and effective follow up on the agreed actions related to the CBR. The transition plan is aligned with the (draft) WMO Strategic Plan (to be adopted by Cg-18) with a view to synchronize the reform process with the planned activities in all technical and capacity development areas and ensure continuity of work needed to achieve its strategic objectives.

It is understood that the reform will be an evolving process which requires flexibility and readjustment of the implementing actions while maintaining the main objectives, milestones and targets. Therefore, the transition plan will be a living document continuously monitored and reviewed with well-established feedback mechanisms and ability for corrective actions.

## 3. Definitions

To ensure consistent understanding of the formats and roles of the new types of subsidiary bodies, the following working definitions<sup>10</sup> should apply:

**Advisory or Coordination Committee of Executive Council**: a committee established by the Executive Council comprising members of the Council and/or additional experts invited by the Council, with a main task to address a specific area of work of WMO and provide advice to EC to inform its decisions.

**Standing Committee of a technical commission**: a quasi-permanent expert body established by and reporting to a technical commission with limited scope and terms of reference defined by the parent commission; normally, established for a period of 4 years. Standing committees are expected to deal mostly with the required normative work in accordance with their Terms of Reference, and submit strategic recommendations and suggestions on behalf of the committee to the respective commission.

**Inter-agency (Standing) Committee**: a committee established jointly by the WMO and one or more partner organization(s) to address cross-cutting areas of interest of these organizations. The establishment of an inter-agency committee should be through an Agreement to be signed by the cooperating organizations establishing inter alia the scope of the Committee, the responsibilities of the signatories, the working mechanisms and a summary of the signatories respective reporting structures.

## 4. Transition process

The transition process will take into consideration the "Current Situation" (current constituent body structure and working mechanisms) and an outline of the current realm of organizational elements that will be impacted by the reform. This will be followed by a clear outline of the "New Situation" (agreed new constituent body structure and working mechanisms).

<sup>&</sup>lt;sup>10</sup> To ensure flexibility in establishing effective sub-structures, these working definitions are not included in the WMO General Regulations, with the understanding that Regulations 33 to 45 will be applicable to any new subsidiary structure to the constituent bodies.

The main element of the transition process will be to form a clear vision of the "Current"-to-"New", i.e., how the necessary changes to any affected area are going to occur. The change elements that will be considered in the process include:

- (a) Organizational culture
- (b) Organizational structure
- (c) Clear roles and responsibilities
- (d) Skills and knowledge
- (e) Policies/Procedures
- (f) Workflow and processes

The Executive Council will establish a CBR Task Force to coordinate, manage and oversee the transition process.

Changes described here should serve to identify key issues to address in the **Communication** *Plan*, in particular the key issues for applicable stakeholders; and the *Risk Management*.

## 5. **Transition schedule**

Note: This schedule outlines the transition milestones, phases and intermittent targets, and related tasks; the target dates are to be further refined by the Constituent Bodies Reform Task Force (CBR-TF).

5.1 A high-level schedule (major milestones only) is provided in Table 1:

5.2 Intermittent arrangements and targets

Phase 1: A to B (between WG-SOP and EC-70)

- *Target A2B-1*: Final draft proposals to EC-70 (EC-70 docs published);
- *Target A2B-2*: TORs of the CBR-TF prepared for approval by EC-70;
- *Target A2B-3*: Secretariat Change Management Committee (CMC) established to support the CBR-TF work according to the reform proposal endorsed by EC-70;
- Target A2B-4: Finalize the Communication Strategy;
- *Target A2B-5*: Governance Reform website functional.

Phase 2: B to C (between EC-70 and Cg-18)

- Target B2C-1: Meetings of CBR-TF (to be scheduled);
- *Target B2C-2*: WMO Reform discussed at the RA III, V and I sessions and other regional events;
- Target B2C-3: Draft Procedural Handbook(s);
- *Target B2C-4*: Prepare the General Regulations amendment proposal;
- *Target B2C-5*: Communication through website and other publications (FAQs, explanatory memoranda, videos, etc.);

Table 1. Transition schedule		
Milestone A:	EC WG-SOP (April 2018)	
	Agree in principle on proposals for restructuring (EC bodies, TCs, Research Board, other bodies reporting to EC and Congress) and submit recommendation for consideration by EC-70;	
	Agree on the need for establishment by the EC of a Constituent Bodies Reform Task Force (CBR-TF);	
	Advise SG to establish change management plan of Secretariat;	
	Endorse a draft (outline) of the Transition Plan.	
Milestone B:	EC-70 (June 2018)	
	Endorse final draft proposal for WMO Governance Review, including the establishment of technical commissions and Research Board for the next financial period with respective recommendations for consideration of Cg-18;	
	Establish a new EC structure with main bodies: Policy Advisory Committee (PAC), Scientific Advisory Panel (SAP) <sup>1</sup> and Technical Coordination Committee (TCC);	
	Establish the CBR-TF, decide on the CBR-TF Chair and members, and decide on the terms of reference;	
	Endorse the Transition Plan and the Communication Strategy;	
	Decide on any other planning and implementation needs including performance evaluation (of the reform process), etc., identified by EC.	
Milestone C:	Cg-18 (June 2019) and EC-71 (June 2019)	
	Adopt WMO Strategic Plan and the Operating Plan;	
	Adopt WMO Governance Review document package, including the establishment of new technical commissions and Research Board;	
	Endorse new EC structure (PAC, SAP, TCC) and provide further advice;	
	Adopt necessary amendments to the General Regulations;	
	Adopt amendments to the TORs of the regional associations;	
	Elect presidents and vice-presidents of the new technical commissions;	
	Update the Transition Plan with a final timeline and targets for operationalizing the new structure;	
	Establish high-level communication with international partner organizations for planning and coordination of joint activities;	
	EC-71 to complete the new composition of EC (PAC, SAP, TCC fully established with respective governance and work programmes).	
Milestone D:	EC-72 (June 2020)	
	New EC structures (PAC, SAP, TCC) to meet in spring 2020 to elaborate decisions for the EC-72;	
	The new technical commissions and the Research Board report on their major outcome of their first sessions, including fully established new working structure, working programmes and plans with milestones;	
	Final Report of CBR-TF on the completion of the transition phase;	
	Plan performance evaluation and follow up.	
<sup>1</sup> All provisions related to SAP will be adjusted following the decision on the way SAP will be established – by EC or by Congress.		

- *Target B2C-6*: Final draft proposals to Cg-18 including proposals for the presidents and vice presidents of new technical commissions and the Research Board, preliminary mapping of the tasks of the current commissions to the new structure, etc. (Cg-18 docs published);
- *Target B2C-7*: Extraordinary session of CHy (Dec 2018) proposal for hydrological bodies.

## Phase 3: C to D (between Cg-18 and EC-72)

- Target C2D-1: Extended meeting of CBR-TF with the current PTCs and PRAs, PTCs and vice presidents elect to make proposals for the establishment of the sub-structure of the new commissions and Research Board standing committees; map the tasks of the current commissions to the new structure and create transition schedules; and communicate with Members for nominations (standing committee chairs, experts, etc.).;
- *Target C2D-2*: Alignment of the new technical commissions and the Research Board structure with the subsidiary bodies of the regional associations and create transition plan;
- Target C2D-3: Finalize and publish Procedural Handbooks;
- *Target C2D-4*: Communication provide updates on the reform phases through website and other publications (FAQs, explanatory memoranda, etc.); ensure two-way communication to receive feed-back from Members and others concerned;
- *Target C2D-5*: Conduct the first sessions of the new technical commissions and the Research Board (possibly conjointly) to formally establish the new working structure, working plans of the commission, with expected deliverables and milestones; EC-71 (after Congress) to decide on the schedule for these sessions, e.g., before EC-72;
- *Target C2D-6*: Final report of CBR-TF for consideration by EC-72.

## 6. Change management

An effective transition requires effective organization-wide change management. Acknowledging the scope and magnitude of the proposed changes in the WMO structure and processes, which are unprecedented in the history of the Organization, the change management plan is a key element for the success of the reform.

Generally, the change management plan (CMP) should cover three phases:

- Phase 1: Prepare for change
- Phase 2: Manage the change
- Phase 3: Reinforce the change

To ensure a synergetic approach, the CBR-TF defined above should also serve as the main change management body throughout the three phases. In addition, change management entity should be created in the Secretariat to ensure an all-inclusive process.

The following are the generic elements of a CMP, to be considered for a list of planned actions:

- A. Demonstrate reasons for the change.
- B. Define the type and scope of change.
- C. Describe stakeholder support.
- D. Create a change management team.
- E. Develop an approach with organization management.
- F. Draw up a plan for each stakeholder.
- G. Create a communication plan.
- H. Track resistance.
- I. Address roadblocks.

The Secretariat Change Management Committee will be chaired by the Secretary-General. A schedule of change management meetings/events covering the above elements A to I should be established in due course. Change management champions from all departments should also be appointed and engaged in the process.

More details about the change management plan elements are provided in Appendix 1.

## 7. Risk Management

Identification and mitigation of risks should be incorporated in the transition and change management processes. The implementation of the reform as a vehicle to a new level of organizational culture and relevance to society may impose risks to meeting the needs and expectations of the Members during and after the transition phase. Continuity of performance and quality should be ensured along with a scheduled approach in introducing the changes. A mechanism for continuous feedback from stakeholders, in particular Members States, on the success of the reform elements and potential performance impacts should be put in place.

In the risk assessment of the reform elements the following factors should be considered (as advised by the WG-SOP deliberations):

- (a) Doing no harm WMO core business is, at a minimum, maintained during and after transition to the new structure;
- (b) Building all WMO Members' resilience to the consequences of weather, hydrological and climate hazards;
- (c) Yielding improved relevance, effectiveness and efficiency through a flexible structure, improving WMO's ability to deliver its core functions and respond to change;
- (d) Evolution toward a seamless Earth system approach whilst minimizing the gap between research and operations;
- (e) Aligning structure with the value chain in provision of hydrometeorological services;
- (f) Improving strategic and structural alignment of the constituent bodies, improving the interrelationships and adaptiveness among the TCs and other constituent bodies, specialized regional centres and RTCs;
- (g) Strengthening of user and client focus through a holistic fit and synergy with other key international, national, and regional organizations;
- (h) Optimizing WMO resources through the ability to attract and use all the best experts, including from outside the NMHS community.

## **APPENDIX 1**

## ELEMENTS OF THE CHANGE MANAGEMENT PLAN

The following are the generic elements of a CMP, to be considered for a list of planned actions:

## A. Demonstrate reasons for the change

• List factors that led to the decision to change, such as performance gaps, new technology, or a shift in the organization's mission. One approach is to describe the current situation of the organization, and the future situation this plan intends to create.

## B. Define the type and scope of change

- Briefly describe the expected nature of the reform and related need for change management;
- Determine whether this will affect roles, process changes, policy changes, and/or structural organization. List departments, work groups, systems, or other components that may undergo change.

## C. Describe stakeholder support

- List all stakeholders affected by the plan, for example officers, managers, sponsors, users, and/or employees affected by the change. Define how each stakeholder would support the change;
- Consider a chart to communicate this clearly and succinctly. One possible template lists Awareness, Degree of Support, and Influence for each stakeholder, rated on a scale of High/Medium/Low;
- Conduct meetings and/or interviews to gauge support.

## D. Create a change management team

- This team is responsible for communicating with all stakeholders, listening to concerns, and ensuring that the change goes as smoothly as possible. Choose people with high credibility in the organization, and good communication skills;
- This should include a change sponsor at the senior executive level;
- Stress that this involves active work promoting the changes, not just a sign-off on the plan.

## E. Develop an approach with organization management

• Complete support from organization heavyweights is critical for the success of the change. Allow each senior staff member to provide feedback on the change, and work with each one to create an active role in demonstrating and championing the changes.

## F. Draw up a plan for each stakeholder

• For each stakeholder, including those who support the change, assess the risks and concerns involved. Assign the change management team the task of addressing these concerns.

## G. Create a communication plan

- Communication is the most important component of change management. Communicate frequently with every group and person affected. Reinforce the reasons behind the change, and the benefits it will bring;
- Stakeholders should receive personal, two-way communication. Face to face meetings are essential;
- Communication should come from the high-level change sponsor, from the direct supervisor of each employee, and from any additional spokespersons the stakeholder trusts. All communication should have a consistent message.

## H. Track resistance

- There is always resistance to change. This happens on the individual level, so communicate with stakeholders personally to discover the cause. Monitor grievances so the change management team can address them. These concerns commonly include:
  - (i) No motivation to change, or no sense of urgency;
  - (ii) No understanding of the bigger picture or why the change is necessary;
  - (iii) Lack of input in the process;
  - (iv) Uncertainty concerning job security, future role, or future job requirements and skills;
  - (v) Failure of management to meet expectations concerning change implementation or communication.

## I. Address roadblocks

- Many grievances should be met by an increase in communication, or a change in communication strategy that addresses specific issues. Others require additional approaches, which may be included in your plan or left to the change management team to implement as necessary. Consider which of these is right for your organization:
  - (i) For any change in job roles or process, make employee training a top priority;
  - (ii) If you expect low morale or a stressful transition, alleviate this with a company event or employee perks;
  - (iii) If stakeholders are not motivated to change, provide incentives;
  - (iv) If stakeholders feel left out of the loop, hold a meeting to gather feedback and consider alterations to the plan.

## Annex 2 to Resolution 36 (EC-70)

## WMO Constituent Bodies Reform Communications and Engagement Strategy overview

During the seventeenth World Meteorological Congress in June 2015, discussions arose on whether the World Meteorological Organization's (WMO) organizational and governance structures enabled effective and efficient decision-making and implementation of strategic priorities of its Members. It was also recognized that rapid global change was driving a need to undertake a governance review to ensure WMO's ability to meet the growing needs for integrated weather, water and climate information and services.

Consequently, Congress requested the Executive Council to provide recommendations to the Eighteenth Congress on constituent body constructs, as appropriate, including possible new structures for Technical Commissions (TCs), Regional Associations (RAs), Executive Council (EC), and also to provide recommendations on rules, procedures, processes, working mechanisms, and duties, of constituent bodies, WMO Officers (President, Vice-Presidents, Presidents of Regional Associations (PRAs) and Presidents of Technical Commissions (PTCs)) and the relationship between them and the WMO Secretariat to enhance the efficiency and effectiveness of the Organization and good governance.

#### **PURPOSE OF THE COMMUNICATIONS & ENGAGEMENT STRATEGY**

This document will support communications and engagement activities immediately following the 70th Executive Council session until the 18th World Meteorological Congress in June 2019. This Strategy is a key element of the WMO Constituent Bodies Reform Transition Plan and aim to elaborate on the principles for success and the benefits of the proposed recommendations for governance reform outlined in the EC-70 decisions and recommendations (to be completed). It is acknowledged that the proposed reform will be an evolving process, and thus the Communications Strategy, will continue to be adjusted and articulated as part of the overall implementation plan.

In order to successfully execute governance reform, a common understanding of the rationale for reform, and a sense of unity regarding the purpose and desired outcomes of the proposed reform are important to set the stage for its success, both within the WMO constituency as well as within external audiences.

The overall objectives of the Communications and Engagement Strategy within the WMO are, therefore, to: inform and highlight the goals and benefits of the WMO constituent body reform (CBR) in a clear and concise way to internal and external stakeholders; to build support, demonstrate how the changes will strengthen WMO's contributions to global priorities; and to identify leaders as champions for communicating this reform to others.

The overall objectives of the Communications and Engagement Strategy within the stakeholder community outside of the WMO are to inform and raise awareness of plans and strategies, and of the intent of the WMO to adopt an integrated approach to the key areas of weather, water and climate; highlight the benefits of reform for stakeholders; and proactively identify opportunities for enhanced dialogue between WMO and external stakeholders to advance dialogue and action on common objectives of importance to the global agenda.

The Communications and Engagement Strategy should also provide opportunity to Members and stakeholders to participate in the discussion and provide feed-back during all phases of the transition, thus enabling timely corrective actions as may become necessary.

## THE CASE FOR CHANGE

WMO is committed to sustaining its leadership role and remaining fit-for purpose, becoming more efficient and cost-effective, and ensuring its structure aligns well with the priorities of the Organization. WMO recognizes the need to continuously adapt to rapidly changing world forces – such as environmental degradation, resource constraints, increased competition, and technological advances, and to maximize its impact on informing and addressing global issues of concern such as climate change. This governance reform will provide opportunities to amplify proactive regional engagement, and enhance integrated and horizontal dialogue that transcends geographical boundaries.

Name	Rationale and Roles	
WMO Members	Ultimately WMO Member States are responsible for decisions on Constituent Body reform, and therefore need to be informed and engaged in the proposals as early as possible, to secure understanding and endorsement. Successful change will be accomplished only if WMO Members endorse and support the change platform, and are able to actively contribute to and benefit from the change.	
Permanent Representatives (PRs)	Designated by Member States to represent their national government, PRs serve as key advisors to inform and influence the position of Member States. Early and effective engagement, and securing buy in from a critical mass of PRs, will be important to gain traction for the change management plan.	

#### **TARGET AUDIENCES: INTERNAL STAKEHOLDERS**

Name	Rationale and Roles		
Executive Council Members	Members of the Executive Council (EC) provide direction and preliminary support for the changes which will be presented at Congress in 2019. They serve as key channels in increasing awareness, communicating and engaging other Members in the transition. EC members have a key role to play as communicators and champions for the change management plan.		
Presidents of Regional Associations (RAs)	Elected leaders directly implicated by changes to the governance of RAs, who can serve as champions to spread awareness and build acceptance among regional Members, experts and others on the need for, and benefits of, change at the regional level.		
Presidents of Technical Commissions (TCs)	Elected leaders directly implicated by changes to the governance of TCs, and who can serve as advocates to raise awareness and build acceptance among global technical experts on the need for, and benefits of, change. As scientific and technical leaders in WMO, Presidents of TCs will ensure the continued relevance and preservation of WMO's strong technical foundations in the transition to a more integrated and horizontal future governance.		
Experts	The many experts involved in WMO's TCs, RAs and other teams and working groups which will be affected by changes to governance will need to be engaged in, and supportive of, the transition, to ensure continued credibility of WMO and value and visibility for their contributions.		
WMO Secretariat Staff	WMO Secretariat structure will be reorganized to align better with updated governance. Staff of WMO work with TCs, RAs and EC, as well as with Members and experts around the world. Their engagement and support during foundational shifts in WMO's governance will assist in broader understanding and support for changes among the many stakeholders of WMO.		

## TARGET AUDIENCES: EXTERNAL STAKEHOLDERS (examples only)

	United Nations Environment Programme (UNEP)		
	World Health Organization (WHO)		
	United Nations Framework Convention on Climate Change (UNFCCC)		
UN Padias	Food and Agriculture Organization (FAO)		
UN Bodies	Intergovernmental Oceanographic Commission (IOC) of UNESCO		
	Intergovernmental Panel on Climate Change (IPCC)		
	International Civil Aviation Organization (ICAO)		
	International Maritime Organization (IMO)		
	World Bank		
Other key International	Intergovernmental Board Climate Services (IBCS) of the Global Framework for Climate Services		
Bodies and Agencies	European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)		
	European Centre for Medium-Range Weather Forecasts (ECMWF)		
	International Forum of Meteorological Societies (IFMS)		
Research institutions and other societies	Meteorological and Oceanographic Societies (such as the American (AMS) Australian (AMOS), Canadian (CMOS), etc.)		
	International Council for Science (ICSU)		
Private sector entities	The Association of Hydro-Meteorological Equipment Industry (HMEI)		

The overarching rationale for engagement with these key external stakeholders is to actively communicate WMO's proposals for reform, consult on implications and communicate benefits, and to reassure partners on how WMO's changes will enhance the WMO's ability to contribute to the broader global agendas and mandates of these stakeholders.

SUMMARY OF COMMUNICATIONS OBJECTIVES BY TARGET AUDIENC	SUMMARY O	<b>OF COMMUNICATIONS</b>	<b>OBJECTIVES BY</b>	<b>TARGET AUDIENCE</b>
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Internal audience	External audience	
Inform and Raise Awareness on content and plans	Inform and Raise Awareness on content and plans	
Build Buy-In and Engagement for the transformation	Highlight the benefits of the reform for stakeholders	
Identify internal champions to further engage and communicate (i.e. cascading communications) the rationale and benefits of the proposals	Identify and create opportunities for enhanced dialogue between WMO and external stakeholders to advance the common goals of the global agenda around weather, water and climate	

## **OVERARCHING KEY MESSAGES**

## 1. TRANSFORMING TO MAXIMIZE EFFECTIVENESS WHILE MAINTAINING WMO EXCELLENCE

The WMO is dedicated to maintaining its core business and mitigating any disruptions to its work during and after any transition. Recognizing that any significant change will have impacts on programs and activities, WMO is committed to addressing the concerns of Members and stakeholders, and identifying and mitigating risks and any negative consequences.

# 2. THE CHANGES HAVE MANY BENEFITS TO MEMBERS, STAKEHOLDERS AND SOCIETY

The current WMO governance structure can be improved and optimized to better meet the need of its Members, external stakeholders and position the organization to more visibly and effectively contribute to the global agenda. The movement away from a silo approach, and toward an integrated approach to addressing weather, water and climate issues, will maximize the organization's flexibility and adaptability regarding its role in facilitating and enabling Members to efficiently and effectively deliver meteorological and hydrological information and services. Undergoing this governance review aims to create more nimble and efficient structures that align with current priorities of its Members, and positions the WMO to contribute more optimally to the global agenda.

## 3. CONTINUOUS IMPROVEMENT IS A MANAGEMENT BEST PRACTICE

In the spirit of continual improvement, there is a need to continually explore options to ensure Member concerns are received and addressed. Constituent Body structures and governance should be reviewed and approved by every Congress. Receiving and responding to feedback from Members and other stakeholders on the impact of reform will allow for continual improvement.

## **ELABORATION OF KEY MESSAGES**

## Targeted to internal audiences

- Better align governance and the Secretariat structure with strategic priorities (form will follow function) and facilitate the delivery and implementation of Congress priorities and the Strategic Plan.
- More efficiently use resources in order to better serve societal and national needs for weather, water and climate information and services.

- Streamline and better integrate programmes and activities, with clear management responsibilities.
- Create mechanisms to build greater alignment and engagement of weather, climate and water agencies and partners in order to increase the support to NMHSs and cooperation among NMSs and NHSs.
- Support WMO's holistic Earth System approach through integrated and horizontal structures to enable delivery of multi-hazard and impact-based seamless services.
- Reinforce mandate for constituent body review at each Congress to:
  - address the changing needs and concerns of Members;
  - improve the productivity of sessions by aligning them with the WMO four-year cycle; and
  - become more flexible and adaptable to changing priorities and contexts, and reduce redundancies.

## Targeted to external audiences

- Better position the Organization to serve the needs of the global agenda (e.g. Disaster Risk Reduction, Climate, Sustainable Development, resilience, etc.), and therefore further international cooperation.
- Better enable the participation of public, private, academic, and other interest groups in WMO discussions and to inform decision making processes.
- Engage key partners in WMO activities to enhance the impact and to ensure sustainable resources and visibility (such as World Bank (WB), International Civil Aviation Organization (ICAO), International Maritime Organization (IMO), etc.).
- Create a more holistic Earth System monitoring and modelling capability to serve national, regional and global service demands.
- Address the growing global need for weather, climate and water expertise.

## **METHODOLOGIES OF ENGAGEMENT**

## 1. Engagement Tools

Different formal and informal communications tools and methodologies, on a variety of platforms, will be used to inform and engage internal and external stakeholders of WMO's change management plan, and to articulate the details and benefits of the proposed changes. Primarily, a Website, emails, meetings and surveys will be used to communicate internally. Meanwhile, status reports, briefings, formal meetings with stakeholders, surveys, Frequently Asked Questions (FAQs), and explanatory memoranda will be used for external communications. A cascading champions approach will be used to deliver information; information will travel from WMO leadership to leads of RAs and TCs, whom will convey the same information to other groups such as task teams and working groups.

## 2. **Regular communications for a wide range of stakeholders**

A critical success factor for effective change management is the issuance of regular, digestible and orderly messages from leadership. This outreach has already begun, with presentations by the Secretary General and senior WMO officials at sessions of Regional Associations and other events with key stakeholders, regarding the background and rationale for this reform. This type of communications will continue, with updates on the progress of each element of the governance reform will follow in terms of potential new arrangements, updates on the evaluation of the Strategic Plan and priorities which the new governance structures will deliver on. At the same time, effective mechanisms for two-way communication will provide opportunity to Members and stakeholders to provide advice and proposals on the course of the reform to enable continuous improvement.

## 3. A centralized source of information

Successful change management relies on sharing information with stakeholders. An effective approach in other organizations has been the establishment of a central web-based portal which serves as a resource for information about all aspects of the transformation. A comprehensive and central resource of information would enhance transparency of the reform process and reduce concerns and potential resistance to the proposed changes. Creating a dedicated WMO Reform webpage would inform Members and external stakeholders, and build situational awareness about the transition process



FIGURE 1: WMO PROPOSED STRATEGIC PLAN



## **FIGURE 2: CURRENT GOVERNANCE STRUCTURE**

## Annex 3 to Resolution 36 (EC-70)

## WMO Constituent Bodies Reform Task Force (CBR-TF)

#### 1. Scope and time span

The CBR-TF will perform an oversight function with regard to the implementation of the WMO Constituent Bodies Reform Transition Plan and Communication Strategy. The group will be active from July 2018 until the completion of the transition of the CBR.

## 2. Terms of Reference

A. To regularly review the Transition Plan and provide guidance and support to the Secretary-General on its development; and provide a report on the updated Transition Plan to Cg-18.
- B. To monitor the implementation of the Transition Plan through a set of success indicators and provide guidance to the Secretariat on corrective actions as necessary.
- C. To monitor the implementation of the WMO Constituent Body Reform Communication Strategy, provide advice on outreach materials and events, and assess their outcomes.
- D. Provide progress reports to the Cg-18 (June, 2019), EC-71 (June, 2019) and a final report to the EC-72 (June, 2020).

## 3. Composition

The CBR-TF will be chaired by Prof. Gerhard ADRIAN and composed by the following EC members: Phil EVANS, Louis UCCELLINI, Toshihiko HASHIDA, David GRIMES, Maxim YAKOVENKO, Albert MARTIS, Chin Ling WONG, Mamadou Lamine BAH, Guillermo NAVARRO. The CBR-TF Chairperson may invite additional expert to support the work of the task force.

#### 4. Working mechanisms

The CBR-TF will conduct regular meetings through videoconferencing and face-to-face meetings. A special webpage on the CBR will be a place for posting relevant materials reflecting the work of the task force. Secretarial support will be provided by the CER Department.

## Resolution 37 (EC-70)

## Financial statements of WMO for the year 2017

THE EXECUTIVE COUNCIL,

Noting Articles 14 and 15 of the Financial Regulations,

**Having considered** the statement of the Secretary-General on the financial statements of the Organization for the year ended 31 December 2017, the report of the external auditor to the Executive Council, and the recommendations of the WMO Audit Committee and the Financial Advisory Committee (see Part II of the present report),

**Noting also** that the Secretary-General has taken swift action to appoint a consultant whose terms of reference include developing a comprehensive implementation plan for all open external auditor recommendations by end of July 2018, and making a study of the weaknesses and appropriate recommendations for overall strengthening of internal controls;

**Gives formal approval** to the audited financial statements for WMO for the year 2017 (see Part II of the present report);

**Requests** the Secretary-General:

- (1) To transmit the financial statements together with the reports of the consultant and the external auditor to all Members of WMO;
- (2) To take step-by-step actions to address the external auditor's observations and recommendations on internal control with a view to implementing all of the recommendations by Eighteenth World Meteorological Congress (June 2019);

- (3) To develop a separate proposal for addressing the year-on-year operating deficits, clearly indicating whether this is going to have an impact on the Organization and when;
- (4) To report progress on these matters to the Executive Council;

**Encourages** the Secretary-General to conduct a review of the internal control frameworks of other United Nations agencies to incorporate United Nations-wide best practices and lessons learnt into the WMO internal control system;

**Notes with concern** the substantial amounts of outstanding assessed contributions of certain Members;

**Urges** the Members to clear their dues at an early date as delayed settlement exposes the Secretariat to the risk of not paying its obligations when they become due.

#### Resolution 38 (EC-70)

#### Amendments to the staff regulations and rules

THE EXECUTIVE COUNCIL,

**Noting** United Nations General Assembly Resolution 70/244 – United Nations common system: Report of the International Civil Service Commission, which approved extensive changes to the conditions of service and the compensation package for the United Nations common system as a result of the comprehensive review undertaken by the International Civil Service Commission in 2015;

**Recalling** Decision 70 (EC-69) – Amendments of Regulations and Rules, in which the Executive Council:

- (1) Noted the amendments made to the Staff Rules and the development of a consolidated document of the Staff Regulations and Rules,
- (2) Requested a revision to the Staff Regulations on the mandatory age of separation,

**Recalling also** Staff Regulation 12.3, which requires that Staff Regulations be amended by the World Meteorological Congress; however, if it would not be in the interests of the Organization to defer an amendment until the next session of Congress, such amendment may be made by the Executive Council, in which case this amendment is subject to the approval by Congress at its next session,

**Decides**, subject to the approval by Congress, to amend the Staff Regulations as follows:

Staff Regulation 9.5 to read:

Staff members shall not be retained in active service beyond the age of 65 years. The Secretary-General may, in the interests of the Organization, retain staff members in service beyond this age limit in exceptional cases;

The retention of a staff member in the Professional category beyond the age of 65 shall require the authorization of the Executive Council;

Staff Regulation 3.4 to read:

The Secretary-General shall establish a scheme for the payment of dependency benefits, education grants and such other allowances as he/she may consider necessary in the interest of the Organization and in accordance with grants, allowances and benefits afforded to the United Nations personnel;

Takes note of the consolidated document of Staff Regulations and Rules, which incorporates:

- (1) All regulations and rules previously approved or noted;
- (2) The aforementioned amendment to Staff Regulation 9.5;
- (3) Consolidated changes emanating from United Nations General Assembly Resolution 70/244;
- (4) Updated salary scales and other entitlement rates as issued by the International Civil Service Commission and the United Nations Secretariat;
- **Takes note** also that the aforementioned amendment to Staff Regulation 3.4 shall be included in the consolidated document.

## Resolution 39 (EC-70)

#### **Review of previous resolutions and decisions**

## THE EXECUTIVE COUNCIL,

#### Noting:

- (1) Resolution 23 (EC-69) Review of previous resolutions of the Executive Council,
- (2) Decision 76 (EC-69) Review of previous decisions of the Executive Council,
- (3) Article 14 (c) of the Convention of the World Meteorological Organization regarding the functions of the Executive Council in considering and where necessary taking action on resolutions, in accordance with the procedures laid down in the General Regulations,
- (4) Regulation 156 (9) of the General Regulations (2015 edition), concerning the review of the Executive Council resolutions, and Rule 27 of the Rules of Procedure of the Executive Council,

**Taking into account** the body of decisions agreed by the Executive Council at its sixty-ninth session,

Having examined the Council's previous resolutions and decisions still in force,

#### Decides:

(1)	То	keep	in	force	the	following	resolutions:
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(2) Not to keep in force the other resolutions adopted before the Council's seventieth session.

#### Also decides:

(1) To keep in force the following decisions:

EC-68: 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 27, 28, 30, 33, 36, 39, 40, 41, 42, 43, 44, 45, 46, 47, 49, 51, 52, 53, 55, 56, 57, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 82, 83, 84, 85, 86, 93, 94

EC-69: 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 25, 26, 27, 28, 30, 31, 33, 34, 36, 37, 39, 40, 41, 42, 43, 44, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 72, 73

(2) Not to keep in force the other decisions adopted before its seventieth session;

**Noting also** the status of implementation of the resolutions of the World Meteorological Congress, and that actions emanating from these resolutions, particularly those of the Seventeenth World Meteorological Congress, are in progress, and a considerable number have already been completed,

**Requests** the Secretary-General to publish the in-force resolutions and decisions of the Council, including those with corrigenda, in a new issue of *Resolutions of Congress and the Executive Council* (WMO-No. 508) and to bring this publication to the attention of all concerned parties.

**Note:** The present resolution replaces Resolution 23 (EC-69) and Decision 76 (EC-69), which are no longer in force.

# **APPENDIX 3. DECISIONS ADOPTED BY THE SESSION**

# Decision 1 (EC-70)

## Organization of the session

THE EXECUTIVE COUNCIL,

Approves the provisional agenda as proposed by the President;

**Adopts** the establishment of committees as:

(1) Committee on strategic and operational planning and budget 2020–2023:

Chairperson: Dr Andrea Celeste Saulo, Second Vice-President

Members: open

(2) Committee on constituent body reform:

Chairperson: Professor Dr Gerhard Adrian

Members: open

**Agrees** the programme of work of the session:

- (1) Working hours of the meetings: 9.30–12.30 and 14.30–17.30;
- (2) Arrangement and allocation of agenda items for the session;

**Notes** General Regulation 112 for the approval of the minutes.

# Decision 2 (EC-70)

## **Consideration of the reports**

#### The Executive Council,

- (1) Paid tribute to the President, who was chairing his last session of the Council, thanking him for his crucial contribution to the Organization during over twenty-five years of service;
- (2) Noted the reports of the President of WMO, presidents of regional associations and the Secretary-General, highlighting progress in the activities of the Organization, its constituent bodies and the Secretariat, since the last session of the Council;
- (3) Noted the decisions made by the President on behalf of the Council since its last session under General Regulation 9 (7) and Article 9.5 of the Staff Regulations;

- (4) Dealt with the reports of presidents of technical commissions, in particular recommendations of sessions held during last year, under the respective agenda items;
- (5) Considered recommendations of meetings of presidents of regional associations and technical commissions under the respective agenda items;
- (6) Noted that the reports will be consolidated in a single volume following the session.

## Decision 3 (EC-70)

## Further implementation of the WMO Disaster Risk Reduction Roadmap

## The Executive Council decides to:

- (1) Endorse the recommendations of the Executive Council Working Group on Disaster Risk Reduction (EC WG/DRR, see EC-70/INF. 3), namely to:
  - (a) Implement the WMO DRR Roadmap on national, regional and global levels,
  - (b) Monitor its further implementation in line with the draft WMO Strategic Plan and its Key Performance Indicators (especially its Goal 1), including recurring reviews of requirements of Members and United Nations (UN) and humanitarian agencies (HAs) and identifying how this implementation further contributes to achieving the relevant goals and targets set in other international frameworks, especially in view of a seamless approach to reducing the risks from weather-, water-, and climate-related hazards and the role National Meteorological and Hydrological Services (NMHSs) are playing in all components of disaster risk management (including for reducing risks from non-hydrometeorological hazards) under national legislation,
- (2) Request the technical commissions, regional associations and technical (including cosponsored) programmes, assisted by their DRR Focal Points (WMO DRR FP RA-TC-TP), to:
  - (a) Ensure that their work plans align with the DRR Roadmap,
  - (b) Map progress with relevant resolutions and decisions against the objectives of the DRR Roadmap and monitor its implementation with the help of quantitative indicators,
- (3) Request the regional associations to support the regional implementation of the WMO DRR Roadmap through:
  - (a) Facilitating the enhancement of national and trans-boundary multi-hazard early warning services of their Members, benefitting from regional support mechanisms,
  - (b) Establishing regional, if needed inter-regional, working groups on DRR to better address regional and national differences in capacities and region-specific hazards,
  - (c) Working closely with the DRR Coordination Mechanism of the Commission for Basic Systems (CBS),
- (4) Request Members to:
  - (a) Continue to engage their NMHSs at the highest level of their national DRR and climate change adaptation mechanisms and include representatives of NMHSs in their national delegations to the Regional and Global Platforms for DRR and other key stakeholder fora,

- (b) Address and consider the uniqueness of national and local sociocultural conditions in the development and delivery of services by the NMHSs, including indigenous knowledge, gender aspects and increased participation of younger generations and persons with disabilities in DRR-related capacity development activities in order to sustain resilience levels,
- (c) Consider contributing to the second Multi-Hazard Early Warning Conference (MHEWC-II) – a joint effort of the partner organizations of the International Network for Multi-Hazard Early Warning Systems (IN-MHEWS) planned for 13–14 May 2019 prior to and as an input to the sessions related to early warning at the 2019 Global Platform for DRR (GP2019) with formal sessions taking place from 15 to 17 May 2019 – through voluntary and/or in-kind contributions and participation of NMHS staff,
- (d) Continue to nominate WMO DRR Focal Points (through their NMHSs) which will be recorded in the WMO Country Profile Database (CPDB), as requested by EC-68, and who will assist with monitoring the implementation of the WMO DRR Roadmap,
- (e) Contribute to WMO mechanisms and events on meteorological, hydrological and climate services for improved humanitarian planning and response (planned for Q4 2018 and Q1 2019),
- (f) Consider providing in-kind support for translating the WMO DRR Roadmap in WMO official languages,
- (5) Request the Secretary-General to:
  - (a) Make available the WMO DRR Roadmap which was approved by the WMO President in April 2017 in all official languages; propose updates of its vision and monitoring framework to the EC WG/DRR for consideration and agreement, in line with the new WMO Strategic Plan as well as with stronger linkages to climate resilience; and promote it among Members, the UN and other stakeholders,
  - (b) Provide an overview of: (i) WMO activities against the framework of the WMO DRR Roadmap, (ii) governance/implementation mechanisms, and (iii) capacities and key gaps and needs of Members/NMHSs, including absorption capacity for projects and funds,
  - (c) Map constituent body resolutions and decisions related to DRR since Cg-17 and provide a progress update to Cg-18,
  - (d) Plan priority activities to be conducted before Cg-18 and aligned with the DRR Roadmap – including deliverables, milestones, timeframes, levels (global to national), responsibilities and resources needed/available – that are derived from the plans of various WMO activities contributing to DRR; update the plan on a biennial basis for approval by EC/Congress, benefitting from the needs, priorities and resource requirements expressed e.g. in the GFCS and Climate Risk and Early Warning Systems (CREWS) documents; and focus on impact-based forecasts and actionable, risk-based warnings through developing respective decision-support systems,
  - (e) Ensure agreements are established between Regional Climate Centres (RCCs) and WMO on projects such as CREWS in order to provide climate services for DRR and emergency management at the regional level,
  - (f) Develop DRR-specific education and training material for capacity development (including training of trainers) that utilizes existing mechanisms and document, share and leverage best practices of Members and lessons learnt in risk assessment, prevention, preparedness, and response and ensure respective training of NMHS staff and the transfer of methods, tools and products developed by e.g. RCCs and their

partners within the framework of specific projects (e.g. Climate Services for DRR in Africa under the Monitoring for Environment and Security in Africa (MESA) programme of the European Union and the African Union),

- (g) Support the development, update, harmonization, cross-referencing and promotion of technical regulations, manuals, standards and guidelines by relevant technical commissions along the four elements of effective early warning systems – (i) disaster risk knowledge, (ii) detection, monitoring, analysis and forecasting of the hazards and possible consequences, (iii) warning dissemination and communication, (iv) preparedness and response capabilities – including updates to the Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes (1970–2012),
- (h) Mobilize expertise along the four elements of effective early warning systems to support NMHSs and WMO global and regional centres with the support of projects (such as those of the CREWS portfolio) and in line with WMO programmes, the GFCS and DRR user-interface mechanisms,
- (i) Coordinate expert assistance from WMO Members, including from their WMO global and regional centres, to Members and their NMHSs in emergency situations, as well as to UN/Humanitarian agencies, and,
- (j) Align with and contribute to the cross-cutting UN agendas on DRR, climate change adaptation, and humanitarian and urban issues, such as the UN Plan of Action on DRR for Resilience.

(See EC-70/INF. 3 – Report of the EC WG/DRR).

#### **Decision justification:**

The EC WG/DRR underlined that:

- (a) There is a distinction between DRR capacities of Members (governments) and NMHSs,
- (b) There is a need for weather, climate and water aspects to be sufficiently and coherently reflected in WMO DRR work,
- (c) These activities contribute to the GFCS in line with the Framework and Mechanism of WMO contributions to the GFCS and their implementation is informed by the priorities and needs identified in the DRR Exemplar of the GFCS and the Priority Needs 2016–2018 document, and
- (d) Other initiatives are leveraged and contributed to, such as the CREWS initiative, which is already co-sponsoring key WMO DRR-related activities, or the Forecast-based Financing (FbF) initiative of the International Federation of Red Cross and Red Crescent Societies (IFRC),

Relevant Decisions and Resolutions of Cg-17 and EC:

- (a) Decision 3 (EC-68) WMO Disaster Risk Reduction Governance, User-Interface Mechanisms and Disaster Risk Reduction Roadmap that established the WMO DRR governance, requested a final draft of the Roadmap for approval by the President of WMO, invited Members to nominate WMO DRR Focal Points, urged representatives of the WMO co-sponsored programmes, joint initiatives and partner organizations to actively engage with the WMO DRR governance bodies, and called for closer cooperation with the implementation mechanisms of the GFCS,
- (b) Decision 16 (EC-68) Country-focused results-based framework and mechanism for WMO contributions to the GFCS,
- (c) Resolution 5 (EC-67) EC WG/DRR which established the EC WG/DRR and its Terms of Reference that include providing guidance on developing the WMO DRR Roadmap and its subsequent updates as required,

- (d) Resolution 6 (EC-67) A mechanism to advance WMO contribution to the Global Framework for Climate Services,
- (e) Resolution 10 (Cg-17) Sendai Framework for Disaster Risk Reduction 2015–2030 and WMO participation in the International Network for Multi-hazard Early Warning Systems,
- (f) Resolution 64 (Cg-17) Development of a results-based framework for WMO support to the implementation of the Global Framework for Climate Services, which requests EC, with the participation of technical commissions, regional associations and co-sponsored programmes, to implement and monitor a mechanism to advance the WMO contribution to the GFCS in line with the results-based framework,
- (g) Resolution 52 (Cg-XVI) Disaster Risk Reduction Programme, which laid out the strategic priorities of the WMO DRR Programme,

The Draft Decision takes into account the:

- (a) Draft Strategic Plan (Recommendation 20 (EC-70)), especially the Strategic Objective 1.1 "Strengthen national multi-hazard early warning systems and extend reach to better enable effective response to the associated risks",
- (b) Sendai Framework for Disaster Risk Reduction 2015–2030 that addresses risks from all hazards, both natural and man-made, with many provisions highly relevant to NMHSs (such as Targets E and G);
- (c) National, Regional and Global Platforms for DRR which are effective mechanisms for NMHSs to engage in multi-stakeholder forums that reflect the commitment of governments to improve coordination and implementation of DRR activities while linking to international and national efforts, as laid out in Section 3.2 – WMO disaster risk reduction services of the Abridged Final Report of Cg-17.
- (d) GFCS and CREWS which provide further frameworks and funding mechanisms for the implementation of WMO DRR priority activities, in view of the need to ensure a seamless provision of weather and climate services in support of DRR,
- (e) Establishment of the CREWS Secretariat and Joint Office at WMO during the EC68 EC69 intersessional period, a cooperative effort by WMO, the World Bank's Global Facility for Disaster Reduction and Recovery (GFDRR) and the UN Office for DRR (UNISDR) for the initiative funded by currently six donors,
- (f) Outcomes of the First Multi-hazard Early Warning Conference (MHEWC-I) in 2017, a key effort by the International Network for MHEWS (IN-MHEWS), which resulted in the updated MHEWS Checklist,
- (g) Contributions by the WMO Flood Forecasting Initiative (FFI) to WMO's DRR work, especially multi-hazard early warning services, and
- (h) Outcomes of the HydroConference: Global Conference for Prosperity through Hydrological Services (7–9 May 2018, Geneva) relevant to the WMO DRR priority,
- The importance of the involvement and contributions of the private sector in DRR activities, especially in the prevention/mitigation phase or as early as possible and not only after a disaster has happened, as government resources only are not sufficient,
- (j) Examples for standardization, such as for community-based landslide early warning systems (ISO TC 22327) based on experiences from Indonesia.

The Regional Platforms for DRR planned in 2018/19 in which representatives from NMHSs could attend and actively engage in sessions and side events, include:

- (a) Americas (Cartagena, Colombia, 20-22 June 2018),
- (b) Central Asia/Caucasus (Yerevan, Armenia, 26-27 June 2018),
- (c) Asia and Pacific (Ulaanbaatar, Mongolia, 3-6 July 2018),
- (d) Africa-Arab (Tunisia, 9-13 October 2018), and
- (e) Europe (Italy, 21–23 November 2018).

Consultations with humanitarian agencies are planned in Q4 2018 and Q1 2019, both high-level consultations (to forge a framework agreement for the provision of meteorological, hydrological and climate data, products and services for improved humanitarian response and recovery efforts) and on a working level (expert workshops and engagement in key humanitarian fora to review humanitarian agency requirements for weather, water and climate information and products and outline a sustainable mechanism for supporting these agencies).

The Second Multi-Hazard Early Warning Conference (MHEWC-II) will review the progress made by countries as well as their gaps and needs with respect to MHEWS since the adoption of the Sendai Framework for DRR 2015–2030 in Sendai in 2015 and since the first Multi-Hazard Early Warning Conference (MHEWC-2017). It will collect and discuss good practices and will outline concrete steps to address the gaps and challenges of Members and their NMHSs and other technical agencies to implement impact-based and risk-informed warnings. The Conference will also explore regional and global needs for national warnings and related hazard information as well as opportunities and challenges for NMHSs and other technical agencies to support humanitarian response and recovery operations.

## Decision 4 (EC-70)

#### **Development of the Global Multi-hazard Alert System**

#### The Executive Council decides:

- (1) To request the Executive Council Working Group on Disaster Risk Reduction (EC WG/DRR)'s Expert Group on GMAS (EG-GMAS) to gather additional user requirements according to the Plan developed by EC WG/DRR based on the drafts developed by the EG-GMAS at its meetings held in October 2017 and March 2018 with support from the Secretariat (EC-70/ INF. 3.2),
- (2) To request the EC WG/DRR to:
  - (a) Document best practices of Members regarding multi-hazard early warning systems (MHEWS)/GMAS and assess how these may help deliver to the documented user requirements ,
  - (b) Based on the requirements, develop options for the implementation of GMAS, including a full featured option to meet all of the user requirements, as well as a minimum viable product which delivers to a subset of prioritized requirements, for consideration by Congress,
  - (c) Based on the identified options , assess the budget and funds needed, including the budgetary requirements for NMHSs based on their responsibilities on NMHSs,
  - (d) Finalize the GMAS Concept based on the outcome of the user requirement exercise,
  - (e) Liaise with existing service providers such as the Global Disaster Alerting Coordination System (GDACS) – a joint initiative of the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), United Nations Institute for Training and Research (UNITAR) Operational Satellite Applications Programme (UNOSAT) and the European Commission's Joint Research Centre (JRC) – which already provide severe weather services to the global community,
  - (f) Undertake a status review of Members, who provide warning products to the WMO Information System (WIS), which would inform the GMAS cost analysis, Concept and implementation plan,

- (3) To submit the GMAS Concept, along with key elements for a possible implementation plan , including responsibilities, and the additional requirements collected and cost estimates to Congress for approval,
- (4) To support Members, especially those of developing countries, Least Developed Countries (LDCs) and Small Island Developing States (SIDSs), in strengthening their capacity to develop, interpret, disseminate and apply MHEWS information for their decision makers,
- (5) To encourage regional associations and Members to continue their efforts in the development of and involvement in MHEWS/GMAS – in partnership with technical commissions – and to share their best practice at national, subregional, regional and global levels, such as Meteoalarm of the European Meteorological Services Network (EUMETNET), Meteoalert of the Federal Service for Hydrometeorology and Environmental Monitoring of the Russian Federation (Roshydromet), South-East European Multi-Hazard Early Warning Advisory System (SEE-MHEWS-A) and GMAS Asia,
- (6) To request the Secretary-General to support the EC WG/DRR and its EG-GMAS in the above tasks and to promote and facilitate sharing of lessons learnt and best practices of Members, including multi-hazard alert platforms mentioned above.

#### **Decision justification:**

- 1. Recommendations from the EC WG/DRR-II (EC-70/INF. 3):
- 2. The EC WG/DRR's Expert Group on GMAS (EG-GMAS) developed the GMAS Concept, the Strategy and the Plan to document user requirements (EC-70/INF. 3.2).
- 3. GMAS will neither replace, nor duplicate what already exists and was developed under the auspices of the WMO technical commissions and regional associations. It will be strongly aligned with the World Meteorological Centres, Regional Specialized Meteorological Centres (RSMCs) with geographical specialization, for specialized activities, marine activities non-real-time coordination activities and general purpose activities, Regional Climate Centres (RCCs), as well as other centres specified in the *Manual on Global Data-processing and Forecasting System*, WMO-No. 485. GMAS will also be aligned with practices and principles already used in other projects, such as for the Severe Weather Forecasting Demonstration Project (CIFDP).
- 4. Recommendation by the EG-GMAS as presented to the EC WG/DRR, namely that (a) GMAS could be built on the alert hub technology, prototyped by the U.S. National Oceanic and Atmospheric Administration (NOAA) Big Data Project, to enable timely aggregation of relevant authoritative warnings and alerts related to high-impact weather, water, ocean and climate events towards an Earth Systems approach, and (b) GMAS can also leverage WIS to maintain a repository of authorized warnings, alerts and related information and to distribute this information to authorized users. Using WIS will guarantee no-cost implication to NMHSs in implementing this initial module of GMAS.
- 5. Recommendation by the EG-GMAS as presented to the EC WG/DRR, namely that the World Weather Information Service (WWIS) and the Severe Weather Information Centre (SWIC) were considered as initial core components of GMAS. They will be developed further to the so called enhanced SWIC/WWIS that will provide a web-based user interface with a Geographical Information Systems (GIS)-based map display to GMAS users, ensuring the attribution of WMO and NMHSs as authoritative sources of warnings and alerts. This module is being developed by the Hong Kong Observatory (HKO) as an in-kind contribution to the development of GMAS. Furthermore, the Worldwide Met-Ocean Information and Warning Service (WWMIWS) web portal hosted by Météo-France already provides many of the functional requirements of the GMAS Concept aimed at shipping users in a simple, low cost but effective manner.
- 6. The EC WG/DRR, at its second session in April 2018, appreciated significant work done by the EG-GMAS on developing the Concept, Strategy and the Plan to document user requirements. It was agreed that the additional requirements have to be gathered, verified and analysed before the Concept could be finalized. Gathering of additional

user requirements will proceed in parallel with the finalization of the Concept, so that the Concept can be submitted to Cg-18 for consideration. The EC WG/DRR demanded that, in addition to what was requested by EC-69, the Concept should also include a cost estimation.

7. The EC WG/DRR agreed to submit the Plan to document user requirements to EC-70 for consideration.

## Decision 5 (EC-70)

## Support to the United Nations and humanitarian agencies

## The Executive Council decides:

- (1) To develop a coordination mechanism that enables easy access to authoritative information and provision of expert advice to the United Nations and humanitarian agencies to respond to their immediate requests in anticipation of, and during or after hydrometeorological hazard situations,
- (2) To align the development of the coordination mechanism with the development of the Global Multi-hazard Alert System (GMAS) concept, by engaging and utilizing the Global Data Processing and Forecasting System (GDPFS) centres and benefitting from relevant demonstration projects,
- (3) To request the EC WG/DRR to provide guidance on the development and performance of the coordination mechanism,
- (4) To request the Commission for Basic Systems (CBS), in coordination with other technical commissions, to contribute to the development of the coordination mechanism,
- (5) To request regional associations and Members to contribute to and participate in this mechanism.
- (6) To request the Secretary-General to:
  - (a) Consult regularly with relevant United Nations and humanitarian agencies on their requirements for authoritative information and expert advice,
  - (b) Facilitate development of an appropriate mechanism, in collaboration with technical commissions and regional associations,
  - (c) Facilitate participation of Members, as well as WMO GDPFS centres in that mechanism,
  - (d) Support strengthening of Members' capacities to provide services to the UN and humanitarian agencies,

**Decision justification:** Recommendations from the EC WG/DRR-II:

1. Decision 13 (EC-68) calls to establish partnership agreements with humanitarian agencies, which would be followed by concrete actions such as the development of standard operating procedures for a coordinated WMO response to major disasters upon the request of humanitarian agencies. The United Nations and humanitarian agencies urgently require an easy access to authoritative information, including a provision of information to be augmented by a consultation and interpretation,

2. The EC WG/DRR, recognized that there is certain urgency to enable an easy access to authoritative information, including a provision of an expert advice, to the United Nations and humanitarian agencies,

3. The EC WG/DRR agreed that a provision of information to the United Nations and humanitarian agencies should be augmented by a consultation and interpretation to enable the full value of the information to be translated into their efficient and effective action.

## Decision 6 (EC-70)

## Implementation of Intergovernmental Panel on Climate Change activities

## The Executive Council decides:

- (1) To congratulate the Intergovernmental Panel on Climate Change (IPCC) on its thirtieth anniversary, noting with appreciation the information provided by the IPCC Chairperson in his report and the success of the IPCC in stabilizing and improving its financial situation;
- (2) To acknowledge the significant contributions of Members to IPCC in 2017 and to call on Members to maintain, and whenever possible, to increase their financial support to IPCC activities through contributions to the IPCC in order to ensure a required level of financial resources in the IPCC Trust Fund crucial to ensure completion of activities and products in the Sixth Assessment Report (AR6) cycle;
- (3) To foster WMO and Members' support to research and provision of information, and engagement in activities related to the IPCC Sixth Assessment Report including all Special Reports;
- (4) To urge Members to actively participate in the activities of the IPCC, in particular through the contribution of scientists and experts from NMHSs, especially from developing countries and to maintain close collaboration of NMHSs with the IPCC focal points, when the focal point is not an NMHS;

#### Requests the Secretary-General:

- (1) To promote active participation of WMO technical, scientific and co-sponsored programmes in the planned IPCC activities on the development of AR6 products;
- (2) To contribute to expanding ongoing IPCC outreach efforts, including through co-branding and joint promotion of IPCC processes and products.

**Decision justification:** Voluntary contributions by Member countries to the IPCC Trust Fund have been reduced in the years prior to 2016, coinciding with a very intense work plan for the Sixth Assessment Report Cycle. Noting as well the resource mobilization strategy that has been undertaken by the IPCC Chair and the secretariat is providing encouraging results and the necessity to continue efforts is recommended in order to ensure the successful completion of three special reports, a methodological report, the three Working Group contributions to the Sixth Assessment Report (AR6) and the AR6 Synthesis Report. (See EC-70/INF. 4.2 for more information).

## Decision 7 (EC-70)

#### Integrated urban services

## The Executive Council:

- (1) Decides to endorse the methodology for building integrated urban services developed as Part I of the draft "Guide for Integrated Urban Weather, Environment and Climate Services" (summary in Annex 1) and the outline for the "Guidelines for the Development of an Integrated Operational Platform to Meet Urban Service Delivery Needs" (Annex 2) being developed as per Decision 41 (EC-69) under the leadership of the Commission of Atmospheric Sciences (CAS) and the Commission for Basic Systems (CBS) by an interprogramme working group;
- (2) Requests Members to provide feedback on the proposed drafts and further directions for the completion of the Guide and Guidelines for consideration by the Cg-18;
- (3) Encourages Members to contribute the good practices to Part II of the Guide and to undertake pilot projects and share their feedbacks with the cross-programme Working Group on Integrated Urban Hydrometeorological/Climate/Environment Services by Cg-18;
- (4) Requests the Secretary-General to support the work of the cross-programme Working Group on Integrated Urban Hydrometeorological/Climate/Environment Services within available budgetary resources.

#### **Decision justification:**

- Decision 41 (EC-69) requests to expedite the work on a Guide for Urban Integrated Hydrometeorological/Climate/Environment Services, using the expertise of the WMO GAW Urban Research Meteorology and Environment (GURME) that would steer the transition from research to operations, to be approved by Cg-18. It further requests that CBS with CAS, in consultation with other Technical Commissions, develop guidelines based on Members' best practices for an integrated operational platform, to support urban service delivery needs;
- The Guide is being developed by the Working Group on Integrated Urban Hydrometeorological/Climate/Environment Services, organized by CAS/RES that includes representatives of CBS, CHy, WCRP, CIMO, GFCS, CCl and user community: Clean Air Asia, ICLEI and IPCC. The CBS OPAG/PWSD is addressing the Guidelines. These documents complement each other and constitute the chain from the services development (Part I), best practices (Part II) and operational services delivery (the Guidelines);
- CBS Management Group (CBS-MG 2018) recommended EC to endorse the outline guidelines following the outcomes of CBS TECO 2018 (Geneva, 26–29 March 2018).

See also EC-70/INF. 10.1 page 4.

## Annex 1 to Decision 7 (EC-70)

#### Guide for Integrated Urban Weather, Environment and Climate Services

#### SUMMARY

Migration to cities creates densely populated environments and associated infrastructure, which result in ever increasing vulnerabilities and exposure to natural and anthropogenic hazards. The United Nations has identified "sustainable cities and communities" as one of its Sustainable Development Goals.

This Guide articulates a vision to support this goal. Advances in high-resolution (space and time) observation and prediction are permitting urban integrated hydrometeorological, climate, marine meteorological and environmental prediction services to meet the needs and requirements of cities. Although Urban Integrated Services are early in development and capability, they include multi-hazard early warnings (such as severe weather, flooding, air quality, health, storm surges, sea level rise) to urban design, planning and zoning that require commensurate micro-climate information on the city-block scale.

From a disaster risk perspective, a cascade of impacts ("domino" effect) may occur in a city as a consequence of an initial extreme event impacting a densely populated area as infrastructure fails. Urban services are within the mandate of city governments. The provision and application of hydrometeorological, climate, marine meteorological and environment urban services are within the capability and capacity of World Meteorological Organization Members. Due to codependencies, delivery of effective and efficient urban services requires the integration, the co-operation and the collaboration amongst different scientific disciplines, different urban professions, various levels of government, the public and the private sector.

Results from two surveys conducted indicate several Members have started implementation of Urban Integrated Services. Urban service requirements are city-specific and, driven by many local factors including: the natural and human-made environment, the science, the applications, the infrastructure, the organizational structure, the mandates and the socioeconomic situation. Indeed, the surveys identified that Members have existing capabilities to deliver urban services but there is often a lack mutual-awareness. There is a lack of interaction, a lack of understanding of the requirements and the capabilities of both the service providers and the service users. The challenge of local versus national mandates, of roles and responsibilities can only be solved through collaboration. Multi-disciplinary and multi-agency approaches are needed. The surveys indicated different levels of maturity with respect to their implementation of Urban Integrated Services. One size does not fit all.

The recommendations are:

- Members to assist decision makers and end-users on capabilities and services; it is important not to wait for a disaster to act. There are examples of well-functioning urban services that can be used as a template for development and implementation in specific situations;
- (2) Encourage Members to contribute in the development coordination and promotion of Urban Integrated Services, including knowledge transfer;
- (3) Ensure that legal and institutional frameworks are in place in the partnerships with cities that clearly define Members mandates, roles and responsibilities to enable, to create and to maintain the Urban Integrated Services;
- (4) Engage with relevant stakeholders, (agencies, universities, the public, other Members, city government, private sector), right from the beginning, including raising awareness and getting feedback;
- (5) Further research, particularly multi-disciplinary cross-cutting studies, is needed to develop urban integrated service capabilities;
- (6) Encourage Members to facilitate wider accessibility of data via influencing ownership issues and technical support to enable Urban Integrated Services;
- (7) Encourage WMO Members to showcase demonstration projects to promote and advance the development and implementation of Urban Integrated Services.

The Guide (Part 1, Concept and Methodology) is available at: http://www.wmo.int/pages/prog/ arep/gaw/documents/UrbanIntegratedServicesPart1aConceptandMethodologyEC-70.pdf.

# Annex 2 to Decision 7 (EC-70)

## Outline of Guidelines for the Development of an Integrated Operational Platform to Meet Urban Service Delivery Needs

#### 1. Introduction

The main goal of the Guidelines will be to articulate the operational and the delivery aspects based on the Guide for Integrated Urban Weather, Environment, Marine Meteorological and Climate Services and provide WMO Members with advice on practical considerations for, service delivery to address the needs of urban communities, including value-added services, as part of the work of the National Meteorological and Hydrological Services (NMHSs).

An integrated operational platform will need to draw on the advancements in technology available through WIGOS and WIS to ensure that it is fully compliant with the "smart cities" concept of high-density, high-resolution urban environmental information.

It will be important, when developing the Guidelines, to coordinate with other WMO activities, in particular the GFCS, and relevant TCs and RAs. It is essential to realise that, at national level, there are many agencies other than NMHSs engaged in urban services development and provisions, for instance for air quality etc., and the Guidelines must reflect this multi-agency reality and be attractive for the other than NMHS service providers. The guidelines should also be flexible enough to allow for the integration aspects articulated in the Guide for Integrated Urban Weather, Environment, Marine Meteorological and Climate Services. In regard to the provision of high-resolution, multi-scale predictions to support urban needs, this requirement will need to be addressed through the ongoing development of the seamless GDPFS.

While the climatological, hydrological, oceanographic and environmental aspects of the urban environment will be comprehensively covered in the Guide, the integrated operational platform should enable easy access to a climatology of impact-based indicators within cities, to facilitate effective risk management in urban areas during periods of high-impact weather, recognizing the potential domino effect of infrastructural failure and its consequences.

## 2. Content

The Guidelines currently include the following sections:

- Executive summary
- Background
- WMO Framework
  - Constituent body decisions and recommendations
  - Role of NMHSs
- Developing a strategy for urban services
- Partnerships and user engagement
- Urban services and products
  - General considerations
  - Types of services and products to be provided
- Water management (including flooding),
- Environmental services (including health),
- Land transport sector
- Marine Meteorological and Ocean services (Sea Level rise, Storm Surges, Coastal inundation, etc.)
- Climate

- Data
- Operational aspects
- Service delivery aspects including dissemination and communication
- Pilot studies
- Capacity development and training
- Evaluation and assessments.

The Guidelines are to be developed based upon best practices and case studies of Members. Best practices will be included in boxes as examples. Also the *WMO Strategy for Service Delivery and Its Implementation Plan* (WMO-No. 1129) and, amongst others, the WMO *Guidelines on Multi-hazard Impact-based Forecast and Warning Services* (WMO-No. 1150) will be considered.

#### 3. Timeline

The final version of the Guidelines is expected in January 2019 and will be presented to WMO at Cg-18 in 2019.

## Decision 8 (EC-70)

#### **IG<sup>3</sup>IS Science Implementation Plan**

**The Executive Council decides** to approve the IG<sup>3</sup>IS Science Implementation Plan endorsed by the Commission for Atmospheric Sciences in which the executive summary is provided in the Annex to this decision;

**Requests** the Secretary-General to provide support to the IG<sup>3</sup>IS activities and assist in promoting IG<sup>3</sup>IS with funding agencies, and work with those Members, especially in developing countries, who plan to undertake IG<sup>3</sup>IS projects, in pursuing extrabudgetary resources to do so;

**Urges** Members to undertake pilot and demonstration projects that facilitate implementation of the IG<sup>3</sup>IS Implementation Plan;

**Requests** Members working with the Regional Associations to assign focal points for the implementation of IG<sup>3</sup>IS and to scale up the existing initiatives for regional knowledge transfer and capacity-building for IG<sup>3</sup>IS implementation in the Regions;

**Requests** Members to improve integration of atmospheric composition observations into the national meteorological observing systems;

**Requests** the Commission for Atmospheric Sciences to coordinate with the appropriate technical commissions, in particular the Commission for Basic Systems, in order to ensure translation of the IG<sup>3</sup>IS scientific tools into operational services and contribution to WIGOS and GDPFS;

**Agrees** that the governance of the IG<sup>3</sup>IS should be established taking into account the Framework Memorandum of Understanding between the WMO and the Secretariat of the United Nations Framework Convention on Climate Change.

See the Annex to the present decision.

## Decision justification:

Resolution 46 (Cg-17) highlights the main objectives and the key activities required for the establishment of the Integrated Global Greenhouse Gas Information System (IG<sup>3</sup>IS),

Decision 19 (EC-68) approved the IG<sup>3</sup>IS Concept Paper and called for the development of the IG<sup>3</sup>IS Implementation Plan by EC-70,

Decision 7 (EC-69) outlined IG<sup>3</sup>IS pilot projects as one of the way for WMO to support implementation of the Paris Agreement,

Decision 51 (EC-69) requested the Commission for Atmospheric Sciences (CAS) to oversee the development of the IG<sup>3</sup>IS Implementation Plan to be delivered by EC-70,

Collaboration Project "Observation-based tools for improved national greenhouse gas emission estimates" under the Framework Memorandum of Understanding (2018) between the WMO and the Secretariat of the United Nations Framework Convention on Climate Change aims at delivery of the several IG<sup>3</sup>IS pilot projects.

The Subsidiary Body for Scientific and Technological Advice (SBSTA) in the report<sup>1</sup> of its fortyseventh session refers to IG<sup>3</sup>IS in the contexts of the increasing capability to systematically monitor greenhouse gas concentrations and emissions, through in situ as well as satellite observations, and its relevance in support of the Paris Agreement.

Switzerland provided financial assistance to the establishment of the IG<sup>3</sup>IS office and support of the other countries will be essential in implementation of the IG<sup>3</sup>IS through the good practices outline in the IG<sup>3</sup>IS Science Implementation Plan.

# Annex to Decision 8 (EC-70)

## **IG<sup>3</sup>IS Science Implementation Plan**

## **Executive Summary**

IG<sup>3</sup>IS looks to serve users (decision-makers) who are able to take action to reduce emissions of greenhouse gases and pollutants that reduce air quality. This service is based on existing and successful methods and use-cases for which the scientific and technical skill is proven. The ultimate success criteria are that the IG<sup>3</sup>IS information is "used" and guides valuable and additional emission reduction actions, building confidence (and skill) in the role of atmospheric composition measurements as an essential part of the climate change mitigation environmental remediation tool kit.

The IG<sup>3</sup>IS takes a highly collaborative "Translation Atmospheric Sciences" approach to deliver science-based services to potential stakeholders/users. Applications will not be initiated and developed without intimate dialogue with users. In this way, researchers are able to learn the value of envisioned information products, and users are introduced to previously unknown capabilities that may drive them to address challenges in new ways. When these discussions establish a value proposition commensurate with the level of investment, then project definition can proceed based on user requirements. This plan presents the main concepts of IG<sup>3</sup>IS, implementation principles and technical solutions.

The IG<sup>3</sup>IS Implementation Plan (full version).

<sup>&</sup>lt;sup>1</sup> http://unfccc.int/resource/docs/2017/sbsta/eng/07.pdf

## Decision 9 (EC-70)

# Promoting the use and interpretation of climate change projections on regional and national scales

## The Executive Council,

## Noting:

- (1) Recommendation 6 (CCI-17) Good practices in the use and interpretation of climate change projections on regional and national scales,
- (2) Memorandum of Understanding signed by WMO with the United Nations Framework Convention on Climate Change (UNFCCC) that includes a project on regional collaboration for supporting adaptation and mitigation action,

## Noting further:

- (1) That regional climate change projections, largely through downscaling of global model simulations, are being extensively used by Members to assess multisector impacts and implications for adaptation planning and that, in most cases, such studies are undertaken at the national level and there is a need to compare and contrast the various approaches on a regional scale and to define guidelines for best practices in the generation of these projections,
- (2) That it will be beneficial in this regard for countries in a region with common climate concerns to share their experience, with a view to develop good practices guidelines,
- (3) That, because of the large uncertainties in the climate projections, establishing good practices in how to represent these uncertainties in downstream impacts is critical to ensure quality and consistency,
- (4) That the considerable expansion of opportunities for producing climate change projections has led to an increased volume and accessibility of model simulations for assessing climate change impacts, that are feeding into developing national and other adaptation plans, with the associated risks of misuse and misinterpretation,

## Noting with appreciation:

- (1) That the WMO Global Review of RCOFs (September 2017, Guayaquil, Ecuador) has recommended expansion of RCOF product portfolio to cover climate change,
- (2) That WMO supported a Best Practices Workshop on Climate Change Projections and their Applications in ASEAN Countries (20–23 March 2018, Singapore), which successfully adapted the ASEANCOF format to facilitate discussions and agree on climate change science issues to be addressed for the south-east Asia Region,

## Decides to:

- Encourage regional collaboration, including through adapting the Regional Climate Outlook Forum (RCOF) format as a means of disseminating expert consensus and facilitating discussion among subregional groupings of Members sharing common climate characteristics on consistent approaches in interpreting and using regional climate change projections made available by the concerned programmes and partners including, inter alia, the World Climate Research Programme (WCRP);
- (2) Support the Commission for Climatology (CCI) initiative to identify requirements and good practices on producing climate change projections on regional scale, including through

highly recommended functions of Regional Climate Centres (RCCs), to promote these good practices and consistent approaches to produce, interpret and use high-resolution climate change projections on regional and national scales;

- (3) Invite the hydrological community, including the relevant subsidiary bodies of Regional Associations and the Commission for Hydrology, as well as cryosphere community, to work closely with CCI and WCRP to ensure that climate change impacts on water availability and quality are well-addressed in the proposed methodology and implementation, especially with regard to climate-proof food, energy and DRR related systems;
- (4) Invite the Intergovernmental Panel on Climate Change (IPCC) to be engaged with the development of the good practices and to ensure alignment with the climate change assessments being undertaken on the global scale;
- (5) Request WCRP to facilitate access to and promote the use of high-resolution data on climate change projections at global and regional scales, including outputs of the Coupled Model Intercomparison Project (CMIP) and Coordinated Regional Climate Downscaling Experiment (CORDEX);
- (6) Urge WCRP, in collaboration with CCl, to pursue closer engagement with RCOFs and Regional Climate Centres (RCCs), through the establishment of a joint research-tooperations platform to address research needs for regional optimization of Climate Services Information System (CSIS) operations;
- (7) Urge RCOFs in close proximity and having common climate influences to closely align and harmonize their operations to enable the concerned Members to derive optimized benefit from the available regional climate change information;
- (8) Request the Secretary-General to support WCRP work in the development, provision of, and access to regional climate projections, and to support CCI work on developing good practices on using them and on organizing corresponding joint workshops and training activities.

#### Decision 10 (EC-70)

#### The Guide to General Service Delivery

**The Executive Council decides** to endorse the outline of the "Guide to General Service Delivery" as contained in the Annex to this decision to be developed with the participation of all technical commissions and programmes of WMO whose functions include service delivery for consideration by Cg-18.

#### **Decision justification:**

- Decision 39 (EC-69) states that "a General Service Delivery Guide based on the work underway to update the "Guide to Public Weather Services Practices" and other existing guidelines developed by WMO Programmes and technical commissions whose mandate includes service delivery should be developed, in order to provide holistic service delivery guidance to Members in major application areas covering weather, climate, water, agriculture, health, marine and other areas;
- CBS Management Group (CBS-MG 2018) recommended that EC-70 endorse the draft outline,
- With the publication of WMO-No. 1129, the WMO Strategy for Service Delivery and its Implementation Plan, in 2014 the concept of service delivery was mainstreamed across WMO areas of activity. Recent years have seen the considerable growth of Climate Services as a key activity, as climate information and climate predictions become increasingly

valuable to societal planning and decision-making. With all of this in mind, EC-69 mandated CBS to take the lead in developing a General Service Delivery Guide for WMO, collaborating closely with the other technical commissions in doing so.

## Annex to Decision 10 (EC-70)

## **Outline of General Service Delivery Guide**

## 1. Introduction

Building Blocks for the General Service Delivery Guide (brief description and relevance)

- (a) WMO Strategy for Service Delivery and its Implementation Plan (WMO-No. 1129)
- (b) Guide to PWS Practices (WMO-No. 834)
- (c) Guide to practices for meteorological offices serving aviation (WMO-No. 732)
- (d) Guide to Marine Meteorological Services (WMO-No. 471)
- (e) Implementation Plan of the Global Framework for Climate Services
- (f) Step-by-Step Guidelines for establishing a national framework for Climate Services (WMO-No. 1206)
- (g) Guide to Hydrological Practices Volume II (WMO-No. 168)
- (h) Valuing Weather and Climate: Economic Assessment of Meteorological and Hydrological Services (WMO/World Bank/USAID)
- (i) WMO Guidelines on Multi-Hazard Impact-based Forecast and Warning Services (WMO-No. 1150)
- (j) Global Weather Enterprise input from beyond the NMHSs
- (k) Service delivery in the private sector

## 2. Standard setting, regulation and accreditation

Public Private Engagement (PPE) Concept of authoritative voice within service delivery

#### 3. Communications

Fundamentals of communication Importance and value of good communication Developing and fostering good communication practices The human dimension

## 4. Technical Foundations

Technical expertise and excellence Robust and resilient systems Efficient production of services to meet user needs

## 5. Channels for Service Delivery

Services to be aligned with advancements in communication technologies

Services to be agile in responding to changes and developments and applications of communication technologies

Machine to machine capabilities and their role in service delivery

#### 6. Customers, Clients, Users and Partners

Definitions, descriptions Importance of user engagement Understanding user needs Managing user expectations

#### 7. User Feedback

Formal and informal feedback Strategies and techniques for gathering user feedback Employment of user feedback in devising improvements to products and services

## 8. Training and development

Changing and evolving role of forecasters in service delivery

Training of users and stakeholders

Training of frontline service delivery personnel

Training of service managers

Management training

#### 9. **Promotion and marketing**

Perceptions of service quality

Building the trust of users and stakeholders

Delivering user satisfaction

#### 10. Monitoring and Evaluation

Setting useful performance indicators User-based evaluation of Service Delivery standards Coordinated evaluation across public and private sectors in line with WMO Guidelines

#### 11. Sector-specific aspects of service delivery

Public Weather Services Aviation Weather Services Marine Weather Services Land transport Services Agro-meteorological Services Hydrological Services Climate Services Services to Emergency Management Services to Media Services to support emerging areas:

- (a) urban and coastal areas
- (b) environment/air quality
- (c) sustained transport
- (d) Weather/Climate and Health
- (e) Energy etc.

#### 12. Service Delivery Action Plan

#### 13. **Bibliography and Further Reading**

#### Decision 11 (EC-70)

#### Concept paper on the development of common interfaces for service delivery

#### The Executive Council:

- (1) Thanks CBS for the development of the Concept Paper on the development of Common Interfaces for Service Delivery (CISD) as contained in the Annex to this decision;
- (2) Acknowledges that as new web-based services emerge from the implementation of WIGOS, WIS 2.0 and seamless GDPFS, that harmonization of these services to provide consistent interfaces will likely benefit to the Global Weather Enterprise;
- (3) Requests that establishment of standard interfaces (e.g. protocols or APIs) for accessing data and services for public service delivery, as expressed in the CISD concept paper, and gathering of the related user requirements be progressed by CBS as part of the seamless GDPFS implementation;
- (4) Further requests Members to share best practices on the development and implementation of web-service interfaces for accessing weather and climate information;
- (5) Further requests CBS collate the feedback from Members and provide guidance, and for the Secretary-General to provide the resources necessary to support this activity.

#### **Decision justification:**

- Decision 40 (EC-69) CBS was tasked by EC to, in coordination with other TCs, set up a mechanism for the development of a concept paper on common interfaces for service delivery. CBS was asked to present the concept paper at EC-70 for consideration for approval;
- CBS Management Group (CBS-MG 2018) recommended that EC-70 endorse the draft Concept Paper.
- Users need to access aggregated "best possible" weather and climate information offered in a seamless manner across geographical and political boundaries. To respond to this need, the Common Interfaces for Service Delivery will seek to meet the requirements of a wide variety of users and provide a technical system for gathering and aggregating weather information from a wide variety of sources, at different levels of technical sophistication. It is an underlying condition that Common Interfaces support the attribution of NMHSs as providers of services, and that the principle of "no Member left behind" be kept in view.

## Annex to Decision 11 (EC-70)

#### Concept paper for the development of common interfaces for service delivery

#### Introduction

The Executive Council of WMO requested that the Commission for Basic Systems develop a Concept Note on the development of Common Interfaces for Service Delivery (CISD) "driven by data from NMHSs and emerging sources to enable users to seamlessly access weather and climate information in a way that would ensure attribution to NMHSs as providers of services".

## Why Common Interfaces for Service Delivery?

In today's world of mass travel, global news, and "always on" internet access to information, Members need users to have access to providers of high-quality weather and climate services in a unified and consistent manner, seamless in space and time, which affirms the provenance and authority of this information. Already some of the major global aggregators of information provide such a seamless service of weather information, but typically this is not based on the high-quality information available for many countries through their NMHSs.

While NMHSs, by their nature, have a national remit, the need is for a single international one-stop service for authoritative weather and climate information; one that will combine the high quality typically available via the separate websites of each NMHSs together with the convenience of a seamless service of aggregated global information provided to PC, tablets and mobile phones. There already exist examples of trans-national service delivery of NMHS forecast and warnings information. Hong Kong China has, through the WWIS and SWIC projects, provided a means to aggregate city forecast information and also weather warnings from NMHSs. The GMAS project aims to extend and develop the SWIC concept towards an integrated, map-based presentation of warnings from all NMHSs. Regionally, Belgium, The Netherlands and Luxembourg have cooperatively produced a weather app for the Benelux area. It is envisaged that the CISD will cooperate with, and build on, these developments to provide a richer range of weather data to a wide range of users. This would include probabilistic information as now available from the growing number of ensemble-based systems, and possibly also impact information.

It will be important, in getting further advice and guidance from EC and Congress, to ensure that the CISD concept is developed within a broader framework which encompasses GMAS, WIS2.0 and other existing and proposed projects.

While focusing on the authoritative nature of weather and climate information available from NMHSs, there also needs to be a recognition of the high quality of information available through many private sector providers which can amplify and augment the information presented by NMHSs, and in particular provide additional depth of detail relevant to specific user groups. Thus the CISD should make provision for the merging of meteorological information provided from a range of reputable sources, and presented in many different data formats and protocols, and synthesise these into a unified stream of weather and climate information that can be readily expressed and visualized on internet-connected devices. From the point of view of users, the information presented through the CISD should conform fully to WMO standards and be authoritative with proper attribution to the providers, be they from the public or private sectors.

In defining the scope of the CISD, the first essential task will be to collect the user needs. Primary users will include private-sector global data aggregators such as Apple, IBM, Alibaba, Amazon, Google and other aggregators and data platforms that will be developed, as well as UN and other humanitarian agencies that have a global reach. The needs of these key users will need to be ascertained, as already a significant percentage of weather information is delivered to the public from a source other than an NMHS directly.

The task of developing a CISD is analogous, in some respects, to those tasks already carried out in developing the WMO Integrated Global Observing System, WIGOS, and the WMO Information System, WIS. The CISD will attempt to achieve the same global coordination, but

in the area of Service Delivery. The CISD must be built upon agreed technical protocols and standards, but these will need to be developed in close consultation with the users if they are to gain widespread acceptance.

In embarking on the challenge of developing the CISD, WMO must be aware of the need to support and enhance the authoritative voice of Members in providing warnings and other information about severe weather and its impacts, and must also keep in view the principle that no Member be left behind. It will be a significant challenge to develop an interface that can accept information from the wide range of technical capabilities of WMO Members and provide a unified output which is compatible with some of the most advanced information and communications technology on earth.

It should be clearly established also what the CISD will not attempt to do. Many NMHSs have, in close cooperation with their users, developed technical interfaces for the delivery of products and services to their own client base. The CISD will not attempt to replicate or improve on these. Rather it will offer meteorological service providers a new route to provide their products and services, in common with products and services from other providers, to an international user-base. It will be important to ensure that technological imbalances between Members are not a barrier to the full engagement of all NMHSs with the CISD as a platform for their products.

The interface, which is envisaged as the CISD, must meet the need for interoperability in the digital world. Meteorological services provided via image and text from nationally-based websites no longer meet the requirements of smooth and seamless operation of a world which has entered the digital age. Standard protocols will be required to provide this interoperability between meteorological services and other information communication systems in the digital world.

This introduces the concept of a Common Interface for Service Delivery (CISD); a technical underpinning for the establishment and growth of the Global Weather Enterprise (GWE), providing a mechanism for the delivery of products and services from different elements within the GWE in a unified and streamlined manner.

#### **Purpose of CISD**

- (a) Open Service Delivery system designed for seamless availability of and accessibility to data and products for users, particularly in partnership with the private sector.
- (b) Establishment of a widely accepted standard interface (protocol) for access to data and products for public service delivery, including impact-based information;
- (c) Establishment of a mechanism to link user requirements to the meteorological service providers who are registered with the CISD.
- (d) Establishment of a one-stop-shop service of PWS products from WMO members and partners, including private sectors.



# Figure 1. More than 100 NWP models/model members are available for each location in earth. How can these be rationalized into one service?

#### Definitions

**Protocol**: First, the CISD will act as a WMO-defined unified protocol, which will aim to be widely accepted by industry and by UN affiliated organizations, and which will include existing standards such as Common Alerting Protocol (CAP), to facilitate the provision of meteorological information services.

**Proxy**: The CISD will act as a WMO proxy to aggregate and release world-wide weather information from either official NMHS (alert and warnings, high impact weather forecasts and regular forecasts) or private sectors (high impact weather and regular forecasts) with source labelling. Proxy here also means partnership between WMO members and other sectors.

**Provider**: The CISD will act as a WMO service provider, ideally delivering the "best" or "optimum" forecast based on the verification and assessment of products from diverse sources, except for weather alerts and warnings which will solely come from NMHSs.

## Users of CISD

- (a) WMO Members who receive global met-services and contribute to CISD;
- (b) Other meteorological service providers who will receive authoritative products from CISD and contribute their own by service linkage following CISD standards;
- (c) UN-affiliated organizations which need aggregated, authoritative weather and climate information;
- (d) Governmental, inter-governmental and non-governmental organizations active in international humanitarian relief and disaster risk reduction;
- (e) Certified/registered sectors or data aggregators like Google / Facebook;
- (f) Other organization or individuals; CISD should be a facility for many levels of user, with different levels of access possible according to need and to considerations of data policy, among others.

## **Relationships between CISD and other CBS Projects**

The CISD will not itself generate products but will act as a channel through which services can be delivered, or alternatively, direct user requests to appropriate product services. So, existing on-line resources such as **GDACS/GMAS/WWIS/SWIC** can become important inputs for CISD.

**WIS 2.0** is a cloud-based information infrastructure and data-exchange platform, which can support the future WMO based functionality of CISD. The relationship between WIS and CISD will be analogous to that between an OS (operating system) and applications. Besides, WIS 2.0 cannot host everything, especially content from private sector providers. The concepts and standards underlying the CISD could also be implemented in other public cloud-based systems such as the Amazon cloud, Google cloud, Alibaba Cloud etc.

## Principles in the Implementation of a Common Interface for Service Delivery

**NMHS-first and mutual benefits**: The CISD will support the authoritative voice of NMHSs and leave no member behind. The CISD will also monitor and measure the products being used, and product providers/owners can decide whether or not to charge for the usage of the products originating with them. This means that CISD is first and foremost a standard of platform, which can be implemented upon WMO/WIS 2.0, or by other sectors.

**Cloud based**: The CISD will operate as an online service which will be based on WMO Information System (WIS 2.0) – a cloud infrastructure to handle massive concurrent data access.

**De-centralized**: The CISD will be connected to nodes on the WIS (WMC, RSMC, NMHS) and to private sectors via the internet. But the CISD will not aim for long-term storage of products from diverse sources, but will cache them for real time access, and for the greater efficiency of the data service.

**Integrated**: Alerts and warnings from NMHSs will go directly via the CISD to enhance the authoritative voice of the NMHSs of WMO Member. Other meteorological service provider information will be carried on the CISD with the source-label provided for user choice. With the help of Seamless GDPFS common platform, products (other than alerts and warnings) can be evaluated and integrated as "best" or "optimum" products, before being distributed via the CISD.

**User oriented**: A thorough investigation of user needs, user application and user scenarios will be essential if the CISD is to be widely accepted. The CISD should have a user-friendly Web application UI to facilitate location-based and on-demand meteorological services. The CISD should also include a set of APIs to assist with the collection of user feedback. This means that CISD registered users will have more privileges in getting access to more valuable data, products and feedback than ordinary visitors.

#### Components

Implementation of CISD will be through an alliance of internet nodes that follow the protocols and standards of CISD; the WMO node will be a starting point based on the architecture and cloud infrastructure of WIS2.0. (Figure 3)

## (1) WMO CISD Node:

(a) **Common Interface Service**: linked to the services of NMHS (Web service), GDPFS centres (GDPFS common platform), WMO projects (e.g. MHEWS), and other sectors, supplying data and products through online interface to users. Other online products could also be registered as one service of WMO Common Interface.

(b) WEBGIS UI: Based on backend service, a WEBGIS system established to facilitate exploration and online analysis (temporal and spatial analysis) of WMO-organized PWSD products such as Impact-Based Forecasts, GMAS warning etc. WEBGIS UI could be a support tool for decision makers in United Nation affiliated organizations.





## Figure 2. WEBGIS for exploration of PWSD products

- (c) **Cache data**: WMO node doesn't keepa long-term storage, but caches products for efficiency of delivery.
- (d) **Registration**: Products from other sectors who want to join the alliance will need to register and provide the relevant metadata relating to their services and products.
- (2) Other CISD Nodes:

## Encourage other sectors to join the CISD alliance.

- (a) **Common Interfaces for Service Delivery**: strictly follow the standard of WMO common interface protocol;
- (b) Entity data centre (optional)

## WEBGIS UI (optional) Challenges of a Common Interface

- (a) The first challenge is to solve the authoritative voice issue. Not to jeopardize but enhance the authority of NMHSs while facilitating private sector service provision through the CISD. The formalizing of the concept of the "Authoritative Voice" and its wide acceptance will be an essential pre-requisite to the operational establishment of the CISD.
- (b) Not all Members will have the technical capacity to provide products following the CISD standards. Therefore, improving the technical capacity in providing products and services through digital means, and developing an agreement among NMHSs on the use of standard protocols, will be another challenge.
- (c) It will be important to work closely with international industry associations and smart phone (wear) manufacturers to ensure their acceptance of CISD standards and protocols, and promotion of weather and climate information provided via the CISD.
- (d) Workshops and Pilot/demonstration project will certainly be needed to fully test the CISD concept at various stages in its development.



#### Figure 3. Conceptual Diagram for Common Interface

Roles of WMO members, data aggregators and private sectors in CISD could be both users and contributors of the CISD.

## Decision 12 (EC-70)

#### Symposium to collect Members experiences with Impact-based Forecast and Warning Services

**The Executive Council decides** to approve the organization of a symposium in 2019 for Members to exchange experiences in Impact Based Forecast and Warning Services (IBFWS) and to collect Members' experiences with IBFWS. It further requests the Secretary-General to provide the necessary support for the Symposium and Members to contribute resources.

#### **Decision justification:**

- Recommendation of the CBS Management Group (CBS-MG);
- Decision 4 (EC-69) to put significant emphasis on the training needs associated with the implementation of impact-based forecast and warning services, and requested the Secretary-General to facilitate resource mobilization in support of such training initiatives;

 It is proposed to organize a conference/symposium on IBFWS in late 2019. This event would be focused on gathering the experiences of Members who have developed impactbased forecast and warning services, together with the experiences of their users, with a view to collecting examples of best practice and publishing these as an adjunct to WMO-No. 1150. The event would be funded mainly from extrabudgetary sources.

## Decision 13 (EC-70)

#### Review plan for the Technical Regulations (WMO-No. 49), Volume III

**The Executive Council decides** to endorse the timetable for the review of the *Technical Regulation* Volume III – Hydrology (WMO-No. 49) adopted by the CHy Technical Regulations Review Task Team as compliant with Decision 93 (EC-68) – Roadmap to an Enhanced Framework for WMO Technical Regulations and to further encourage CHy to pursue its work of revision and harmonization of the regulatory material of its competence, also by pursuing its cooperation with CIMO, CBS and other international standardization institutions such as ISO.

**Decision justification:** CHy-15 decided to engage in the review and update of the *Technical Regulations* (WMO-No. 49), Volume III and related regulatory publications relevant to its mandate and responsibility. A task team of experts has been established to review and assess the regulatory material, establish a detailed plan for updating it and prepare a revised text of the *Technical Regulations*, Volume III. The team will also consider the benefits and risks of aligning the hierarchy and naming of CHy regulatory material with WMO general practice.

Pursuing the decision taken by the ISO/TC 113 – Hydrometry in Noida (India) in September 2017, WMO and ISO have set up a Working Group to review the WMO Manual on Stream Gauging with a view to making it suitable also as an ISO TR (Technical Report). WMO is also regularly providing inputs on the development of new standards by ISO in the area of hydrometry, in order to maintain them consistent with WMO regulatory material and provide to Members a coherent regulatory framework.

The task team of experts adopted the following timetable for its review work:

- End April 2018: First draft consolidating members' contribution on proposed modifications to *Technical Regulation* Volume III
- Mid-June 2018: Review by Task Team members of the consolidated document with special focus on mandatory vs non mandatory provisions (shall vs. should).
- End August 2018: Task Team members provide draft inputs on parts where wording revision was suggested, carry out a review of the Annexes and identify other regulatory material documents to review
- End September 2018: Second consolidated draft including revised texts.
- End-October 2018: Task Team meeting to adopt a final draft of the amended *Technical Regulation* Volume III (excluding Annexes) and agree on timetable and deadlines for finalizing the overall review of the regulatory material by the time of Cg-18 in light of the findings of its work.

## Decision 14 (EC-70)

#### **Establishment of Regional WMO Integrated Global Observing System Centres**

#### The Executive Council decides to:

- Request all Regional Association Management Groups and its Panel of Experts on Polar and High Mountain Observations, Research and Services (EC-PHORS) to strongly support the establishment of Regional WIGOS Centres (RWCs) in pilot mode in their respective Region and the Antarctic and take appropriate actions;
- (2) Request Members to actively participate in the implementation of RWCs in their Region, in collaboration with other RWCs where applicable;
- (3) Request the Secretary-General to provide all the necessary assistance and Secretariat support for the establishment of RWCs in the WMO.

#### **Decision justification:**

Resolution 2 (EC-68) Plan for the WMO Integrated Global Observing System (WIGOS) preoperational phase 2016–2019; Decision 30 (EC-68) Regional WMO Integrated Global Observing System Centres; Decision 30 (EC-69) Guidance on establishing Regional WMO Integrated Global Observing System Centres in pilot phase.

The development, implementation and operational activities of the WIGOS Data Quality Monitoring System, primarily regional WIGOS performance monitoring and incident management, and support to Members in improving the data availability and quality, strongly depend on the establishment of Regional WIGOS Centres (RWCs), to be initiated in pilot mode from 2018. Details on the activities to be undertaken by RWCs are provided in "Technical Guidelines for Regional WIGOS Centres on the WIGOS Data Quality Monitoring System for surface-based stations of GOS" (See http://www.wmo.int/pages/prog/www/wigos/tools.html for more information).

A successful RWC pilot has been established in Regional Association VI via the EUCOS Observing Monitoring Facility (currently located at DWD in Offenbach) operated under the EUMETNET Observation Programme Management. This pilot has the responsibility for operating an automated web-based Quality Monitoring Portal that displays data quality monitoring statistics for the EUMETNET members, accessible for all RA VI Members.

China and Japan submitted their formal proposals to the RA II President and the proposals have been endorsed by RA II Management Group; Belarus and the Russian Federation have expressed interest in operating an RWC pilot for parts of Regions VI and II; likewise, in RA V, Australia, Indonesia, Fiji and Singapore have also expressed their interest on hosting RWC; Trinidad and Tobago is considering taking on the main operational role of RWC for the Englishspeaking countries in RA IV, tentatively in collaboration with the Caribbean Meteorological Organization.

## Decision 15 (EC-70)

## WMO Integrated Global Observing System station identifiers

#### The Executive Council decides:

- To update the provisions on WIGOS Station Identifiers (WSI) in the *Manual on WIGOS* (WMO-No. 1160), section 2, to clarify the circumstances and the process under which the Secretary-General will issue WSIs as outlined in Annex 1 to this decision;
- (2) To endorse a draft WSI transition plan as presented in Annex 2 to this decision.

#### **Decision justification:**

#### Procedure to allow Secretary-General to issue a WIGOS Station Identifier

The Manual on the WMO Integrated Global Observing System (WMO-No. 1160) specifies the procedures for the assignment of WIGOS Station Identifiers (WSI); the *Guide to the WMO Integrated Global Observing System* (WMO-No. 1165) provides further guidance. Members are requested to follow these procedures for all observing stations/platforms under their responsibility, including those owned and/or operated by partner organizations. Currently there are several cases of approved observing stations operating under observing programs and initiatives that in turn are approved by the WMO Congress (e.g. GAW, GCOS, GCW) not being able to obtain a WSI due to a lack of response from the PR.

CBS-TECO-2018 and the CBS Management Group considered the draft presented in the Annex 1 to this decision and recommended that it be reflected in the amendment of the *Manual on the WMO Integrated Global Observing System* (WMO-No. 1160).

There is the critical dependency of the WIGOS on accurate and robust location metadata.

Further, several Members raised their concern regarding the potential impact on software used in operational systems for the collection and processing of observational data.

#### WSI Transition Plan

Transition to operational use of the new WIGOS Station Identifiers is a complex process that requires careful planning and involvement of representatives from both providers and users of observations; detailed guidance for Members is also needed.

CBS-TECO-2018 and the CBS Management Group considered the draft presented in the Annex 2 to this decision and recommended its endorsement.

## Annex 1 to Decision 15 (EC-70)

#### WIGOS Station Identifiers (WSI)

# I. PROCEDURE FOR A STATION OPERATOR TO APPLY FOR A WIGOS STATION IDENTIFIER

This document is intended to guide the operator of an observing facility through the process of assigning a WIGOS station identifier for that facility. It also applies to users running data rescue activities that need to allocate a WIGOS station identifier for an observing facility for which they have discovered data (for the purposes of this document they are "operating" the facility).

# 1. Verify that a WIGOS station identifier is needed

1.1 Check that the observing facility has not already been allocated a WIGOS station identifier.

1.1.1 If the observing facility has previously delivered observations under a WMO or cosponsored programme for which it had been issued a traditional station identifier, then it will automatically have been assigned a WIGOS station identifier derived from the earlier identifier.

1.1.2 Check for observing facilities already recorded in OSCAR/surface that are close to the position of the facility for which a WIGOS station identifier is being sought (https://oscar.wmo.int/surface) to see whether the facility already has a WIGOS station identifier.

# 2. **Provide evidence that the observing facility meets the requirements to be allocated a WIGOS station identifier**

2.1 The authority that issues the WIGOS station identifier will require evidence of the following:

2.1.1 That the operator of the observing facility commits to providing and maintaining WIGOS metadata for that facility;

2.1.2 That the observing facility is being operated to conform with the Technical Regulations relevant to the programme supported by the observations from that facility;

2.1.3 That observations from that facility are intended to be shared in support of a WMO or co-sponsored programme (even if the programme has not confirmed participation of that facility);

The Manual on WIGOS requires the operators of observing facilities that are allocated WIGOS station identifiers to commit to providing and maintaining WIGOS metadata for that facility and to operating the facility so that it conforms to the WMO Technical Regulations. Evidence of that commitment will be needed by the authority for issuing the WIGOS station identifier.

# 3. Apply for a WIGOS station identifier

3.1 Contact the OSCAR/surface focal point for the country within which the observing facility lies (or, for a mobile station, in which the operator of the station is registered) asking that a WIGOS station identifier is allocated to the facility. The focal point will explain the information needed by their national process for allocating a WIGOS station identifier.

3.1.1 When the WIGOS station identifier is issued, the operator of the observing facility will be told by the OSCAR/surface focal point how to maintain the WIGOS metadata for that observing facility (this could be a national notification process or entering the information directly into OSCAR/surface).

3.2 If the country does not have a focal point for OSCAR/surface listed at https://www .wmo.int/cpdb/workgroups/view/cbs\_FP\_OSCAR-surface, contact the WMO secretariat (wigos -help@wmo.int) who will pass the application to the relevant Permanent Representative directly.

3.3 If the observing facility does not lie within the boundaries of a WMO Member and the operator of that facility is not subject to the jurisdiction of a WMO Member, then the application should be passed directly to the Secretary-General (wigos-help@wmo.int).

# 4. **Invoking the escalation procedure**

4.1 The OSCAR/surface focal point should arrange for a WIGOS station identifier to be allocated within a reasonable time. Before escalating, the user should attempt to contact

the OSCAR/surface focal point to confirm that the application has been received and is being responded to. If no response is received within two months, the user may wish to start the escalation procedure.

4.2 If the OSCAR/surface focal point does not issue a WIGOS station identifier and the user considers that the reason given is not appropriate, the user may wish to start the escalation procedure.

# II. PROCEDURE FOR THE SECRETARY-GENERAL TO ISSUE A WIGOS STATION IDENTIFIER

This procedure is intended to be used in circumstances where it is necessary to record metadata about an observing facility but no Member considers themselves to be in a position to issue a WIGOS station identifier for that facility.

## 1. Invoking the procedure

1.1 This procedure is invoked when the operator of an observing facility or a contributor to the data rescue activities of the Commission for Climatology applies to the Secretary-General for a WIGOS station identifier.

## 2. Validating the application

2.1 The secretariat confirms with the organization requesting the WIGOS station identifier that:

2.1.1 The organization has contacted the OSCAR/surface focal point for the country in whose borders the observing facility lies and that no WIGOS station identifier has been issued, and that there was not a valid reason for refusing to issue a WIGOS station identifier;

2.1.2 The organization is committed to creating and maintaining the metadata for the observing facility in OSCAR/surface to an extent that is appropriate for the observing facility (there is a lower expectation of complete metadata for observing facilities that no longer exist);

2.1.3 The observing facility (if it still exists) will be operated to the standards required in the Technical Regulations for the programme(s) to which it contributes;

2.1.4 Observations from the observing facility are intended to be shared with other organizations.

2.2 The secretariat confirms that the observing facility is not already recorded in OSCAR/ surface. If it is, the applying organization should be informed of this and the procedure terminated.

2.3 The secretariat confirms with the OSCAR/surface focal point for the country within whose boundaries the observing facility is located that the application for a WIGOS station identifier was received and that the outcome was as described by the applicant.

2.3.1 If the application was not received, or the outcome was not as described by the applicant, the secretariat will facilitate communications between the applicant and the OSCAR/ surface focal point.

2.4 If the observing facility is not located within the territory of any Member, the Secretary-General issues a WIGOS station identifier using the "issuer of identifier" allocated to the Secretary-General and the procedure is terminated.

# 3. Escalation of the application

3.1 If no WIGOS station identifier has been issued and no valid reason for not issuing a WIGOS station identifier has been provided by the OSCAR/surface focal point within 30 days from the date the secretariat contacted the OSCAR/surface focal point, the application will be escalated.

3.1.2 Observing Facility contribution approved by a Constituent Body.

3.1.2 In the case that the observing facility has been officially recognized by the governance mechanism of an approved WMO or WMO co-sponsored programme, the Director of WMO responsible for WIGOS activities will provisionally allocate a WIGOS Station Identifier using either the issuer of identifier for the programme (if the station has already been assigned an identifier for that programme) or that allocated to the Secretary-General, and at the same time in writing inform the PR of the country or territory where the observing facility is located of this step, giving him or her 30 days to formally object to this decision.

3.1.3 Observing Facility contribution not yet approved by a Constituent Body.

3.1.3.1 If the observing facility has not yet been approved by a constituent body as contributing to a WMO or co-sponsored programme, the Director of WMO responsible for WIGOS activities writes formally to the Permanent Representative of the country within whose territory the observing facility is located. Normally a period of 30 days will be given for the Permanent Representative to respond by either issuing a WIGOS station identifier or by providing a valid reason for not doing so.

3.1.3.2 If within the specified period the Permanent Representative does not issue a WIGOS station identifier, or does not provide a valid reason for not issuing one, the Secretary-General will issue a WIGOS station identifier using the "issuer of identifier" allocated to the Secretary-General, and at the same time in writing inform the PR of the country or territory where the observing facility is located of this step, giving him or her 30 days to formally object to this decision.

# 4. Identification of observing facilities whose metadata have been recovered through data rescue activities

4.1 Metadata for observing facilities identified through data rescue activities are likely to be less reliable than for facilities that continue to operate. OSCAR/surface metadata records that are maintained by organizations performing data rescue activities, rather than by the operator of the station, should be identified by associating them with the "Data rescue" programme. Should the responsibility for maintaining the metadata subsequently pass to the organization (or its successor) that originally operated the facility, then the association with the "Data rescue" programme should be removed.

# Annex 2 to Decision 15 (EC-70)

# **WSI Transition Plan**

# 1. Background

The overall concept and the actual structure of the WIGOS Station Identifiers (WSI) were approved by the Seventeenth World Meteorological Congress (Cg-17) (2015) as part of the WIGOS regulatory material, *Technical Regulations*, Volume I, Part I – WIGOS, (WMO-No. 49) and *Manual on WIGOS*, (WMO-No. 1160). The initial Guide to WIGOS also contains WSI related material.

During 2017 the efforts to implement the WSIs, included training on the structure and on the procedures to assign WSIs, e.g. in the context of OSCAR/Surface training events for Members at regional level (Offenbach, Germany, May 2017; Lima, Peru, September 2017) several concerns were raised by participants about the implementation and operational use of WSI, and additional guidance on this issue was requested.

At the same time similar concerns about the potential impact on software used in operational systems that collect and process observational data were raised by several global NWP centres, in part triggered by the development activities of the WIGOS Data Quality Monitoring System (WDQMS).

In parallel, discussions have been ongoing within structures such as EUMETNET, GAW, JCOMM, trying to find the best approaches for the assignment and for the implementation of the WSIs, specially for the stations operated by non-Met Services organizations.

Finally, it should be mentioned that there is a strong relation between the implementation of the WSIs and the BUFR migration process – the TAC reports are not compatible with the new WSIs.

## 2. **Objectives**

From the concerns listed in Section A. above, the need for careful planning and detailed guidance emerges very clearly. The issue was discussed at ICG-WIGOS-7, where it was agreed to establish a specific Task Team to take responsibility for developing a transition plan for WSIs (TT-WSI).

So, the objective of this (draft) plan is to identify the necessary steps to ensure that all the parties involved, NWP and World Data centres, as well as Members and partner organizations, are ready to move to WSIs before the final transition to using them in operations in order to avoid/limit any negative impacts, e.g. in the form of data loss.

The key contents of a transition plan for introduction of WSI have been identified under the four following themes, and endorsed by ICG-WIGOS:

- (a) Identification of issues to be addressed by Members,
- (b) Advice and tools for members to address issues,
- (c) Testing environment,
- (d) Resolving issues with exchange of information.

## 3. Timescale

Taking into account that the WIGOS Pre-operational Phase is planned to run until the end of 2019, ideally, the timescale for the transition plan of WSIs should be from "now" (i.e. to start immediately, or as soon as possible during the first quarter of 2018), until the end of 2019, i.e. approximately two years before the WIGOS operational phase begins in 2020.

The calendar of the transition plan should be aligned with the above-mentioned four themes, according to the following generic schedule:

## Second quarter 2018:

- (a) identify high priority issues (tranche 1) to be addressed;
- (b) Implement procedure for resolving issues with exchange of information (use the TT-UABUFR recommendations);
## Third quarter 2018:

- (a) develop advice and tools for Members to address the high priority (tranche 1) issues;
- (b) identify next level of priority issues (tranche 2) to be addressed;

## Fourth quarter 2018:

- (a) Implement testing environment for tranche 1 issues;
- (b) develop advice and tools for Members to address the tranche 2 issues;
- (c) identify next level of priority issues (tranche 3) to be addressed;

## First quarter 2019:

- (a) Implement testing environment for tranche 2 issues;
- (b) develop advice and tools for Members to address the tranche 3 issues;
- (c) identify next level of priority issues (tranche 4) to be addressed;
- (d) Monitor implementation of solutions to tranche 1 issues and amend solutions if needed;

## Second quarter 2019

Follow the above pattern.

#### 4. Approach

The topics and sub-topics under each theme are presented in detail here below:

## 4.1 *Identification of issues to be addressed by Members*

#### Management procedures

- (a) Delegating authority to issue identifiers
- (b) Ensuring OSCAR/surface maintained
- (c) Internal procedures to decide on identifiers and to make sure that identifiers are unique

#### Observing systems

- (a) Update software in systems that generate observation reports for external delivery to use the WIGOS station identifier
- (b) Update software (including databases) that collects observation information in internal (proprietary) formats and distributes them to the external community.
- (c) Decide on the WIGOS station identifier that will be used for each class of report from that station (for example, synoptic reports might use a different WIGOS identifier from GAW reports to assist other users with their migration)

#### Data repositories

(a) Ensure that the repository can store WIGOS station identifiers as (one of) the identifiers for the station

- (b) Determine and implement methods of accepting reports that include any combination of WIGOS and traditional station identifiers
- (c) Determine and implement methods to extracting observations from the repository in a format that allows them to be used in downstream processing.
- (d) Determine and implement methods to ensure that all reports from the same station are identified as such even if the reports themselves contain different WIGOS station identifiers.

#### Application software

- (a) Determine and implement how observations that do not have traditional station identifiers will be handled in the application.
- (b) Ensure that applications can process observations received by the organization in BUFR.
- (c) Determine and implement methods to ensure that all reports from the same station are identified as such even if the reports themselves contain different WIGOS station identifiers.

#### 4.2 Advice and tools for members to address issues

Central repository for advice that can be referred to in all communications

Collect examples of how centres are handling WIGOS station identifiers with legacy systems

With links to offered software

Involve HMEI members

Briefing workshop for HMEI members on the issues

OSCAR/surface tool to allow all WIGOS station identifiers associated with a station to be downloaded (for a single station or a list of stations)

OSCAR/Surface tool to provide assistance in generating a WIGOS ID for a new station

Central guidance on how to decide which WIGOS station identifier in which type of report, e.g.:

- (a) For existing stations the WIGOS station ID corresponding to the traditional station for that type of report;
- (b) For new stations only assign a single WIGOS station identifier (if not possible, assign the minimum number of identifiers that is possible):
  - If an external programme or body (such as ICAO) requires a traditional alphanumeric code to be used for reports, use the WIGOS station identifier associated with that code form (for example, an new airport would use a WIGOS identifier of the form 0-20006-0-abcd);
  - If there are no external constraints, use a WIGOS station identifier in the range delegated to the operating country.
- (c) Any time table over which reports will converge to using a single identifier (this depends on migration of all systems to using reporting formats that are capable of recording the WIGOS station identifier explicitly).

## 4.3 **Testing environment**

Sample reports in BUFR with different combinations of traditional and WIGOS station identifiers (including reports that will highlight incorrect assumptions in the processing)

## 4.4 **Resolving issues with exchange of information**

Mechanisms for users to report and resolve problems with:

- (a) WIGOS station identifiers recorded in observation reports;
- (b) Inconsistencies between information in reports from a station and that in OSCAR/surface for that station, including:
  - Use of the wrong WIGOS station identifier;
  - Incorrect report contents;
  - Incorrect OSCAR/surface contents;
  - WIGOS station identifier not in OSCAR/surface.
- (c) Inability to obtain a WIGOS station identifier to associate with an observation report.

## 5. Tasks, Activities and Responsibilities

The TT-WSI will review the lists of themes and topics and will develop accordingly a detailed work-programme with the necessary tasks and activities to address each of the topics/subtopics of this transition plan; these may include surveys, workshops, visits and TT-WSI sessions.

The support from the Secretariat includes initially the following units of the Observing and Information Systems Department:

- (a) WIS Branch
- (b) WIGOS Project Office;
- (c) Other departments/divisions to be identified as needed;

#### 6. Communication & outreach

The communications and outreach activities will be developed by the Secretariat in collaboration with the Chair TT-WSI, using the available WIGOS and WIS tools, such as Webpages, WIKI pages, the WIGOS Newsletter and the WWW Operational Information Service (OIS) newsletter.

## 7. **Project Management and Risks**

A Web-based project management application will be used to manage and to keep track of the activities of this transition plan.

The risks are mostly related to non/inappropriate use of the "project management" tools, for example if not updating and sharing the progress and/or any unexpected issues/delays, and also to non-adherence to the plan, due to ad-hoc decision making.

## Decision 16 (EC-70)

## **Observing Systems Capability Analysis and Review Tool/Surface user interface**

#### The Executive Council decides to:

- (1) Endorse the development of the OSCAR/Surface user interface in all WMO languages and requests Secretary-General to allocate the resources required;
- (2) Urge Members to provide financial resources to the WIGOS Trust Fund for the translation of the OSCAR/Surface user interface into other WMO languages.

#### **Decision justification:**

Availability of OSCAR/Surface in all WMO languages is essential for the operational uptake among all Members of this critical WIGOS tool.

OSCAR/Surface is the key source of information about all observing systems and platform, and is being populated and updated with required WIGOS metadata for those observations that are exchanged internationally.

At WIGOS workshops, training events and other meeting events, recurring requests were made regarding: (i) the user interface of OSCAR/Surface to be made available in all WMO languages; (ii) hands-on training in OSCAR/Surface provided in the WMO language(s) most relevant in the particular Region; (iii) development of e-learning tools in all WMO language(s), and (iv) the development of a stand-alone version of OSCAR that can be installed nationally in order to facilitate management of station information at the national level.

#### Decision 17 (EC-70)

#### Review plan for the Manual on the WMO Information System (WMO-No. 1060) and the Guide to the WMO Information System (WMO-No. 1061)

**The Executive Council requests** the Commission for Basic Systems (CBS) to complete development of the amendments to technical regulations as listed in the Annex to this decision and to consult with Members in preparation for their recommendation to eighteenth World Meteorological Congress (Cg-18), and **decides** to include those amendments on the agenda of Cg-18.

See the Annex to the present decision.

**Decision justification:** CBS Management Group, following discussion at the 2018 Technical Conference of the CBS, recommended that these amendments be discussed by Cg-18.

#### Annex to Decision 17 (EC-70)

# Review plan for the *Manual on the WMO Information System* (WMO-No. 1060) and the *Guide to the WMO Information System* (WMO-No. 1061)

#### The topics to be included on the agenda for Cg-18 shall include:

- 1. Amendments to WMO-No. 1060 Manual on the WMO Information System and WMO-No. 1061 Guide to the WMO Information System concerning:
  - (a) A generic on-site audit process that could be applied to the audit of specialist centres of any WMO programme against the requirements of that programme as described the CBS TECO 2018 document CBS-TECO-2018-Doc-5(3)-Annex1-Audit\_draft1;
  - (b) Management of risks to the WMO Information System of cybersecurity incidents through the introduction of a procedure for responding to cybersecurity incidents as described in the CBS TECO 2018 document CBS-TECO-2018-Doc-5(3)-Annex2-SecurityProcedure\_draft1;
  - (c) Operational monitoring of the WIS infrastructure as a "GISC watch" that would be implemented as described in issue 5(3)/4 of CBS TECO 2018 document CBS-TECO-2018-Doc-5(3)-WIS-Operations\_draft1;
  - (d) Escalation procedures to resolve operational issues that cannot be decided by mutual agreement between the parties involved as described in issue 5(3)/5 of CBS TECO 2018 document CBS-TECO-2018-Doc-5(3)-WIS-Operations\_draft1;
  - (e) Coordination of GISC activities as described in issue 5(3)/3 of CBS TECO 2018 document CBS-TECO-2018-Doc-5(3)-WIS-Operations\_draft1;
  - (f) Introduction of standards and guidance on information management for centres supporting WMO programmes ("WIS Part C") as described in the CBS TECO 2018 information paper CBS-TECO-2018-Inf-5(4)-WIS-Information-Management;
  - (g) Introduction of standards and guidance on operation of information and communications technology in support of the activities of WMO programmes as described in the CBS TECO 2018 information paper CBS-TECO-2018-Inf-5(2)-WIS-ICT-Operations\_draft1;
  - (h) Plan for removing WMO-No. 386 Manual on the Global Telecommunication System and transferring any of its content that remain necessary to WMO-No. 1060 Manual on the WMO Information System or WMO-No. 1061 Guide to the WMO Information System.
- Amendments to WMO-No. 306 Manual on Codes Volume 1.3 Part D Representations derived from data models to implement the XML representation of WMO Integrated Global Observing System (WIGOS) metadata including substantial improvements on the draft in Decision 8 (CBS-16).

# Decision 18 (EC-70)

#### WMO Information System 2.0 implementation approach

**The Executive Council noting** the WMO Information System 2.0 Strategy, endorsed by Resolution 8 (EC-69) and the Draft WMO Information System 2.0 implementation approach as described in the document presented to the Commission for Basic Systems (CBS) Technical Conference (TECO) 2018 (CBS-TECO-2018-Inf-5(1)-WIS2-Implentation-approach\_draft1),

**Noting further** that CBS Management Group recommended EC-70 consideration for referral to Congress,

#### **Requests** the CBS:

- (1) To consult with Members on amendments needed to further develop the Strategy and Implementation Approach and specific design requirements;
- (2) To provide Congress with the updated Strategy and Implementation Approach and a plan to document specific design requirements;
- (3) To provide more information to Members about the technical infrastructure supporting WIS 2.0 and a comparison of the functional architectures for the original WIS and WIS 2.0;

**Encourages** Members to provide feedback to CBS on amendments needed to further develop the Strategy and Implementation Approach;

Agrees to consider the status of WIS 2.0 at Cg-18 with a view toward implementation and;

**Decides** to request from Congress to authorize EC to make a decision on implementation once the updated documents, including design requirements, are submitted by CBS.

**Decision justification:** CBS Management Group, following discussion at the CBS TECO 2018, recommended that WIS 2.0 be discussed by Cg-18.

## Decision 19 (EC-70)

#### Mechanisms for provision of shared services

**The Executive Council noting** that the Secretariat should only coordinate and not operate operational systems,

**Further noting** the potential requirement for procurement and contract management by the Secretary-General of services for shared use by Members and partner organizations,

**Requests** the Secretary-General to explore the financial and regulatory mechanisms for provision of such services and report to Congress.

**Decision justification:** The strategies for WIGOS, WIS and the DPFS are built on an expectation of increased sharing of service provision by Members. The experience of WIS in the provision of the Main Telecommunication Network using a commercial provider of telecommunication system is that requiring Members and partner organizations each to enter into a contractual relationship with the provider is not possible because of differing national constraints. The Commission for Basic Systems has proposed an approach in which the

Secretary-General procures a service, to be funded by Members and partner organizations, the contract for which is managed by the Secretary-General, but the service is used and monitored by Members and partner organizations.

## Decision 20 (EC-70)

#### Pilot project for the exchange of information and metadata between Global Information System Centres

**The Executive Council noting** the work of the Commission for Basic Systems (CBS) in the development and prototyping of a clearing house for the rapid exchange of information and discovery metadata between Members operating Global Information System Centres (GISCs),

**Noting further** that a pilot capability will be hosted and managed by a Member or partner organization,

**Requests** all Members operating GISCs to participate in this pilot project;

**Requests** the Secretary-General to explore financial mechanisms for the establishment and long-term provision of such a shared service in the future.

**Decision justification:** The three-year pilot providing a clearing house for the exchange of information and discovery metadata between GISCs is expected to deliver the following direct benefits to members operating GISCs:

- Reduction in the number of telecommunication connections that need to be operated by each GISC;
- Transfer of information between GISCs in situations where direct telecommunication connections are physically or politically difficult;
- Ability to scale the technology to match the level of demand;
- Reduction in the end-to-end delivery times of high priority warning messages.

Lessons learned from this pilot will be used when procuring a longer-term operational service.

WIS 2.0 (Decision 18 (EC-70) would rely on systems that are shared between Members and make extensive use of cloud technologies. Cloud technologies themselves are commonplace in the IT market and are used by an increasing number of Members for their internal operations. WIS 2.0, however, would require those technologies to be applied in situations where the costs and operational management of the services need to be shared between Members with differing national constraints on procurement and information technology policies. In addition to its operational benefits, phase I of the cache in the cloud project aims to demonstrate the technical, financial and procurement practicality of operational use of cloud services that are shared by Members. This project was discussed by the 2018 Technical Conference of the Commission for Basic Systems (CBS), and endorsed by the CBS Management Group at its meeting on 29 March 2018. Additional background material is provided in the report of the CBS Expert Team on Communication Techniques and Systems on the topic.

# Decision 21 (EC-70)

## Intergovernmental Oceanographic Commission Ocean Data and Information System

**The Executive Council decides** to endorse Recommendation 2 (JCOMM-5) – The Intergovernmental Oceanographic Commission Ocean Data and Information System (ODIS) (on assisting the development of the ODIS concept paper) and requests CBS to work with JCOMM (through the Intercommission Task Team on WIS (ITT-WIS)) to ensure that the development of WIS 2.0 will complement the development of ODIS.

**Decision justification:** Recommendation 2 (JCOMM-5).

## Decision 22 (EC-70)

#### Ocean data standards and best practices

**The Executive Council decides** to endorse Recommendation 3 (JCOMM-5) on Ocean data standards and best practices;

**The Executive Council requests** JCOMM to collaborate with the IOC of UNESCO International Ocean Data and Information Exchange Committee (IODE) to facilitate the submission and review of standards to the Ocean Data Standards and Best Practices project, and submission of best practice documents to the IODE Ocean Best Practices repository and the WIGOS Information Resource (WIR).

**Decision justification:** Recommendation 3 (JCOMM-5).

#### Decision 23 (EC-70)

#### Establishment of Data Acquisition Centres, Global Data Assembly Centres and Centres for Marine Meteorological and Oceanographic Climate Data within the new Marine Climate Data System

**The Executive Council decides** to approve Recommendation 4 (JCOMM-5) – Establishment of Data Acquisition Centres (DACs), Global Data Assembly Centres (GDACs) and Centres for Marine Meteorological and Oceanographic Climate Data (CMOCs) within the new Marine Climate Data System (MCDS);

**The Executive Council decides**, subject to a parallel approval by the fifty-first session of the IOC Executive Council, to establish:

- The World Ocean Database (WOD) of NOAA National Centers for Environmental Information (NOAA-NCEI) to operate as CMOC under MCDS;
- (2) The Marine Environmental Data Section (MEDS) of Department of Fisheries and Ocean (DFO), Canada, and Coriolis Data Center of IFREMER (Institut Français de Recherche pour l'Exploitation de la Mer), France, to operate as GDACs under MCDS.

## **Decision justification:** Recommendation 4 (JCOMM-5). It is to be noted that:

- (i) Appendix VII.1 of revised version of WMO No. 558 (adopted by the Executive Council through Resolution 10 (EC-70)) includes the list of Established Centres for Marine Meteorological and Oceanographic Climate Data (CMOCs). In particular, the list includes the CMOC operated by China in Tianjin. The World Ocean Database of NOAA, USA will be added to the list.
- (ii) Paragraph 3.2 of Appendix 8.1 of revised version of WMO-No. 471 (adopted by the Executive Council through Resolution 10 (EC-70)) includes the list of established Global Data Assembly Centres (GDACs) in the Marine Climate Data System (MCDS). In particular, the Global Collecting Centres (GCCs) of Germany and the United Kingdom are now integrated in the MCDS as specialized GDACs for Delayed-Mode VOS data and are listed in WMO-No. 471 as such. The new GDACs operated by Canada and France will be added to the list.

## Decision 24 (EC-70)

#### Negotiation of satellite communications tariffs

**The Executive Council decides** to endorse JCOMM Recommendation 11 (JCOMM-5) on Negotiation of Satellite Data Telecommunication Tariffs.

**Decision justification:** Recommendation 11 (JCOMM-5). Satcom forum was established by Congress through Resolution 31 (Cg-17). The objective of the Satcom Forum according to its terms of reference is to address remote data communication requirements - including tariff negotiations as needed – for automatic environment observing systems. Since 1984, the JTA provides for an international mechanism to find cost-effective locations and data processing of data collected through the Argos system. There is also growing provision from Satcom providers of fixed-price satellite data communication tariffs for environmental monitoring applications, which offer opportunities to negotiate tariff for other systems than Argos. Through its Recommendation 11 (JCOMM-5) JCOMM recommended the Executive Council (i) to approve the inclusion of the Argos Joint Tariff Agreement (JTA) as a subprogramme of the Satcom forum; (ii) to give authority to the Chairperson of JTA to approve the JTA Argos Global Tariff Agreement on behalf of WMO and IOC, as negotiated on a yearly basis within the JTA framework. JCOMM also invited the Satcom forum, based on the results of the Satcom-Survey 2017, to pursue, with Satcom providers, negotiation of a "WMO–IOC branded disaster alerting" tariff".

## Decision 25 (EC-70)

#### **Emerging data issues**

#### The Executive Council:

**Requests** CBS to consult with presidents of regional associations and presidents of technical commissions on the draft report of the CBS-led review of emerging data issues, both to socialise the contents and get comments to assist in refining and finalizing the draft review report;

**Requests** the Working Group on Strategic and Operational Planning, with support from the Secretariat and in consultation with PRA and PTCs, to finalize the recommendations in the report for consideration by Congress; and decides to include a discussion of that report and recommendations on the agenda for the Eighteenth World Meteorological Congress.

#### **Decision justification:**

Resolution 65 (Cg-17) requested the Commission for Basic Systems, in coordination with other technical commissions, in particular the Commission for Hydrology, to undertake a review of emerging data issues. The CBS-led team produced a draft report that was discussed by CBS Management Group, following discussion at the 2018 Technical Conference of the Commission for Basic Systems. CBS recommended that the report be discussed by the Eighteenth World Meteorological Congress. The full draft of the report is in EC-70/INF. 7.3(1). Following is an executive summary of the draft report of the CBS-led review on emerging data issues.

This report responds to a request from the Seventeenth WMO Congress (Cg-17) to provide clarity for Members in navigating the rapidly changing world of data and data technologies, and especially to provide some insight regarding trends and emerging issues in data and its use. While the paper necessarily refers to technical aspects of data, its focus is on the impact (both positive and negative) of emerging data issues on WMO and its Members, and how they might respond collectively and individually, at global, regional and/or national levels.

This CBS-Led Review of Emerging Data Issues drew on a wide range of source materials and experts, including material compiled by the technical commissions at the request of the President of WMO and ongoing discussions in Congress, Executive Council, CBS and in working bodies associated with WIGOS, WIS, GDPFS and PWSD. The discussion and the framing of potential advice to bring back to Congress roamed widely from evolution to revolution, including the need to strengthen the 'irreducible core' of NMHSs and WMO through reinforcing the essential role of the WWW; the aspiration that 'no Member will be left behind' and that 'no Member stands alone'; the need to engage, be inclusive and build alliances; the need to create and exploit opportunities through data; and the need to challenge traditional pathways while recognizing the important ongoing, though potentially changing, roles of people.

Emphasis was placed on harnessing the excellent work already being provided through WMO response to data and technology, in particular through WIGOS, WIS/WIS 2.0, GDPFS/S-GDPFS and SDS, on equipping Members with the essential tools and advice to adapt to, adopt and respond to these opportunities, and on mobilizing WMO as a brand focussed on standardization, coordination and facilitation of a global community in the service of society.

The review converged around the important reminder that data is a means to an end, not an end in itself. It is only through its intelligent use in engaging with users and in the development and uptake of services and associated outcomes that meet societal needs that data delivers its full value, be it over the long term required for historical climate insight and impact management, the medium term for effective water and natural resource management and disaster preparedness, or over the shorter term to warn of, and support response to, impending severe weather events and disasters. The review provided a response framework featuring concrete actions centred on thinking global, acting local and reaching forward.

Emerging trends in data and data technologies offer WMO as a whole and Members, in particular, the opportunity to reimagine what efficient, effective and relevant services and service delivery could look like and how genuine value can be delivered.

# Decision 26 (EC-70)

#### Impact assessment for observing system design and evolution

#### The Executive Council decides:

- (1) To agree that priority should be given to studies that address the identified Science Questions provided in the Annex to this Decision, and which are requiring Numerical Weather Prediction (NWP) Impact Assessments for Observing System Design and Evolutions that are anticipated to include observation impact assessment for longer-range forecasting and non-NWP application areas;
- (2) To request CBS to organize the seventh WMO Workshop on the Impact of Various Observing Systems on NWP in the Republic of Korea in 2020;
- (3) To request Members:
  - (a) To continue the development and research of adjoint- and ensemble-based observation impact assessment tools, as a complement to traditional OSEs;
  - (b) To develop OSEs for the optimization of regional composite networks;
  - (c) To address the science questions listed in the Annex to this Decision , and have Numerical Weather Prediction Centres to undertake the required impact studies (e.g. Observing System Experiments – OSEs – and Observing System Simulation Experiments – OSSEs) during the period 2018 to 2020, and have National Meteorological and Hydrological Services and NWP centres to actively participate in the seventh WMO Workshop on the Impact of Various Observing Systems on NWP (Republic of Korea, 2020).

See EC-70/INF. 7.4(1) for more information.

**Note:** The present decision replaces Decision 24 (EC-69), which is no longer in force.

**Decision justification:** CBS Management Group (Geneva, 29 March 2018), following experts advice provided at CBS TECO 2018 (Geneva, 26–29 March 2018) agreed on the need to assess the impact of various observing systems on NWP. Observation impact studies provide a wealth of information of relevance to the evolution of the Global Observing System, and that the traditional OSE and OSSE techniques are complemented by new adjoint- and ensemble-based approaches that help inform network design activities and investment.

#### Annex to Decision 26 (EC-70)

#### Science questions requiring NWP impact assessments for observing system design and evolutions

Short name: Full name	Science question	
Surface-based		
S1 AMDAR: Coverage of AMDAR	Encourage studies of impact assessment of AMDAR and MODE-S in data-spar- regions. Examples include for instance (1) trade space studies between additivertical profiles over land versus en route data over the oceans, and (2) increasing measurements over poles versus tropics. Provide general guidance AMDAR extension priorities.	

Short name: Full name	Science question		
S2 Radar: Radar observations	What are the impacts of current radar observations, particularly radar polarization, but also wind profiles, radial winds and reflectivity?		
S3 PBL: Observations of the PBL for regional and high-resolution NWP	What should be the focus of improvements for observations of the planetary boundary layer (PBL) in support of regional and high-resolution NWP? Which variables and what space-time resolution?		
S4 HighElev: High elevation surface observing stations	Estimate the actual and potential impacts of high elevation meteorological data from the high mountain regions, for example using OSSE, OSE or FSOI, on appropriate environmental models.		
Space-based			
S5 SatLand: Satellite sounding over land and ice	What is the impact of new developments in the assimilation of radiance data over land, snow and sea ice?		
S6 Sounders: Impact of multiple satellite sounders	What benefits are found when data from more than one passive sounder are available from satellites in complementary orbits?		
S7 AMVs: Atmospheric Motion Vectors	Which AMV characteristics (temporal resolution, height, etc.) should be enhanced from the next generation of satellites (such as Geo)?		
General			
S8 UA: Regional upper-air network design studies	Upper-air network design studies such as those that have been performed for the European composite observing system (EUCOS) are required also in other Regions, especially in Region I where the basic networks are under pressure. Assessments of recent changes in the networks, including the impact of launching radiosondes once per day or at non-synoptic times.		
S9 Sfc and Sat : Impact of satellite observing capabilities on the design of the surface-based observing systems	What is the impact of the increasing capabilities of space-based observing systems on the design and evolution of surface-based observing systems? With special emphasis on the impact on network design in areas with very sparse surface-based networks. Examples include (1) For marine observing systems: What density of surface pressure observations over the ocean is needed to complement high-density surface wind observations from satellites? And (2) For upper air observations: What network of in situ profiling observations is needed in the stratosphere to complement current satellite observations (including radio occultation)? Assessments addressing the Tropics are encouraged.		
S10 AdjEns: Application of adjoint and ensemble methods	What insights can be gained from adjoint and ensemble-based impact measures tailored for applications such as severe weather, aviation and energy? Specific impact metrics may be required.		
S11 Ocean: Impact in ocean-coupled assimilation	Which ocean observations are particularly important for NWP? Investigate the role of ocean observations, in particular profile observations provided for example by the moored buoy arrays, in coupled atmosphere-ocean data assimilation with a focus on the 7–14 day range.		
S12 Land: Impact in land-coupled assimilation	Which land-surface observations are particularly important for NWP at all forecast time ranges? Investigate the role of surface observations in coupled atmosphere-land data assimilation with a focus on the 7–14 day range.		
S13 Data frequency/ Timeliness	Assess the impact of increased frequency and/or timeliness/latency of observations? Consider the case of AMDAR, radiosonde, GEO satellites AMVs and ground-based remote sensing observations (such as Doppler radar, wind profiler, ground based GNSS receivers) for regional and global NWP.		
S14 Atmospheric composition	Study observation impact in atmospheric composition and air quality application and the impact of atmospheric composition observations (e.g. aerosol) on NWP.		
S15 OSSEs	Observing system simulation experiments are encouraged in support of satellite system design criteria such as orbit optimization for GNSS-RO satellites, or for emerging technology sensors (such as Geo-based hyperspectral IR or MW sounders, Small/Cube satellites, etc).		

Short name: Full name	Science question
S16 Impact Assessment for Seasonal And Climate Applications	Observational Impact Studies are encouraged for extended range prediction systems, especially using coupled models. These could be used to investigate ways to optimize the design of climate observing systems networks.
S17 Ground-Based GNSS	Promote undertaking impact studies to assess the impact of ground-based GNSS on NWP. This will help measure the potential need to exchange data internationally. In addition to regional impacts, global impacts or at least wide-regional impacts are encouraged.

## Decision 27 (EC-70)

## Sustaining the VLab technical support officer

**The Executive Council decides** to request Members to consider providing financial contributions to the WMO – Coordination Group on Meteorological Satellites (CGMS) Virtual Laboratory for Training and Education in Satellite Meteorology (VLab) Trust Fund.

**Decision justification:** Satellite providers in CGMS provide annual financial contributions to keep the Fund operational; however, a broader diversity of donor contributions by Members would strengthen robustness of the Fund, and help support training activities for a wider range of WMO Application Areas (e.g. climate, marine meteorology). Commission for Basic System (CBS) Management Group (Geneva, 29 March 2018), following experts advice provided at CBS Technical Conference 2018 (Geneva, 26–29 March 2018) agreed to strengthen the financial support basis for the WMO-CGMS Virtual Laboratory for Training and Education in Satellite Meteorology (VLab) technical support officer, and that: (i) the WMO VLab Trust Fund established for this purpose is receiving in total about 80K CHF/year from CGMS satellite operators (EUMETSAT, Korea Meteorological Administration – KMA) and NOAA National Weather Service (NWS); and (ii) a broader diversity of donor contributions by Members would strengthen robustness of the Fund, and enable the VLab to support more training activities in a wider range of WMO Application Areas.

See EC-70/INF. 7.4(1) for more information.

#### Decision 28 (EC-70)

#### Education and outreach strategy regarding data buoy vandalism

#### The Executive Council decides:

- To endorse JCOMM Recommendation 5 (JCOMM-5) on education and outreach strategy for data buoy vandalism;
- (2) To request Members to actively engage, support and collaborate in the efforts of the JCOMM to collect existing education and outreach materials related to national or regional mitigation of data buoy vandalism efforts.

#### **Decision justification:** Recommendation 5 (JCOMM-5)

See EC-70/INF. 7.4(1) for more information.

#### Decision 29 (EC-70)

#### Management of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology In Situ Observations Programme Support Centre

#### The Executive Council decides:

- (1) To endorse Recommendation 6 (JCOMM-5) on the Management of the JCOMM in situ Observations Programme Support Centre (JCOMMOPS),
- (2) To request Members to investigate how they could strengthen their support to JCOMMOPS and assist for making the funding of JCOMMOPS more stable and sustainable,
- (3) To request the Secretary-General to monitor the JCOMMOPS review and to contribute to this review.

**Decision justification:** Recommendation 6 (JCOMM-5)

See EC-70/INF. 7.4(1) for more information.

#### Decision 30 (EC-70)

#### Long-term ship observing stations

#### The Executive Council decides:

- To approve Recommendation 7 (JCOMM-5) on long-term observing stations and to establish an evaluation process to identify long serving ships in the marine observations;
- (2) To request JCOMM to establish an evaluation process to identify the long serving ships on the marine observations and to establish a process to award certificates to those ships that have provided ocean observations for a longer period of time.

**Decision justification:** Recommendation 7 (JCOMM-5)

See EC-70/INF. 7.4(1) for more information.

# Decision 31 (EC-70)

## Reduction of the number of voluntary observing ship classifications

## The Executive Council decides:

- To endorse Recommendation 9 (JCOMM-5) to reduce the number of voluntary observing ship (VOS) classifications;
- (2) To request JCOMM to:
  - (a) Fully define the new classes, propose required changes to VOS metadata formats, reporting procedures for PMOs, and make proposals on how the new third party ships should be administered and supported in the future;
  - (b) Develop and propose the required changes in the *Manual on the Global Observing* System (WMO-No. 544), Volume I – Global Aspects, the *Guide to the Global Observing* System (WMO-No. 488), and the WMO *Manual on Codes* (WMO-No. 306);
- (3) To approve:
  - (a) Recommended changes to VOS Classifications to be reflected in WMO-No. 544 and WMO-No. 488, and transitioned to the *Manual on the WMO Integrated Global Observing System* (WMO-No. 1160) and the *Guide to the WMO Integrated Global Observing System* (WMO-No. 1165) as appropriate per WIGOS Pre-Operational Phase implementation;
  - (b) To make appropriate amendments to the code tables of the *Manual on Codes* (WMO-No. 306), Vol. I.2, using the "Simple (Fast-track) procedure" of Resolution 12 (EC-68).

**Decision justification:** Recommendation 9 (JCOMM-5)

See EC-70/INF. 7.4(1) for more information.

## Decision 32 (EC-70)

## Voluntary observing ship metadata

#### The Executive Council decides:

- (1) To endorse Recommendation 10 (JCOMM-5) on freezing the *International List of Selected, Supplementary and Auxiliary Ships* (WMO-No. 47) and moving to WMO Integrated Global Observing System metadata structures;
- (2) To approve:
  - (a) The freezing and archival of publication WMO-No. 47, at version 4.2;
  - (b) The submission of ship metadata from Members directly through the JCOMM In Situ Observations Programme Support Centre (JCOMMOPS);

(c) The full integration of the publication WMO-No. 47 within the WIGOS Metadata Standard, and the transfer metadata from the WMO-No. 47 Database to OSCAR/ Surface (https://oscar.wmo.int/surface/), via JCOMMOPS.

**Decision justification:** Recommendation 10 (JCOMM-5)

See EC-70/INF. 7.4(1) for more information.

## Decision 33 (EC-70)

#### **Contribution to Global Ocean Observing System Strategy**

#### The Executive Council decides:

- (1) To contribute to the implementation of the Global Ocean Observing System 2030 Strategy;
- (2) To encourage further dialogue between the IOC-WMO-UNEP-ICSU Global Ocean Observing System (GOOS) Steering Committee (GSC) and WIGOS in the development of requirements and observing system evaluation relevant for WMO objectives;
- (3) To request Inter-Commission Coordination Group on WIGOS (ICG-WIGOS) to guide CBS and JCOMM on how to facilitate such dialogue;
- (4) To request CBS and JCOMM to engage with the GSC according to ICG-WIGOS guidance.

See EC-70/INF. 7.4(1) for more information.

#### Decision 34 (EC-70)

#### Designation of new regional instrument centres

#### The Executive Council decides:

 That CIMO is charged with assessing the capabilities of a candidate Regional Instrument Centre (RIC) and with CIMO lies the authority and the responsibility to make recommendations to a regional association on the capability of a candidate to perform the functions of a RIC;

**Decision justification:** WMO joined the Intergovernmental Oceanographic Commission (IOC) of UNESCO as a co-sponsor of the Global Ocean Observing System (GOOS) in 1991, and WMO recognizes the importance of ocean observations for weather and climate. JCOMM-5 formally recognized the role played by the JCOMM Observations Coordination Group (OCG) for GOOS, and adopted Decision 24 (JCOMM-5) on GOOS co-sponsorship of the JCOMM OCG. Development of requirements by GOOS for observations related to marine ecosystem health, and their importance in understanding climate impacts and developing appropriate responses are appreciated by WMO. The draft Global Ocean Observing System 2030 Strategy (IOC/EC-LI/2 Annex 8) as submitted to the 51st Session of the IOC Executive Council, 3–6 July 2018 for its approval, is available from here: http://www.ioc-unesco.org/index.php?option=com\_oe&task =viewDocumentRecord&docID=21552.

- (2) That a regional association may formally designate a RIC, only upon positive assessment by CIMO of its capability to perform the functions of a RIC;
- (3) To request CIMO to document the process for assessing the capabilities of a candidate RIC.

**Decision justification:** Terms of Reference for RICs were developed by CIMO and approved by EC, while regional associations are responsible for the designation of RICs in their region. Assessing the capabilities of a candidate requires specific technical expertise lying in CIMO.

See EC-70/INF. 7.4(1) for more information.

## Decision 35 (EC-70)

#### Architecture for climate monitoring from space

#### The Executive Council decides:

- (1) To note the concept paper as described in the Annex of this decision;
- (2) To request the Commission for Basic Systems, in consultation with the CEOS-CGMS Working Group, to consider the added value of the concept paper in the light of the new CGMS baseline and the Vision for WIGOS 2040, and to provide advice to ICG-WIGOS in relation to the development of the an implementation plan for the WIGOS Vision 2040;
- (3) To request the Secretary-General to invite the CEOS-CGMS Joint Working Group on climate to give a demonstration of the architecture for climate monitoring from space at the Congress-18.

See EC-70/INF. 7.4(2) for more information.

**Decision justification:** WMO Resolution 19 (Cg-XVI) called for the development of an Architecture for Climate Monitoring from Space to provide a framework for the sustained and coordinated monitoring of the Earth climate from space.

## Annex to Decision 35 (EC-70)

#### Concept for the physical view of the architecture for climate monitoring from space

The Physical View of the "Climate Constellation" should be a virtual constellation composed of virtual sub-constellations providing the observations to derive a single or a group of ECVs. The sub-constellations will belong to either CEOS members or CGMS members or a combination of both. At present, there is already a set of CEOS virtual sub-constellations covering a set of ECVs and reporting to the CEOS SIT (Strategic Implementation Team). CGMS should establish its own virtual sub-constellations covering atmospheric-related ECVs which will become sub-constellations in the overall system. In the future, new virtual sub-constellations may be required as new ECVs and GFCS observational requirements emerge. Each virtual sub-constellation will have the responsibility for the generation of Fundamental Climate Data Records [FCDRs] (and Thematic Climate Data Records [TCDRs] when appropriate). The CEOS and CGMS sub-constellations should report to the CEOS-CGMS Joint Working Group on Climate on scientific, coordination, and technical issues. The CEOS-CGMS Joint Working Group on Climate will have the responsibility to "follow" the generation of the Climate Data Records (CDRs) thus enabling stewardship for those CDRs where satellite data are utilized. The CEOS-CGMS Joint Working Group on Climate will also have the responsibility: to continue the analyses conducted for each ECV to include new data sets; to respond to reports from the individual sub-constellations; and to inform and recommend appropriate actions by any space agency or organization involved in CDR production.

#### CONCEPT FOR THE PHYSICAL VIEW OF THE ARCHITECTURE FOR CLIMATE MONITORING FROM SPACE

#### 1. **INTRODUCTION**

The Architecture for Climate Monitoring consists of two parts: a generic (ECV-independent) logical view that represents the functional components (called Pillars) of the assumed requirements baseline (based on GCOS documentation) and a companion physical view that is designed to capture the current and planned physical implementation arrangements on an ECVby-ECV basis and will also include future GFCS observational requirements. Consensus has been achieved on the overall logical view as described in the Strategy Towards an Architecture for Climate Monitoring from Space, 2013. The logical view comprises the following 4 Pillars: Pillar-I: Sensing the Earth environment from space; Pillar-II: Climate record creation and presentation; Pillar-III: Applications; and Pillar-IV: Decision making. Up to now, the main emphasis over the last years has been on Pillar-II and concentrated on the establishment of an inventory of the available climate data records held by space agencies. The physical view has yet to be defined. The purpose of this paper is to propose the physical view for Pillars I and II (in this document called Physical View), in concept, and seek CGMS approval. The reason for limiting at this moment the Physical View to Pillars I and II is that those pillars are under the responsibilities of the space agencies. The physical view of Pillars III and IV will have to be established by those entities dealing with applications, e.g. GFCS and decision making-industry, and governments.

The Physical View of the "Climate Constellation" should be a virtual constellation composed of virtual sub-constellations providing the observations to derive a single or a group of ECVs. The sub-constellations will belong to either CEOS members or CGMS members or a combination of both. At present, there is already a set of CEOS virtual sub-constellations covering a set of ECVs and reporting to the CEOS SIT (Strategic Implementation Team). CGMS should establish its own virtual sub-constellations covering atmospheric-related ECVs which will become sub-constellations in the overall system. In the future, new virtual sub-constellations may be required as new ECVs and GFCS observational requirements emerge. Each virtual sub-constellation will have the responsibility for the generation of Fundamental Climate Data Records [FCDRs] (and Thematic Climate Data Records [TCDRs] when appropriate). The CEOS and CGMS sub-constellations should report to the CEOS-CGMS Joint Working Group on Climate on scientific, coordination, and technical issues. The CEOS-CGMS Joint Working Group on Climate will have the responsibility to "follow" the generation of the Climate Data Records (CDRs) thus enabling stewardship for those CDRs where satellite data are utilized. The CEOS-CGMS Joint Working Group on Climate will also have the responsibility: to continue the analyses

conducted for each ECV to include new data sets; to respond to reports from the individual sub-constellations; and to inform and recommend appropriate actions by any space agency or organization involved in CDR production.

## 2. BACKGROUND

The Strategy Towards an Architecture for Climate Monitoring from Space, 2013 ("Strategy 2013" henceforth) focuses on satellite observations for climate monitoring from space, and the need for an international architecture that ensures delivery of these observations over the time frames required for analysis of the Earth climate system and providing the required data sets for the provision of climate services. The strategy, however, is not sufficient, in and of itself, and therefore also presents a logical architecture that represents an initial step in the development of a physical architecture – an end-to-end system – capable of delivering the necessary observations for climate monitoring from space.

The proposed architecture calls for a constellation of research and operational satellites, broad, open data-sharing policies and contingency planning. It includes agreements that are essential for bringing the same continuity to long-term and sustained climate observations that we have today for weather observations. The task of climate monitoring, however, has requirements that must extend beyond the capabilities of one-time research missions and operational satellite systems in existence today.

# 3. CLIMATE CONSTELLATION, SUB-CONSTELLATIONS AND VIRTUAL CONSTELLATIONS

The physical architecture should capture the current and planned implementation strategies, on an Essential Climate Variable (ECV)-by-ECV basis since each ECV will be either a single climate variable or a set of climate variables. For example, the ECV entitled "sea surface temperature" is a single ECV while the ECV entitled "cloud properties" includes six different ECV products (cloud amount, cloud top temperature, cloud top pressure, cloud optical depth, cloud water path and cloud effective particle radius). Thus, an optimum "macro-scale" space system configuration and its components would be in the form of sub-constellations for each ECV or groups of ECVs, as well as the respective ground systems from the combined perspective of the logical and physical architectures (Strategy 2013, p.35).

CEOS has developed the concept of "Virtual Constellations" aiming to foster partnerships in addressing key observational and scientific gaps on specific themes, and prepare for the routine collection of critical observations. A CEOS Virtual Constellation is a set of space and ground segment capabilities operating together in a coordinated manner, in effect a virtual system that overlaps in coverage in order to meet a combined and common set of Earth observation requirements. The individual satellites and ground segments can belong to a single owner or to multiple owners. The Constellation concept builds upon or serves to refocus already existing projects and activities. The Constellations effort provides a unique forum to achieve political visibility and increase mutual benefit among space and other environmental agencies. There are currently seven CEOS Virtual Constellations (suggested virtual constellation abbreviations are shown:

- 1. Atmospheric Composition Virtual Constellation (AC-VC)
- 2. Ocean Surface Topography Virtual Constellation (OST-VC)
- 3. Precipitation Virtual Constellation (P-VC)
- 4. Land Surface Imaging Virtual Constellation (LSI-VC)
- 5. Ocean Color Radiometry Virtual Constellation (OCR-VC)
- 6. Ocean Surface Vector Wind Virtual Constellation (OSVW-VC)
- 7. Sea Surface Temperature Virtual Constellation (SST-VC)

The above seven CEOS Virtual Constellations should be able to provide almost 70% of the ECVs. Thus, the virtual constellation approach is deemed the most appropriate approach for subconstellations, i.e. a sub-constellation should be virtual and the Climate Constellation will be comprised of virtual sub-constellations.

CGMS has established over the last 40 years five working groups that report at regular CGMS plenary meetings. The five Working Groups are (and suggested virtual constellation abbreviations are shown):

- 1. International TOVS Working Group Vertical Temperature Virtual Constellation (VTP-VC)
- 2. International Radio-Occultation Working Group Radio-Occultation Virtual Constellation (RO-VC)
- 3. International Precipitation Working Group Precipitation Virtual Constellation (P-VC)
- International Winds Working Group Atmospheric Motion Vector Virtual Constellation – (AMV-VC)
- 5. International Clouds Working Group Clouds Virtual Constellation (C-VC)

The above five working groups activities should be expanded to include production of specific ECVs. If the five working groups also establish virtual sub-constellations as indicated, then almost 20% of the remaining ECVs could be provided. It might be necessary to combine the CEOS virtual constellation on precipitation with the activities of the International Precipitation Working Group of CGMS.

Thus, a Climate Constellation comprised of CEOS and CGMS virtual sub-constellation would provide almost 90% of all ECVs. The remaining ECVs not yet covered could be through additional virtual sub-constellations and allow CEOS and CGMS to provide observational data for 100% of ECVs requiring satellite observations.

## 4. **GOVERNANCE**

At the core of good governance is a clear articulation of roles and responsibilities, including decision-making and resource commitments, coupled with structures of accountability for outcomes. For long-term governance, it is strongly recommended to use and strengthen existing coordination mechanisms first and resist the temptation to create a new mechanism or body that is duplicative (Strategy 2013, p.33/34). Fortunately, the virtual sub-constellation approach allows the use of the CEOS and CGMS virtual constellation structures to be responsible for the creation of Fundamental Climate Data Records (FCDRs). Creation of FCDRs is best performed by space agencies operating the specific sensor.

The generation of Higher-Level Climate Information Records such as climate indices often needs the combination of both FCDRs originating from spaceborne and ground-based systems, as well as modelling components. Thus, an activity producing CDRs might be best placed in an organization that combines information, such as reanalysis centres, climate service centres or environmental agencies. Therefore, the generation of CDRs would most likely not be made within space agencies but there should be a governance mechanism to link the individual FCDR producers to the CDR producer. This linking mechanism should be within the responsibility of CEOS and CGMS and it should provide the interface. The CEOS-CGMS Joint Working Group on Climate has already demonstrated considerable expertise in analyzing data sets and performing gap analyses. To utilize this existing mechanism would be very advantageous. Therefore, the CEOS-CGMS Joint Working Group on Climate should have overall responsibility and coordinate amongst all virtual sub-constellation and "follow" the generation of the Climate Data Records (CDRs) thus enabling stewardship for those CDRs where satellite data are utilized. The CEOS-CGMS Joint Working Group on Climate should also have the responsibility: to continue the analyses conducted for each ECV to include new data sets; to respond to reports from the individual sub-constellations; and to inform and recommend appropriate actions by any involved space agency or organization involved in CDR production.

## 5. OTHER ACTIVITIES - CALIBRATION (CEOS WGCV, GSICS, AND QA4EO)

The need for minimal uncertainty in climate monitoring, together with the need to combine data from a variety of sources (space and in situ), and emerging products with data assimilation, have placed "traceability" and its quantification at the top of the agenda. Intercalibration enables consistency among satellite measurements to be achieved. Without traceability to stable reference standards, intercalibration is, however, exposed to the risk of drifting over time and such drifts may obscure the climate trend over several decades. Therefore, strategies are being developed to improve traceability to SI units and evaluate biases with sufficient accuracy that enables time series of data sets to be appropriately and reliably linked.

# 5.1 Activities of the CEOS Working Group on Calibration and Validation (WGCV)

The mission of the WGCV is to ensure long-term confidence in the accuracy and quality of EO data and products, and to provide a forum for the exchange of information, for coordination, and for cooperative activities on calibration and/or validation. It is instrumental in the establishment of a common technical language amongst the users of EO data and customers of satellite-derived products. The WGCV coordinates and supports joint experiments and the sharing of facilities, expertise and resources. The group also addresses the need to standardize ways of combining data from different sources to ensure the interoperability required for the effective use of existing and future EO systems. Thus, the WGCV and its thematic subgroups contribute to improving the performance of all Earth observation programmes.

# 5.2 Activities of the Global Space-based Intercalibration System (GSICS)

The Global Space-based Intercalibration System (GSICS) was initiated in 2005 by WMO and CGMS with a goal to ensure consistent calibration of satellite measurements from different instruments and missions contributing to the Global Observing System (GOS), and tie the measurements to SI units. GSICS has defined and implemented procedures for operational, in-orbit satellite instrument intercalibration. This consists of relating the measurements of one instrument to those of a reference instrument with a stated uncertainty, when both instruments are viewing the same scenes at the same time, from the same viewing angle. For satellite data time series in an archive, the overlapping records of two satellite instruments can be compared once a number of effects, such as diurnal cycle, are taken into account. Earth-based or celestial targets are also used as a complement. GSICS intercalibration allows biases to be removed among satellite measurements. Fifteen operational or research and development (R&D) space agencies are contributing to GSICS.

## 5.3 **QA4EO – A Quality Assurance for Earth Observation (QA4EO)**

The fundamental principle of the Quality Assurance Framework for Earth Observation (QA4EO) is that "all EO data and derived products have associated with them a documented and fully traceable quality indicator (QI)". QA4EO seeks to ensure that this universally applicable principle is implemented in a consistent manner throughout all EO.

A framework document provides information on the principles and concepts that underpin the QA4EO philosophy. It is complemented by a set of key guidelines to support the adoption of the QA4EO ethos for operational working. These are further enhanced by numerous community-specific guidelines that assist in the practical implementation of QA4EO at the working level.

With the proposed physical view of the Architecture, it will be important for the calibration activities of all three above entities to be expanded to all virtual sub-constellation regardless of CEOS or CGMS ownership. The combined impact of all three calibration activities will improve each FCDR and thus also improve CDRs.

## 6. USER COMMUNITIES

The most relevant and comprehensive set of specific user requirements has been provided by GCOS within their supplement Systematic Observation Requirements for Satellite-Based Products for Climate (GCOS-154) to the GCOS Implementation Plan (GCOS-138),<sup>2</sup> applicable to climate change and long-term variability monitoring. The GCOS requirements were given for a set of Essential Climate Variables (ECV) where the feasibility of satellite measurements has been demonstrated. The CEOS-CGMS Joint Working Group on Climate has conducted its first gap analysis using available space agency data sets compared to those GCOS ECVs and its first report should have been available in the second half of 2017. Thus, the first report should have provided a preliminary indication of the ability of CEOS and CGMS to produce FCDRs that could be used as CDRs for climate change and long-term variability monitoring as well as input into climate information services. The first report should also allow the identification of missions and instruments that would constitute an initial Climate Constellation.

The GFCS adds another dimension to the requirements that is the direct link to user applications. It defines climate services as climate information prepared and delivered to meet needs of users. The GFCS describes a need for climate information that encompasses many application areas ranging from disaster risk reduction, agriculture and food security, water resources, health to energy applications and highlights the needs to support developing countries in particular. From this broad range of applications, it is clear that the needs of decision makers will be very diverse. Thus, the need for tailored services, including observational but also prediction components, will certainly arise from the implementation of GFCS. GFCS further states that decision makers in many developing countries do not have the information that would help.

## 7. ACTIONS AND/OR RECOMMENDATIONS FOR CONSIDERATION BY CGMS PLENARY SESSION

CGMS to approve the proposed Physical View for the Climate Constellation.

The Physical View of the "Climate Constellation" should be a virtual constellation composed of virtual sub-constellations providing the observations to derive a single or a group of ECVs. The sub-constellations will belong to either CEOS members or CGMS members or a combination of both. At present, there is already a set of CEOS virtual sub-constellations covering a set of ECVs and reporting to the CEOS SIT (Strategic Implementation Team). CGMS should establish its own virtual sub-constellations covering atmospheric-related ECVs which will become sub-constellations in the overall system. In the future, new virtual sub-constellations may be required as new ECVs and GFCS observational requirements emerge. Each virtual sub-constellation will have the responsibility for the generation of Fundamental Climate Data Records [FCDRs] (and Thematic Climate Data Records [TCDRs] when appropriate). The CEOS and CGMS sub-constellations should report to the CEOS-CGMS Joint Working Group on Climate on scientific, coordination, and technical issues. The CEOS-CGMS Joint Working Group on Climate will have the responsibility to "follow" the generation of the Climate Data Records (CDRs) thus enabling stewardship for those CDRs where satellite data are utilized. The CEOS-CGMS Joint Working Group on Climate will also have the responsibility: to continue the analyses conducted for each ECV to include new data sets; to respond to reports from the individual sub-constellations; and to inform and recommend appropriate actions by any space agency or organization involved in CDR production.

<sup>&</sup>lt;sup>2</sup> Updated by the GCOS 2016 Implementation Plan (GCOS-200).

# Decision 36 (EC-70)

## Development of the Space-based Weather and Climate Extremes Monitoring Demonstration Project

## The Executive Council decides:

- (1) To request the Commission for Climatology and Commission for Basic Systems to review the SEMDP Implementation Plan in East Asia and Western Pacific Regions with the goal to have it updated in advance of the Eighteenth World Meteorological Congress to reflect feedback from Members during its demonstration phase;
- (2) To consider that the Eighteenth World Meteorological Congress decides on matters concerning:
  - (a) Implementation of the SEMDP in East Asia and Western Pacific Regions in operation phase;
  - (b) Implementation of the SEMDP in other regions.

**Decision justification:** EC-69 decided to support a demonstration project on spacebased weather and climate extremes monitoring (SEMDP) in WMO Regions to the extent that resources are available, and requested the presidents of the Commission for Climatology (CCl) and the Commission for Basic Systems (CBS), with the support of the other TCs and RAs, to establish a demonstration project on space-based weather and climate extremes monitoring (SEMDP) and decide on priority WMO Region(s) starting in 2018 for a two year duration.

(See EC-70/INF. 7.4(3) for more information)

## Decision 37 (EC-70)

## Inter-programme Expert Team on Aircraft-based Observing Systems

## The Executive Council decides:

- To authorize the president of the Commission for Basic Systems to establish, in consultation with the president of the Commission for Instruments and Methods of Observation, an Inter-Programme Expert Team on Aircraft-Based Observing Systems, with the Terms of Reference given in the Annex to this Decision;
- (2) To requests CBS to collaborate with CIMO in the selection of the chairperson and members of the Inter-Programme Expert Team and in the establishment of its work plan;
- (3) Calls on all technical commissions to ensure that the Inter-Programme Expert Team is aware of their priorities concerning aircraft based observing systems requirements, as appropriate.

**Decision justification:** CBS and CIMO WMO Working Structures currently include (i) a CBS Expert Team on Aircraft-Based Observing Systems, and (ii) a CIMO Expert Team on Aircraft Observations. Following discussions between CBS and CIMO Management Groups, it is believed that there are sufficient potential synergies existing between the two Expert Teams to propose merging them into a new Inter Programme Expert Team. CBS and CIMO Presidents, in consultation with the Management Groups of CBS and CIMO, and the relevant OPAGs, concurred

with and proposed the Terms of Reference provided in the Annex to this draft Decision. Considering the current focus on coordination, and expansion of Aircraft-Based observing systems, including in collaboration with IATA (see Recommendation 9 (EC-70)), it is proposed to place the IPET under CBS leadership.

## Annex to Decision 37 (EC-70)

#### Terms of reference of the Inter-Programme Expert Team on Aircraft-Based Observations And Systems (IPET-ABO)

Within the WIGOS framework and the auspices of the WMO Aircraft-Based Observing System Programme (ABO), under the governance of CBS and the joint guidance of CBS and CIMO, act as the WMO primary working group on aircraft-based systems and observations with responsibility to:

- 1. Oversee and coordinate the programmatic, scientific, and technical development and operation of aircraft-based observing systems (including AMDAR, Mode-S, ADS and other commercial systems), and of aircraft-based instruments and methods of observations;
- Develop and manage the work plan and associated activities of the expert team, including the budget for associated expenditure of the AMDAR Trust Fund in line with its Terms of Reference;
- 3. Coordinate the development, scientific testing, validation and inter-comparison of existing and new methods of observation (including humidity, turbulence and inflight icing) for aircraft-based observing systems, as well as for Unmanned Aerial Vehicles (UAVs);
- Organize and conduct the development, maintenance and provision of technical standards and specifications associated with aircraft-based observations according to user requirements;
- 5. Collaborate with the aviation industry (e.g. the airlines and IATA), relevant international and regional organizations (e.g. ICAO), on relevant matters, and oversee the international and regional aspects of management of aircraft-based observational data;
- 6. Promote development and maintenance of the aircraft-based observations component of the WIGOS Data Quality Monitoring System;
- Review outcomes of relevant CIMO Testbed(s) and/or Lead Centre(s), and coordinate inclusion of guidance material in IOM reports and WMO-No. 8, Guide to Meteorological Instruments and Methods of Observations;
- Compile and review updates and new material on aircraft-based observations and observing systems, including in particular maintenance of relevant Regulatory and Guidance Material, in WMO-No. 8, WMO-No. 1160, WMO-No. 1165, and WMO-No. 1200;
- Conduct and provide support for training and outreach activities of WMO, to support the development of aircraft-based observing systems and the use of aircraft-based observations;
- 10. Work in collaboration and cooperation with other teams and WMO on the above activities as appropriate and as necessary;
- 11. Report on issues, activities and progress to CBS and CIMO, as well as to CAeM if required.

# Decision 38 (EC-70)

## Development of a WMO position on critical satellite data

The Executive Council noting the Critical Satellite Data Position Paper provided in the Annex, requests CBS in consultation with other technical commissions and programmes, taking into account the discussions at the 14th session of the Consultative Meetings on High-Level Policy on Satellite Matters, to finalize the position paper with the aim to providing recommendations to EC-71 for further actions.

**Decision justification:** The fourth session of the Inter-Programme Expert Team on Satellite Utilization and Products (IPET-SUP), held from 26 February to 1 March 2018, finalized the position paper on critical satellite data for WMO applications, and implications of a possible revision of WMO Resolution 40 Annex 1.

The position paper is a key outcome of discussions in IPET-SUP regarding principles that should govern global exchange of satellite data under a scenario where the prospect of private-sector operators of basic satellite systems has triggered renewed attention to the issue of data access and availability for global WMO applications, in particular for near-real-time applications. It formulates eight principles that providers of satellite data should fulfil to meet the critical needs of the meteorological community and defines what critical satellite data are.

The position paper was presented to and discussed in the Technical Conference of the Commission for Basic Systems (CBS), held from 26 to 29 March 2018. Subsequently, the CBS Management Group (CBS-MG) agreed to submit a draft decision for the 70th session of the WMO Executive Council (EC-70) to translate the Critical Satellite Data Position Paper into WMO guidance material and to publish it as a WMO Space Programme technical publication.

See the annex to the present decision for more information.

## Annex to Decision 38 (EC-70)

## **Critical Satellite Data Position Paper**

#### (WMO Space Programme, Final Draft, 28 February 2018)

#### Summary and Purpose of Document

The prospect of private-sector operators of basic satellite systems has triggered renewed attention to the issue of data access and availability for global WMO applications, in particular for near-real-time applications. IPET-SUP decided in 2015 to develop a Position Paper from the satellite user perspective on what types of satellite data should be considered critical for the protection of life and property.

The Position Paper formulates eight principles that providers of satellite data should fulfil to meet the critical needs of the meteorological community, and defines what critical satellite data are.

## **CRITICAL SATELLITE DATA POSITION PAPER**

#### Introduction

The prospect of private-sector operators of basic satellite systems has triggered renewed attention to the issue of data access and availability for WMO applications, in particular for near-real-time applications such as nowcasting and numerical weather prediction. Noting the validity of WMO Resolution 40, the satellite-specific provisions in the Resolution reflect the technical and political landscape of the mid-1990 (when the main use of satellite data was imagery for nowcasting) and need revisiting.

There is concern in the meteorological community about the future role of commercial providers of meteorological satellite data. Commercialization of basic data may lead to considerably different data dissemination and exchange models than what is current best practice, undermine the model of international exchange of data that is critical to applications, and thus jeopardize continuing progress of the meteorological enterprise.

IPET-SUP decided to develop a Position Paper from the satellite user perspective on the criteria for satellite data that should be considered critical for the protection of life and property.

IPET-SUP has stressed that for users, in addition to meeting the timeliness demands of applications, transparency and traceability in data generation were key criteria for using data, including satellite-based data. The Position Paper should help Members define high-level best practices regarding the use of basic satellite observations generated by commercial entities.

The paper uses the term "critical satellite data" (in the sense of being critical for the protection of life and property), to avoid confusion with the defined term "essential" in the context of WMO Resolution 40.

#### **Purpose of this Document**

To provide a satellite data user perspective on the principles that should apply to critical satellite data generation and distribution, i.e., to data that are critical for the protection of life and property. It is intended to guide public agencies responsible for the provision of satellite data for weather, water, climate and related environmental applications, and commercial operators of Earth-observing satellite systems.

#### Background

For meteorological and related systems, satellite industry has so far most often assumed a role of contractor delivering a system to the governmental customer, and government has been owning and distributing the data to the user community. Rapid changes in the space industry are driven by the commercialization of space activities and high demand for weather and climate information: for instance, commercial sector delivering observations in addition to systems; by sharing financial and technical risks in a different manner, e.g. through public/ private partnerships; by implementing satellite missions and distributing data on a purely commercial basis. These approaches could open opportunities to enhance the observing system, however, for WMO and user communities, there are also risks associated with a changing role of industry which should be anticipated and addressed carefully, in the following areas:

- Limitations to the exchange of data due to its commercialization, resulting in overall less availability of data;
- (b) Lack of publicly-available information on the detailed technical specifications of the system, resulting in loss of traceability, reliability and credibility of the science behind the data. This could undermine user uptake and readiness;

(c) Risk that potential benefits of commercial initiatives in the short term undermine decision processes, funding mechanisms and sustainability of long-term national or regional programmes which are essential to meet national, regional or global requirements.

Given the opportunities and risks, it is important to identify the conditions under which commercial initiatives could make a successful contribution to the global space-based observing system such that it serves the requirements of WMO.

International exchange of observational data among Members in near-real time and as soon as possible after launch has been critical for the excellent advances over the past decades witnessed in meteorology, climate and related sciences, having led to improved skill of global prediction models and improved warnings. The success of weather forecasting and warnings relies on the near-real time availability of global data because they are a prerequisite for weather forecasting with numerical models. There is strong inter-dependency among Global Producing Centres and NMHSs in delivering and exchanging high-quality forecast products. Many studies on the benefit of observations – notably on satellite observations – have demonstrated how much modern societies gain from good weather forecasting and continuous weather awareness, e.g. for risk reduction and planning of many weather dependent businesses. This has been achieved thanks to global cooperation, duly considering the global nature of the discipline. The WMO Resolution 40 (Cg-XII) provides the policy framework for the international exchange of data. Global data exchange will remain a key requirement to inform global and regional applications, and the data policies of satellite data providers should facilitate such exchange.

Without assuming to coordinate commercial sector initiatives, WMO can have a beneficial influence on the provision of observational data by commercial operators through setting overall principles and priorities, highlighting the importance of data quality and interoperability standards, and advocating full visibility of the science behind the data. The latter is an essential element to verify the quality of data and products.

#### **Current WMO Activities**

#### **Guidance on WIGOS Data Partnerships**

Under the auspices of the Inter-Commission Coordination Group on the WMO Integrated Global Observing System (ICG-WIGOS), a guidance document on WIGOS data partnerships was produced. The document provides specific guidance related to incorporating and sharing data from non-NMHS sources into the WIGOS framework (focussing on surface-based observational data). It highlights the potential benefits and challenges of data from external providers, and clarifies the roles and expectations of NMHSs in integrating external data in compliance with WIGOS technical regulations.

The paper notes that "private data providers are increasingly offering their observations (typically surface-based, GPS-Radio Occultation, and aircraft data) to NMHSs for use in the generation of products and services. The license terms are typically more restrictive than those in the above category and they may not allow onward sharing and exchange. Members are encouraged to pursue licence terms that permit the open or broadest exchange of data wherever possible."

#### **Executive Council**

A task team working under EC auspices is exploring a WMO position on public-private sector engagement for all service areas. It is led by the President of WMO, David Grimes (Environment and Climate Change Canada).

## **Basic Principles for Critical Satellite Data**

The following principles should apply to critical satellite data from the users' perspective:<sup>3</sup>, <sup>4</sup>

**Principle 1**: Free and unrestricted international exchange between WMO Members of critical satellite data in near real-time

Rationale: International exchange of meteorological and related data has been the engine for advances of the meteorological enterprise, such as improved global forecasts. No country is in a position to collect all the observational data it requires for driving model forecasts.

Principle 2: Transparency in instrument characteristics and processing steps

Rationale: Understanding basic observational data is critical to ensure their correct usage and positive contribution in applications. For this purpose, information about instrument properties and advance notification on their change over time (due to degradation, for example) is required to be able to discern observing system effects from changes in the observable, and to quantify uncertainty. Details about the processing of data (for example, calibration coefficients) are equally important.

**Principle 3**: Documented user engagement and potential impact on applications

Rationale: Providers of critical satellite data should directly address and respond to user requirements in the definition phase of the satellite system, and ensure the demonstration of the potential positive impact in applications.

**Principle 4**: Documented algorithms and information to support validation (indication of maturity)

Rationale: To correctly apply data and products, and to validate uncertainties, information about the algorithms and validation procedures is critical.

Principle 5: Information on data latency, data format, processing tools available

Rationale: Users need to know when to expect data, i.e. the time delay between acquisition and availability of data with users, as well as the data format and metadata that are indispensable to correctly interpret data. Many users benefit from processing tools delivered alongside data, especially if they do not have their own processing and analysis systems.

Principle 6: Timely provision of pre-validated data to users

Rationale: To accelerate and streamline the ingestion of data from new or upgraded spacebased systems into applications, users require preview of various forms of preliminary data. These include synthetic data, simulated data, proxy data, and pre-operational data.

Principle 7: Unrestricted access to archived data<sup>5</sup>

Rationale: Satellite data providers should allow unrestricted access to archived data, to enable non-real-time applications, and the generation of climate data records. Full records of metadata should be maintained along with the data to enable correct interpretation. Quality assurance processes, version control and regular reprocessing of data should be the norm.

Principle 8: Plans for sustained data provision

<sup>&</sup>lt;sup>3</sup> Details on information required to enable user readiness are provided in the *WMO Guideline on Best Practices on Achieving User Readiness for New Meteorological Satellites* (WMO-No. 1187) (see e.g., p. 15/16).

<sup>&</sup>lt;sup>4</sup> Detailed guidance on climate dataset generation is provided in GCOS-143; the GCOS climate monitoring principles are provided in GCOS-200 (p. 48).

<sup>&</sup>lt;sup>5</sup> WMO Res. 60 defines the WMO Data Policy regarding climate data.

Rationale: Operational WMO applications usually require provision of data on a long-term basis: climate applications require multi-year datasets which are generally based on continuity of comparable observing technology; NWP centres' investments in infrastructure is only cost-effective if the data are available for a long time period (at least five years)

Type of satellite data and source <sup>1</sup>	Principal applications driving spatial-temporal requirements <sup>2</sup>						
Data from geostationary orbiting satellites							
GEO imagery	Nowcasting, NWP						
GEO sounding channels	Nowcasting, NWP						
GEO lightning	Nowcasting						
GEO space environment and weather data	Space weather						
Data from Low-Earth orbiting satellites							
Operational LEO VIS-IR imagery	Nowcasting, Ocean applications, Agricultural meteorology						
LEO IR sounding	Global NWP						
LEO MW sounding	Global NWP						
LEO MW Imagery	Global NWP, Nowcasting, Ocean applications						
Scatterometry	Ocean applications, Global NWP						
Ocean surface topography by radar altimetry	Ocean applications						
Radio-occultation sounding	Global NWP						
Broadband VIS/IR radiometry for Earth Radiation Balance	Global NWP						
Total Solar Irradiance	Global NWP						
Atmospheric composition	Atmospheric Composition services in Urban and Populated Areas; Forecasting Atmospheric Composition						
Narrow-band VIS/NIR imagery for ocean colour, vegetation, aerosols	Ocean applications; Agricultural meteorology; Aviation meteorology						
High-resolution multi-spectral VIS/IR imagery	Agricultural meteorology; Hydrology						
IR dual-angle view imagery for SST	Ocean applications, Sub-seasonal to longer predictions						
Particle detection and/or electron density	Space weather						
Magnetic field	Space weather						
Solar activity	Space weather						

#### **Table 1: Critical Satellite Data**

<sup>1</sup> Following the mission types in the CGMS Baseline for the Operational Contribution to the GOS, *Manual on the WIGOS* (WMO-No. 1160), Attachment 4.1, p. 123.

<sup>2</sup> Observation requirements for WMO Application Areas are being maintained in the WMO Rolling Review of Requirements process (http://www.wmo-sat.info/oscar/applicationareas). The quantitative requirements for observing geophysical variables provide guidance for the definition of the spatial and temporal resolution of critical datasets.

## Decision 39 (EC-70)

## Outcomes of the fourteenth session of the WMO Consultative Meeting on High-level Policy on Satellite Matters

#### The Executive Council decides to:

- Endorse the Summary Statement provided by the President following the 14th Consultative Meeting on High Level Policy on Satellite Matters, included in the annex to the present decision;
- (2) Request all Members to actively work with their national space agencies and/or international space agencies in which they are partners to ensure full and open access to all relevant satellite observations for all global processing centers;
- (3) Request the Secretary-General to schedule future CM Sessions so as to not coincide with EC and/or Congress Sessions in order to ensure (i) participation of relevant representatives from both WMO and the space agencies, and (ii) that recommendations made by the CM can be incorporated into decisions made by the WMO governing bodies.

#### **Decision justification:**

The 14th Session of the Consultative Meetings on High-level Policy on Satellite Matters (CM-14) was held at WMO in Geneva, Switzerland on 23 June 2018. Approximately 60 participants from space agencies, WMO Executive Council delegations, invited experts and the WMO Secretariat attended the meeting.

The role of the Consultative Meetings on High-level Policy on Satellite Matters is to support a high-level dialogue between the satellite operators and WMO representatives, including the President, Vice-Presidents, Presidents of Technical Commissions and Regional Associations, Secretary-General and Directors (Resolution 6 (Cg-XIV)). As decided by the Executive Council, the CM session is normally held every two years (Resolution 10, EC-66).

An important purpose of the meetings is to ensure a better mutual understanding between WMO and the agencies of all issues related to the space-based observation system. Among the intended deliverables are (i) guidance to the WMO Space Programme and (ii) recommendations to the WMO constituent bodies and/or the space agencies.

## Annex to Decision 39 (EC-70)

#### Summary statement by the Chair, CM-14

Over the last two decades it has become clear that space-based observations, due to their impact on the global numerical weather prediction systems that form the backbone of most meteorological products, are playing and will continue to play a critical role in the ability of all WMO Members to deliver vital services to their constituencies in order to help save lives, protect property and foster economic growth. Full and open access to all relevant satellite data for all global processing centers of the WMO Members is therefore essential.

The wish of private sector entities to play a larger role in the acquisition and delivery of spacebase observations is well recognized. Acknowledging the expertise and the adaptability of the private sector, this development should be welcomed, as long as it does not jeopardize the overall access to observations mentioned above. While recognizing the growing role and importance of the space-based observing system, its synergies with, and dependence on, surface-based observations must be kept in mind. In keeping with the overall philosophy of WIGOS as an integrated system that includes both space-based and surface-based assets, WMO must continue to diligently study the respective impacts and contributions of the two sides and develop guidance material that clearly articulates the specific roles and relevance of both space-based and surface-based observations.

Regarding future sessions of the Consultative Meeting, the meeting recommended that in order to ensure optimal attendance of representatives from both WMO and the space agencies and to allow sufficient time for recommendations developed by the CM to be incorporated into the workflow of the Executive Council, CM Sessions are not to be scheduled during the Executive Council, but that consideration be given to possibly taking advantage of appropriate technical commission sessions instead. It was further recommended that the agenda for future meetings should reflect the clear and unique role of the CM and not duplicate deliberations already made by CEOS and/or CGMS.

## Decision 40 (EC-70)

## Further development of a seamless Global Data-processing and Forecasting System Implementation Plan

#### The Executive Council decides:

- (1) That the Executive Council Steering Group on the Seamless Data-processing and Forecasting System, chaired jointly by the Presidents of CBS and CAS will:
  - (a) Continue the consultation process to deliver a refined implementation plan to Congress,
  - (b) Identify further potential pilot projects and develop project plans for those proposals that have a sufficient level of maturity,
  - (c) Rename the future GDPFS in a way that would be easy to pronounce and that conveys information on the System, similar to its WWW sister programmes which evolved from GTS to WIS and from GOS to WIGOS;
- (2) To endorse the recommendation of CBS Management Group for the organization of a World Meteorological Centre (WMCs) workshop involving operations and research to ensure collaboration among the centres and the development of new initiatives to support Members, especially LDC and SIDS. The EC also acknowledged China's proposal to host the first WMCs workshop in Beijing, China in 2019.
- (3) To request the Secretary General to:
  - (a) Distribute the draft implementation plan to Members for their comments and;
  - (b) Make the resources available to support the continued development of the draft implementation plan in a manner that strengthens the synergies between science and services
- (4) To urge the Members to:
  - (a) Provide their comments on the draft implementation plan and to assist in the definition of future pilot projects,

- (b) Contribute to the Trust Fund and support secondments to facilitate the development of the draft implementation plan and establishment of pilot projects
- (5) To request the Presidents of CBS and CAS to:
  - (a) Review the membership of the Steering Group to ensure the availability of the expertise necessary for completion of the draft implementation plan,
  - (b) Propose to Congress a coordination mechanism aligned with the future structure and governance of the WMO, that ensures the continued joint responsibility of research and operations for the implementation of the future seamless GDPFS.

#### **Decision justification:**

The implementation of future GDPFS is an extremely complex undertaking requiring ongoing consultation among regional associations, technical commissions, GDPFS Producing Centres, NMHSs, academia and other partners to stay abreast of evolving science and technology to regularly refine and adapt implementation plans and activities indicating a clear need for dedicated resources to ensure timely and effective implementation.

GDPFS needs to evolve, similar to its sister programmes within the World Weather Watch (WWW) Programme, which have evolved respectively from the Global Telecommunication System (GTS) into WMO Information System (WIS) and from the Global Observing System (GOS) into WMO Integrated Global Observing System (WIGOS).

## Decision 41 (EC-70)

#### Space weather linkage with the WMO Strategic Plan

**The Executive Council decides** that, CBS, in coordination with CAeM, develops a new "Four-Year Plan for WMO Coordination of Space Weather Activities" for tabling at Cg-18 (2019) for its approval.

**Decision justification:** Resolution 38 (Cg-17) requested the finalization of the "Four-Year Plan (2016–2019) for WMO Coordination of Space Weather Activities" which was approved by Decision 33 (EC-68) which also requested the Secretary-General to submit to the Eighteenth World Meteorological Congress (Cg-18) a report on the results achieved and a proposal for future activities in this domain. A new WMO Strategic Plan was developed and there is a requirement to update the current Space Weather Plan to be in line with it.

Note: See EC-70/INF. 8.4 for more information

## Decision 42 (EC-70)

## WMO High-mountain Summit 2019

## The Executive Council decides:

- To organize a WMO High-mountain Summit in February 2019, with the goal of framing the WMO high-mountain agenda for the next financial period, and make recommendations to Congress with advise from EC-PHORS;
- (2) To request EC-PHORS to facilitate the execution of this Decision, to engage with CCI, CHy, CBS, regional associations, and partner organizations with regard to high-mountain region activities, and to develop relevant recommendations to Congress and EC-71 for framing the WMO high-mountain agenda in the next financial period.

See EC-70/INF. 9 for more information.

**Decision justification:** We are experiencing unprecedented rates of change of weather, water, climate and cryosphere at various time scales in high-mountain regions. In this context, it is important for WMO to be able to understand and predict such changes in these regions and beyond in order for the Organization to be able to deliver and enhance services addressing the impact of such changes on the availability of water resources and food security, and climate risks and resilience. While the importance of observations, research, and services components in the High-Mountain regions is recognized, the goal of framing such activities is to promote long term support from governments in high-mountain regions in the view to improve provision of socioeconomic benefits focusing on water resources and climate risk and resilience.

## Decision 43 (EC-70)

## Proposal for the declaration of 2020 as the United Nations International Year of Snow and Ice

**The Executive Council decides** to support the proposed initiative of Iceland for the designation by the United Nations of the year 2020, as an United Nations (UN) International Year of Snow and Ice, as a coordination mechanism for increasing the focus and sustaining the awareness and understanding of the importance of snow and ice in the climate system and of the implications of impending changes in the Earth's cryosphere for human societies;

**Invites** EC PHORS, Technical Commissions, and Regional Associations to use the opportunity of the UN International Year of Snow and Ice to collaborate on specific and relevant actions aligned with WMO strategic objectives;

**Invites** Members to support the further development and refinement of activities and objectives that contribute to this initiative;

**Requests** the Secretary-General to contribute to consultations with a view of submitting to the General Assembly of the United Nations a timely proposal for declaring the year 2020 as the International Year of Snow and Ice, in collaboration with Iceland, UNESCO IHP, and other interested Members.

#### **Decision justification:**

WMO has already acknowledged that unprecedented changes in the Earth's cryosphere have ramifications that extend well beyond the areas where snow and ice are present, posing serious threats to water resources and ecosystems, and in many cases changing the appropriate design and operating assumptions of societal infrastructure. As a result, WMO has assumed an active leadership role on bringing together the operational and scientific communities regarding arctic and high mountain environments, through its existing working programmes and projects, and has been granted Observer status with the Arctic Council.

The International Year of Snow and Ice will provide a mechanism to continue the support to priority activities, within the WMO Strategic Plan, addressing the UN Sustainable Development Goals.

#### Decision 44 (EC-70)

#### Memorandum of understanding between WMO and the Scientific Committee on Antarctic Research and the International Arctic Science Committee

The Executive Council decides to request the Secretary-General to explore signing a Memorandum of Understanding between WMO, SCAR and IASC in order to enhance cooperation on a number of scientific, observational, services and policy-relevant activities in the polar regions.

See EC-70/INF. 9 for more information.

**Decision justification:** This is in recognition that WMO already works in partnership with both the Scientific Committee on Antarctic Research (SCAR) and the International Arctic Science Committee (IASC) on a number of issues (see examples in EC-70/INF. 9). Also previous MoUs have existed between SCAR, IASC and the WMO/IOC-UNESCO/ICSU World Climate Research Programme. Finally, potential exists for stronger cooperation between WMO, SCAR and IASC on a number of scientific, observational, services, and policy-orientated activities, for example with regards to the design and implementation of the Polar Regional Climate Centres, the Global Cryosphere Watch, co-design of future scientific activities and further collaboration in polar policy fora, in particular the Arctic Council and Antarctic Treaty Consultative Meetings.

Decision 45 (EC-70)

#### Polar Space Task Group

#### The Executive Council decides:

(1) To endorse, as a priority of the Panel of Experts for Polar and High-mountain Observations, Research, and Services (EC PHORS), conducting a gap analysis of the availability and requirements for observing critical Earth System parameters required for monitoring polar and high-mountain regions, and other relevant cryospheric ecosystems (e.g. lake and river ice), both, in situ and remotely sensed observations, as a collaborative effort of the Polar Space Task Group (PSTG), the Global Cryosphere Watch, and technical commissions, in particular CBS and JCOMM;

- (2) To request EC-PHORS that PSTG undertake an assessment of currently available space cryosphere products in the polar and high-mountain regions, with a view of extending its mandate and membership (e.g. other space agencies), to address gaps, especially in highmountain areas;
- (3) That on the basis of these analyses, EC-PHORS reviews and updates the Terms of Reference of PSTG and its membership, for consideration by Cg-18.

See EC-70/INF. 9 for more information.

**Decision justification:** The mandate of the Polar Space Task Group (PSTG) is to provide coordination across Space Agencies to facilitate acquisition and distribution of fundamental satellite datasets, and to contribute to or support the development of specific derived products for cryospheric scientific research and applications in polar regions (Resolution 16 (EC-69)). Recently, requirements have emerged for similar products over high mountains.

Decision 48 (EC-69) defined high-mountain regions as "mountain areas where seasonal or perennial cryosphere is present and poses potential and serious risks to society related to water scarcity and disaster resilience".

Given the societal importance of high-mountain ice, snow, glaciers, an extension of the PSTG mandate is recommended. A key challenge remains as there are observing capability gaps over high-mountain regions. The full engagement of Agencies active in the high-mountain areas, along with specific commitments of satellite resources are needed, to address well-defined objectives.

The reviewed mandate of PSTG would complement the mandates of other polar and highmountain activities, e.g. the Global Cryosphere Watch, in achieving the strategic observations and services objectives for polar, high-mountain regions, with a focus on cryosphere.

## Decision 46 (EC-70)

#### Antarctic Observing Network

## The Executive Council decides:

- (1) To approve the inclusion of the stations listed in the Annex to the present decision, in the existing Antarctic Observing Network (AntON);
- (2) To requests the Secretary-General to ensure adequate support within the allocated budget for the execution of this decision.

See EC-70/INF. 9 for more information.

#### **Decision justification:**

- Decision 47 (EC-69) Antarctic Observing Network
- Resolution 41 (Cg-17) Antarctic Observing Network

The recommendations of the eighth session of the Executive Council Panel of Experts on Polar and High-mountain Observations, Research, and Services (EC-PHORS-8) (Levi, Finland, 21–23 March 2018), regarding the Antarctic Observing Network.

# Annex to Decision 46 (EC-70)

## Antarctic Observing Network

These stations are included in 2018 in the Antarctic Observing Network (AntON), established through Resolution 41 (Cg-17)

WMO ID	Station	Operator	Program Affiliation
87938	Ushuaia Aero	Argentina	GOS, CLIMAT(C), RBCN, RBSC(S)
87925	Rio Gallegos Aero	Argentina	GOS, GSN, CLIMAT(C), RBCN, RBSC(S)
87934	Rio Grande B.A.	Argentina	GOS, CLIMAT(C)
0-20000-0-85934	Punta Arenas	Chile	CTBTO, GOS, GSN, GUAN, CLIMAT(C), RBCN, RBSN(ST)

Note:

CTBTO: Comprehensive Nuclear-Test-Ban Treaty Organization

GAW: Global Atmosphere Watch

GOS: WMO World Weather Watch Global Observing System

GUAN: GCOS Upper-Air Network

LALINET: Latin America Lidar Network

NDACC: Network for the Detection of Atmospheric Composition Change

RBCN: Regional Basic Climatological Network

RBSN(ST): Regional Basic Synoptic Network

# Decision 47 (EC-70)

# **Polar Regional Climate Centres and Regional Climate Outlook Forums**

## The Executive Council decides:

- To endorse the implementation plan of the Arctic Regional Climate Centre Network (ArcRCC-Network);
- (2) To note the commencement of the demonstration phase of ArcRCC-Network in May 2018 and invite Members to support its operations, use its services and provide feedback;
- (3) To note with appreciation the successful organization and outcomes of the first Pan-Arctic Regional Climate Outlook Forum (PARCOF-1) in May 2018 at Ottawa, Canada, and encourage ArcRCC-Network to lead and sustain PARCOF operations on a regular basis;
- (4) To endorse the structure of the Third Pole RCC-Network (TPRCC-Network) based on geographical distribution of responsibilities with three nodes, namely Northern Node led by China, Southern Node led by India and Western Node led by Pakistan, and invite the President of Regional Association II to facilitate the development of a detailed implementation plan under the guidance of EC-PHORS, CCI and CBS and commencement of a demonstration phase;
- (5) To endorse the initiatives to develop an Antarctic RCC-Network (AntRCC-Network) through a survey and scoping process, and invite the support of the concerned Members and other relevant stakeholders, for example the Antarctic Treaty and its Committee for Environmental Protection;
- (6) To request CCI and CBS to adequately take into account the requirements of Polar RCCs while reviewing and updating RCC functions, products and criteria, in consultation with EC-PHORS, GCW and JCOMM.

Decision iustification: As a follow-up to Decision 46 (EC-69) on Development and Implementation of the Arctic Polar Regional Climate Centre Network and of Polar Regional Climate Outlook Forums, the EC-PHORS has finalized the implementation plan of the Arctic RCC-Network in consultation with the relevant stakeholders, and also agreed on a roadmap to the implementation of RCC-Networks in the Antarctic and Third Pole regions. Environment and Climate Change Canada hosted the inaugural session of PARCOF at Ottawa, Canada, on 15-16 May 2018, and the demonstration phase of ArcRCC-Network was launched on the occasion. A Scoping Meeting of the representatives of Members from the Third Pole region, held at Geneva on 27-28 March 2018, agreed on the structure for TPRCC-Network based on geographical distribution of responsibilities among China, India and Pakistan, with China as the overall coordinating node. EC-PHORS, at its eighth session in March 2018, agreed on a survey to be conducted to determine the needs and capacities for an RCC implementation in the Antarctic, followed by a scoping workshop to determine the suitable structure for AntRCC-Network. CCI, at its seventeenth session in April 2018, adopted Resolution 5.1/1 (CCI-17) on enhancing WMO Regional Climate Centre operations to revisit RCC functions and propose suitable updates and revisions.

## Decision 48 (EC-70)

## WMO Global Campus initiative

**The Executive Council decides** to endorse the WMO Global Campus initiative for developing a coordinated and collaborative network of institutions that work together to meet the growing education and training needs of WMO Members, building upon the existing network of WMO Regional Training Centres (RTCs) and other WMO training partners.

## **Decision justification:**

Given significant progress demonstrated by the feasibility study as reported in EC-70/INF. 11.1, the strong endorsement of the 2017 Symposium on Education and Training (SYMET-13), and the recommendation of the EC Panel of Experts on Education and Training.

See EC-70/INF. 11.1 for the Report of the twenty-eighth Meeting of the EC Panel of Experts on Education and Training.

See EC-70/INF. 11.1 for the Status Report on the WMO Global Campus Feasibility Study, as well as the WMOLearn portal (http://learn.wmo.int).

# Decision 49 (EC-70)

## Governance of education and training

**The Executive Council decides** to recommend to Congress that the governance of capacity development including education and training is given adequate consideration in the context of the WMO reform process taking into consideration previous work and the current Terms of Reference of both the EC Panels on Education and Training and Capacity Development.

In this regard, EC also requests the Secretary-General to strengthen the Organization's support to fellowships and continuing education and to capacity development overall, so as to provide a strong basis for strengthening the capacity of Members and in particular to focus also on Leadership and Management skills as well as technical skills.

**Decision justification:** The WMO Regional Associations have responded by noting a large number of capacity development priorities. See also recommendations within EC-70/INF. 11.1, the Report of the twenty-eighth Meeting of the EC Panel of Experts on Education and Training.

# Decision 50 (EC-70)

## Nominal allocation of the Voluntary Cooperation Programme Trust Fund for 2018

#### The Executive Council:

**Noting** the VCP Report for 2018 as contained in the Report of the Informal Planning Meeting of the VCP which can be found at: http://www-newdev.wmo.int/pages/prog/dra/vcp/ eventsandmeetings.php.

**Decides** to approve the proposed provisional allocation for the VCP-TF for 2018 as provided in the Annex to this decision.

**Decision justification:** The Voluntary Cooperation Programme reached its 50th year of operation in 2017 and the Executive Council expressed its appreciation to VCP donors members for the invaluable efforts in supporting the Members through the VCP that clearly remains an important delivery mechanism for capacity development support to Members. According to the Rules of the Voluntary Cooperation Programme, priority areas and nominal allocation of the fund should be proposed for approval by the Executive Council.

#### Annex to Decision 50 (EC-70)

#### VCP Trust Fund 2018

VCP Trust Fund 2018		Nominal Allocation (USD) 2018
Balance at 01/01/18	190,000	
Anticipated Contributions 2018	100,000	
Anticipated Available 2018	290,000*	

	VCP Trust Fund 2018	Nominal Allocation (USD) 2018
	Priority Areas	
1	Spares/shipping	5,000
2	Expert services	50,000
3	(Short-term) fellowships and training activities	20,000
4	Improvement of Observing Systems	25,000
5	Agricultural meteorology activities	20,000
6	Support to CDMS and climatological activities	20,000
7	Institutional Strengthening (Legal & Strategic Plans)	50,000
10	Sub Total	190,000
11	Reserve	100,000

Supplemented by XB Projects also

## Decision 51 (EC-70)

## Drafting Team on Preparation of a Policy Act on Public–Private Engagement for consideration by the Eighteenth World Meteorological Congress

THE EXECUTIVE COUNCIL,

**Establishes** a Drafting Team to prepare a draft text of a high-level policy document (Declaration or Resolution) for consideration by the 18th Congress reflecting the WMO position, policy and guidance on the Global Weather Enterprise and the public-private engagement in the light of the global developments outlined in the UN Agenda for Sustainable Development 2030, the Paris Agreement and the Sendai Framework for Disaster Risk Reduction,

**Designates** Dr Michael STAUDINGER as a chairperson and Celeste SAULO, Phil EVANS, Louis UCCELLINI, Jean-Marc LACAVE, Kanduri RAMESH, Toshihiko HASHIDA, David GRIMES as core members of the Drafting Team, and authorizes the chairperson to invite additional experts to assist the work of the Team as necessary, including the designate regional focal points on public-private engagement as well as a representative of the private sector through HMEI,

**Requests** the chairperson to initiate the work of the Drafting Team as soon as possible and to deliver a first draft, in consultation with EC WG/SOP, based on the outline provided in the Annex, by 30 September 2018 to be circulated to the EC members for review and comments, followed by preparation of a EC-endorsed draft for consultation with Members,

**Acknowledges** the need for building a global consensus on the high-level policy act prior to the 18th Congress, therefore

**Agrees** that the EC-endorsed draft should be circulated to all Members for consultation not later than 31 December 2018,

**Tasks** the Drafting Team, supported by the Secretariat, to process the comments received during the consultation process and prepare the final draft in time for submission to the 18th Congress,

**Requests** the Secretary-General to provide support to the Drafting Team, and to ensure full transparency of the process to all GWE players.

**Decision justification:** Follow up of Decision 61 (EC-69), Public-Private Engagement: A road map to the Eighteenth World Meteorological Congress.

## Annex to Decision 51 (EC-70)

#### Declaration of the Eighteenth World Meteorological Congress

We, the delegates from 191 Member States and Territories of the World Meteorological Organization (WMO), meeting in Geneva from XX to XX June 2019 at the Eighteenth World Meteorological Congress, declare as follows:

**We NOTE** [global agenda drivers – UN SDG, Sendai Framework, Paris agreement and their call for engagement with private sector, academia and society and the role of WMO and NMHSs in achieving the global agenda goals];

**We FURTHER NOTE** [other drivers – science and technology, stress on public funding, growing demand from business for decision-support service, etc. ];

**We RECOGNIZE** [the Earth system approach and the evolving WMO flagship programmes, etc. ];

**We FURTHER RECOGNIZE** [acknowledgement of the existence of a global weather enterprise as a multi stakeholder composite which is rapidly growing];

**We ACKNOWLEDGE** [possibilities and opportunities for increase socioeconomic benefits through partnerships in the GWE context];

**We REAFFIRM** [the vital importance of the mission of the National Meteorological and Hydrometeorological Services in observing and understanding weather and climate and in providing meteorological and related services in support of national needs];

**We WELCOME** [possibilities and opportunities for increase socioeconomic benefits through partnerships with private sector, academia and community-based players in the GWE context];

**We ACKNOWLEDGE THE NEED** [for development of adequate principles, governance and continuous dialogue between the GWE stakeholders to ensure its growth and sustainability, while maintaining to key role of the NMHSs];

**We APPEAL** to all Governments [to ensure that the national practices in force in their countries will conform with the agreed policies, practice and guidelines for the international exchange of meteorological and related data and products];

**We RECOGNIZE** [national and regional variations and the primacy of the national legal frameworks, at the same time calling for further exchange of best practice and harmonization];

**We URGE** [that whatever form or model the National Meteorological and Hydrometeorological Services take, government financial support be provided to operate and maintain the required relevant basic infrastructure, monitoring and services in the national and global public interest, and that such support be strengthened where needed, including through effective PPP];

**We CALL on all Governments** [to give due consideration to the statements expressed in this Declaration. We believe that this will be in the interest of sustainable development, in support of national economies and social progress and that this contributes significantly to the reduction of loss of life and property caused by natural disasters and other catastrophic events, as well as to safeguard the environment and the global climate for present and future generations of humankind].

## Decision 52 (EC-70)

## Adoption of working arrangements with the Association of Hydro-Meteorological Equipment Industry and granting consultative status to the International Forum of Meteorological Societies

THE EXECUTIVE COUNCIL,

**Noting** that HMEI had been granted consultative status by its fifty-fourth session (2002) and that since then the two organizations had exercised a productive and mutually-beneficial cooperation,

**Considering** the growing need for public-private engagement which requires more specific working arrangements with the organizations representing the industry,

**Noting with appreciation** that the HMEI Council at its meeting on 9 May 2018, had approved Working Arrangements between the HMEI and WMO, recognizing WMO as an international standardization body,

Approves the Working Arrangements as presented in the Annex to this decision,

**Requests** the Secretary-General to inform HMEI about this decision and to arrange a respective amendment to the *WMO Basic Documents No. 3, Agreements and Working Arrangements with International Organizations* (WMO-No. 60),

**Noting further** the request of the International Forum of Meteorological Societies (IFMS) for granting consultative status with WMO,

**Acknowledging** that the objectives and scope of activities of the IFMS aimed at building cooperation between the professional societies, fostering and encouraging communication and exchange of knowledge, ideas and resources, are coherent with the established common basis of cooperation with international non-governmental organizations interested in the activities of the WMO,

**Grants** the IFMS consultative status with WMO under the definition of Consultative Status in *WMO Basic Documents No. 3, Agreements and Working Arrangements with International Organizations* (WMO-No. 60), Chapter VI;

**Requests** the Secretary-General to inform IFMS of this decision and to arrange a respective amendment to the *WMO Basic Documents No. 3, Agreements and Working Arrangements with International Organizations* (WMO-No. 60).

Decision justification:	See the Annex to the present decision.
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## Annex to Decision 52 (EC-70)

## Working arrangement between the World Meteorological Organization (WMO) and the Association of the HydroMeteorological Equipment Industry (HMEI)

## Introduction

The working arrangement concluded between the World Meteorological Organization (WMO) and the international Association of the HydroMeteorological Equipment Industry (HMEI) was approved on behalf of the WMO by the Executive Council at its seventieth session in June 2018 and on behalf of the HMEI by its Chairman on the basis of HMEI Council decision in 9 May 2018.

## **Working Arrangement**

## 1. Background

1.1 The international Association of the HydroMeteorological Equipment Industry (HMEI) and the World Meteorological Organization (WMO) have been working in close cooperation since the granting of consultative status to HMEI by the WMO Executive Committee at its fifty-fourth session in 2002.

1.2 This Working Arrangement between WMO and HMEI aims to strengthen the cooperation between the two organizations regarding matters related to technology of hydrometeorological measurement equipment and systems, service provision and delivery, related development of standards and recommended processes, and implementation guidance. The arrangement also covers cooperation in promotion and development of effective partnerships between the public and private sector, with support from academia, aimed at enhanced sustainability, quality and efficiency of data, information and services provided at national, regional and global levels.

## 2. Consultation and collaboration

2.1 The two Organizations, with a view to facilitating the attainment, in the most effective and economical manner, of the objectives set forth in their respective constitutions, will act in close cooperation and will consult together regularly on matters of common interest, and each Organization will keep the other informed of all developments in regard to any of its current or projected activities in which the other Organization may have an interest.

2.2 Subject to their respective rules and procedures, and within the limits of their responsibility and available resources, WMO and HMEI will share with each other relevant information regarding their respective work programmes addressing meteorological, climatological, hydrological, marine and related environmental observing systems, information products and services.

2.3 Each Organization may invite a representative or representatives of the other to participate in sessions or meetings of its constituent bodies, committees or working groups, when items on the agenda are of interest to the other Organization and, subject to such preliminary consultation as may be necessary, each Organization may include, on such agenda, items proposed by the other Organization.

2.4. When appropriate and subject to mutual agreement, joint working groups of the two Organizations may be established to deal with matters of common interest.

# 3. Scope of Application

# 3.1 **Development of standards and promotion of compliance**

3.1.1 The WMO and HMEI will collaborate in the development of draft standards and recommended practices for promulgation in the WMO technical regulations. HMEI will be encouraged to nominate experts to participate and contribute to the work of relevant WMO technical commissions and their expert bodies responsible for development and maintenance of the WMO technical regulations.

3.1.2 HMEI will promote compliance with relevant WMO technical standards to its industry members. It will also provide an industry perspective and feedback on the applicability, relevance and other implementation aspects to help in the continuous improvement of the standards and regulations promulgated by the WMO.

# 3.2 *Guidance on technical specifications and project design*

3.2.1 The WMO and HMEI will coordinate the development of standardized technical specification outlines related to development and modernization projects planned for implementation by WMO Member countries and funded through development and other financial agencies.

3.2.2 The WMO and HMEI will promote service-oriented project design with assurance of sustainability of the investments into national infrastructure and contributing to the enhancement of WMO Members' capacity to deliver services.

# 3.3 **Public-Private Partnership**

3.3.1 The WMO and the HMEI will collaborate to promote and encourage, through their respective memberships, the utilization of mutually beneficial public-private partnership arrangements aimed at assisting WMO Member countries to produce and make available high-quality data and services fit-for-purpose to support sustainable development. In doing this, both organizations will accord high priority to developing sustainable and affordable solutions to meet the capacity needs of the Least Developed Countries, Small Island Developing States, and countries in post-crises situations.

3.3.2 The WMO and the HMEI subject to available resources will collaboratively develop educational and promotional material on the modalities of public-private partnership, providing practical guidance on their implementation and highlighting related socioeconomic benefits.

3.3.3 The WMO and the HMEI will collaborate in the establishment of a Code of Ethics, aligned with relevant UN partnership principles and guidance, such as the Global Compact, for all stakeholders of the weather enterprise and will promote its enactment through their respective memberships.

# 4. General provisions

4.1 Any dispute between the Parties concerning the interpretation or application of this Working Arrangement which cannot be settled amicably would, at the request of either Party, be settled by arbitration in accordance with the Arbitration Rules of the United Nations Commission on International Trade Law (UNCITRAL).

4.2 This Working Arrangement may be amended by the Parties at any time. Any such amendment shall be agreed by mutual consent and will be effected by an exchange of letters.

4.3 This Working Arrangement may be supplemented by additional arrangements between the Parties. These additional arrangements will be in writing and fully respect the provisions of this Working Arrangement.

4.4 Each Party will appoint a Representative who will coordinate relations with the other Party, including between technical experts of the Parties, and who will keep the Head of his or her organization informed. Any change of Representative will be communicated in writing to the other Party.

4.5 This Working Arrangement will enter into force the date after both Parties have signed it and shall remain in force for a period of four years. It may thereinafter be renewed in writing, each time for a period of four years.

4.6 Notwithstanding the above Section 4.5, this Working Arrangement may be terminated by either Party at any time by giving at least six (6) months prior written notice to the other Party.

4.7 Nothing contained in this Working Arrangement will be deemed a waiver of any of the privileges or immunities enjoyed by WMO.

Done in duplicate in the English language.

Signed on behalf of the association of the HydroMeteorological Equipment Industry (HMEI) Signed on behalf of the World Meteorological Organization (WMO)

\_\_\_\_\_

Mr. Brian Day Chairman Prof. Petteri Taalas Secretary-General

Done in Geneva, the (date)

Done in Geneva, the (date)

Decision 53 (EC-70)

## WMO engagement in global and regional private initiatives

**The Executive Council decides** that in cases of proposed collaborative partnerships on global and regional initiatives with private companies, such as the Google Flood Initiative, the following principles should be observed in considering WMO involvement:

- All decisions should be based on the high-level policy on public-private engagement (PPE) to be considered by Cg-18 and related existing policies such as Resolutions 40 (Cg-XII), 25 (Cg-XIII) and 60 (Cg-17) on data sharing and exchange;
- (2) The full spectrum of other similar initiatives developed by WMO Members or regional grouping of Members should be taken into consideration, in coordination with the regional associations concerned, to explore possible synergies and potential conflicts;

- (3) The relevant technical body of WMO should review and evaluate the proposal from a technical and scientific perspective and provide advice on its feasibility and potential impacts;
- (4) Special attention should be paid to self-protecting measures to mitigate reputational risk and misuse of WMO organizational identity;
- (5) The final decision on WMO level of engagement will be taken by the Executive Council based on the analysis of (1) to (4) above. Should the timescales require a decision within the intersessional periods between EC meetings, the President may take this decision on behalf of the Executive Council in accordance with general regulation 9(5).

**The Executive Council requests** the Secretary-General to further develop this decision making process in the context of the planned PPE Declaration and report back to the Executive Council.

#### **Decision justification:**

Google launched the Google Flood Forecasting Initiative with a view to develop scalable, high spatial resolution and high precision flood forecasting systems. The system will be based on Google machine learning capacity. Google intend to make their forecast products publicly available for free.

They are already working on river discharge estimation using remote sensing (data generation) as well as hydrologic and hydrodynamic modelling.

Google is willing to collaborate with governments to improve flood forecasting services in relevant regions and is seeking the support of WMO for technical exchanges and for sharing available hydrometeorological data, for the benefit of WMO Members. Their hydrological knowhow is limited but evidently their IT and financial resources are immense, so it is suggested to drive the process rather than responding to independent developments.

Possible areas of collaboration could be:

- Definition of project goals, products and services that would have the greatest impact on reducing fatalities and flood-related damages, and would be most useful for governmental and international organizations in dealing with floods;
- Definition of data requirements for hydrological models, and access to existing near-realtime and historical hydrological data;
- Improvement of hydrological modelling;
- Collaboration with governments and local institutions.

## Decision 54 (EC-70)

## **Decade of Ocean Science for Sustainable Development**

## The Executive Council decides:

- (1) To thank the IOC Chairperson, Professor Peter Haugan, for his excellent presentation on the Decade of Ocean Science for Sustainable Development (20212030);
- (2) To ensure WMO contribution, within existing structures and available resources, to the Decade as it would be beneficial to all Members dependent on marine and maritime

economy or exposed to coastal and marine hazards, in particular Small Island Developing States and Member Island Territories and coastal least developed and developing countries;

- (3) To endorse WMO voluntary commitments registered at the 2017 Ocean Conference as WMO contributions in support to Sustainable Development Goal 14 – Conserve and sustainably use the oceans, seas and marine resources for sustainable development:
  - (a) International Network for Multi□Hazard Early Warning Systems (IN-MHEWS) and Global Multi-hazard Alert System, noting the need to strengthen coordination efforts between IOC Intergovernmental Coordination Groups for the Tsunami Warning and Mitigation Systems and WMO initiatives to address coastal hazards;
  - (b) Responding to El Niño: improving international coordination for improved early warning;
  - (c) Weather and climate services for African, Caribbean and Pacific SIDS;
  - (d) Year of Polar Prediction;
- (4) To underline the importance of science in Polar and tropical seas to better understand the dynamics of the global ocean and atmospheric phenomena, noting the contribution of observation campaigns such as the "Years of the Maritime Continent";
- (5) To foster a continuous research-to-operations-to-services value chain to support seamless Earth system forecasting, involving international organizations, government institutions, academia and the private sector, including an enhanced constant interaction in science between WMO and IOC supported by CBS and CAS and other technical commissions;
- (6) To endorse the position paper "The ocean and WMO: ocean issues, opportunities and priorities that contribute to the WMO Strategic Plan" (EC-70/INF. 12.3) as a preliminary contribution to the scoping exercise for WMO input to the Decade in the areas of services, observation, research and capacity development;
- (7) To request the Secretary-General to arrange for the representation of WMO expertise in the planning group for the Decade and contribution to its co-design and implementation, in particular through JCOMM and the co-sponsored programmes WCRP, GCOS and GOOS, and based on the long-term goals and strategic objectives of the Strategic Plan;
- (8) To confirm WMO commitment to interagency coordination and cooperation on ocean matters, including through UN-Oceans;
- (9) To encourage Members to participate in the consultation and implementation of the Decade according to their national marine priorities;
- (10) To recommend the inclusion in the agenda of the Eighteenth Congress of a dedicated dialogue on WMO marine activities, including contribution to the Decade and the next anticipated Ocean Conference in 2020.

# Decision 55 (EC-70)

# Implementation of WMO Gender Equality Policy and Action Plan

## The Executive Council decides to:

- Review the WMO Gender Equality Policy and WMO Gender Action Plan with a view to assessing progress in their implementation and proposing necessary updates for adoption by the Eighteenth World Meteorological Congress (Cg-18);
- (2) Request technical commissions and regional associations to appoint a member of their management groups to serve as "a gender custodian" at constituent body sessions, with the specific task of (a) screening the agenda and documentation, (b) identifying relevant entry points for gender and diversity aspects, (c) ensuring their consideration and discussion, and (d) liaising with the Chair of the Advisory Panel of Experts on Gender Mainstreaming and the Secretariat on a continuous basis;
- (3) Accelerate implementation of the WMO Gender Action Plan at the regional and national levels through the active role of regional associations;
- (4) Continue collecting good practice from Members on (a) attracting more girls and women into science, (b) mainstreaming gender in organizational policies and practices, and (c) making weather, hydrological and climate services more gender-sensitive for publication on the dedicated WMO webpage;
- (5) Invite Members to send their national and/or NMHS gender policies and action plans to the Secretariat to be posted on the WMO gender webpage and to be used as a resource in the review of WMO Gender Policy and Action Plan.

**Decision justification:** After four years of implementation, the WMO Gender Action Plan needs updating based on progress achieved and gaps identified. Better coordination is required among the Secretariat, constituent bodies and the EC Advisory Panel of Experts on implementation of the Action Plan. The WMO Gender Equality Policy has to be examined to ensure meeting the criteria of the UN System-Wide Action Plan (UN-SWAP) on gender equality and the empowerment of women. Lastly, whereas gender has consistently been incorporated in the agenda of constituent bodies, it is not sufficiently mainstreamed in the discussions and technical documentation.

# Decision 56 (EC-70)

# Themes of World Meteorological Day for 2019 and 2020

The Executive Council decides, upon proposal by the President,

(1) That the themes of World Meteorological Day for 2019 and 2020 will be as follows:

2019: "The Sun, the Earth and the Weather";

2020: "Climate and Water", which will align with the theme of World Water Day 2020, focusing on climate change and water;

(2) To invite Members to undertake activities to celebrate World Meteorological Day in 2019 and 2020 using the above themes;

- (3) To take note of the preliminary proposal by the Secretary-General for the theme of World Meteorological Day for 2021 to be "The ocean, our climate and weather", in conjunction with the launch of the United Nations Decade of Ocean Science for Sustainable Development;
- (4) To invite the Secretary-General to confirm the above proposal with National WMO Focal Points for Information and Public Affairs with a view to present it to the President for approval after consultations with the Council and notification to Members.

Decision justification: Decision 63 (EC-69) – World Meteorological Day theme for 2019

The theme of World Meteorological Day since 1961 are available on the WMO website: WMD themes since 1960s: https://public.wmo.int/en/resources/world-meteorological-day/previous -world-meteorological-days.

#### Decision 57 (EC-70)

## **Reports of oversight bodies**

The Executive Council decides to:

- Note the report and endorse the recommendations of the Financial Advisory Committee (FINAC) when making decisions on financial and budgetary matters under agenda items 16.3 and 17.1 [EC-70/INF. 16.1(1)];
- (2) Note the report and endorse the recommendations of the WMO Audit Committee when dealing with respective matters [EC-70/INF. 16.1(2)];
- (3) Note the report and to consider the recommendations of the External Auditor, in accordance with Financial Regulation 15.10 when dealing with financial statements under agenda item 17.1 [EC-70/INF. 16.1(3)];
- (4) Note of the annual accountability report of the Internal Oversight Office in accordance with Financial Regulation 13.10 [EC-70/INF. 16.1(4)];
- (5) Endorse the proposed response to the recommendations of the Joint Inspection Unit (JIU) addressed to the legislative bodies of WMO, as reviewed by the WMO Audit Committee, and to note that JIU recommendations have been addressed appropriately by the Secretary-General [EC-70/INF. 16.1(5)];
- (6) Note the report of the Ethics Office [EC-70/INF. 16.1(6)].
- **Note:** The reports of the oversight bodies will be presented to the Council by Chairs/Heads of offices. Recommendations contained in the reports will be addressed by the Council when dealing with relevant agenda items.

# Decision 58 (EC-70)

## WMO-IOC Consultation Group on the Reform of JCOMM

## The Executive Council decides:

To propose that the groups and teams of the Joint WMO-IOC Technical Commission on Oceanography and Marine Meteorology (JCOMM) are co-sponsored from the WMO side by the Commission for Observation, Infrastructure and Information System and the Commission for Application and Services, and from the IOC side by relevant structures,

To propose the creation of a Joint WMO-IOC Committee for Oceanography and Meteorology (JCOM), as a high-level coordination and integration mechanism with broader engagement of the key relevant bodies of the WMO and IOC, with the terms of reference as given in the Annex to draft Resolution xx/3 (Cg-18),

To invite governing bodies of IOC to join WMO in creating a joint consultation group, with the terms of reference as provided by the annex to the present decision, with the goal of preparing parallel resolutions for the Eighteenth World Meteorological Congress (2019) and the Thirtieth IOC Assembly (2019).

# Annex to Decision 58 (EC-70)

## WMO-IOC Consultation Group on the Reform of JCOMM

## **Terms of Reference**

- (a) Examine the proposal for a creation of JCOM,
- (b) Consult WMO Members and IOC Member States,
- (c) Propose final Terms of References of JCOM,
- (d) Identify working arrangements and sponsorship for all bodies presently in JCOMM, the relationship between existing co-sponsored programmes (GCOS, GOOS, WCRP) and JCOM, and any other jointly-undertaken work,
- (e) Prepare a six-month transition plan for implementation in second half of 2019,
- (f) Prepare parallel resolutions for the Eighteenth World Meteorological Congress and Thirtieth IOC Assembly by March 2019.

## Membership

- (a) For WMO:
  - (i) Representatives of Members appointed by the President,
  - (ii) Representatives of JCOMM (marine meteorology) and CBS;
- (b) For IOC:
  - (i) Representatives of Member States appointed by the IOC Chairperson,
  - (ii) Representatives of JCOMM (oceanography), IODE, and TOWS-WG;
- (c) Representatives of co-sponsored programmes (GCOS, GOOS, WCRP).

#### Working procedures

The group will be expected to work primarily by electronic means.

Two co-chairs representing the meteorological and oceanographic communities will be selected by the group.

The co-chairs, in consultation with the group, may wish to invite other experts to participate in the work of the group.

## Decision 59 (EC-70)

#### **Preparations for the Eighteenth World Meteorological Congress**

### The Executive Council decides:

- The Eighteenth Congress to be held on 3–14 June 2019 (15 June reserved) followed by the seventy-first session of Executive Council from 17–19 June 2019; preceded by the session of the Financial Advisory Committee to be held on 1–2 June 2019,
- (2) The provisional agenda for the Eighteenth Congress should be as shown in Annex 1 to the present decision,
- (3) The invitations to Congress should be extended to the United Nations, international organizations and non-Member countries listed in Annex 2,
- (4) To urge Members to include Directors/Heads of the Hydrological Service in national delegations,
- (5) The winner of the sixty-third IMO Prize shall be invited to deliver the IMO lecture,
- (6) Parallel events should be organized and contribute to Congress deliberations: hydrological assembly and public-private dialogue (in conjunction with the World Meteo Expo at Palexpo),
- (7) High-level segment could be structured around strategic and policy matters,
- (8) The delegations to the Eighteenth Congress should be seated in alphabetical order of their countries as spelt in French, starting from the front of the hall and beginning with "Q",
- (9) To entrust the President and the Secretary-General with finalizing the programme and making arrangements for the Congress.

Annex 1 to Decision 59 (EC-70)

#### **Provisional agenda for the Eighteenth Congress**

## 1. AGENDA AND ORGANIZATION OF THE SESSION

- 1.1 Opening of the session
- 1.2 Approval of the agenda

- 1.3 Establishment of committees
- 1.4 Programme of work
- 1.5 Approval of the minutes

# 2. **REPORTS**

- 2.1 Report by the President of the Organization
- 2.2 Report by the Secretary-General
- 2.3 Reports by presidents of regional associations
- 2.4 Reports by presidents of technical commissions

# 3. STRATEGIC PLAN AND BUDGET 2020-2023

# 4. GOVERNANCE REVIEW

# 5. WEATHER, CLIMATE, HYDROLOGICAL AND RELATED ENVIRONMENTAL SERVICES

- 5.1 Multi-hazard early warning systems
- 5.2 Climate information and services
- 5.3 Hydrological services and support of sustainable water management
- 5.4 Weather information and services
- 5.5 Integrated weather, climate, hydrological and environmental services

# 6. EARTH SYSTEM OBSERVATIONS AND PREDICTIONS

- 6.1 WMO Integrated Global Observing System
- 6.2 WMO Information System
- 6.3 WMO Global Data Processing and Forecasting System

# 7. EARTH SYSTEM RESEARCH

- 7.1 Scientific knowledge of the Earth system
- 7.2 Science for service and predictive capabilities
- 7.3 Science for policy

# 8. CAPACITY DEVELOPMENT

- 8.1 Capability to provide and utilize essential services
- 8.2 Core competences and expertise
- 8.3 Development partnerships for investment

# 9. POLICY AND LEGAL MATTERS

- 9.1 Questions concerning the Convention
- 9.2 Membership of the Organization
- 9.3 Amendments to the General, Technical, Financial and Staff Regulations
- 9.4 Policy matters
- 9.5 Gender equality
- 9.6 Review of previous resolutions of Congress

# 10. ELECTIONS AND APPOINTMENTS

10.1 Appointment of the Secretary-General

- 10.2 Election of the President and Vice-Presidents of the Organization
- 10.3 Election of members of the Executive Council

### 11. DATE AND PLACE OF NEXT CONGRESS

#### 12. CLOSURE OF THE SESSION

#### Annex 2 to Decision 59 (EC-70)

#### List of international organizations to be invited to the Eighteenth World Meteorological Congress

#### **ORGANIZATIONS WITHIN THE UN SYSTEM<sup>6</sup>**

Economic and Social Commission for Asia and the Pacific (ESCAP) Economic and Social Commission for Western Asia (ESCWA) Economic Commission for Africa (UNECA) Economic Commission for Europe (UNECE) Economic Commission for Latin America and the Caribbean (ECLAC) Food and Agriculture Organization of the United Nations\* (FAO) Intergovernmental Oceanographic Commission of UNESCO (IOC/UNESCO) International Atomic Energy Agency\* (IAEA) International Civil Aviation Organization\* (ICAO) International Fund for Agricultural Development\* (IFAD) International Labour Organization (ILO) International Maritime Organization\* (IMO) International Monetary Fund (IMF) International Organization for Migration (IOM) International Telecommunication Union\* (ITU) Joint Inspection Unit of the United Nations (JIU) Office of the High Commissioner for Human Rights (OHCHR) Office of the United Nations High Commissioner for Refugees (UNHCR) United Nations Children's Fund (UNICEF) United Nations Conference on Trade and Development (UNCTAD) United Nations Convention on Biodiversity (UNCBD) United Nations Convention to Combat Desertification (UNCCD) United Nations Development Programme (UNDP) United Nations Educational, Scientific and Cultural Organization (UNESCO) United Nations Environment Programme\* (UNEP) United Nations Framework Convention on Climate Change\* (UNFCCC) United Nations Human Settlements Programme (UN-Habitat) United Nations Industrial Development Organization (UNIDO) United Nations Institute for Training and Research (UNITAR) United Nations Office for Disaster Risk Reduction (UNISDR) United Nations Office for the Coordination of Humanitarian Affairs (UN OCHA) United Nations Office on Drugs and Crime (UNODC) United Nations Population Fund (UNFPA) United Nations University (UNU) United Nations\*(UN) UN Women Universal Postal Union\*(UPU) World Bank\*

<sup>&</sup>lt;sup>6</sup> Regulation 131 (a) (2015 edition) requires that an invitation be sent to the United Nations. The organizations within the UN system marked with an asterisk (\*) have an agreement or a working arrangement with WMO, which provide for reciprocal representation. They should, therefore, normally be invited to Congress.

World Food Programme (WFP) World Health Organization\*(WHO) World Intellectual Property Organization (WIPO) World Tourism Organization\*(UNWTO) World Trade Organization (WTO)

# ORGANIZATIONS WITH AN AGREEMENT OR WORKING ARRANGEMENTS WITH WMO PROVIDING FOR REPRESENTATION

Abdus Salam International Centre for Theoretical Physics (ICTP) African Union (AU) Agency for Air Navigation Safety in Africa and Madagascar (ASECNA) Arab Centre for the Studies of Arid Zones and Dry Lands (ACSAD) Arab League Educational, Cultural and Scientific Organization (ALECSO) Arab Organization for Agricultural Development (AOAD) Assembly of French Speaking International Civil Servants (AFFOI) Association of Hydro-Meteorological Equipment Industry (HMEI)Association of Private Meteorological Services (PRIMET) Baltic Marine Environment Protection Commission (Helsinki Commission) Caribbean Meteorological Organization (CMO) Central African Economic and Monetary Community (CEMAC) Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) Preparatory Commission Cooperation Council for the Arab States of the Gulf (GCC) Danube Commission East African Community (EAC) Economic Community of West African States (ECOWAS) European Centre for Medium-Range Weather Forecasts (ECMWF) European Commission (EC) Economic Interest Grouping for National Meteorological and Hydrological Services in Europe (ECOMET) European National Meteorological Services (EUMETNET) European Organization for Nuclear Research (CERN) European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) European Space Agency (ESA) Green Climate Fund (GCF) Indian Ocean Commission (IOC) Intergovernmental Council for Hydrometeorology of the Commonwealth of Independent States (ICH CIS) International Air Transport Association (IATA) International Association for Urban Climate (IAUC) International Committee for Weights and Measures (CIPM) International Council for Research and Innovation in Building and Construction(CIB) International Council for the Exploration of the Sea (ICES) International Energy Agency (IEA) International Federation of Red Cross and Red Crescent Societies (IFRC) International Hydrographic Organization (IHO) International Institute for Applied Systems Analysis (IIASA) International Mobile Satellite Organization (IMSO) International Ocean Institute (IOI) International Organization for Standardization (ISO) International Renewable Energy Agency (IRENA) International Science Council (ISC)\*\* International Seismological Centre (ISC) International Space Environment Services (ISES) International Union for the Conservation of Nature (IUCN) International Union of Geodesy and Geophysics (IUGG) Islamic Educational, Scientific and Cultural Organization (ISESCO) Lake Chad Basin Commission (LCBC) League of Arab States (LAS)

Niger Basin Authority (NBA) Open Geospatial Consortium (OGC) Organisation internationale de la Francophonie (OIF) Pacific Community (SPC) Parliamentary Assembly of the Mediterranean (PAM) Permanent Inter-State Committee on Drought Control in the Sahel (CILSS) Permanent Joint Technical Commission for Nile Waters (PJTC) Permanent South Pacific Commission (CPPS) South Pacific Regional Environment Programme (SPREP) World Farmers' Organization (WFO) World Federation of Engineering Organizations (WFEO) World Organization for Animal Health(OIE)

\*\*A new name following the merger, in July 2018, of the International Social Science Council and the International Council for Science.

## **ORGANIZATIONS WITH CONSULTATIVE STATUS**

The consultative status (Resolution 2 (EC-IV)) accords to a non-governmental international organization entitlement to be represented by an observer without voting rights as sessions of constituent bodies in conformity with Article 26 (b) and Resolution 2 (EC-IV).

International Association of Broadcast Meteorology (IABM) International Association of Oil and Gas Producers (OGP) International Astronautical Federation (IAF) International Astronomical Union (IAU) International Commission on Irrigation and Drainage (ICID) International Federation of Airline Pilots' Associations (IFALPA) International Forum of Meteorological Societies (IFMS) International Maritime Radio Committee (CIRM) International Society of Biometeorology (ISB) International Society of Soil Sciences (ISSS) International Union of Radio Science (IURS) Organization to the ETC Group-Action on Erosion Technology and Concentration (ETC Group) World Energy Council (WEC) World Federation of United Nations Associations (WFUNA)

## **OTHER ORGANIZATIONS**

African Centre of Meteorological Applications for Development (ACMAD) African Development Bank (AfDB) Asian Development Bank (ADB) Asian Disaster Reduction Centre (ADRC) Association of South-East Asian Nations (ASEAN) Arctic Council Secretariat (ACS) Committee on Earth Observations Satellites (CEOS) Centro internacional para la investigación del fenómeno El Niño (CIIFEN) Common Market for Eastern and Southern Africa (COMESA) Comité Regional de Recursos Hidraulicos del Istmo Centroamericano (CRRH) Communauté Economique des Etats de l'Afrique Centrale (CEEAC) Coordination Group for Meteorological Satellites (CGMS) Council for Europe (CE) Economic Cooperation Organization (ECO) European and Mediterranean Plant Protection Organization (EPP) European Bank for Reconstruction and Development (EBRD) European Co-operation in Science and Technology (COST) European Meteorological Society (EMS) Global Water Partnership (GWP)

Group on Earth Observations (GEO) Inter-American Development Bank (IADB) Inter-American Institute for Cooperation on Agriculture (IICA) Intergovernmental Authority on Development (IGAD) International Chamber of Shipping (ICS) International Commission for the Hydrology of the Rhine Basin (CHR) International Council of Aircraft Owner and Pilot Associations (IAOPA) International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) International Research Institute for Climate and Society (IRI) Latin American Energy Organization (OLADI) Organization of American States (OAS) Secretariat of the Antartic Treaty Southern African Development Community (SADC) The International Rice Research Institute (IRRI) World Aerospace Education Organization (WAEO) World Water Council (WWC)

## **INVITATIONS GOVERNED BY RESOLUTION 39 (Cg-VII)**

State of Palestine

## **INVITATIONS TO NON-MEMBER COUNTRIES**

In accordance with Regulation 20 of the General Regulations, countries that are not Members of WMO but are Members of the United Nations and countries that are neither Members of WMO nor Members of the United Nations but have been accorded observer status by the United Nations shall be invited to attend Congress as observers, provided that such countries maintain Meteorological or Hydrometeorological Services. Invitations will be issued to the following non-Member countries because of their status as Members of, or observers to, the United Nations:

Andorra Equatorial Guinea Grenada Holy See Liechtenstein Marshall Islands Nauru Palau San Marino Saint Kitts and Nevis Saint Vincent and the Grenadines

There are no other names of independent countries, for which prior approval of the WMO Members is required, that were brought to the attention of the Secretary-General.

## Decision 60 (EC-70)

## Plan for funding liability for after-service health insurance

## The Executive Council,

Recalling Decision 69 (EC-69) - Plan for Funding Liability for After-Service Health Insurance;

**Noting** that no new reports have been issued by the United Nations Working Group on ASHI since February 2017;

Noting further that the liability for ASHI increased during 2017;

Decides to keep Decision 69 (EC-69) in force;

**Requests** the Secretary-General to:

- (1) Develop cost-containment measures related to ASHI with urgency, regardless of the timing of the final report of the UN Working Group on ASHI; and
- (2) Propose recommendations to Congress which respond to the report of the UN Working Group on ASHI.

#### **Decision justification:**

FINAC-37 Recommendation 2 (EC-70/INF. 16.1(1))

EC-70/INF. 17.2 – Plan for Funding Liability for After-Service Health Insurance

EC-70/INF. 16.1(1) - Report of the thirty-seventh Meeting of the Financial Advisory Committee

## Decision 61 (EC-70)

#### **Revised salaries of ungraded officials**

**The Executive Council decides** to set the net base salary for WMO ungraded officials with retroactive effect from 1 January 2018 as follows:

	Existing Provision (US\$)	New Provision (US\$)
Secretary-General	169,296	170,937
Deputy Secretary-General	155,398	156,905
Assistant Secretary-General	142,764	144,148

#### **Decision justification:**

In December 2017, the General Assembly of the United Nations adopted a new base salary scale for the staff of the United Nations Common System in the Professional and higher categories, which came into effect on 1 January 2018. This scale reflected an adjustment of 0.97 per cent, which was implemented by increasing the base salary and commensurately decreasing post adjustment multiplier points, resulting in no change in net take-home pay;

In accordance with Staff Regulation 3.1, the revised salary scale had been implemented in the Secretariat in respect of staff members in grades P.1 to D.2;

Seventeenth Congress had decided to authorize the Executive Council to carry out any adjustment of salary in respect of the Secretary-General, the Deputy Secretary-General and the Assistant Secretary-General, which might become necessary if an increase in the salaries of comparable United Nations staff occurred during the seventeenth financial period;

Comparable United Nations agencies, in particular the International Telecommunication Union and the Universal Postal Union, had adjusted the salaries of their ungraded officials accordingly.

## Decision 62 (EC-70)

## Revised pensionable remuneration of ungraded officials

The Executive Council decides to set the level of annual pensionable remuneration for ungraded officials with retroactive effect from 1 February 2017 and 1 February 2018 as follows:

	Existing Provision (US\$)	New Provision (US\$)	
		Effective 1 February 2017	Effective 1 February 2018
Secretary-General	336,941	363,912	369,221
Deputy Secretary-General	311,400	336,326	341,233
Assistant Secretary-General	288,180	311,248	315,789

## **Decision justification:**

In accordance with the provisions of Article 51(b) of the Regulations of the United Nations Joint Staff Pension Fund, the scale of pensionable remuneration for the Professional and higher categories should be adjusted on the same date as the net remuneration amounts of officials in the Professional and higher categories in New York are adjusted and by a uniform percentage equal to the weighted average percentage variation in the net remuneration amounts, as determined by the International Civil Service Commission;

The International Civil Service Commission promulgated revised pensionable remuneration scales for staff in the Professional and higher categories effective 1 February 2017 and 1 February 2018;

In accordance with the provisions of Article 25 (a) of the Regulations of the United Nations Joint Staff Pension Fund, WMO contributes 15.8% of pensionable remuneration for each staff member. Further considering that the additional annual cost of implementing the revised scales effective 1 February 2017 and 1 February 2018 is US\$ 11,845 and US\$ 2,332 respectively;

Comparable United Nations agencies, in particular the International Telecommunication Union and the Universal Postal Union, had adjusted the pensionable remuneration of their ungraded officials accordingly.

# Decision 63 (EC-70)

## International Meteorological Organization Prize and other awards

## The Executive Council decides:

- (1) To award the sixty-third IMO Prize to Dr Antonio Divino Moura (Brazil);
- (2) To invite Dr Moura to deliver a scientific lecture at the eighteenth session of the Congress;
- (3) To award the 2018 WMO Research Award for Young Scientists to Chang-Eui Park (Republic of Korea), Su-Jong Jeong, Manoj Joshi, Timothy J. Osborn, Chang-Hoi Ho, Shilong Piao, Deliang Chen, Junguo Liu, Hong Yang, Hoonyoung Park, Baek-Min Kim and Song Feng for the paper entitled "Keeping global warming within 1.5 C constrains emergence of aridification" published in *Nature Climate Change*, 8 (2018): 70–74, doi.org/10.1038/s41558 -017-0034-4;
- (4) To award the twenty-sixth Professor Dr Vilho Väisälä Award for an Outstanding Research Paper on Instruments and Methods of Observation to Asko Huuskonen, Mikko Kurri (Finland) and Iwan Holleman (Netherlands) for the paper entitled "Improved analysis of solar signals for differential reflectivity monitoring" published in *Journal of Atmospheric Measurement Techniques*, 31 (2016): 31833192, doi.org/10.5194/amt-9-3183-2016;
- (5) To award the seventh Professor Dr Vilho Väisälä Award for the Development and Implementation of Instruments and Methods of Observation in Developing Countries to Fan Yang, XingHua Yang, Wen Huo, Mamtimin Ali, XinQian Zheng, ChengLong Zhou and Qing He (China) for the paper entitled "A continuously weighing, high frequency sand trap: Wind Tunnel and field evaluations" published in *Geomorphology*, 293 (April 2017): 84–92, doi .org/10.1016/j.geomorph.2017.04.008.

# Decision 64 (EC-70)

# Designation of acting members of the Executive Council

**The Executive Council decides** to designate as acting members of the Executive Council, Professor Sani Abubakar MASHI (Nigeria), to fill the position of Mr Daouda Konate (Côte d'Ivoire), who became acting president of Regional Association I,

- Mr Jeremiah LENGOASA (South Africa), to replace Dr Linda Makuleni (South Africa),
- Dr Jaecheol NAM (Republic of Korea), to replace Mr KO Yunhwa (Republic of Korea),
- Mr Francisco DE ASSIS DINIZ (Brazil), to fill the position of Professor A. Celeste Saulo, who was elected as Second Vice-President of WMO and also serves as Acting First Vice-President of the Organization,
- Dr Ken TAKAHASHI GUEVARA (Peru), to fill the position of Dr Guillermo E. Navarro (Chile), who was elected as president of RA III.
- Dr Arlene LAING (Ms) (British Caribbean Territories), to fill the position of Mr Tyrone Sutherland (British Caribbean Territories), with effect from 27 June 2018,
- Mr Maxim YAKOVENKO (Russian Federation), to replace Mr Alexander Frolov (Russian Federation),

 Mr Phil EVANS (United Kingdom of Great Britain and Northern Ireland), to replace Mr Robert Varley (United Kingdom), who was elected as First Vice-President of the Organization, prior to his departure from the National Meteorological Service.

Based on the provisions of Article 4 (b) of the Convention, and Regulations 9 (2), 9 (4), 9 (5) and 17 of the General Regulations, the President of the Organization, in consultation with the presidents of Regional Associations and members of the Executive Council, have decided to designate on an exceptional basis, as acting members of the Executive Council:

- Dr Árni SNORRASON (Iceland), in place of filling the seat of the First Vice-President of the Organization, and
- Mr Franz UIRAB (Namibia), in place of filling the seat of the Third Vice-President of the Organization, in the best interests of the Organization.

## Decision 65 (EC-70)

## Review of subsidiary bodies and other bodies reporting to the Executive Council

## The Executive Council decides:

#### Audit Committee

- In accordance with the terms of reference of the WMO Audit Committee (Resolution 8 (EC-LXIII)):
  - (a) To appoint the following seven (7) members for a 3-year term:

Mr Tuncay Efendioglu (Turkey) – from 1 July 2018 – until 30 June 2021

Ms Elvira Lazzati (Argentina) – from 1 July 2018 until 30 June 2021

Mr Graham Miller (UK) - from 1 July 2018 until 30 June 2021

Mr Fetene Teshome (Ethiopia) – from 1 July 2018 until 30 June 2021

Ms Setsuko Yamazaki (Japan) - from 1 July 2018 until 30 June 2021

Mr Kamlesh Vikamsey (India) – from 1 March 2019 until 28 February 2022

Ms Caroline Najm (Canada) – from 13 June 2019 12 June 2022

(b) To establish a reserve in case of unexpected replacement in intersessional period comprised of the following individuals:

Mr J. Graham Joscelyne (South Africa/USA), Ms Margaret Kireeta-Mwanja (Uganda), Mr John (Jack) Hayes (USA), Mr Albert Martis (Curacao and Saint Maarten), Ms Irena Petruskeviciene (Lithuania)

## Joint Scientific Committee for the WCRP

- (2) In accordance to the terms of reference of the Joint Scientific Committee for the WCRP (Agreement between the World Meteorological Organization, the International Council of Scientific Unions and the Intergovernmental Oceanographic Commission on the World Climate Research Programme):
  - (a) To approve that the JSC should consist of 15 members;

- (b) To renew terms of appointment of the following six (6) current eligible JSC members for a further 2-year term, 1 Jan 2019–31 Dec 2020: Mr Jens Christensen (Denmark), Ms Helen Cleugh (Australia), Mr Masahide Kimoto (Japan), Ms Amanda Lynch (United States of America), Mr Thomas Peter (Germany), and Mr Martin Visbeck (Germany);
- (c) To approve the following nine (9) preferred candidates for appointment as new JSC members for an initial 4-year term 1 Jan 2019–31 Dec 2022: Ms Lisa Alexander (Australia), Mr Tercio Ambrizzi (Brazil), Ms Pascale Braconnot (France), Ms Susanna Corti (Italy), Mr Pierre Friedlingstein (United Kingdom), Mr James Hurrell (United States of America), Mr Pedro Monteiro (South Africa), Mr Krishnan Raghavan (India), Mr Huijun Wang (China);
- (d) To endorse the following three (3) preferred candidates in case JSC should be maintained at 18 members: Ms Pandora Hope (Australia), Mr Igor Shkolnik (Russian Federation), Mr Rowan Sutton (United Kingdom);
- (e) To endorse the following three (3) scientists as alternates in case replacement is needed during the next 2-years: Mr Venkatachalam Ramaswamy (United States of America), Mr Detlef Stammer (Germany), Mr Ken Takahashi (Peru);
- (f) To entrust the Secretary-General to establish the final list of new members for appointment in consultation with IOC and ICSU.
- (3) To make the following replacements and changes in the composition of subsidiary bodies of the Council:

#### Working Group on Strategic and Operational Planning

- J. Lengoasa to replace L. Makuleni
- P. Evans to replace R. Varley
- M. Yakovenko (new member)
- K. Takahashi (new member)

#### Working Group on Disaster Risk Reduction

- S. Mashi to replace D. Konate
- P. Evans to replace R. Varley
- F. De Assis to replace C. Saulo

#### **Task Team on Data Policy and Emerging Issues**

F. Uirab (new member)

#### Panel of Experts on Polar and High Mountain Activities

- M. Yakovenko to replace A. Frolov
- G. Navarro (new member)
- Expert from IOC (to be nominated)

#### **Panel of Experts on Capacity Development**

- J. Nam to replace Y. KO
- A. Laing to replace T. Sutherland
- F. De Assis (new member)

#### **ICG WIGOS Focal Points**

A. Laing to replace T. Sutherland

## **Gender Mainstreaming Focal Points**

S. Barrell, F. Branski, P. Evans, C. Saulo, J. Smith, M. Jean (President of CBS)

## Constituent Bodies Reform Task Force (Resolution 36 (EC-70))

G. Adrian (Chairperson), M.L. Bah, P. Evans, D. Grimes, T. Hashida, A. Martis, G. Navarro , C.L. Wong, L. Uccellini, M. Yakovenko

# **Drafting Team on Preparation of a Policy Act on Public-Private Engagement** (Decision 51(EC-70))

M. Staudinger (Chairperson), C. Saulo, P. Evans, D. Grimes, T. Hashida, J. Lacave, K. Ramesh, L. Uccellini

## Task Force on Water (Resolution 18 (EC-70))

Á. Snorrason (Iceland) (Chairperson), K. Takahashi (Peru), K. Ramesh (India), J Zúñiga (Costa Rica), J. Fenwick (New Zealand), A. Jenkins (United Kingdom), S. Otunga Koding (South Sudan), President of CHy, President of CAS

(4) To designate the following members of EC committees:

## Selection Committee for membership of the WMO Audit Committee

J.-M. Lacave (Chairperson), C.L. Wong, G. Navarro, A. Ghulam

## Selection Committee for the membership of the JSC/WCRP

C. Saulo (Chairperson), J. Nam, L. Uccellini, A. Johnson

#### **Selection Committee for the IMO Prize**

G. Adrian (Chairperson), Y. Liu, A. Kijazi, K. Takahashi

## Selection Committee for the Young Scientists Award

A. Martis (Chairperson), A. López, R. Philippe, K.J. Ramesh

#### Selection Committee for the Vaisala Award

T. Sutherland (Chairperson), S. Cau, K.J. Ramesh, Vice-president CIMO

## **WMO Staff Pension Committee**

G. Navarro (Chairperson), L. Bah, J. Lengoasa

#### **Decision justification:**

- 1. Designation of acting members of the Executive Council (Decision 64 (EC-70)).
- 2. TOR of the Audit Committee Resolution 8 (EC-LXIII)
- 3. MOU between WMO-IOC-ICSU on WCRP.

# Decision 66 (EC-70)

## **Scientific lectures**

## **Executive Council decides**:

- (1) To thank Mr McBean, the laureate of the sixty-second IMO Prize, for his lecture entitled "Integrated Environmental Prediction Addressing the 2030 Global Agenda";
- (2) To request the Secretary-General to arrange for the appropriate publication of the lecture.

# **APPENDIX 4. RECOMMENDATIONS ADOPTED BY THE SESSION**

# Recommendation 1 (EC-70)

## On the approach to cataloguing high-impact events

## THE EXECUTIVE COUNCIL,

## **Recalling:**

- (1) Resolution 9 (Cg-17) Identifiers for cataloguing extreme weather, water and climate events, through which Congress decided to standardize information on weather, water, climate, space weather and other related environmental hazards and risks, and develop identifiers for cataloguing weather, water and climate extreme events,
- (2) Decision 4 (EC-68) Systematic characterization and cataloguing of extreme weather, water and climate events and standardization of respective hazard information, which established the WMO Inter-programme Task Team on Cataloguing Extreme Weather, Water and Climate Events,

**Noting with satisfaction** the collaboration between the Commission for Basic Systems (CBS) and the Commission for Climatology (CCI) in the organisation of an International Workshop on Cataloguing and Managing Information on Extreme Weather and Climate Events, which proposed an approach to cataloguing high-impact events consisting in assigning universally unique identifiers to high-impact events. The Workshop also endorsed a living list of event types,

**Noting also** the decision made by the Regional Association for Europe (RA VI) that National Meteorological and Hydrological Services (NMHSs) of Members and Regional Climate Centres (RCCs) carry out a test phase of the proposed approach in collaboration with other stakeholders in the Region,

**Noting further** the establishment of the Expert Team on Disaster Risk Reduction during the fifth session of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM),

**Mindful** of the importance of the test phase to develop guidance for Members on implementation of the approach and to document its feasibility, including the requirements for data collection, processing and dissemination, and of the collaboration between the stakeholders, for ensuring a swift transition from the test to the operational phase,

Having examined the scientific and technical foundations of the proposed approach,

**Having considered** the recommendation of the Executive Council Working Group on Disaster Risk Reduction to endorse the cataloguing approach and to consider the conclusion of the test phase with further refinement, as necessary,

**Requests** the Secretary-General to provide the necessary support for conducting the test phase and to facilitate the expert work during the test phase to be conducted during 2018-2019;

**Requests** the Executive Council Working Group on Disaster Risk Reduction:

- To assess the results of the test phase in RA VI and provide conclusions and recommendations to fine-tune the approach and understand its implications for coordination and operationalization;
- (2) To formulate the final proposal to be submitted to Congress for consideration;
- (3) To facilitate and support the implementation of the activities in other regional associations;

(4) To solicit the advice and support of technical commission expert teams, such as the newly established JCOMM Expert Team on Disaster Risk Reduction, as appropriate;

**Requests** other regional associations to test the concept and provide feedback on the outcomes to the Executive Council Working Group on Disaster Risk Reduction;

**Requests** the Commission for Basic Systems, the Commission for Climatology, and the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology to develop a roadmap on the future operation and service for the Executive Council Working Group on Disaster Risk Reduction;

**Requests also** the Commission for Basic Systems and the Commission for Climatology:

- (1) To consider any feedback provided for consideration in updating high-impact event types and their definitions, and in establishing criteria for what constitutes a high-impact event;
- (2) To provide guidance as to whether events should be classified according to meteorological criteria alone or in terms of impact;
- (3) To provide guidance on how multi-hazard events should be handled;

**Urges** Members to contribute to the test phase on a voluntary basis in collaboration with World Meteorological Centres, Regional Specialized Meteorological Centres, Regional Climate centres and National Meteorological Centres of NMHSs;

**Recommends** that the proposed approach to cataloguing high-impact events provided in the annex to the present recommendation, with the necessary refinement as per the conclusions of the test phase and lessons learnt, be submitted to the Eighteenth World Meteorological Congress for consideration and adoption.

# Annex to Recommendation 1 (EC-70)

# Approach to cataloguing high-impact weather, water and climate events

# 1. **Overview of the approach**

1.1 The approach centres on identifying events uniquely, while at the same time being able to group together events which are hydrometeorologically related. The scheme involves assigning a universally unique identifier (UUID) number to each event and incorporating the UUID and key attributes of the event into a data record (Figure 1). The UUID is an ISO-standard random number generated by a relevant national, regional or global authority. Key attributes contained in the data record include information that defines the event, such as event start and end times, spatial extent, and event type. Other attributes provide context such as description, local identifier (e.g. local or regional names of storms), and links to other events (e.g. heavy rain to tropical cyclone) which enables the clustering of events (e.g. events linked to other events) into larger scale (synoptic) phenomena. Additional information about each event can be stored in a separate database, also associated with the UUID, for storing relevant hydrometeorological parameters (wind speeds, precipitation amounts, values of hydrometeorological indexes, etc.). Importantly, authorities responsible for assessing and cataloguing information on loss and damage would be able to use the same UUID to associate this type of non-hydrometeorological information with the events as well.

1.2 The scheme also addresses the issue of events being associated with each other, e.g. a cyclone, leading to heavy rain, strong winds, storm surge flooding and landslides. Each event and sub-event can have its own UUID, yet incorporating the UUIDs of associated events in any given event record allows the entire chain of events to be linked to each other, along with any associated data.



# Figure 1. Event record containing UUID and key event attributes (attributes in red are mandatory entries)

# 2. **Recording process and analysis**

It is envisioned that the national meteorological and hydrological services record and conduct post analysis for linking events into a hierarchical clustering from synoptic to meso- and local scales. Partnerships with loss and damage database and social media (e.g. crowd sourcing) stakeholders will be useful to verify and finalize event information (e.g. spatial area and/or relationships among events cross-referenced in event records of each other).

# 3. Event types

A draft typology (reference: EC-70/INF. 3.1(3)) which lists types of events associated with impacts has been compiled from authoritative WMO references and resource materials. The typology contains an initial list of event types with which losses and damage are potentially associated. The typology will be a standard living list that can be amended by countries and regions through the appropriate WMO governance mechanism, such as the GDPFS.

## Recommendation 2 (EC-70)

## **Climate data modernization**

THE EXECUTIVE COUNCIL,

## Recalling:

- (1) Resolution 34 (Cg-17) Definition of standards for Climate Data Management Systems and their reference in the WMO Information System,
- (2) Resolution 60 (Cg-17) WMO policy for the international exchange of climate data and products to support the implementation of the Global Framework for Climate Services,
- (3) Decision 15 (EC-69) Strengthening regional- and global-scale Climate Services Information System operations,
- (4) Resolution 4 (CCI-17) Climate data modernization,

**Recalling further** that the sixty-fifth session of the Executive Council had requested the Commission for Climatology to work closely with other commissions and programmes to move from a concept to the definition of a *High-quality Global Data Management Framework* (*Executive Council, Abridged Final Report of the Sixty-fifth Session* (WMO-No. 1118), General summary, 4.4.70),

**Noting with satisfaction** the progress made by the Commission for Climatology in guiding Members on climate data-related issues, including specifications for climate data management systems (CDMSs) (see *Climate Data Management Systems Specifications* (WMO-No. 1131)), and the strategy concept for CDMSs,

**Noting further** the Commission for Climatology's ongoing work on the High-quality Global Data Management Framework for Climate, as formulated in Resolution 4 (CCI-17),

**Having been informed** on the progress made on the draft Manual on the High-quality Global Data Management Framework for Climate (see EC-70/INF. 4.5(2)),

**Taking note** of the collaboration between the Global Climate Observing System and the Commission for Climatology to develop guidance on the use of weather radar and lightning data for climate applications that can be referred to in the Manual on the High-quality Global Data Management Framework for Climate, as an emerging aspect of data management for climate,

**Convinced** of the importance of such a manual for guiding Members on standards and recommended practices with regard to the management of climate data, including terminology, definitions, dataset maturity assessment, data management operations, discovery and exchange; and convinced also that these aspects should be described appropriately in the WMO Technical Regulations,

**Recommends** to Congress draft Resolution XX/1 (Cg-18) – *Manual on the High-quality Global Data Management Framework for Climate,* as provided in the annex to the present recommendation;

**Urges** the president of the Commission for Climatology to arrange for completion of the final draft of the manual, in collaboration with other technical commissions and programmes, to be submitted to the Eighteenth World Meteorological Congress for consideration;

#### **Requests** the Secretary-General:

- To arrange for the collection of Members' feedback on the content of the reference Manual on the High-quality Global Data Management Framework for Climate, after approval by the president of the Commission for Climatology;
- (2) To facilitate collaboration between the Commission for Climatology and other technical commissions and programmes to finalize and submit the draft reference manual, after considering Members' feedback, with a view to adoption by the World Meteorological Congress at its Eighteenth session.

## Annex to Recommendation 2 (EC-70)

## Draft Resolution XX/1 (Cg-18)

## Manual on High-quality Global Data Management Framework for Climate

#### THE CONGRESS,

#### **Recalling**:

- (1) Resolution 60 (Cg-17) WMO Policy for the International Exchange of Climate Data and Products to Support the Implementation of the Global Framework for Climate Services,
- (2) Resolution 34 (Cg-17) Definition of Standards for Climate Data Management Systems and their reference in the WMO Information System,
- (3) Decision 15 (EC-69) Strengthening Regional and Global Scale Climate Services Information System Operations,
- (4) Resolution 4 (CCI-17) Climate Data Modernization,
- (5) Recommendation 2 (EC-70) Climate data modernization,

**Mindful** of the increased emphasis given by the Members to climate data including its quality and management as expressed at the Commission for Climatology since its 15th session when CCl re-emphasized the critical and necessary collaboration of all Members to ensure high quality, timely and accessible climate data from all possible sources and recommended the development of a High Quality- Global Data Management Framework for Climate (HQ-GDMFC),

#### Recognizing:

- that the definitions of standards for climate data management should form an important building block of a long-term modernization process for climate data and related management practices and systems,
- (2) the importance of capacity development needs and provision of guidance to enable Members to fulfil their role in managing and exchanging the climate data that are required for the implementation of climate services,

**Recognizing further** the growing need in providing standards and advising on recommended practices for managing climate data from all available sources, including in-situ, remote sensing, marine, hydrology and atmospheric data and ensuring its quality standards to support the development on climate knowledge and informed policy making at global, regional and national levels,

**Noting** the progress made by CCl in guiding Members on climate data including on *Climate Data Management Systems Specifications* (WMO-No. 1131), the Strategy concept for CDMSs and the CCl ongoing work on High Quality Global Data Management Framework for Climate (HQ-GDMFC),

**Welcoming** Resolution 4 (CCI-17) on Climate Data Modernization, agreeing that a reference Manual on HQ-GDMFC should be finalized,

**Convinced** of the importance of such a manual for guiding Members on standards and recommended practices with regards to managing climate data, including on terminology, definitions, dataset maturity assessment, data management operations, discovery and exchange, and that these aspects should be described appropriately in the WMO technical regulations,

**Appreciating** CCI efforts and its collaboration with other commissions and programmes for finalizing the draft reference manual on HQ-GDMFC,

**Approves** the draft reference manual on High Quality Global Data Management Framework for Climate (HQ-GDMFC) as provided in the annex to this Resolution for inclusion to the WMO technical regulations;

**Requests** the Secretary-General to arrange for the publication of the reference manual on HQ-GDMFC after ensuring compliance with WMO editing standards and practices and inform Members on its formal release;

**Requests** the Commission for Climatology to oversee the update of the reference manual on HQ-GDMFC;

**Requests** the Commission for Basic Systems to refer to the standards included in the reference manual on HQ-GDMFC in other relevant technical regulations such as WIGOS, WIS and GDPFS for ensuring consistency in the terminology, concepts and definitions of climate data and their management.

## Recommendation 3 (EC-70)

## Strengthening WMO contributions to the provision of climate information and services in support of policy- and decision- making

## THE EXECUTIVE COUNCIL,

#### **Recalling**:

- (1) Resolution 4 (EC-XLI) Global climate change,
- (2) Resolution 15 (Cg-17) World Climate Programme,
- (3) Resolution 60 (Cg-17) WMO policy for the international exchange of climate data and products to support the implementation of the Global Framework For Climate Services,
- (4) Resolution 62 (Cg-17) Relationship and interaction between the Intergovernmental Board on Climate Services and WMO constituent bodies,
- (5) Resolution 64 (Cg-17) Development of a results-based framework for WMO support to the implementation of the Global Framework For Climate Services,

- (6) Decision 16 (EC-68) Country-focused results-based framework and mechanism for WMO contributions to the Global Framework for Climate Services,
- (7) Decision 17 (EC-68) WMO support to the implementation of activities of the Intergovernmental Panel on Climate Change,
- (8) Decision 7 (EC-69) WMO support to implementation of the Paris Agreement,
- (9) Decision 11 (EC-69) Implementation of the country-focused results-based framework and mechanism for WMO contributions to the Global Framework For Climate Services,

**Having considered** the *Commission for Climatology, Abridged Final Report of the Seventeenth Session* (WMO-No. 1216), particularly Recommendation 2 (CCI-17) – Strengthening the integration and coordination of WMO contributions to the provision of policy- and decisionsupporting climate information and services, and Recommendation 3 (CCI-17) – Continuation and strengthening of the work of the Commission for Climatology,

**Noting** the relevance of WMO climate science products to the implementation of the Global Framework for Climate Services (GFCS) and to the Intergovernmental Panel on Climate Change (IPCC) as well as to high-level climate-related policy processes such as the United Nations Framework Convention on Climate Change, the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction,

**Noting with satisfaction** that WMO climate products such as the *WMO Statement on the State of the Global Climate*, the *El-Niño/La Niña Update*, the *Greenhouse Gas Bulletin* and other products under development, such as the Global Seasonal Climate Update, constitute authoritative sources of information which support informed policy- and decision-making and complement the IPCC assessment reports,

## Recognizing:

- (1) In this regard, the essential contributions of all four components of the World Climate Programme (WCP), namely the World Climate Services Programme, the Global Climate Observing System Programme, the World Climate Research Programme and the Global Programme of Research on Climate Change Vulnerability, Impacts and Adaptation,
- (2) The operational responsibilities of National Meteorological and Hydrological Services (NMHSs) and regional and global centres constituting WMO infrastructure, and the key roles of climate forums at the regional and national levels in convening stakeholders and aligning their efforts,
- (3) The particular roles of:
  - (a) The GFCS, in securing the engagement of international partner organizations in support of improved country-level climate-related development outcomes,
  - (b) The IPCC, in organizing the scientific community's efforts to provide scientific assessments that inform the Conference of the Parties to the United Nations Framework Convention on Climate Change and other climate-related policy processes,
  - (c) The World Climate Research Programme, in facilitating the analysis and prediction of climate system variability and change for use in an increasing range of practical applications of direct relevance, benefit and value to society,
- (4) The many contributions of WMO regional associations and technical commissions,

## **Recognizing further** the continuing need for:

- (1) Enhancing and synchronizing the efforts of operational WMO centres, including Regional Climate Centres and Global Producing Centres, to support the delivery of services by Members at country level,
- (2) Ensuring global coordination of key climate-related processes such as regional and national climate forums, exchange of data and products, translating research results into operations, and developing and assembling inputs for policy-related products and services,
- (3) Technical and scientific inputs for guiding and supporting the work of Members and other WMO entities in this regard,

**Recommends** to the Eighteenth World Meteorological Congress draft Resolution XX (Cg-18) — WMO contributions to the provision of climate information and services in support of policy- and decision-making, as provided in the annex to the present recommendation.

#### Annex to Recommendation 3 (EC-70)

#### Draft Resolution XX (Cg-18)

### WMO contributions to the provision of climate information and services in support of policy- and decision- making

THE CONGRESS,

#### **Recalling**:

- (1) Resolution 4 (EC-XLI) Global climate change,
- (2) Resolution 15 (Cg-17) World Climate Programme (WCP),
- (3) Resolution 60 (Cg-17) WMO policy for the international exchange of climate data and products to support the implementation of the Global Framework For Climate Services,
- (4) Resolution 62 (Cg-17) Relationship and interaction between the Intergovernmental Board on Climate Services and WMO constituent bodies,
- (5) Resolution 64 (Cg-17) Development of a results-based framework for WMO support to the implementation of the Global Framework For Climate Services,
- (6) Decision 16 (EC-68) Country-focused results-based framework and mechanism for WMO contributions to the GFCS,
- (7) Decision 17 (EC-68) WMO support to the implementation of activities of the Intergovernmental Panel on Climate Change (IPCC),
- (8) Decision 7 (EC-69) WMO support to implementation of the Paris Agreement,
- (9) Decision 11 (EC-69) Implementation of the country-focused results-based framework and mechanism for WMO contributions to the Global Framework For Climate Services,

**Noting** the relevance of WMO climate science products to the implementation of the Global Framework for Climate Services (GFCS) and to the Intergovernmental Panel on Climate Change

(IPCC) as well as to high-level climate-related policy processes such as the United Nations Framework Convention on Climate Change, the Sustainable Development Goals, and the Sendai Framework for Disaster Risk Reduction,

**Having considered** the *Abridged Final Report of the Seventeenth Session of the Commission for Climatology* (CCI) (WMO-No. 1216),

**Decides** to establish formal overall coordination of WMO contributions to the provision of policy- and decision-supporting climate information and services, ensuring, inter alia:

- An enlarged scope which encompasses the provision of services to high-level climate related policy processes in addition to supporting country-level service delivery by Members, taking into account the current mechanism for WMO contributions to the GFCS, and ensuring a focus on delivering to the agreed WMO Strategic Plan and priorities;
- (2) Formalization of roles and responsibilities for ensuring effective coordination among all the bodies responsible for World Climate Programme (WCP) implementation;
- (3) Representation from the governance structures of the Intergovernmental Panel on Climate Change (IPCC) and the Global Framework for Climate Services (GFCS);
- (4) Engagement of the operational WMO entities of the Climate Services Information System, including Global Producing Centres, Regional Climate Centres and NMHSs, and other relevant organizations, programmes and initiatives with whom cooperation and coordination is needed to strengthen WMO contributions to the provision of policy- and decision-supporting climate information and services;
- (5) That the ongoing work and planned deliverables approved at the 17th session of the Commission for Climatology are continued;

**Requests** the Secretary General to convene the presidents of technical commissions, presidents of regional associations, and chairs persons and key focal points of WCP entities, IPCC and GFCS to identify appropriate arrangements;

**Requests** the President to make a recommendation on the implementation of this Resolution to the Executive Council.

# Recommendation 4 (EC-70)

# WMO contributions to the provision of agricultural meteorology information and services

THE EXECUTIVE COUNCIL,

Recalling Resolution 43 (Cg-XVI) - Terms of reference of the technical commissions,

**Having considered** the *Commission for Agricultural Meteorology, Abridged Final Report of the Seventeenth Session* (WMO-No. 1217), in particular Resolution 3 (CAgM-17) – Review of previous resolutions and recommendations of the Commission for Agricultural Meteorology, Resolution 4 (CAgM-17) – Priorities (2018–2022) of the Commission for Agricultural Meteorology, and Recommendation 5 (CAgM-17) – Continuation and strengthening of the work of the Commission for Agricultural Meteorology,

**Recognizing** the need to keep experts of agricultural meteorology engaged in WMO activities and to ensure that their contributions are and will continue to be recognized in the future,

**Recommends** to the Eighteenth World Meteorological Congress draft Resolution XX/1 (Cg-18) – WMO contributions to the provision of agricultural meteorology information and services, as provided in the annex to the present recommendation.

## Annex to Recommendation 4 (EC-70)

## Draft Resolution XX/1 (Cg-18)

# WMO contributions to the provision of agricultural meteorology information and services

THE CONGRESS,

## Recalling:

- (1) Resolution 22 (Cg-XVI) Agricultural Meteorology Programme,
- (2) Resolution 43 (Cg-XVI) Terms of reference of the technical commissions,
- (3) Resolution 17 (Cg-17) Integrated Drought Management Programme,
- (4) Decision 44 (EC-69) Enhancing national and regional drought-monitoring systems,

**Having considered** the Abridged Final Report with Resolutions and Recommendations of the Seventeenth Session of the Commission of Agricultural Meteorology (CAgM) (WMO-No. 1217),

**Noting** WMO achievements in assisting Members with the provision of a wide range of deliverables for supporting national agricultural meteorological services including national and regional drought monitoring and early warning systems and national drought policies and plans,

## Recognizing:

- The contribution of agricultural meteorological services to the United Nations Sustainable Development Goals including: 1 – Zero Poverty, 2 – No Hunger, 5 – Gender Equality, 6 – Clean Water, 7 – Clean Energy, 13 – Climate Action, 15 – Life on Land, and 17 – Partnerships for the Goals,
- (2) The crucial importance of food security to Members and the provision of weather and climate services for Members to increase food production and reduce impacts of extreme weather and climatic events and climate change on food productivity and stability,
- (3) The continued work of the Global Framework for Climate Services (GFCS) with a focus on the agriculture and food security and disaster risk reduction priority areas,
- (4) The ongoing work of the Integrated Drought Management Programme (IDMP) with over 34 partner organizations,

**Decides**, in the context of the ongoing WMO governance structure reform:

(1) That the ongoing work and planned deliverables approved at the Seventeenth Session of the Commission for Agricultural Meteorology be adequately incorporated into the governance review outcome,
(2) That the CAgM priority areas (2018–2022) and the Terms of Reference of the Commission for Agricultural Meteorology in Resolution 43 (Cg-XVI) – Terms of reference of the technical commissions \_ be taken into account, as the basis for any new structure focused on agricultural meteorology such as may arise from the governance review.

# Recommendation 5 (EC-70)

# **Global Basic Observing Network**

# THE EXECUTIVE COUNCIL,

# **Recalling:**

- (1) Resolution 2 (EC-68) Plan for the WMO Integrated Global Observing System preoperational phase 2016–2019,
- (2) Decision 21 (EC-69) Regional Basic Observing Network,

**Acknowledging with appreciation** the development of the next edition of the *Manual on WMO Integrated Global Observing System* (WMO-No. 1160), which will include all relevant material from the current *Manual on the Global Observing System* (WMO-No. 544) and new provisions relevant to the Regional Basic Observing Network and WMO Integrated Global Observing System (WIGOS) data quality monitoring,

**Having considered** the essential role played by global applications such as numerical weather prediction (NWP) and climate analysis as a backbone for all products and services provided by all WMO Members to their constituencies, even at regional and local levels,

**Having considered also** the continued need to serve these global applications with comprehensive sets of observations also from surface-based observing systems, and the essential role played by WMO in facilitating and coordinating the acquisition and international exchange of such observations,

**Having considered further** the preliminary reports from the WIGOS Data Quality Monitoring System NWP Pilot Project showing continued poor observational data coverage over many areas of the global domain,

Requests the Commission for Basic Systems:

- To develop an overarching design for the Global Basic Observing Network to meet threshold requirements for Global Numerical Weather Prediction and Global Climate Monitoring (Analysis) as established by the Rolling Review of Requirements, taking into account the respective contributions of space-based and surface-based components of WIGOS;
- (2) With joint efforts of all regional associations and the Global Cryosphere Watch Steering Group, to design, establish and monitor the Regional Basic Observing Networks to conform to the overarching Global Basic Observing Network design, providing real-time observations for international exchange with the required accuracy, spatial and temporal resolution and timeliness;

**Requests** the Intercommission Coordination Group on WIGOS to develop relevant provisions of the *Manual on the WMO Integrated Global Observing System* (WMO-No. 1160) regarding the implementation of the Global Basic Observing Network, and submit them to the World Meteorological Congress at its Eighteenth Session in 2019;

**Requests** Members to provide their feedback to the Secretary-General on the draft *Manual on the WMO Integrated Global Observing System* (WMO-No. 1160).

# Recommendation 6 (EC-70)

# Vision for the WMO Integrated Global Observing System in 2040

THE EXECUTIVE COUNCIL,

**Recalling** Resolution 2 (EC-68) – Plan for the WMO Integrated Global Observing System preoperational phase 2016–2019,

**Noting** that the Executive Council at its sixty-sixth session (2014) had requested the Commission for Basic Systems to take the lead in developing a Vision for the WMO Integrated Global Observing System (WIGOS) in 2040, which would include a vision for the WIGOS component observing systems in 2040, to be submitted to World Meteorological Congress at its Eighteenth Session in 2019,

**Noting further** that the Vision reflects how new and more efficient technologies will become available to Members for both space-based and surface-based observing systems, and that it provides high-level goals to help guide the evolution of WIGOS well into the future,

**Noting with satisfaction** the development of the integrated overall draft Vision led by the Co-Chairs of the Intercommission Coordination Group on WIGOS with continued involvement of the lead authors of the surface- and space-based contributions, which is now approaching its final form,

Endorses the current draft Vision for WIGOS in 2040 as provided in EC-70/INF. 7.1(3);

**Recommends** that the Eighteenth World Meteorological Congress approve the Vision for WIGOS in 2040 in the final draft form submitted to it;

**Requests** the Secretary-General to take the necessary steps to finalize the draft Vision and provide it to Members, WMO technical commissions, regional associations, fellow United Nations agencies, other international organizations and private sector representatives, for their review prior to its submission to the Eighteenth Congress in 2019;

**Requests** technical commissions to contribute to the finalization of the draft Vision as needed;

**Invites** international partner organizations to provide their feedback as needed.

# Recommendation 7 (EC-70)

# The WMO Integrated Global Observing System in the WMO programmatic structure from 2020 onwards

THE EXECUTIVE COUNCIL,

**Recalling** the essential role of observations as the foundation upon which all products and services provided by the WMO Members to their constituencies in the areas of weather, climate and water are built,

**Recalling further** more than 60 years of success of the World Weather Watch due to its integration of observations, data exchange and quantitative prediction systems in support of production and delivery of watches, warnings and other forecast products,

**Noting** that the draft WMO Strategic Plan clearly establishes, as its Goal 2, to "Enhance Earth system observations and predictions: Strengthening the technical foundation for the future",

**Noting** further the increasingly close links between the various disciplines and application areas that span WMO activities, as concerns both modelling and observations,

**Noting with satisfaction** the progress made during the WMO Integrated Global Observing System (WIGOS) implementation phase and the WIGOS pre-operational phase toward integration of the surface- and space-based observing programmes for all application areas covered by WMO into a single system,

**Having examined** the recommendations from the seventh session of the Intercommission Coordination Group on WIGOS (January 2018), as provided in the annex to the present recommendation,

**Having considered** Recommendation 25 (EC-70) – WMO technical commissions and other bodies, in particular as concerns the establishment of a new Commission for Observations, Infrastructure and Information Systems,

**Endorses** the recommendations from the Intercommission Coordination Group on WIGOS, as provided in the annex to the present recommendation;

**Recommends** to the Eighteenth World Meteorological Congress that WIGOS be designated essential WMO infrastructure with the role of providing the observational basis for all WMO programmes and application areas;

**Requests** the Commission for Basic Systems, drawing on the experience of the Intercommission Coordination Group on WIGOS, to develop a proposal for giving the WMO Information System and the Global Data-processing and Forecasting System a status similar to WIGOS, and for managing the three systems jointly as essential infrastructure supporting all WMO programmes and application areas, using the World Weather Watch as a model.

# Annex to Recommendation 7 (EC-70)

#### Recommendations from the seventh session of the Intercommission Coordination Group on WIGOS

- WIGOS must continue as a core WMO activity supporting all WMO programs and application areas, and it must continue to involve all regions and technical and scientific discipline areas;
- (b) WIGOS must be given a clear and permanent status with a governance mechanism that is firmly anchored in the WMO constituent body structure;
- (c) Rather than affiliating WIGOS with an existing program or creating a new program, there is a preference for considering WIGOS as "Basic WMO observational infrastructure"; as such it should include and fully integrate the observing components of all existing and emerging WMO programmes in support of all WMO activities;
- (d) It was pointed out that the WMO Information System (WIS) and eventually also the Global Data Processing and Forecast System (GDPFS) have similar roles and could be seen together with WIGOS as core elements of such infrastructure;

- (e) Continued effort will have to be devoted to the removal of any barriers to working together across different user communities, program areas, and scientific disciplines, including both WMO and co-sponsored observing systems; without pre-empting any particular outcome of the governance reform discussions, this issue must be directly addressed in the restructuring;
- (f) In order to further increase the level of integration of the various WIGOS components and to maximize efficiency and effectiveness of the work, the Secretary General is encouraged to organize the Secretariat support of WIGOS along lines that mirror the eventual outcome of the governance reform.

# Recommendation 8 (EC-70)

# Joint WMO and Intergovernmental Oceanographic Commission Strategy for Marine Meteorological and Oceanographic Data Management (2018–2021)

# THE EXECUTIVE COUNCIL,

# Noting:

- (1) Decision 19 (JCOMM-5) Joint World Meteorological Organization and Intergovernmental Oceanographic Commission Strategy for Marine Meteorological and Oceanographic Data Management (2018–2021) (hereafter, "the Strategy"), which authorized the co-presidents of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology to recommend that the updated draft Strategy be adopted by the executive bodies of WMO and the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO),
- (2) The updated draft Strategy, as contained in EC-70/INF. 7.2(2),
- (3) The recommendation of the JCOMM co-presidents that this latest draft of the Strategy is satisfactory and can be submitted to Congress for its adoption, subject to further review and concurrence by the IOC International Oceanographic Data and Information Exchange (IODE),

Considering the rationale detailed in the annex to the present recommendation,

**Concurs** with the draft Strategy as contained in EC-70/INF. 7.2(2);

**Recommends** that the Eighteenth World Meteorological Congress adopt draft Resolution XX/1(Cg-18) – Joint World Meteorological Organization and Intergovernmental Oceanographic Commission Strategy for Marine Meteorological and Oceanographic Data Management (2018–2021), as contained in the annex to the present recommendation;

**Invites** the Intergovernmental Oceanographic Commission to have the draft Strategy reviewed by IODE with a view to submitting it to the Thirtieth IOC Assembly in 2019;

**Requests** the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology:

- (1) To collaborate with IODE to finalize the Strategy ahead of the twenty-fifth session of the IODE Committee in February 2019;
- (2) To develop an implementation plan responding to the Strategy in consultation with subsidiary bodies and IODE;

(3) To assist the Commission for Basic Systems in developing the information management component of the WMO Information System (WIS), engaging with the implementation of WIS 2.0, and to seek to implement the Strategy in a way compatible with WIS 2.0.

# Annex to Recommendation 8 (EC-70)

# Draft Resolution XX (Cg-18)

# Joint WMO and Intergovernmental Oceanographic Commission Strategy for Marine Meteorological and Oceanographic Data Management (2018–2021)

THE WORLD METEOROLOGICAL CONGRESS,

# Recalling:

- (1) Resolution 69 (Cg-17) WMO Strategic Plan (2016–2019),
- (2) Recommendation 8 (EC-70) on the Joint WMO and IOC Strategy for Marine Meteorological and Oceanographic Data Management (2018–2021),
- (3) Decision 18 (EC-70) on the overall approach to implement the WMO Information System (WIS) 2.0 Strategy, WIS 2.0,

#### Noting:

- The Intergovernmental Oceanographic Commission (IOC) of UNESCO Medium Term Strategy 2014–2021, and the IOC Strategic Plan for Data and Information Management (2017–2021),
- (2) That one of the objectives of the JCOMM is to implement and maintain a fully integrated end-to-end data management system across the entire marine meteorology and oceanographic community,
- (3) That the seventeenth World Meteorological Congress in Resolution 33 (Cg-17) decided to develop "Part C" of the WMO Information System (WIS) to provide guidance and standards for information management for which the first step of development was the WMO Workshop on Information Management held 2–4 October 2017,
- (4) With satisfaction the work of JCOMM in collaboration with its subsidiary bodies and with IOC of UNESCO to develop the Joint WMO and IOC Strategy for Marine Meteorological and Oceanographic Data Management (2018–2021) referred below as Strategy,
- (5) The draft Implementation Plan developed by JCOMM and responding to the Strategy,

# Considering:

- (1) The need to have a holistic and strategic approach with regard to marine meteorological and oceanographic data management in the WMO and IOC frameworks, involving all Programme Areas and the IODE,
- (2) That such strategic approach should be consistent with the current 2016–2019 and future WMO Strategic Plans, and the IOC Medium Term Strategy 2014–2021, including in particular the WMO Information System 2.0 Strategy and the IOC Strategic Plan for Data and Information Management (2017–2021),

(3) The need to be able to respond to fast technological developments in the area of data management, information systems, and emerging data issues (e.g. big data),

**Acknowledging** that JCOMM and the IODE will be able to offer their expertise to assist other groups (e.g. the Ocean Observations Panel for Climate) to specify and implement their own data management requirements, with the overall goal of integrating their data management into the overall end-to end data management system,

**Realizing** that the implementation of the Strategy may encounter limitations based on availability of resources,

**Adopts** the draft strategy as provided in the Annex to this Resolution, subject to parallel approval of the IOC assembly;

#### Requests:

- JCOMM to finalize the draft Implementation Plan responding to the Strategy in consultation with subsidiary bodies and the International Oceanographic Data and Information Exchange (IODE) of IOC of UNESCO;
- (2) JCOMM to assist the Commission for Basic System(CBS) in developing the information management component of WIS, engaging with the implementation of WIS 2.0, and to seek to implement the Strategy in a way compatible with WIS 2.0;

#### Invites:

- (1) IOC Assembly to approve the Strategy and to collaborate in the implementation of the Strategy;
- (2) IOC Assembly to promote the Strategy and its implementation with IOC Member States;

**Encourages** Members/Member States and all other contributors identified in the Strategy to collaborate with JCOMM with the view of realizing the outcomes expected from the Strategy;

**Requests** the Secretary General to bring the present resolution to the attention of all concerned.

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# Annex to draft Resolution XX (Cg-18)

# Joint WMO and Intergovernmental Oceanographic Commission Strategy for Marine Meteorological and Oceanographic Data Management (2018–2021)

The final version of the strategy will be included in the Annex to the draft Resolution XX/1 (Cg-18) in due course. The current version of the strategy is available in EC-70/INF. 7.2(2).

#### **Recommendation 9 (EC-70)**

#### Establishment of collaboration between the International Air Transport Association and WMO on the operation and development of the WMO Aircraft Meteorological Data Relay Programme

#### THE EXECUTIVE COUNCIL,

#### **Recalling**:

- (1) Decision 60 (EC-69) Potential future collaboration of WMO and the International Air Transport Association on the operation and development of the WMO Aircraft Meteorological Data Relay Programme, which endorsed the establishment of a Working Arrangement between WMO and the International Air Transport Association (IATA) under which the two organizations would work together to develop the terms of reference and concept of operations for future collaboration on the WMO Aircraft Meteorological Data Relay (AMDAR) Programme,
- (2) Decision 19 (EC-70) Mechanisms for provision of shared services, on the principle of procurement and contract management by the Secretary-General of services for shared use by Members and partner organizations,

**Noting** that a Working Arrangement was established between IATA and WMO in July 2017 regarding cooperation on matters related to the automated measurement and transmission of meteorological data from an aircraft platform, currently operational as the AMDAR programme, considered a key component of the WMO Global Observing System,

**Noting also that** Decision 60 (EC-69) requested the Secretary-General, in coordination with the president of the Commission for Basic Systems (CBS), to work with IATA to finalize and establish the Working Arrangement between the two organizations and to subsequently develop the concept of operations for the future possible collaboration between WMO and IATA on the operation and development of the AMDAR Programme,

**Noting further** Resolution 10 (RA VI-17) – Development of the Region VI AMDAR Programme under the IATA-WMO collaboration on AMDAR, through which Regional Association VI (RA VI) decided that, subject to IATA and WMO entering into a formal collaboration on AMDAR, on the basis of a decision of the Eighteenth World Meteorological Congress in 2019, RA VI would compile its requirements for AMDAR observations by July 2018, with a view to beginning development of the WMO Region VI AMDAR Programme under the IATA-WMO collaboration agreement in January 2019 and potentially beginning operation of the programme in January 2020,

**Having been informed** of the ongoing work on development of the proposed concept of operations and terms of reference for the IATA-WMO collaborative AMDAR Programme,

**Having been further informed** that IATA will play a significant role in ensuring that the agreed required AMDAR observations are provided efficiently and economically through promotion and coordination with its member airlines and the wider aviation industry,

**Convinced** that the collaboration will lead to the expansion and enhancement of the WMO AMDAR observing system globally and, as a result, bring increased and further benefits to meteorological applications and improvement to forecasting skills and services to aviation,

Endorses the continuing development of the IATA-WMO collaboration on AMDAR;

**Decides** to re-establish the Task Team on the IATA-WMO Collaboration on AMDAR, previously adopted by CBS, with the terms of reference provided in the annex to the present recommendation and reporting directly to the Executive Council, and authorizes the WMO

President to appoint the Task Team following the recommendation of the Management Group of the Commission for Basic Systems, which will keep the President of the Commission for Aeronautical Meteorology informed on this activity;

**Further decides** that the Secretary-General, in consultation with the Presidents of the Commission for Basic Systems and the Commission for Aeronautical Meteorology, will recommend to Congress the Working Arrangement, supporting agreement and Concept of Operations developed by the Task Team on the IATA-WMO Collaboration on AMDAR;

**Recommends** that Congress consider for approval the establishment of a Working Arrangement and supporting agreement between WMO and IATA to implement and operate the AMDAR Programme, subject to the satisfactory finalization by the Task Team of the proposed Concept of Operations and terms of reference of the collaboration, and of the draft Implementation Plan of the IATA-WMO Collaborative AMDAR Programme. This should potentially begin operation in January 2020;

**Requests** the Secretary-General and the Commission for Basic Systems to continue to coordinate, with the Executive Council, the information about the programme, seeking the endorsement of the Concept of Operations of the IATA-WMO Collaboration on AMDAR by all regional associations.

# Annex to Recommendation 9 (EC-70)

#### Terms of reference of the Task Team on the IATA-WMO Collaboration on AMDAR

The Task Team shall:

- 1) Work with International Air Transport Association (IATA) to investigate and resolve potential legal and other issues relating to the establishment of the IATA-WMO Collaborative WMO Aircraft Meteorological Data Relay (AMDAR) Programme;
- 2) Review and finalise the Concept of Operations and other related and required documentation necessary to support the decision making process for EC and Cg;
- Develop its proposal in accordance with Decision 19 (EC-70) on the principle of procurement and contract management by the Secretary-General of services for shared use by Members and partner organizations;
- 4) Oversee the formulation of related recommendations to EC-70 and Cg-XVIII;
- 5) Oversee the final establishment of the IATA-WMO Collaborative AMDAR Programme (IWCAP), its governance and operational structure and related agreements; and
- 6) Report as directed or as necessary to the WMO President on progress and issues.

# Recommendation 10 (EC-70)

# Members' contribution to the actions specified in the Implementation Plan for the Evolution of Global Observing Systems, in the context of the future WMO Integrated Global Observing System Implementation Plan

# THE EXECUTIVE COUNCIL,

**Recalling** Resolution 10 (EC-65) – Report of the fifteenth session of the Commission for Basic Systems relevant to integrated observing systems, which approved Recommendation 6 (CBS-15) – Implementation Plan for the Evolution of Global Observing Systems,

# Noting:

- (1) The Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP), WIGOS Technical Report No. 2013-4,
- (2) The final report of the eighteenth session of the Commission for Basic Systems Management Group, held in Geneva on 29 March 2018,

# Having considered:

- The need to facilitate implementation by Members of the actions specified in the EGOS-IP by raising awareness and commitment of the Permanent Representatives with regard to the benefits stemming from those actions,
- (2) That the Commission for Basic Systems, having monitored the status of EGOS-IP actions, found that they showed slow or limited progress (see EC-70/INF. 7.4(1)),
- (3) That the future WMO Integrated Global Observing System (WIGOS) Implementation Plan, which will be developed in response to the new WIGOS Vision 2040, due to be considered for approval by the Eighteenth World Meteorological Congress, will build on the EGOS-IP,
- (4) That there is an ongoing need to ensure appropriate evolution of global observing systems in order for WMO to be able to address the critical gaps of application areas,

**Recommends** that Congress request Members and identified implementing agents to take steps to better address implementation of some specific EGOS-IP actions, as listed in the annex to the present recommendation.

# Annex to Recommendation 10 (EC-70)

# Key actions of the Implementation Plan for the Evolution of Global Observing Systems to be carried out by Members

Members are encouraged to focus on the key EGOS-IP actions listed in the table below, and to provide feedback on how they are implemented at the national level. However, the remaining actions are also important and need to be addressed by the identified actors in the EGOS-IP.

Action No.	Action	Performance indicator
C3	WIS Standards – Ensure all operators producing observations adhere to the WIS standards.	Extent to which WIS standards are applied.

Action No.	Action	Performance indicator
C4	Users consultation – Careful preparation is required before introducing new (or changing existing) observing systems. The impact needs to be assessed through prior and ongoing consultation with data users and the wider user community. Also, data users need to be provided with guidance on data reception/ acquisition, processing and analysis infrastructure, the provision of proxy data, and the provision of education and training programmes.	Extent to which user community concerns are captured.
C7	"Change management" procedures – Ensure time continuity and overlap of key components of the observing system and their data records, in accordance with user requirements, through appropriate change-management procedures.	Continuity and consistency of data records.
C8	Data sharing principles – For WMO and co-sponsored observing systems, ensure continued adherence to WMO data sharing principles irrespective of origin of data, including data provided by commercial entities.	Continued availability of all essential observational data to all WMO members.
C12	Radio frequencies – Ensure a continuous monitoring of the radio frequencies which are needed for the different components of WIGOS, in order to make sure they are available and have the required level of protection.	Observation frequency bands available/not available with required level of protection.
G2	Hourly data exchange – Ensure, as far as possible, a global exchange of hourly data which are used in global applications, optimized to balance user requirements against technical and financial limitations.	The standard monitoring indicators used in global NWP.
G4	WIGOS Standards – Ensure exchange of observations from atmosphere, ocean, terrestrial observing system, according to the WIGOS standards. If needed, organize different levels of pre-processed observations in order to satisfy different user requirements.	Statistics on the data made available to each application.
G7	Radiosondes in data-sparse areas – Expand radiosonde stations, or re-activate silent radiosonde stations, in the data sparse areas of Regions I, II and III which have the poorest data coverage. Make all possible effort to avoid closing of existing stations in these data sparse areas, where even a very small number of radiosonde stations can provide an essential benefit to all the users.	The standard monitoring indicators used in NWP
G13	Radiosonde data availability – Identify radiosonde stations that make regular measurements (including radiosondes operated during campaigns only), but for which data are not transmitted in real time. Take actions to make data available.	A number of the above radiosonde stations providing data to GTS, plus standard monitoring indicators on radiosonde data availability and timeliness.
G14	HR Radiosonde data – Ensure a timely distribution of radiosonde measurements at high vertical resolution, together with position and time information for each datum, and other associated metadata.	Number of radiosonde sites providing the high resolution profiles.
G17	Regional remote sensing profiling stations – Develop networks of remote-sensing profiling stations on the regional scale in order to complement the radiosonde and aircraft observing systems, mainly on the basis of regional, national and local user requirements (although part of the measured data will be used globally).	A number of profiling stations providing quality- assessed data in real time to WIS/GTS.
G18	Processing & exchange of profiler data – Ensure, as far as possible, the required processing and the exchange of profiler data for local, regional and global use. When profiler data can be produced more frequently than 1 hour, a dataset containing only hourly observations can be exchanged globally following the WIS principles.	A number of profiling stations exchanged globally.

Action No.	Action	Performance indicator
G40	Metadata & representativeness of special stations – Ensure, as far as possible in real time, exchange of observations, relevant metadata, including a measure of representativeness made by surface-based stations serving specific applications (road transport, aviation, agricultural meteorology, urban meteorology, etc.).	A percentage of observations from the above stations exchanged regionally and globally in real-time.
G45	Dual polarization radars – Increase the deployment, calibration and use of dual polarization radars in those regions where it is beneficial.	Data coverage obtained from this type of radar for each Region.
G47	Weather radars for developing countries & DRR – For areas in developing countries which are sensitive to storms and floods, a special effort has to be made to establish and maintain weather radar stations.	The number of operational weather radar stations in the above areas.

# Recommendation 11 (EC-70)

# Use of the Observing Systems Capability Analysis and Review tool/Surface for the collection and recording of the WMO Integrated Global Observing System metadata

THE EXECUTIVE COUNCIL,

#### Noting:

- (1) The *Manual on the WMO Integrated Global Observing System* (WMO-No. 1160), and the obligation of Members to submit WMO Integrated Global Observing System (WIGOS) metadata about the observing systems they operate,
- (2) Recommendation 28 (CBS-16) Submission and maintenance of WMO Integrated Global Observing System metadata in the Observing System Capability Analysis and Review tool by Members,
- (3) The final report of the eighteenth session of the Commission for Basic Systems Management Group, held in Geneva on 29 March 2018,

**Having considered** that the development of machine-to-machine interfaces for the exchange of metadata between existing databases (including national databases) and the Observing Systems Capability Analysis and Review tool (OSCAR) is essential for the upload and management of the WIGOS metadata, for avoiding duplication of work and for increasing reliability and quality of WIGOS metadata in OSCAR,

# Recognizing:

- (1) That some observing systems, namely the Global Atmosphere Watch (GAW) with the GAW Station Information System (GAWSIS), the Global Ocean Observing System (GOOS), sponsored by the Intergovernmental Oceanographic Commission, the World Meteorological Organization, the United Nations Environment Programme and the International Science Council, with the JCOMM in situ Observations Programme Support Centre (JCOMMOPS) and the Global Observing System (GOS) with the WMO Weather Radar Database (WRD), have already developed their own information systems for WIGOS metadata,
- (2) That the above information systems should continue to be used and interfaced with OSCAR/Surface for centralizing all WIGOS metadata of surface-based observing systems within OSCAR/Surface,

(3) That Members have also developed national databases for the recording of WIGOS metadata, and that such databases ought to be preferably interfaced with OSCAR/Surface through machine-to-machine interfaces in order to reduce the workload of OSCAR/Surface National Focal Points and the risk of introducing typographic errors when using the human interface,

**Adopts** Recommendation 28 (CBS-16) – Submission and maintenance of WMO Integrated Global Observing System metadata in the Observing Systems Capability Analysis and Review tool by Members;

**Requests** the Secretariat and OSCAR/Surface Project Committee to ensure development and operational implementation of the Application Program Interface (API) for machine-to-machine interface with OSCAR/Surface by the end of 2018;

#### **Recommends** that Congress request:

- (1) Members to submit to OSCAR the required WIGOS metadata for all observing stations, as described below:
  - (a) For all relevant WIGOS observing systems operated by them, in addition to the ones explicitly listed below, (i) preferably through machine-to-machine interface as soon as available, or (ii) directly to OSCAR using human interface;
  - (b) For any GAW observing stations they operate, through the GAW Information System (GAWSIS);
  - (c) For any weather radars they operate, through the WRD;
  - (d) For any marine meteorological and oceanographic observing systems they operate, through JCOMMOPS;
- (2) Members operating their own databases of WIGOS metadata to develop and implement procedures for the use of machine-to-machine interfaces with OSCAR;
- (3) Members to consider collaborating and contributing to efforts of the Commission for Basic Systems to develop a WMO stand-alone national implementation metadata management tool for holding national WIGOS metadata;
- (4) Members who have not already done so to nominate OSCAR/Surface National Focal Points as soon as possible in order to ensure that WIGOS metadata in OSCAR/Surface are maintained to the agreed standard;
- (5) The Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology to ensure that JCOMMOPS will be fully compliant with the WIGOS metadata standard and to facilitate ingestion of relevant WIGOS metadata in its database while providing fully compliant machine-to-machine interfaces with the surface-based observation system component of OSCAR (OSCAR/Surface).

# Recommendation 12 (EC-70)

#### Radio frequencies for meteorological and related environmental activities

THE EXECUTIVE COUNCIL,

**Recalling** Resolution 29 (Cg-17) – Radio frequencies for meteorological and related environmental activities, and subsequent Executive Council decisions listed in the annex to the present recommendation,

**Noting** the final report of the eighteenth session of the Commission for Basic Systems Management Group, held in Geneva on 29 March 2018,

**Considering** the rationale detailed in the annex to the present recommendation,

**Recommends** that Congress adopt Draft Resolution XX (Cg-18) – Radio frequencies for meteorological and related environmental activities, as provided in the Annex to the present recommendation.

#### Annex to Recommendation 12 (EC-70)

#### Draft Resolution XX (Cg-18)

#### RADIO FREQUENCIES FOR METEOROLOGICAL AND RELATED ENVIRONMENTAL ACTIVITIES

THE WORLD METEOROLOGICAL CONGRESS,

#### **Recalling**:

- (1) Resolution 29 (Cg-17) Radio frequencies for meteorological and related environmental activities,
- (2) Decision 33 (EC-69) Preserving the radio-frequency spectrum for meteorological and related environmental activities at the World Radiocommunication Conference 2019,
- (3) Decision 22 (CBS-16) Preserving the radio-frequency spectrum for meteorological and related environmental activities at the World Radiocommunication Conference 2019,

#### Considering:

- (1) The prime importance of the specific radiocommunication services for meteorological and related environmental activities required for the detection and early warning of hazards and the prevention and mitigation of natural and technological (human-induced) disasters, the safety of life and property, the protection of the environment, climate change studies and scientific research,
- (2) The importance of information provided by the Earth exploration systems including meteorological systems for a wide range of economic activities such as agriculture, transportation, construction and tourism,
- (3) The crucial importance of the allocation of suitable radio-frequency bands for the operation of surface-based meteorological observing systems, including in particular radiosondes, weather radars and wind profiler radars,

(4) The crucial importance of the allocation of suitable radio-frequency bands for the operation of meteorological and research and development satellites, including remote-sensing, data collection and data distribution links,

**Stressing** that some radio-frequency bands are a unique natural resource due to their special characteristics and natural radiation enabling spaceborne passive sensing of the atmosphere and the Earth surface, which deserve adequate allocation to the Earth exploration satellite service (passive) and absolute protection from interference,

**Expresses** its serious concern at the continuing threat to several radio-frequency bands allocated to the meteorological aids, meteorological-satellite, Earth exploration satellite and radiolocation (weather and wind profiler radars) services posed by the development of other radiocommunication services;

**Requests** the Commission for Basic Systems to pursue the continuous review of regulatory and technical matters related to radio frequencies for operational and research meteorological and related environmental activities, and preparation of guidance and information for National Meteorological and Hydrological Services, in coordination with other technical commissions especially the Commission for Instruments and Methods of Observation, and in liaison with other relevant international bodies, in particular the Coordination Group for Meteorological Satellites;

**Requests** regional associations to coordinate on a regional basis contributions of meteorological experts to the work of relevant regional telecommunication organizations and of ITU-R, especially ITU-R Study Groups 5 and 7 on Terrestrial (including radiolocation) and Science Services, respectively;

Encourages RAs to establish a focal point on RFC matters;

**Urges** all Members to do their utmost to ensure the availability and protection of suitable radio-frequency bands required for meteorological and related environmental operations and research, and in particular:

- To ensure that their national radiocommunication administrations are fully aware of the importance of and requirements for radio frequencies for meteorological and related activities, and to seek their support in the ITU World Radiocommunication Conferences and Radiocommunication Sector (ITU-R) activities;
- (2) To participate actively in the national, regional and international activities on relevant radiocommunication regulatory issues and, in particular, to involve experts from their Services in the work of relevant regional telecommunication organizations and of ITU-R, especially ITU-R Study Groups 5 and 7 on Terrestrial (including radiolocation) and Science Services, respectively;
- (3) To register adequately with their national radiocommunication administrations all radiocommunication stations and radio frequencies used for meteorological and related environmental operations and research;

**Appeals** to the International Telecommunication Union and its Member Administrations:

- To ensure the availability and absolute protection of the radio-frequency bands which, due to their special physical characteristics, are a unique natural resource for spaceborne passive sensing of the atmosphere and the Earth surface and are of crucial importance for weather, water and climate research and operations;
- (2) To give due consideration to the WMO requirements for radio-frequency allocations and regulatory provisions for meteorological and related environmental operations and research;

(3) To pay special attention to the WMO positions related to the WRC agenda, in the light of Appeals (1) and (2) above;

**Requests** the Secretary-General:

- (1) To bring the present resolution to the attention of all concerned, including the International Telecommunication Union;
- (2) To pursue as a matter of high priority the coordination role of the Secretariat in radiofrequency matters, especially with ITU-R, including participation of WMO in ITU-R Radiocommunication Study Groups, conference preparatory meetings and World Radiocommunication Conferences;
- (3) To facilitate the coordination between National Meteorological and Hydrological Services and their national radiocommunication administrations, particularly in preparing for the ITU World Radiocommunication Conferences, by providing appropriate information and documentation;
- (4) To assist the Commission for Basic Systems in the implementation of the present resolution.

**Note:** This resolution replaces Resolution 29 (Cg-17).

# Recommendation 13 (EC-70)

# **Tropical Pacific Observing System 2020**

THE EXECUTIVE COUNCIL,

**Recalling** Decision 28 (EC-69) – Tropical Pacific Observing System 2020, which contains the rationale for WMO support to the Tropical Pacific Observing System (TPOS) 2020, recognized as a WIGOS preoperational phase pilot project, and an acknowledgment that the first report on the TPOS 2020 project includes recommendations for the sustained backbone observing system, and identification of pilots and process studies to further refine the future design while targeting forecast model systematic errors with key actions,

**Noting** Decision 27 (JCOMM-5) – Tropical Pacific Observing System 2020 transition and implementation, supporting implementation of the System through the TPOS 2020–JCOMM Transition and Implementation Task Team,

**Noting also** the efforts of TPOS 2020 to prepare a second report with recommendations on the implementation of a tropical pacific observing system, and that the report should be available around the beginning of 2019 at the latest,

**Recommends** that Congress review the second report and consider supporting its recommendations with relevant guidance to Members and constituent bodies.

# Recommendation 14 (EC-70)

# Ensuring adequate marine meteorological observations and data coverage for the safety of navigation and the protection of life and property in coastal and offshore areas

# THE EXECUTIVE COUNCIL,

# Recalling:

- (1) Article 2 of the Convention of the World Meteorological Organization, committing Members: "(a) To facilitate worldwide cooperation in the establishment of networks of stations for the making of meteorological observations as well as hydrological and other geophysical observations related to meteorology ... ", and "(b) "To promote the establishment and maintenance of systems for the rapid exchange of meteorological and related information",
- (2) The United Nations Convention on the Law of the Sea of 10 December 1982 (UNCLOS),
- (3) The report of the Third Committee (Preservation of the marine environment, Scientific research, Development and transfer of technology) of the Third United Nations Conference on the Law of the Sea (1973–1982), expressing the uncontested opinion of the Chairman that the provisions of part XIII of UNCLOS on marine scientific research would not create any difficulties or obstacles hindering adequate meteorological coverage from the ocean areas, including areas within the exclusive economic zones, carried out both in the framework of existing operational activities and international research programmes and by all vessels and indispensable for the issue of timely and accurate storm warnings for the safety of navigation as well as for the protection of life and property in coastal and offshore areas, since such operational and research activities had already been recognized as routine observation and data collecting which, although not covered by part XIII of the negotiating text, were in the common interest of all countries and had undoubted universal significance,
- (4) Resolution 9 (Cg-IX) United Nations Conference on the Law of the Sea, which requested the Executive Council and the Secretary-General: (a) To arrange, in close consultation with the president of the Commission for Marine Meteorology (now Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology), for a continuing review of the implications of the legal provisions of the Convention on the ocean-related activities of WMO with a view to informing the United Nations and Members of WMO, as appropriate; and (b) To take action, as necessary, to ensure that the ocean-related activities of WMO, both operational and scientific, are undertaken under the most favourable conditions,
- (5) Resolution 40 (Cg-XII) WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities, which recognizes marine meteorological observations as essential data,
- (6) The International Convention for the Safety of Life at Sea (SOLAS, 1974) as amended,

# Noting:

- (1) The Technical Regulations (WMO-No. 49), Volume I, Part I,
- (2) The Manual on the WMO Integrated Global Observing System (WMO-No. 1160),
- (3) The *Manual on Marine Meteorological Services* (WMO-No. 558), Volume I, Part I, defining WMO Members' responsibility for issuing warnings for high seas and coastal waters according to internationally agreed procedure,

**Realizing** that, at present, WMO plans and coordinates two types of activity over the oceans:

- Operational activities, such as those undertaken within the frameworks of the World Weather Watch and the Marine Meteorology and Oceanography Programme, and regulated under the WMO Integrated Global Observing System (WIGOS),
- (2) Marine scientific research activities, which are regulated under UNCLOS and may be undertaken or coordinated by WMO and partner organizations within the framework of WMO research and co-sponsored programmes such as the Global Ocean Observing System and Global Climate Observing System, sponsored by the Intergovernmental Oceanographic Commission (IOC), the World Meteorological Organization, the United Nations Environment Programme (UNEP) and the International Science Council (ISC),

# Considering:

- (1) That adequate marine meteorological data coverage from ocean areas, including those from the Exclusive Economic Zones (EEZs), is indispensable for the issue of timely and accurate storm warnings for the safety of life at sea and the protection of life and property in coastal and offshore areas,
- (2) That the SOLAS Convention, Chapter V, Safety of Navigation, Regulation 5, specifies that the contracting governments undertake, inter alia, to encourage the collection of meteorological data by ships at sea and to issue warnings of gales, storms and tropical storms,
- (3) That Members of WMO have undertaken the responsibility of issuing warnings for the high seas and coastal waters according to internationally agreed procedures,
- (4) That WMO-coordinated research programmes require extensive marine meteorological and oceanographic data sets from the world ocean, including EEZs,
- (5) That meteorological observations from satellites over the oceans, including over EEZs, are routinely made available for operational purposes,
- (6) That marine meteorological and oceanographic observations included in numerical models contribute to improving prediction skills at all time scales,
- (7) That marine observing platforms such as voluntary observing ships, data buoys, uncrewed surface vehicles, Argo profiling floats and sub-surface gliders are capable of providing meteorological observations primarily from data sparse areas of the ocean,

# Recognizing:

- (1) That since Resolution 9 (Cg-IX) was adopted, the observational user requirements of operational WMO applications, including global and high-resolution numerical weather prediction and sub-seasonal to longer-range prediction, and climate services have substantially evolved, and are now increasingly relying on marine meteorological and oceanographic observations,
- (2) The future direction of WMO, as part of the Strategic Plan, in support of Earth system prediction, which coupled with ocean models will be relying greatly on marine meteorological and oceanographic data made routinely available to WMO,
- (3) That in situ observations over the oceans complement satellite data for calibration and validation purposes, and that some of the marine meteorological and oceanographic observations, such as sea-level pressure, sub-surface temperature and salinity profile, cannot currently be adequately measured from space,

- (4) That technological advances can now provide in situ observational data of the requisite enhanced quality and spatial and temporal resolution, from the world oceans, including from EEZs,
- (5) That there is no clear regulation in place for the collection of marine meteorological and oceanographic measurements within EEZs in support of operational applications of WMO, while the IOC Guidelines for the Implementation of Resolution XX-6 of the IOC Assembly Regarding the Deployment of Profiling Floats in the High Seas within the Framework of the Argo Programme (IOC Resolution EC-XLI.4) are operated effectively,

**Recommends** that the eighteenth World Meteorological Congress adopt a resolution on the making of marine meteorological and oceanographic observations over the oceans, including EEZs, to replace Resolution 9 (Cg-IX);

**Requests** the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology jointly with the Commission for Basic Systems and the Commission for Instruments and Methods of Observation, including participating Members, to prepare a draft resolution on collecting operational meteorological measurements from EEZs for Congress approval, with the following objectives:

- (1) To check that operational meteorological observations are obtained from EEZs, and to propose new Technical Regulations in this regard;
- (2) To urge Members to continue to promote marine meteorological and related oceanographic observational and research programmes over the ocean for operational purposes;
- (3) To identify a mechanism for a continuing review of the implications of the legal provisions of SOLAS for the ocean-related activities of WMO with a view to informing the United Nations and Members of WMO, as appropriate;
- (4) To propose the necessary actions to ensure that WMO ocean-related operational and research activities aimed at supporting safety of navigation and protection of life and property are undertaken under the most favorable conditions;
- (5) To invite Members to support the referring of such a Congress resolution in the Resolution on Oceans and the Law of the Sea to be adopted by the seventy-fourth session of the United Nations General Assembly.

# Recommendation 15 (EC-70)

#### Seamless Global Data-processing and Forecasting System Implementation Plan

# THE EXECUTIVE COUNCIL,

#### Recalling:

- (1) Resolution 11 (Cg-17) Towards a future enhanced integrated and seamless Dataprocessing and Forecasting System, which:
  - (a) Decided to initiate a process for the gradual establishment of an enhanced, integrated and seamless WMO Data-processing and Forecasting System, in light of the conclusions of the first World Weather Open Science Conference (Montreal, Canada, August 2014),

- (b) Requested the Executive Council to provide terms of reference for this process and a description of the set of items the system should produce, for consideration by the eighteenth World Meteorological Congress,
- (2) Decision 55 (EC-68) Implementation of the Seamless Data-processing and Forecasting System, which endorsed the Vision for the Seamless Data-processing and Forecasting System and established a Steering Group with the main task of developing and proposing the implementation plan of the Seamless Data-processing and Forecasting System for consideration by the sixty-ninth session of the Executive Council,
- (3) Resolution 17 (EC-69) Seamless Data-processing and Forecasting System, which:
  - (a) Decided that the Executive Council Steering Group on the Seamless Data-processing and Forecasting System be co-chaired by the presidents of the Commission for Basic Systems (CBS) and the Commission for Atmospheric Sciences (CAS),
  - (b) Requested the Steering Group on the Seamless Data-processing and Forecasting System to develop a detailed implementation plan, in line with the ongoing development of the WMO Information System and the WMO Integrated Global Observing System, through consultations with regional associations and technical commissions, for consideration by the Executive Council at its seventieth session,
  - (c) Requested also the Secretary-General to arrange for the establishment of the Trust Fund for the implementation of the seamless Data-processing and Forecasting System,
- (4) Decision 50 (EC-69) An integrated research and development approach, which endorsed the principle of filling the gap between research and operations, and emphasized the need for a continuous joint consultation of research and operations with the user community, building research guidance related to operational support for impact-based forecast and risk-based warning systems,

**Considering** Strategic Objective 2.3 of the draft WMO Strategic Plan for the next financial period, 2020–2023 (see Recommendation 20 (EC-70)) on forecasting and prediction, which states: "Enable access and use of numerical analysis and Earth system prediction products, at all temporal and spatial scales, from the WMO seamless Global Data-processing and Forecasting System"; and Strategic Objective 3.2 : "Enhance the science-for-service value chain ensuring scientific and technological advances improve predictive capabilities",

**Considering further** that one of the focus areas of Strategic Objective 2.3 is to "Advance the GDPFS to accommodate increased emphasis on probabilistic forecasting and coupled Earth system modelling to improve predictions over timescales ranging from long-term climate variability to seasonal/sub-seasonal to short-term weather events",

**Noting** that the implementation of the future Global Data-processing and Forecasting System (GDPFS) is an extremely complex undertaking requiring ongoing consultation among regional associations, technical commissions, GDPFS Producing Centres, National Meteorological and Hydrological Services (NMHSs), academia and other partners to stay abreast of evolving science and technology in order to regularly refine and adapt implementation plans and activities, indicating a clear need for dedicated resources to ensure timely and effective implementation,

**Noting further** that the GDPFS needs to evolve, similarly to its sister programmes within the World Weather Watch (WWW) Programme, which have evolved respectively from the Global Telecommunication System (GTS) into the WMO Information System (WIS) and from the Global Observing System (GOS) into the WMO Integrated Global Observing System (WIGOS),

**Noting with satisfaction** the work of the Steering Group on the Seamless Data-processing and Forecasting System in developing the draft Seamless GDPFS Implementation Plan (see EC-70/INF. 8(2)), **Recognizing** that the consultation with the technical commissions, regional associations, World Meteorological Centres, Regional Specialized Meteorological Centres and other relevant bodies is ongoing and will lead to improvements in the Implementation Plan in the coming year,

**Endorses** the overall approach of the Executive Council Steering Group on Seamless GDPFS to the implementation of the future Seamless GDPFS, as described in EC-70/INF. 8(2), which was submitted to the CBS Technical Conference (TECO), the CBS Management Group meeting (March 2018) and the CAS Management Group (April 2018). The Executive Summary is provided in the annex to the present recommendation;

**Recommends** the draft Seamless GDPFS Implementation Plan to the Eighteenth World Meteorological Congress for approval;

**Urges** Members:

- (1) To provide their comments on the draft Implementation Plan and to assist in the definition of future pilot projects;
- (2) To contribute to the Trust Fund and support secondments to assist in fostering the Implementation Plan and establishing pilot projects;

**Requests** the Secretary-General to make available the resources needed to support the continued development of the Implementation Plan in a manner that strengthens the synergies between science and services.

#### Annex to Recommendation 15 (EC-70)

# Future Seamless Global Data-processing and Forecasting System Implementation Plan

#### **EXECUTIVE SUMMARY**

Authoritative weather, ocean, water, climate and other related environmental information is critical in preparing for and responding to natural disasters, and in ensuring the safety and efficiency of day-to-day socioeconomic activities and sustainable long-term planning and decision-making. When combined with socioeconomic and vulnerability data the information can help to understand the impacts of environmental conditions and be used to improve the safety, security and competitiveness of citizens and economies.

The effect of environmental conditions on society is increasing as the climate changes, as populations move to mega-cities, as reliance on infrastructure and connectivity grows and becomes essential to food production, water supply protection and overall quality of life. Recent scientific and technological advances bring new opportunities for the provision of environmental information but also present new challenges. This is fundamentally impacting the way meteorology and hydrology is conducted and delivered globally and is forcing WMO Members to rethink National Meteorological and Hydrological Service (NMHS) business models and the World Weather Watch (WWW).

The three components of the WWW are evolving given advances in science and technology and the evolving needs of society. As the Global Observing System (GOS) evolves into the WMO Integrated GOS (WIGOS) and the Global Telecommunications System into the WMO Information System (WIS), the GDPFS needs to evolve into the future seamless GDPFS (S/GDPFS) given: the need to move beyond the WWW to address societal needs for relevant, coherent and authoritative weather, water, climate and other environmental information; the trend toward Earth system modelling to provide products at all timescales and to all sectors and applications that require such information; the opportunity to leverage the recent unprecedented improvement in the availability of computing power and the accuracy and forecast lead-time of numerical prediction across a wide range of time and space scales; the need to consider the increasing role of the private sector in the global weather enterprise and rethink engagement with partners; and the need for increased effectiveness and efficiency in delivering on the core purpose of WMO.

In the context of the S/GDPFS, seamless refers not only to all compartments of the Earth system, but also all disciplines of the weather-climate-water-environment value cycle (monitoring and observation, models, forecasting, dissemination and communication, perception and interpretation, decision-making, end-user products) to deliver tailor-made weather, climate, water and environmental information covering minutes to centuries and local to global scales.

The GDPFS is an international mechanism that coordinates Members capacities to prepare and make meteorological analyses and forecast products available to all Members. The Manual on the GDPFS (WMO-No. 485) provides the overall framework of technical regulations and includes the criteria for designation of operational centres at Global, Regional and National levels. The GDPFS has proven to be an effective mechanism to make modeling and prediction capabilities available to countries that do not have them so that they can provide better meteorological services to their populations. However, more and more, the private sector is becoming active in the delivery of value-added meteorological services around the world. The GDPFS evolution needs to take advantage of this in order to increase its usefulness and maintain its relevance to Members.

EC-68 endorsed a Vision for a future Seamless Global Data-processing and Forecasting System (S/GDPFS) with the following characteristics:

- (a) The future S/GDPFS will be a flexible and adaptable ecosystem of independent centres that will expand and strengthen prediction of the environment, making impact-based forecasts and risk-based warnings accessible, thus enabling Members and partners to make better informed decisions;
- (b) The S/GDPFS will facilitate partnerships and collaboration globally and regionally among jurisdictions, academia and the private sector to access and make available related information of relevance to the mandate of WMO across all timescales and domains of the Earth system;
- (c) The S/GDPFS will, as much as possible, share authoritative weather, water, climate and related environmental data, products and services freely and openly and in a viable and sustainable way, ensuring no Members are left behind.

This implementation plan is built on the solid foundation of the current GDPFS structure, considered as a baseline. It lays out areas in which action must be taken in order to develop the S/GDPFS system, deliver the necessary research and innovation and enhance the accessibility of the information. A number of overarching challenges need to be addressed as part of the implementation process. Furthermore, the need for a new interactive model linking science and services is emphasized. Pilot projects and benchmarks will be designed to advance all action areas with appropriate time built in for "shakedown" and realistic target dates for operationalization. In fact, there are many initiatives already under way that can be linked directly to GDPFS evolution.

This implementation plan will be further developed and refined in preparation for submission to Cg-18, responding to the decisions of EC-70, in close consultation with the WMCs and RSMCs, and taking input from all relevant WMO programmes, technical commissions and regional associations and from external partners.

#### **Overarching Issues**

The GDPFS Manual will articulate a business model and will have built-in processes and mechanisms to ensure flexibility, sustainability and long-term relevance.

Governance mechanisms will be improved to identify and fill internal gaps in capabilities, broaden coverage to include Earth system compartments while avoiding proliferation of centres and duplication of effort, and sharpen the WMO designation process.

All facilities of the future S/GDPFS platforms will adhere to a Quality Management System and will be regularly audited for compliance with designation criteria. Verification procedures will be established with reporting and tracking of product quality. Mechanisms will be developed to identify end users and obtain their feedback and initiate activities to provide the necessary improvements.

A strategy to develop a skilled, trained, knowledgeable, innovative and diverse workforce will be implemented. Training methodologies will be implemented to increase the capacity within NMHSs to use S/GDPFS platforms, information and tools.

Key sectors of the weather enterprise will be identified, and interfaces designed to enable a smooth interaction by all players involved. Networking people with different kinds of knowledge and ways of tackling problems will be leveraged to promote innovation in the Earth system sciences and a better link will be established between WMO activities and related existing initiatives.

A culture of co-designing future activities that involves all players will facilitate achievement of some of the Sustainable Development Goals and could leverage access to financial resources from the societal sectors where effective user engagement is taking place or from international funding structures.

#### System and services action areas

#### Integration and customization

Through this action area, WMO will evaluate and foster the development of seamless services using the outputs and results of the Quality Management System (QMS) which will assess the technical and scientific quality of the services including the value to members and users.

# Interoperability

The future S/GDPFS will be able to exchange and use data from a variety of sources, including vulnerability and exposure data to facilitate impact-based forecasting and risk-based warnings across different disciplines.

# **Coordination and regulations**

The future S/GDPFS will benefit from a higher level of coordination internally, with other WMO systems and with external agencies and organizations.

#### **Research and innovation action areas**

#### Science for services

Research and innovation will strengthen the science linkages among compartments of the Earth system to spawn the development of innovative products on all time-space scales, adapt to new emerging technologies, and promote socioeconomic research within the weather enterprise value cycle. Key elements will be modularity, operational-oriented development of modelling and data tools, and open-source strategy. A rolling review will be established to understand user requirements in all socioeconomic sectors acts as a key input to research in support of the development of impact-based services.

#### Seamless prediction

All compartments of the Earth system as well as disciplines of the weather enterprise value cycle will be advanced through seamless prediction. Research in all relevant disciplines will facilitate delivery of tailor-made environmental information from minutes to decades and from global to local.

# Accessibility and web platform action areas

# Availability and visibility

The system will provide access to data, models and products in a user-friendly manner, ensuring interoperability and integration with other systems, geospatial reference data, metadata and advanced standards and documentation. Technological aspects such as federated nodes and bandwidth issues will be considered and linked to WIS development. The whole S/ GDPFS infrastructure will be visible and easy to identify.

# Usability: monitoring software and user-oriented tools

Software infrastructure will produce web tools for handling data and creating on-demand products based on core requirements; the maintenance of metadata and infrastructure will be clarified in collaboration with WIS-WIGOS. The usability of the future S/GDPFS will be enhanced significantly, considering aspects such as authenticity of the source, quality of access and cost effectiveness. Focus areas are providing tools/documentation on how to combine/interpret multiple datasets, providing guidance on seamless products (help desk services), developing integrated web tools for tailoring information, ensuring local ownership and developing downstream statistics.

# Developing an interactive model linking science and services

A new interactive model for integrating science and services will increase the effectiveness of research to operations knowledge transfer to provide improved weather, climate, water and related environmental services to Members and include multiple interactions between the research and operational communities to address the needs of users, stakeholders and decision-makers.

A key part of the implementation of the future S/GDPFS will be the definition and carrying out of benchmarks, pilot projects and test beds. These can, for example, allow some of the more challenging aspects to be tested in a research or quasi-operational setting. Currently a number of potential activities have been identified around:

- Developing and strengthening regional partnerships e.g. around the new RSMC on nowcasting in Japan and the existing SWFDP to co-design activities, develop products of mutual benefit and work together on verification;
- Seamless prediction at the weather-climate interface e.g. by leveraging the Polar Prediction Project to engage and determine stakeholder requirements to identify how the future requirements might develop across a range of time and space scales;
- Seamless Prediction from minutes to hours: enabling a seamless transition from nowcasting to numerical weather prediction in a probabilistic framework; e.g. around the RSMCs on nowcasting, limited-area deterministic weather prediction, and limited-area ensemble numerical prediction in Offenbach (Germany) and the WWRP;
- Developing public-private partnerships e.g. leveraging pilot projects in the field of big data and analytics currently underway in Canada and the US with IBM and others to demonstrate the potential of these private sector applications;

- Seamless prediction at multiple geographic scales e.g. developing integrated air quality monitoring, prediction and forecast systems in Africa under the auspices of Global Atmosphere Watch from Pan-African to Urban scale to inform populations of expected acute pollution events;
- Developing probabilistic products e.g. a pilot project to link the CHAMP project with GLOFAS to develop experimental hydrological products such as ensemble streamflow forecasts, flood warnings, and net basin supply and make them visible and accessible;
- Assessing future multiscale requirements e.g. a joint activity of the Lead Centre for Long-range Forecasting and the Seasonal to Sub-seasonal Prediction Project to enhance the visibility of the Lead Centre, improve access to data and quantify its usage, define and implement an interactive science-to-services approach based on the value cycle for selected applications.

The future S/GDPFS will bring benefits to different user communities including:

- stakeholders responsible for high-impact events preparedness;
- sectors using weather and climate information (e.g. energy, agriculture);
- health sector;
- urban stakeholders and city planners.

Those benefits will include:

- Members are enabled to harness the power of environment prediction;
- Enhanced information is available to make quicker and better decisions;
- Improved access to information and data by NMHS saves time and resources, allowing them to add more value to their services;
- Members will have the tools and skills to handle the growing and complex data and information;
- NMHSs will have more time to apply skills and expertise through further automation of routine tasks;
- New observations, new science and new technologies are pulled through into operational services; and
- By 2025, in line with WIS2 implementation plan milestones, the further development of S/ GDPFS will result in substantial benefits for developing NMHSs.

While this IP can be considered a "roadmap" it is by no means the detailed work plans that are needed to identify specific deliverables, their interdependencies, the resources required and identification of responsible persons or working groups in carrying them out. It will be important for the Steering Group to task development of detailed plans for implementation to the various constituent bodies and their working structures as soon as possible. The Steering Group must be vigilant in terms of overarching policy concerns and from time to time review and seek guidance from Congress/EC where appropriate e.g. related to governance, data policy, role of the private sector, etc.

The design and development phase will continue until at least the end of 2019 in order to consolidate project participants and contributing stakeholders. Following approval of the implementation plan by Cg-18 (2019), initial implementation activities will start in mid-2019 and by 2025, the core services required for the operation of S/GDPFS will be fully operational.

Building on experience from SWFDP, a Project Office with a full-time programme manager will be established within the Secretariat to coordinate the implementation and support of all implementation activities.

# Recommendation 16 (EC-70)

# Key directions of the polar and high-mountain agenda for the next WMO financial period (2020–2023)

THE EXECUTIVE COUNCIL,

# **Recalling:**

- (1) Resolution 40 (Cg-17) WMO polar and high-mountain activities,
- (2) Decision 45 (EC-69) Development and implementation of the Global Cryosphere Watch,
- (3) Decision 48 (EC-69) Polar and high-mountain regions priority activity,
- (4) Resolution 16 (EC-69) Executive Council Panel of Experts on Polar and High-mountain Observations, Research and Services,

**Noting** the reports of the sixth, seventh and eight sessions of the Executive Council Panel of Experts on Polar and High-mountains Observations, Research and Services (2015, 2017 and 2018),

# Having considered:

- (1) The need to scope WMO polar and high-mountain activities within the draft Strategic Plan,
- (2) That WMO is an Observer to the Arctic Council and an invited Expert to the Antarctic Treaty, and the need to provide input on polar policy matters to the Arctic Council and Antarctic Treaty,

**Recommends** considering WMO polar and high-mountain activities as part of the WMO Strategic Plan;

**Recommends** to Congress draft Resolution XX (Cg-18) – WMO polar and high-mountain activities, as provided in the annex to the present recommendation;

**Requests** the Executive Council Panel of Experts on Polar and High-mountains Observations, Research and Services to keep the list of proposed activities under review and to make a final proposal to Congress (i.e. a revision of the annex to the present recommendation, with details about each planned activity).

# Annex to Recommendation 16 (EC-70)

# Draft Resolution XX (Cg-18)

# WMO polar and high-mountain activities

THE WORLD METEOROLOGICAL CONGRESS,

#### Recalling:

- (1) Resolution 40 (Cg-17) WMO polar and high-mountain activities,
- (2) Resolution 41 (Cg-17) Antarctic Observing Network,
- (3) Resolution 48 (Cg-17) Global Integrated Polar Prediction System,
- (4) Resolution 49 (Cg-17) Year of Polar Prediction,
- (5) Resolution 43 (Cg-17) Global Cryosphere Watch,
- (6) The WMO Strategic Plan,
- (7) Resolution 40 (Cg-XII) WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities,

**Noting** *Manual on WMO Integrated Global Observing System* (WMO-No. 1160), and the regulation of the Antarctic Observing Network (AntON),

# Having considered:

- (1) That considerations 1 to 11 of Resolution 40 (Cg-17) with regard to the rationale for WMO polar and high-mountain activities remain valid,
- (2) The societal needs in both polar and high-mountain regions related to weather, water and climate changes, and the risks to society related to water scarcity and disaster resilience in high-mountain regions,
- (3) The achievements of the Executive Council Panel of Experts on Polar and High-mountain Observations, Research and Services (EC-PHORS) in ensuring coordination of operational activities with other international organizations active in polar and high-mountain regions and in engaging WMO technical commissions and regional associations in the work of the Panel,
- (4) The role of WMO being an Observer to the Arctic Council and an invited Expert to the Antarctic Treaty;

# Decides:

- (1) That an integrated approach continues to be needed to provide required services to users and advice to governments about adaptation and mitigation, based on an understanding of the global impact of changes in polar and high-mountain regions, and as the changing climate in the polar regions will have an impact on weather and climate in other regions of the world, teleconnection impact studies will be part of this integrated approach;
- (2) That the future priorities for WMO Polar and High-Mountain Regions Activities within the new Strategic Plan should be those provided in Annex to this Resolution;

- (3) That operational and research observing networks including AntON, the observing component of GCW, oceanographic observations and other activities in polar and High-Mountain regions, should be integrated within the framework of WIGOS and WIS;
- (4) That concerted efforts continue to be made to engage Members, technical commissions and regional associations, as well as the World Weather and Climate Research Programmes and other relevant research and international bodies, to improve services in high-latitude and high altitude regions by promoting observations and predictive capability on timescales from hours to centuries;

**Invites** Members, particularly those that have operational activities in polar and high-mountain regions:

- (1) To ensure continuity of their weather, climate, hydrology and related environmental activities in polar and high-mountain regions;
- (2) To ensure that appropriate hydrometeorological and related environmental data from publicly funded research is made available to the operational community in real time or near real time;
- (3) To provide additional observations in polar and high-mountain regions by using manned and automatic hydrometeorological stations, atmospheric soundings, remote-sensing systems and other geophysical observatories on land, by recruiting additional voluntary observing ships, by equipping aircraft with appropriate means of recording and distributing observations, and by deploying automated observing platforms on and under the sea and ice, in order to meet the needs of numerical weather prediction, hydrological services, climate studies and research programmes, including in particular the Year of Polar Prediction Special Observing Periods (SOPs);
- (4) To enhance their satellite programmes in delivering appropriate satellite observing system infrastructure and products and services required for polar and high-mountain regions;
- (5) To consider the possibility of cooperating with other Members in sharing the costs of reopening and operating previously functioning stations, in expanding existing stations or in deploying new observing and communication systems;
- (6) To support WMO polar and high-mountain activities by providing both human and financial resources in its endeavours to enhance observations, research and services in polar and high-mountain regions;

**Encourages** Members to liaise with all their national groups that may have operational activities in polar and high-mountain regions;

#### Requests the Executive Council:

- (1) To promote the coordination of weather, climate, hydrology and related environmental activities in polar and high-mountain regions and facilitate execution of this Resolution,
- (2) To ensure close collaboration with other international organizations concerned such as the Antarctic Treaty Consultative Meeting, the Arctic Council, the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization, the Group on Earth Observations and the International Science Council and their relevant bodies (for example, the Scientific Committee on Antarctic Research, the International Arctic Science Committee, the International Association of Cryospheric Sciences) and other relevant associations of the International Union of Geodesy and Geophysics, the Council of Managers of National Antarctic Programs, the Forum of Arctic Research Operators, the Third Pole Environment, and the International Centre for Integrated Mountain Development,

(3) To ensure that WMO polar and high-mountain priority activities described in the Annex to this Resolution are aligned with the WMO Strategic Plan;

**Requests** the regional associations and the technical commissions to support WMO polar and high-mountain activities;

**Requests** the Secretary-General to bring the present resolution to the attention of all concerned.

Note: This resolution replaces Resolution 40 (Cg-17), which is no longer in force.

# Annex to draft Resolution XX (Cg-18)

# Priority activities for polar and high-mountain regions for the next financial period, as part of the WMO Strategic Plan

The following priority activities are proposed for WMO polar and high-mountain activities as part of the Strategic Plan:

No.	Activity	Strategic Goals
1	Surface and Space Observations	2, 3
2	Polar Predictions and Services, including Climate Services	1 and 2
3	GCW Preoperational Phase	1, 2 and 4
4	High-Mountain Activities	1, 2, 3, 4 and 5
5	Transition from Research to Operation and Services	2, 3 and 5
6	Resources and Partnership	2, 3 and 5

[Secretariat note: The above activities are described in detail in EC-70/INF. 9; EC-PHORS is tasked to further elaborate them in the view to propose a new version of this annex with details about each activity]

# Recommendation 17 (EC-70)

# Preoperational phase of the Global Cryosphere Watch

THE EXECUTIVE COUNCIL,

# Recalling:

- (1) Resolution 43 (Cg-17) Global Cryosphere Watch,
- (2) Resolution 27 (EC-70) Terms of reference of the Executive Council Panel of Experts on Polar and High-mountain Observations, Research and Services,
- (3) Resolution 29 (EC-70) Global Cryosphere Watch Surface Observing Network,

**Noting** the recommendations of the eighth session of the Executive Council Panel of Experts on Polar and High-mountain Observations, Research and Services,

#### Having considered:

- (1) The overall progress made in the development of the Global Cryosphere Watch (GCW) as a cross-cutting, end-to-end activity within the WMO Programmes,
- (2) The progress made on engaging research and operational organizations in establishing the Global Cryosphere Watch Surface Observing Network, including its regulatory framework,
- (3) The joint efforts of GCW and the Arctic and Third Pole Regional Climate Centres (under development) to define relevant cryosphere-specific climate products,
- (4) The engagement of GCW at the regional level,

**Recommends** to Congress draft Resolution XX (Cg-18) – Preoperational phase of the Global Cryosphere Watch, as provided in the annex to the present recommendation.

# Annex to Recommendation 17 (EC-70)

#### Draft Resolution XX (Cg-18)

#### Preoperational phase of the Global Cryosphere Watch

# THE WORLD METEOROLOGICAL CONGRESS,

# Noting:

- (1) Resolution 43 (Cg-17) Global Cryosphere Watch,
- (2) Resolution 27 (EC-70) Terms of Reference of the Executive Council Panel of Experts on Polar and High-mountain Observations, Research and Services,
- (3) Resolution 29 (EC-70) Global Cryosphere Watch Surface Observing Network,
- (4) Decision 21 (RA II-16) Development of the Asia High-Mountain Global Cryosphere Watch Observing Network,
- (5) Decision 20 (RA IV-17) Development and implementation of the Global Cryosphere Watch in the polar and high-mountain regions of Regional Association IV,
- (6) Decision RA VI-17/18 on the RA VI engagement with the Global Cryosphere Watch,
- (7) Resolution 1 (CHy-15) Response of the Commission to decisions of Congress of relevance to hydrology and water resource management,
- (8) Resolution 8 (JCOMM-5) Services and Forecasting Systems Programme Area, and Annex to Resolution 8 (JCOMM-5),
- (9) Decision 6 (JCOMM-5) Collaboration with the Global Cryosphere Watch,

#### Further Noting:

(1) The GCW Implementation Plan, as updated under the auspices of the Executive Council,

(2) That GCW is a significant contributor to the implementation of Global Framework for Climate Services,

#### Noting with satisfaction:

- (1) The progress made on engaging research and operational organization on establishing the GCW Surface Observing Network, and development of the GCW Data Portal as a Data Collection and Production Centre,
- (2) That joint efforts between GCW and the Arctic and Third Pole Regional Climate Centres are resulting in the definition and use of relevant cryosphere specific climate products,
- (3) The engagement with the Arctic, Antarctic, and high-mountain scientific communities on standardization of observations, data exchange, and information on the state of the cryosphere;

**Noting also** that the development of GCW has progressed with resources allocated by Seventeenth Congress, and with support from extra-budgetary resources,

Taking note of the outcome of the WMO High-mountain Summit,

**Appreciating** the important contributions being made by Members, partner organizations and programmes towards the implementation of GCW as a mechanism for providing authoritative information on the state of the world snow and ice resources,

# Mindful:

- (1) That cryosphere is global, existing in various forms spanning all latitudes and occurring in approximately 100 countries in addition to the Antarctic regions,
- (2) That cryosphere-related feedbacks in the amplification of climate change cause impacts on weather, climate and water globally;

**Decides** that the development of GCW will continue during its preoperational phase in the eighteenth financial period, with the aim proving to Members the benefits of a fully operational, end-to-end GCW, as a cross cutting activity, from 2024 onward;

#### Decides further:

- (1) That the GCW priorities during the preoperational phase, will be:
  - (a) Supporting Members in developing national frameworks for cryosphere end-to-end monitoring and service partnership;
  - (b) Developing and publishing value added cryosphere products, relevant to water resource and ecosystems management, to safety (e.g. transportation), to understanding natural hazards and risks, to energy production, etc.;
  - (c) Establishing the GCW Data Portal as a Data Collection or Production Centre (DCPC) in the WMO Information System (WIS), thus improving the access to, and the management of quality of current and past cryosphere data, information, and products;
  - (d) Developing and publishing GCW regulatory and guidance material, including for supporting capacity development;
- (2) That special priority must be given to those activities which will assist Members in addressing national cryosphere related priorities (e.g. water resource management, disaster risk reduction), with a special focus on developing countries;

#### **Requests** the Executive Council:

- (1) To approve the draft Plan for the GCW preoperational phase;
- (2) To provide oversight of GCW during the preoperational phase;
- (3) To re-establish the GCW Steering Group, with strengthened regional representation, to guide the further implementation of GCW;
- (4) To develop a plan for the transition of GCW within the working structure of WMO, by the end of the eighteenth financial period;
- (5) To ensure the representation of agencies undertaking cryosphere related activities;

#### **Requests** the regional associations:

- (1) To support Members regarding specific cryosphere related priorities within the framework of the GCW Implementation Plan, subject to availability of resources;
- (2) To collaborate with GCW on the development of cryosphere products, capacity development, and outreach activities, relevant to their Members;

**Requests** the Technical Commissions to collaborate with GCW in developing technical standards, guidelines, and products for sustainable cryosphere services;

#### **Urges** Members:

- (1) To further sustain the observing component of GCW, within the WMO Integrated Global Observing System, especially in data-sparse regions, and in support of application areas relying on cryosphere information;
- (2) To develop national cryosphere related implementation plans, addressing emerging issues on climate, water, natural hazards, etc.;
- (3) To make historic research and routine cryosphere data available via the GCW Data Portal or other appropriate Data Collection and Production Centres, and archiving them for climate purposes;
- (4) To include the GCW stations within the framework of the WIGOS Data Quality Management System;
- (5) To contribute to the GCW Trust Fund, facilitating the development of products and services, as defined in the Implementation Plan;

#### **Invites** partner organizations:

- (1) To participate in relevant activities during the GCW preoperational phase;
- (2) To support the implementation of GCW by contributing with human and financial resources;

# Requests the Secretary-General:

- To ensure, to the extent possible, within available resources, the appropriate support for preoperational phase of GCW;
- (2) To take the necessary actions to further develop and maintain WMO collaboration in matters of cryosphere, through GCW, with relevant organizations, agencies, groups and institutions.

**Note:** This resolution replaces Resolution 43 (Cg-XVII), which is no longer in force.

# Recommendation 18 (EC-70)

# Future WMO research and supporting activities

THE EXECUTIVE COUNCIL,

**Having considered** the recommendations of the seventeenth session of the Commission for Atmospheric Sciences, as contained in the abridged final report of that session,

**Appreciates** the work done by the Commission for Atmospheric Sciences and the outcomes of the Science Summit that preceded the seventeenth session of the Commission;

#### Recommends to Congress:

- (1) Draft Resolution XX/1 (Cg-18) Integrated and coordinated WMO research to serve society, as laid out in Annex 1 to the present recommendation;
- (2) Draft Resolution XX/2 (Cg-18) A seamless research structure for WMO, as laid out in Annex 2 to the present recommendation;
- (3) Draft Resolution xx/3 (Cg-18) Seamless regional research for water, as laid out in Annex 3 to the present recommendation;
- (4) Draft Decision XX (Cg-18) Creating an environment for innovation and its optimal resourcing, as laid out in Annex 4 to the present recommendation;

**Considering** the need for promoting research across temporal and spatial scales, and the outcomes of the mid-term review of the Sub-seasonal to Seasonal Prediction project (see EC-70/INF. 10.1),

**Considering further** the advances made in downscaling atmospheric chemical composition forecasting, and the outcomes of the meeting on air-quality forecasting for Africa (see EC-70/INF. 10.1),

Endorses the second phase of the Sub-seasonal to Seasonal Prediction project;

**Requests Members** to support the Monitoring, Analysis and Prediction of Air Quality project as a priority activity for Region I;

**Taking note** of the request made by the seventeenth session of the Commission for Atmospheric Sciences to the Environmental Pollution and Atmospheric Chemistry Scientific Steering Committee to develop a recommendation on the use of low-cost sensors for air-quality observations,

**Noting with appreciation** the statement of the Commission for Atmospheric Sciences entitled:Low-cost sensors for the measurement of atmospheric composition: overview of topic and future applications (see EC-70/INF. 10.1),

**Requests** the Commission for Atmospheric Sciences, in collaboration with the Commission for Instruments and Methods of Observation, to continue developing guidance on good practices for characterization and utilization of emerging measurement technologies, including low-cost sensors and reference instruments;

**Recommends** to consider the representatives of the regional associations in the Commission for Atmospheric Sciences Management Group as a crucial point of contact for WMO research programmes, and to task the regional representatives with advocating the agreed priorities of the region and with promoting the interaction of regional associations with the WMO research programmes for mutual benefit;

**Requests** the Secretary-General, within available resources, to provide support to ocean research in particular in least developed countries, developing countries and small island developing States, in collaboration with relevant bodies.

# Annex 1 to Recommendation 18 (EC-70)

# Draft Resolution XX/1 (Cg-18)

# Integrated and coordinated WMO research to serve society

THE WORLD METEOROLOGICAL CONGRESS,

# **Recalling:**

- (1) Decision 50 (EC-69) An integrated research and development approach, which includes the main principles to fill the gap between research and operations,
- (2) Decision 41 (EC-69) Guidelines for the development of an integrated operational platform to meet urban service delivery needs, which requested to "expedite work on a Guide for Urban Integrated Hydrometeorological/Climate/Environment Services, using the expertise of the WMO GAW (Global Atmosphere Watch) Urban Research Meteorology and Environment (GURME)" project, which would improve the connection between research and operations,

# **Recognizing:**

- (1) The advances in Earth system prediction that integrate different time scales and compartments, and the growing need of the user community for more sophisticated services,
- (2) That better integration of science and services requires a move from the current linear model of sporadically transferring research results to operations, to an interactive model in which stakeholders assess and articulate their future needs, researchers work in dialogue with stakeholders to define and implement appropriate research programmes, the research results are transferred to operations at appropriate intervals, and stakeholder needs and research programmes are refined taking into account the knowledge and experience gained,
- (3) That the World Climate Research Programme and programmes of the Commission for Atmospheric Sciences (the World Weather Research Programme and Global Atmosphere Watch) draw on the capabilities of a much larger science community than those in National Meteorological and Hydrological Services (NMHSs), and that those capabilities are fundamental for advancing the WMO strategy for service delivery,
- (4) That WMO research activities have a central role in promoting innovation across different service applications and that their coherence and consistency are an added value for WMO in promoting its international profile,

**Noting** that the development of specific services in diverse application areas requires involvement of the scientific community at all stages of the production chain,

**Decides** that WMO research needs to be better integrated and more closely coordinated across weather, climate, water and related environmental domains in order to provide the necessary scientific and technical advances needed to address the growing need for targeted and societally relevant services and to create an attractive environment in which NMHSs, academic institutions, the private sector and end users can engage in research to their mutual benefit;

**Requests** WMO technical commissions and regional associations:

- To co-design in advance, when designing operational projects that rely on research, with WMO research Programmes the full range of activities that are required to bring a new or improved service or supporting system from conception through the different phases of production;
- (2) To promote the development of integrated research pilots to foster the value chain approach by jointly identifying research needs based on regional priorities for meteorological and environmental services;

**Urges** Members to improve connections between NMHSs and research institutions and academia on a national level to ensure that research responds to the requirements for the development of new services, and that the advances in research are appropriately included in operations;

#### **Requests** the Secretary-General:

- To take all necessary actions, within available budgetary resources, to ensure a strongly coordinated and integrated WMO research function to support science-based services that will promote innovation across the Organization;
- (2) To ensure a coordination mechanism within the Secretariat, led by the Research Department, to identify and coordinate, according to the agreed principles of the integrated research and development approach, WMO activities aimed at developing new or improving existing services and supporting systems in the weather, climate, water and related environmental domains;
- (3) To assist Members in promoting research as part of the development of new and enhancement of existing services, particularly in developing countries, by promoting capacity-building, facilitating training and exchange of scientists, and providing guidance and advice, as required, within available budgetary resources;
- (4) To take all necessary actions to initiate, develop and maintain WMO collaboration in matters related to weather, climate, water and related environmental research with relevant organizations, agencies, groups and institutions, from both the public and private sectors.

#### Annex 2 to Recommendation 18 (EC-70)

# Draft Resolution XX/2 (Cg-18)

#### A seamless research structure for WMO

THE WORLD METEOROLOGICAL CONGRESS,

#### Noting:

- (1) That leveraging the predictive skill at a broad range of temporal and spatial scales that are inherent in the various components of the Earth system and their interactions would allow Members to improve their services,
- (2) That the Data-processing and Forecasting System (DPFS), through Resolution 17 (EC-69) Seamless Data-processing and Forecasting System, will become a pillar in the future WMO Service Delivery Strategy,
- (3) Decision 50 (EC-69) An integrated research and development approach, which endorsed the principles towards better integrated research and development support to Members,
- (4) Decision 49 (EC-69) WMO priority actions in hydrology and water resources management, in support of the ambitious work plan of the Commission for Hydrology,

**Recalling** that the implementation plans of the World Weather Research Programme (WWRP) and of the Global Atmosphere Watch (GAW) Programme, endorsed by Decision 61 (EC-68) – World Weather Research Programme Implementation Plan for the period 2016–2023, and Decision 62 (EC-68) – Global Atmosphere Watch Implementation Plan for the period 2016–2023, respectively, call for development of integrated modelling products and services,

# Considering that:

- Advancing the scientific understanding of the Earth system has been endorsed by Decision 65 (EC-69) – Preparation of WMO Strategic Plan 2020–2023, as a strategic objective (strategic objective 3.1) of the Plan,
- (2) Collaborations among GAW, WWRP and other partners are essential to make research advances in the emerging strategic areas of WMO, in particular on aspects of model development, the water cycle and urban development,
- (3) The ongoing Sub-seasonal to Seasonal Prediction Project (S2S Project) (Resolution 16 (EC-64) Sub-seasonal to Seasonal Prediction Project), Polar Prediction Project (Resolution 17 (EC-64) Polar Prediction Project), High-impact Weather Project (Resolution 12 (EC-66) High-impact Weather Project), GAW Urban Research Meteorology and Environment Project, and Integrated Global Greenhouse Gas Information System (Decision 51 (EC-69) The Integrated Global Greenhouse Gas Information System Implementation Plan) complement each other towards a seamless-oriented research structure,

# Agrees that:

- Research plays a critical role in developing future predictive seamless systems and in underpinning decisions on the development of related observing systems for weather, climate, water and environment;
- (2) The Working Group on Numerical Experimentation should play a central role in coordinating the development of seamless research components across GAW, WWRP and the World Climate Research Programme (WCRP), including interacting and building connections with

the Commission for Basic Systems (CBS) and Commission for Hydrology (CHy) subsidiary bodies that work on aspects of numerical experimentation and with JCOMM on marine research;

**Requests** the Joint Steering Committee of WCRP and the Scientific Steering Committees of WWRP and GAW to provide the Commission for Atmospheric Sciences Management Group with suggestions on how to further strengthen collaborative efforts between the Programmes mentioned in the preceding paragraph to support innovation for DPFS;

**Requests** the Scientific Steering Committee of WWRP and the Joint Steering Committee of WCRP to encourage CHy and the Commission for Agricultural Meteorology to further promote the use of S2S Project database products, and strengthen interactive feedbacks between multidisciplinary research activities within WMO;

**Requests** the Secretary-General to align the appropriate research activities and resources in WMO to optimally support the development and enhancement of DPFS and of the Global Framework for Climate Services;

**Requests** Members to actively participate in research activities for predictive seamless systems, to contribute to the trust funds of the above-mentioned Programmes and to provide strong support for the implementation of project activities in their respective countries;

# **Decides:**

- (1) That GAW, WWRP and WCRP, in collaboration with relevant subsidiary bodies of CBS, CHy and JCOMM, shall play a major role in promoting research across temporal and spatial scales and across environmental domains towards a unified, integrated Earth system modelling approach in an interactive set-up that ensures the transfer of research concepts, tools and techniques to operations as informed by users;
- (2) To facilitate this integrated and interactive approach by organizing an overarching Open Science Conference on the Earth System, possibly in 2022.

# Annex 3 to Recommendation 18 (EC-70)

# Draft Resolution XX/3 (Cg-18)

#### Seamless regional research for water

THE WORLD METEOROLOGICAL CONGRESS,

# Noting:

- (1) Resolution 12 (EC-66) High-impact Weather Project, which established the Project,
- (2) Decision 5 (EC-69) Flood forecasting, which requested the relevant technical commissions to ensure that the future Global Data-processing and Forecasting System is an operational system that has a direct interface to applications such as the Flash Flood Guidance System,
- (3) Decision 49 (EC-69) WMO priority actions in hydrology and water resources management, which expressed support for the ambitious work plan of the Commission for Hydrology (CHy),
### Noting further:

- (1) That sustainable development requires a systematic assessment of water resources from global to regional and local scales,
- (2) The common interests of the World Weather Research Programme (WWRP), the World Climate Research Programme and the International Groundwater Resources Assessment Centre in the monitoring of groundwater and dissemination of data,
- (3) The need to develop links between the Global Atmosphere Watch Programme, WWRP and the Global Energy and Water Cycle Experiment on aspects of extreme events and precipitation processes, such as quantitative precipitation forecasts and urban flooding,
- (4) The role of water vapour as a climate driver and an atmospheric chemical constituent,

### Stressing:

- (1) The need to strengthen WMO regional activities related to the understanding and assessment of the coupled water cycle, avoiding redundancy and duplications across weather, climate, water and environment programmes,
- (2) The need to establish integrated pilot projects, which should be developed in collaboration with key partners, as well as with stakeholders and users, following the example the Hydrological Cycle in the Mediterranean Experiment,

**Requests** the technical commissions, in particular CHy and the Commission for Basic Systems, to co-design research activities focusing on the exchange processes between Earth system components related to water, in cooperation with the WMO research Programmes;

**Requests** the Secretary-General to strengthen or establish cooperation on water-related issues with relevant United Nations and other international organizations.

### Annex 4 to Recommendation 18 (EC-70)

### **Draft Decision XX (Cg-18)**

# Creating an environment for innovation and its optimal resourcing

THE WORLD METEOROLOGICAL CONGRESS,

### **Recalling:**

- Decision 73 (EC-68) Cooperation between the public and private sectors for the benefit of society, which promotes a framework for fruitful collaboration between National Meteorological and Hydrological Services (NMHSs) and the private sector for the benefit of society,
- (2) Decision 50 (EC-69) An integrated research and development approach, which endorsed the principles towards better integrated research and development, and among which it stressed the role of co-design and continuous consultation between users and stakeholders,
- (3) Decision 69 (EC-68) Resource mobilization, which approved the WMO Resource Mobilization Strategy that highlighted, among potential mechanisms, appropriate partnerships with the private sector and increased focus on research funding mechanisms,

(4) Resolution 17 (EC-69) – Seamless Data-processing and Forecasting System, which requested the Steering Group on the Seamless Data-processing and Forecasting System (DPFS) to develop a detailed implementation plan, and the Commission for Atmospheric Sciences (CAS) to utilize its forthcoming Science Summit and its seventeenth session as a platform for interaction between the Commission for Basic Systems, CAS and representatives of other technical commissions and regional associations, to define the scientific progress needed to realize the future seamless DPFS,

**Recalling also** Decision 65 (EC-69) – Preparation of WMO Strategic Plan 2020–2030, which endorsed the overarching priorities of the WMO Strategic Plan for that period, which contains as goals advancing targeted research with the purpose of improved understanding of the Earth system and the implications to weather, climate, water and related environmental matters, and enhancing predictive capabilities in a seamless context through the application of scientific and technological advances,

### Noting that:

- (1) The development of integrated services for urban environments was requested by Members and supported by the technical commissions and the Global Framework for Climate Services, and that development of such services requires advances in science and innovation to resolve processes on different spatial and temporal scales,
- (2) Research and operations need to work hand in hand with user needs as a target in advancing the seamless DPFS,
- (3) Research activities are at the base of any innovation, and that these require adequate investment, the involvement of a critical mass of experts through shared facilities and virtual partnership, and a culture that recognizes and values excellence,

**Mindful** that non-optimal use of resources in research and the duplication of effort between different stakeholders lead to the depletion of innovation potential,

**Satisfied** with the fact that the private sector and foundations create opportunities for innovation through open calls and competition,

**Recognizing** that research needs a balanced approach, combining long-term activities that will support continuous improvement and short-term innovation for targeted challenges,

### Agrees that:

- (1) There is a need to join efforts between NMHSs, the private sector, civil society and the academic world in promoting partnerships at the national, regional and global levels;
- (2) There is a need to involve key international partners in co-designing WMO research activities with a special focus on the seamless DPFS and on cross-cutting areas of interest;
- (3) There is a need for a formal engagement of key international stakeholders in setting up the WMO research agenda in order to deliver the WMO Strategic Plan and long-term goals and in providing concrete inputs to research implementation and governance;

### Urges Members:

- To contribute to the WMO research coordination efforts through global partnerships towards a dramatic increase in predictive skills, to be materialized in improved services of the seamless DPFS;
- (2) To sustain funding for long-term research activities and fund research supporting the development of new products and services, including research activities that incorporate social sciences;

(3) To work closely with funding agencies and other resourcing mechanisms to ensure inclusion of the unified scientific priorities defined by the WMO Strategic Plan and long-term goals in their agendas;

**Encourages** NMHSs to take a more active part in innovation calls supported by the private sector;

**Requests** technical commissions and regional associations to work towards the establishment of centres of excellence and virtual networks to be driven by ambitious scientific targets in order to catalyse innovation, for example using the Severe Weather Forecasting Demonstration Project as an opportunity to foster innovation through co-design between research and operations;

**Requests** Members to ensure support of communication systems to allow distributed access to the centres of excellence and virtual networks and for effective cooperation on research challenges;

### **Requests** the Secretary-General:

- (1) To take all necessary action, within the available budgetary resources, to encourage the culture of innovation and research across the Organization;
- (2) To assist Members in establishing global partnerships towards the development and utilization of distributed centres of excellence;
- (3) To assist Members in mobilizing resources through research funding mechanisms;
- (4) To promote the value of research and innovation in partnership with the private sector and other stakeholders in civil society within WMO, and acknowledge the excellence of groups for their contribution;
- (5) To ensure that excellence in science is recognized through appropriate incentive schemes;
- (6) To take all necessary actions to initiate, develop and maintain WMO collaboration on matters related to weather, climate, water and related environmental research with relevant organizations, agencies, groups and institutions, from both public and private sectors.

### Recommendation 19 (EC-70)

# WMO mandatory publications and distribution policy for the eighteenth financial period

THE EXECUTIVE COUNCIL,

Recalling Resolution 58 (Cg-17) - Publications for the seventeenth financial period,

**Having considered** the report of the Secretary-General on production of publications during the seventeenth financial period, and relevant recommendations by constituent bodies,

**Recommends** to Congress draft Resolution XX (Cg-18) – WMO mandatory publications and distribution policy for the eighteenth financial period, as provided in the annex to the present recommendation.

### Annex to Recommendation 19 (EC-70)

# Draft Resolution XX (Cg-18)

# WMO mandatory publications and distribution policy for the eighteenth financial period

THE CONGRESS,

Recalling Resolution 58 (Cg-17) - Publications for the seventeenth financial period,

**Reaffirming** that the free and unrestricted dissemination of WMO publications to the operational, scientific, educational and other interested institutions of Members promotes awareness and broader use of WMO standards, guides and other products,

### **Reaffirming further:**

- (1) That the management of the Publications Programme, notably the presentation and method of reproduction of publications and the most economical use of the available publication funds, including the revenue from sales of publications, shall be the responsibility of the Secretary-General within the framework established by the World Meteorological Congress and taking into account the guidance given by the Executive Council,
- (2) That additional publications may be produced during the eighteenth financial period given the availability of the necessary funding,

**Mindful** that web distribution is given preference over the distribution of hard-copy versions, which are reserved only for exceptional cases,

**Adopts** the list of WMO publications proposed by the Executive Council as mandatory for production during the eighteenth financial period and included in the regular budget as provided in Annex 1 to the present resolution;

**Approves** the Distribution Policy of WMO Publications as provided in Annex 2 to the present resolution;

**Requests** the Secretary-General to provide the Executive Council with the appropriate mechanism and resources for the regular review of the Publications Programme, and to allocate funding within the available budget and to take the necessary measures for translating and publishing more technical publications as requested by Members;

**Invites** Members to provide in-kind support to translation and publishing and through contributing to WMO Mandatory Publications Trust Fund to have more technical publications available in all WMO official and working languages.

**Note:** This Resolution replaces Resolution 58 (Cg-17), which remains in force until 31 December 2019.

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# Annex 1 to draft Resolution XX (Cg-18)

# List of WMO publications proposed as mandatory for production during the eighteenth financial period and included in the budget proposal

Dubli L	N/	1	D
Publication	Number	Languages	Responsibility
1. Governance and technical publications			
Basic documents	WMO-No. 15	A, C, E, F, R, S	CER
Abridged reports with resolutions of Congress		A, C, E, F, R, S	ASGO
Abridged reports with resolutions of the Executive Council		A, C, E, F, R, S	ASGO
Abridged reports with resolutions and recommendations of the regional associations		Same as for session documentation	DRA
Abridged reports with resolutions and recommendations of the technical commissions		A, C, E, F, R, S	Technical departments
Abridged reports with resolutions of the Intergovernmental Board on Climate Services		A, C, E, F, R, S	GFCS Office
Abridged reports with resolutions of the Management Committee of IBCS		E	GFCS Office
<i>Resolutions of Congress and the Executive Council</i>	WMO-No. 508	E	CER
WMO Strategic Plan		A, C, E, F, R, S	CER
WMO Operating Plan 2020-2023		A, C, E, F, R, S	CER
Technical Regulations, Volume I	WMO-No. 49	A, C, E, F, R, S	Technical commissions, technical departments
Technical Regulations, Volume II	WMO-No. 49	A, C, E, F, R, S	CAeM, WDS
Technical Regulations, Volume III	WMO-No. 49	A, C, E, F, R, S	Chy, CLW
Technical Regulations, Annexes:			
Annex I – International Cloud Atlas, Volume I – Manual on the Observation of Clouds and Other Meteors	WMO -No. 407	A, C, E, F, R, S	CIMO, OBS
Annex II – <i>Manual on Codes</i> , Volume I.1 (Part A – Alphanumeric Codes); Volume I.2 (Part B – Binary Codes, Part C – Common Features to Binary and Alphanumeric Codes), Volume I.3 (Part D – Representations derived from data models)	WMO-No. 306	E, F, R, S	CBS, OBS
Annex III – Manual on the Global Telecommunication System	WMO-No. 386	E, F, R, S	CBS, OBS
Annex IV – Manual on the Global Data- processing and Forecasting System	WMO-No. 485	E, F, R, S	CBS, OBS

Publication	Number	Languages	Responsibility
Annex V- <i>Manual on the Global</i> <i>Observing System</i> , Volume I	WMO-No. 544	E, F, R, S	CBS, OBS
Annex VI- <i>Manual on Marine</i> <i>Meteorological Services</i> , Volume I	WMO-No. 558	E, F, R, S	JCOMM, OBS and WDS
Annex VII – Manual on the WMO Information System	WMO-No. 1060	A, C, E, F, R, S	CBS, OBS
Annex VIII – Manual on the WMO Integrated Global Observing System	WMO-No. 1160	A, C, E, F, R, S	CBS, OBS
Manual on Flood Risk Mapping	WMO-No.	E	CHy, CLW
<i>Guide to Meteorological Instruments and Methods of Observation</i>	WMO-No. 8	A, C, E, F, R, S	CIMO, OBS
Guide to Climatological Practices	WMO-No. 100	A, C, E, F, R, S	CCI, CLW
<i>Guide to Hydrological Practices,</i> Volumes I and II	WMO-No. 168	E, F, R, S	Chy, CLW
Guide to Marine Meteorological Services	WMO-No. 471	E, F, R, S	JCOMM, OBS
Guide to the Global Observing System	WMO-No. 488	C, E, F, R, S	CBS, OBS
<i>Guide to the Practices for Meteorological</i> <i>Offices Serving Aviation</i>	WMO-No. 732	E, F, R, S	CaeM, WDS
<i>Guide to Public Weather Services</i> Practices	WMO-No. 834	E, F, R, S	CBS, WDS
<i>Guide to aeronautical meteorological services cost recovery: principles and guidance</i>	WMO-No. 904	E, F, R, S	CaeM, WDS
<i>Guidelines on the role, operation and management of NHS</i>	WMO-No. 1003	A, C, E, F, R, S	CHy, CLW
Guide to the WMO Information System	WMO-No. 1061	A, C, E, F, R, S	CBS, OBS
Guide to Information Technology Security	WMO-No. 1115	E	CBS, OBS
<i>Guide to participation in Radio Frequency</i> <i>Coordination</i>	WMO-No. 1159	A, C, E, F, R, S	CBS, OBS
<i>Guide to the WMO Integrated Global</i> Observing System	WMO-No. 1165	A, C, E, F, R, S	CBS, OBS
WIGOS Metadata Standard	WMO-No. 1192	A, C, E, F, R, S	
<i>Use of radio spectrum for meteorology: weather, water and climate monitoring and prediction</i>	WMO-No. 1197	A, C, E, F, R, S	CBS, OBS
Guide to Aircraft-Based Observations	WMO-No. 1200	A, C, E, F, R, S	CBS, OBS
Guide to General Service Delivery	WMO-No.	A, C, E, F, R, S	CBS, WDS
Guide to information management	WMO-No.	A, C, E, F, R, S	CBS, OBS
Satellite Data Telecommunication Handbook	WMO-No.	A, C, E, F, R, S	CBS, OBS
Technical Reference on the Global Data Management Framework for Climate	WMO-No.	A, C, E, F, R, S	CCI, CLW

Publication	Number	Languages	Responsibility
WMO Annual Report		All	CER
WMO Bulletin	WMO-No.	E, F, R, S	CER
MeteoWorld		E, F	CER
World Meteorological Day package		E, F, R, S	CER
WMO Statement on the State of the Global Climate		A, C, E, F, R, S	CLPA/CLW
WMO Greenhouse Bulletin		A, C, E, F, R, S	ARE
GFCS Success Stories		A, C, E, F, R, S	GFCS office

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# Annex 2 to draft Resolution XX (Cg-18)

### **Distribution policy of WMO publications**

### 1. Distribution to Members and experts from NMHSs

1.1 To further the objectives of the Organization and its Members, the Secretariat pursues WMO publications sales and distribution policies, including pricing, within the framework established by Congress and taking into account the guidance given by the Executive Council and the views of WMO Members.

1.2 The Secretariat should make publications freely available online and inform Members and experts from NMHSs of each release. Unlimited and free distribution of WMO publications (both, in low and high resolution) to Members and experts from NMHSs would be effected by electronic means. Any requests for hard copies within that free distribution would be met only in the case of least developed country Members, using the most cost-effective way, for example by providing a printout of the electronic files.

1.3 Certain publications, like some technical ones and public information material, such as the WMO Bulletin, annual report, information brochures and kits produced for special events, may be distributed both in hard-copy format and electronically. In such cases free distribution of printed copies is done according to the list of recipients defined in the best interests of the Organization and approved by the Secretary-General.

### 2. Distribution to non-Members and public users

Electronic copies in low resolution are freely available to non-Members and all web public users, whereas high-resolution and/or printed copies are sold through the WMO bookstore.

# Recommendation 20 (EC-70)

### WMO Strategic Plan

### THE EXECUTIVE COUNCIL,

### Recalling:

- (1) Decision 65 (EC-69) Preparation of the WMO Strategic Plan 2020–2023,
- (2) The recommendations of the Working Group on WMO Strategic and Operational Planning,

**Confirms** that the final version of the draft WMO Strategic Plan has been prepared in accordance with the above-mentioned decision of the Executive Council and the recommendations of the Working Group;

**Recommends** to the Eighteenth World Meteorological Congress draft Resolution XX (Cg-18) – WMO Strategic Plan, as laid out in the annex to the present recommendation.

# Annex to Recommendation 20 (EC-70)

# Draft Resolution XX (Cg-18)

# WMO Strategic Plan

# THE CONGRESS,

### Noting:

- (1) Resolution 69 (Cg-17) WMO Strategic Plan (2016–2019),
- (2) Resolution 71 (Cg-17) Preparation of the Strategic and Operating Plans 2020–2023,
- (3) Decision 65 (EC-69) Preparation of the WMO Strategic Plan 2020-2023,
- (4) Recommendation 20 (EC-70) WMO Strategic Plan,

**Noting further** that the WMO strategic planning process for the period 2020–2023 and beyond is based on and comprises three interlinked key components, namely:

- (1) The WMO Strategic Plan, which provides a high-level vision and overarching priorities of the future direction of WMO, articulated in long-term goals and strategic objectives with focused implementation areas for the financial period 2020–2023 and related monitoring indicators,
- (2) The WMO Operating Plan, which presents outcomes in the form of benefits to Members, outputs, activities and related performance indicators to address the global societal needs and achieve the strategic objectives,
- (3) The WMO Results-based Budget, which identifies resources for implementing the Strategic Plan, including functioning of constituent bodies, the Secretariat and activities,

**Approves**, under the provision of Article 8 (a), (b) and (c) of the Convention of the World Meteorological Organization, the WMO Strategic Plan, as contained in the annex to the present resolution;

**Urges** Members to take the WMO Strategic Plan into account in developing and carrying out their national development, disaster risk reduction, climate services and other relevant strategies on programmes in meteorology, hydrology and related disciplines, as well as in their participation in the programme activities of the Organization;

**Requests** the Executive Council, the regional associations, the technical commissions and the Secretary-General to adhere to the vision, overarching priorities, long-term goals and strategic objectives set forth in the Strategic Plan and to organize programme activities so as to achieve the expected outcomes;

**Requests** the Executive Council to use the Strategic Plan, complemented by the WMO Operating Plan, as a benchmark to monitor progress and performance in achieving the expected outcomes by implementing programmes and activities of the Organization and to submit a report to the Nineteenth World Meteorological Congress;

**Requests** the Secretary-General to arrange for the publication of the Strategic Plan, for its distribution to all Members and constituent bodies of WMO, to United Nations system and other partner organizations, as appropriate.

**Note:** This resolution replaces Resolution 69 (Cg-17), which is no longer in force.

Annex to draft Resolution XX (Cg-18)

WMO Strategic Plan

# World Meteorological Organization

# **STRATEGIC PLAN**

# Draft

Foreword

(will be added at the stage of publishing) Executive summary (will be a separate publication for external communication)

### **Our Vision**

By 2030, we see a world where all nations, especially the most vulnerable, are more resilient to the socioeconomic consequences of extreme weather, climate, water and other environmental events;<sup>1</sup> and underpin their sustainable development through the best possible services, whether over land, at sea or in the air.

### **Our Mission**

Our Mission is outlined under Article 2 of WMO Convention as to facilitate worldwide cooperation on monitoring and predicting changes in weather, climate, water and other environmental conditions through the exchange of information and services, standardization, application, research and training.

(Box)

#### WMO is a specialized agency and an authoritative voice of the United Nations

WMO Member States and Territories own and operate the scientific infrastructure required for providing the weather, climate, water and related environmental services, and primarily delivered through their national meteorological and hydrological organizations.

WMO enables the performance of its Member States and Territories in the provision of their monitoring, forecasting and warning services, leads and informs the global agenda where it best serves their interest through provision of credible information, reports and assessment at global, regional scales, channels their scientific expertise to address emerging issues such as climate change, and fosters effective and strategic partnerships.

For more than a century, WMO has been providing the essential worldwide leadership and coordination in support of nations' responsibilities to provide weather, climate, water and related environmental services that protect lives, property and livelihoods. The cross-border nature of the weather, water and climate phenomena requires close coordination among all WMO Members States and Territories in building highly standardized systems for their monitoring, analysis and prediction. WMO, through its various bodies and programmes, has established and facilitated an unprecedented global scientific and operational cooperation, encompassing Members' National Meteorological and Hydrological Services (NMHSs), academic and research institutions, business partners, communities and individuals.

The role of WMO will remain to support the activities of its Member States in understanding the past, monitoring the present and predicting the future state and interactions of the atmosphere, the hydrosphere and other vital elements of our planet, enabling adequate and effective preparedness, adaptation and response to related natural extremes. This will require further enhancement of coordinated and interoperable networks and systems for data collection and processing, improvement of predictive skill through advanced science and computational technologies, and finally highly innovative approaches of service delivery that will ensure that accurate, fit-for-purpose information will reach its users on time for making their weather-, water- and climate-informed decisions.

In the context of this Strategic Plan, the term "weather" refers to short-term variations in the state of the atmosphere and their phenomena or effects, including wind, cloud, rain, snow, fog, cold spells, heat waves, drought, sand and dust storms and atmospheric composition, as well as tropical and extratropical cyclones, storms, gales, the state of the sea (e.g. wind-generated waves), sea ice, coastal storm surges etc. "Climate" refers to longer-term aspects of the atmosphere-ocean-land surface systems. "Water" includes freshwater above and below the land surfaces of the Earth, their occurrence, circulation and distribution, both in time and space. Related "environmental" issues refer to surrounding conditions affecting human beings and living resources, for example the quality of air, soil and water, as well as "space weather" - the physical and phenomenological state of the natural space environment, including the Sun and the interplanetary and planetary environments.

# **Our Core Values**

The WMO recognizes, above all, in fulfilling its mandate, the principles of striving to ensure that "no Member State or Territory should be left behind", and to sustain the public trust and confidence in the science underpinnings and the authoritative voice of the Organization and its Members. As WMO works to translate its vision into results, the Organization will be guided by the following values:

- (1) Accountability for results and transparency. To serve as an authoritative voice and a global leader in its field of work, WMO decisions and actions must be characterized by adherence to the highest scientific and technical standards, integrity, professionalism, capacity to perform and effectiveness. WMO sets clearly defined objectives and assumes responsibility for delivering high-quality results. In so doing, the WMO remains mindful of the need for quality management and cost-effectiveness;
- (2) Collaboration and partnership. Collaboration lies at the foundation of WMO mandate. WMO recognizes the importance of partnerships among Members, multilateral and bilateral development partners and other relevant actors, including the private sector, academia and other non-state players, to leverage investment, enhance capability and performance of National Meteorological and Hydrological Services, and deliver improved outcomes for society. WMO would expect that any such partners uphold the highest standards of ethical behavior;
- (3) Inclusiveness and diversity. WMO is committed to support all Members and narrow the capacity gaps among them in the delivery of services by sustaining government support, international cooperation, catalyzing investment and targeted assistance. Based on the priorities identified by its regional bodies, WMO will ensure the coordination and implementation of its programmes, strategies and activities and facilitate the transfer of knowledge within and across regions to better serve the needs of its Members. WMO will also pursue gender equality and effective participation of women and men in governance, scientific cooperation and decision-making in implementation of Sustainable Development Goal 5, the WMO Gender Equality Policy, and UN criteria.

The WMO Core Values also guide the behaviour of Secretariat staff. As custodians of the Organization's image and reputation, they are expected to uphold a commitment to the highest standards of ethical behaviour as expressed in the WMO Code of Ethics and the Standards of Conduct for the International Civil Service.

### **Key Drivers**

*Global agenda creating unprecedented demand for actionable, accessible and authoritative science-based information* 



The 2030 Agenda for Sustainable Development, the Paris Agreement on climate change, and the Sendai Framework for Disaster Risk Reduction serve as the centrepieces for national and international policymaking and action. And as a consequence, their implementation will increasingly demand actionable, accessible and authoritative information and services on the changing states of the entire Earth System.<sup>2</sup>

(Box/infographics) The meteorological and hydrological information and services provided through Member States' institutions are essential to achieve the Sustainable Development Goals related to poverty, agriculture and food security, health, water, climate change, oceans, energy, settlements, consumption and production, and partnerships.

As governments, organizations and international bodies align their development activities within these frameworks, WMO and NMHSs in particular, have enormous roles to play in supporting implementation. The concomitant decisions at all levels will continue to be contingent upon a better understanding of the changing threat levels from natural hazards, weather, water and climate extremes and climate change. The measurements and reports of the WMO community in these areas currently serve as the backbone of Earth System monitoring and prediction services. Global Earth System observations will provide a basis for meeting the demand for increasing seamless prediction capability from weather to climate scales based on a unified modeling approach.

As new forms of measurements emerge, and new uses for these measurements become more sophisticated, the reliance on WMO through its Members for this authoritative information will only increase. Furthermore, advancing the global observation and numerical modeling system will provide a foundation for addressing the increasing requirements for impact decisions related to a wide range of applications from public safety, to agriculture, energy, health, and water resource management and relevance to climate change.

This means that the quality of these decisions will depend to a greater extent on the WMO ability to properly measure and report on changes in the climate, to assess and communicate weather, climate, water-related and air quality risks and to provide effective multi-hazard, extended range forecasts and early warnings. Governments, organizations, and international bodies will increasingly rely on information from WMO and NMHSs as they pursue their sustainable development goals on land, at sea and in the air.

The provision of climate services at global, regional and national levels for economic sectors in support of energy, water, health, and food production among others will be vital in building a low-carbon and climate-resilient economy. The Global Framework for Climate Services (GFCS) provides a basis to support international policies and actions, National Adaptation Plans and progress towards achieving Nationally Determined Contributions.

To address these growing demands for actionable scientific information, Members' NMHSs will need targeted investments, scientific and technical development and strategic partnerships.

<sup>&</sup>lt;sup>2</sup> In this context, the Earth is being considered as an integrated system of atmosphere, ocean, cryosphere, hydrosphere, biosphere and geosphere, which informs policies and decisions based on a deeper understanding of the physical, chemical, biological and human interactions that determine the past, current and future states of the Earth.

# Increasing threats of extreme weather and climate urge action for resilience, mitigation and adaptation

High-impact weather, water and climate extremes have devastating consequences for the safety of people, national economies, urban and rural environments, and food and water security. Extreme hydrometeorological<sup>3</sup> events currently account for more than 80% of the world's natural disasters. According to the Intergovernmental Panel on Climate Change, these extremes are expected to occur with greater frequency and intensity as

#### (Box/Graph)

The World Economic Forum identified weather extremes, natural disasters, failure of climate change adaptation and mitigation, and water crises as the highest four global risks in 2018. According to Munich Re, the costs of natural catastrophes in 2017 spiralled upwards to US\$ 330 billion, less than half of which are insured, including the costliest hurricane season on record (US\$ 215 billion) and a major humanitarian disaster in South Asia due to floods.

greenhouse gas concentrations continue to rise. Sea levels rise, also linked to climate change, will further increase the threat to more than half of the world's population who are living in coastal regions.

Society's exposure and vulnerabilities to these hazards will be further exacerbated due to: population growth, reaching more than 9 billion by 2050; the development of human settlements, further urbanization and growth of mega cities worldwide, particularly in flood plains and coastal zones; significant expansion of built environments and critical infrastructures to service human needs; and the relocation of vulnerable populations. To affect smart mitigation and adaptation policy development and decision-making by governments at all levels, international institutions, economic decision-makers and citizens, demand for increasingly useful, accessible, and authoritative meteorological and hydrological information and services is growing.

To support national agendas for disaster risk reduction and climate adaptation, WMO fosters the production and delivery of accessible and authoritative meteorological and hydrological information and services. This information is critical to strengthening resilience to the impacts of high impact weather, climate and water extremes. It provides an essential underpinning to support the development and implementation of National Adaptation Plans under the Paris Agreement and UN system needs on humanitarian and crisis management.

#### Growing capacity gap threatens global infrastructure and services

All WMO Member States collectively contribute to the global meteorological and hydrological infrastructure and facilities. While this collective global system is a public good that benefits all, the contribution and service performance among the Members continues to be uneven. Many NMHSs are facing substantial development needs and capability gaps in providing the weather, climate, water and related environmental information and services to meet national, regional and global requirements. The typical challenges center around maintaining sustainable infrastructure, human resources, and the ability to benefit from the advances in science and technology.

Such deficiencies are often present in those countries that are particularly vulnerable to natural disasters. These could jeopardize effective protection of life and property and slow down socioeconomic recovery. Moreover, globalization and the interdependence of critical infrastructure may further contribute to widening capacity gaps among NMHSs and related agencies. Narrowing the capacity gaps by sustaining government support, international cooperation, catalyzing investment and targeted assistance is more important than ever in view of the increasing frequency and intensity of weather-, climate- and water-related extremes.

# *Rapid advancements in science and technology and changing landscape of data and service delivery urge for innovative partnerships*

Rapid progress in science and technology provides the opportunity to greatly improve services and to make them more accessible. Advanced weather, climate and hydrological services contribute to timely and effective planning and decision-making, resulting in greater socioeconomic benefits. The contribution of science and technology is further enhanced by accelerating the research-to-operations cycle in all fields.

This poses challenges to WMO since the 21st century systems for monitoring, prediction and service delivery are of the highest complexity handling increasingly large datasets and sophisticated numerical models. Therefore, WMO plays a major role in the transfer of modern knowledge and technology from developed to developing countries to enable them to benefit from the new information era.

The increasing demand for more and more diverse services from increasingly sophisticated and capable users changes rapidly the service delivery and business models in many parts of the world. Trends like "big data", "crowd sourcing" and "open system", the appearance of commercial observing networks, data and service providers, the affordability of digital technology, the introduction of artificial intelligence and cognitive computing to rapidly extract useful information from "big data", all are game changers. The private sector, as well as academia and other players, contribute by accelerating the uptake of technological innovations, and assisting Member States in offering more efficient, attractive and accessible services in support of their sustainable development goals. There are many opportunities for optimization and efficiency through integration of networks, computing power and service delivery through use of social media.

Member States must support their NMHSs to better and readily adapt to this dynamic changing environment, while WMO must elaborate the means to strengthen cooperation, mutual reinforcement and complementarity among state and non-state actors. It is important to advocate for the essential role of NMHSs in providing the critical infrastructure, competence and authoritative services for serving their governments' fundamental public good function for protecting life and property.

### **Overarching Priorities**

The Strategic Plan sets out long-term goals for 2030 horizon and strategic objectives, focused on addressing the most pressing developments and needs during the 2020-2023 planning cycle of the Organization. The Plan articulates expected outcomes expressing clear benefits to Members. As we translate these goals and objectives into detailed plans we will focus our resources in accordance with three overarching priorities:

- (1) Enhancing preparedness and reducing losses of life and property from hydrometeorological extremes;
- (2) Supporting climate-smart decision making to build resilience and adaptation to climate risk;
- (3) Enhancing socioeconomic value of weather, climate, hydrological and related environmental services.

Reflecting on these key priorities, there will be a need to involve a broad set of stakeholders and multidisciplinary expertise to address the current and future challenges facing society as a consequence of changing weather, climate and water patterns worldwide. To be effective, WMO fosters collaborative mechanisms to better align interests, build community and engage stakeholders and experts under weather, climate and water.

# Long-term Goals and Strategic Objectives

# Goal 1 Better serve societal needs: delivering, authoritative, accessible, user-oriented and fit-for-purpose information and services

*Long-term outcome:* Enhanced capability of Member States to develop, access and utilize accurate, reliable and fit-for-purpose weather, climate, water and related environmental impact-based services to best support the policy-making and actions that implement sustainable development and mitigate weather, climate and water-related risks.

(Box/illustration) WMO authoritative flagship products

WMO Statement on the State of the Global Climate Greenhouse Gas Bulletin WMO Antarctic Ozone Bulletin El-Niño – La-Niña Update ...

# Objective 1.1 Strengthen national multi-hazard early warning/alert systems and extend reach to better enable effective response to the associated risks

Warnings on weather, climate, water and other environmental extreme events are essential for the safety of lives and livelihoods, recognized under UN Global Agenda and foundational to all governments' NMHSs' mandates. In many countries capacities to deliver warnings are lacking and will be addressed, particularly through focused action in the most vulnerable least developed countries.

### Focus in 2020-2023:

- Enhance impact- and risk-based extended forecast and warning products and services to enable better preparedness and response to hydrological and meteorological events.
- Strengthen national capacity in multi-hazard early warnings.
- Enhance access to official national meteorological and hydrological forecasts and warnings globally in support of regional and global requirements.

# Objective 1.2 Broaden the provision of policy- and decision-supporting climate information and services

The Global Framework for Climate Services (GFCS) provides a unique platform for guiding and supporting activities across the value chain for climate services, which contribute to adaptation, mitigation and reduction of loss and damage. Availability and access to these products will be expanded and broadened to benefit all Members.

- Advance a climate service information system enabling all Members to access, and add value to, the best available global and regional climate information products and methodologies through improved processing, exchange and enhancement of information on past, present and future climate.
- Support Members' production and delivery of authoritative national climate information products and services in GFCS priority areas to adapt and respond to climate variability and change, including through participation in National Adaptation Plans, and to avert loss or damage as well as to optimize benefits from climate-related opportunities.
- Refine WMO products containing key climate indicators, seasonal outlooks, and improved characterization of extremes and associated impact information recognized as key inputs for international climate-related policy implementation and UN system action.

#### Objective 1.3 Further develop services in support of sustainable water management

To mitigate related risks and subsequent losses, improved access to reliable global and regional information on the current status and future conditions of water resources is critical, but stakeholders do not have a central source for this information. WMO will establish a system to enable easy access to essential water resources information to support informed decisions based on current and expected hydrological conditions.

#### Focus in 2020-2023:

- Enable better access to improved hydrological services, forecasts and warnings for water resources, drought and flood risk management and planning.
- Facilitate exchange of transboundary data and products through the Global Hydrological Status and Outlook System to enhance understanding of current and future water resources.
- Regular reporting on the state of global water resources.

# Objective 1.4 Enhance the value and innovate the provision of decision-supporting weather information and services

Weather-informed decision-making for all modes of transport (aviation, marine, land), energy, agriculture, health, tourism, urban and other sectors will be raised to new levels, resulting in substantial productivity gains and positive environmental impacts. Service delivery approaches will be innovated to build Members' capacity to provide modern, fit for purpose and high quality services.

- Enhance and increase weather services by uptake of modern technology in service delivery and quality management principles.
- Design and implement new weather and water prediction services for the specific needs of megacities and other urban areas.
- Provide NMHSs with further guidance and assistance in the assessment and enhancement of socioeconomic benefits of their services.
- Establish principles and guidance for successful public-private engagement, and facilitate a continuous dialogue between players and stakeholders based on collaboration and mutual reinforcement.
- Develop and adopt international standards, quality control mechanisms and recommended practices in a holistic manner for all service areas based on best national practices.

# Goal 2 Enhance Earth system observations and predictions:

# Strengthening the technical foundation for the future

*Long-term outcome:* An integrated Earth system observational network increasingly automated and optimized to ensure effective global coverage. High

(Box/illustrations) WMO core global public good systems

WIGOS and its component networks WIS schematics GDPFS global and specialized centres

quality fit-for-purpose measurements feeding a continuous global data exchange underpinned by data management and data processing mechanisms.

# Objective 2.1 Optimize the acquisition of Earth system observation data through the WMO Integrated Global Observing System (WIGOS)

All in-situ and space-based observing programmes of WMO are being consolidated in a single integrated system, the WIGOS, which will be operational in 2020. Worldwide implementation of WMO standards, principles and tools will enable Members to optimize their observing networks. It will allow Members to leverage observing systems operated by all relevant government agencies, research entities, non-profit organizations and private companies, including also non-traditional data acquisition vehicles such as crowd-sourcing and the Internet of Things.

### Focus in 2020-2023:

- Advance the implementation of WIGOS rapidly through coordinated global and regional plans, in particular further development and operational implementation of Global Basic Observing Network (GBON), electronic metadata inventories for all observing platforms, along with quantitative tools to monitor their data delivery and data quality.
- Increase compliance with regulations and standards, and identify critical gaps in observational data coverage and address that through the integrated design of observing networks.
- Develop additional regulatory and guidance material developed to facilitate integration of externally-sourced observations under the WIGOS umbrella.

# Objective 2.2 Improve and increase access to, exchange and management of current and past Earth system observation data and derived products through the WMO Information System

The useful shelf life for observations accessed through the WIS is unlimited. Atmospheric composition, climate, hydrological and oceanographic observations from all times will need to be continuously available and accessible for research, climate monitoring, re-analysis and other applications. Therefore, WMO will streamline and coordinate all WMO data management systems.

- Foster the continuous growth and evolution of WIS to accommodate and exploit the different technical capabilities of the Members and provide continued access to all observations acquired under WIGOS and all data generated under the Global Data Processing and Forecasting System for all Members.
- Further develop regulatory and guidance material governing international exchange of data, along with strengthened monitoring of compliance.
- Consolidate and further develop WMO data management systems and practices through WIS to help ensure that all observational data and key products are properly archived.

Objective 2.3 Enable access and use of numerical analysis and Earth system prediction products at all temporal and spatial scales from the WMO seamless Global Data Processing and Forecasting System

Major weather patterns are routinely predicted more than a week ahead, tropical cyclone landfalls are predicted accurately several days ahead, and even small-scale severe weather with high local impact is often forecasted with enough lead-time to mitigate its impact. WMO will further promote the development of Earth system Prediction, facilitate the use of cascading seamless system of numerical models<sup>4</sup> operated by centres around the world and coordinated through WMO to enhance national forecasting capabilities of all Members.

### Focus in 2020-2023:

- Advance the GDPFS to accommodate increased emphasis on probabilistic forecasting and coupled Earth system modelling to improve predictions over time scales ranging from long-term climate variability to seasonal/sub-seasonal to short-term weather events.
- Further develop regulatory and guidance material governing the functioning of the GDPFS.
- Enhance the GDPFS to enable all Members to develop and/or improve their own national predictive capabilities benefiting from advances in quantitative model- and impact-based forecasting products.

# Goal 3 Advance targeted research: Leveraging leadership in science to improve understanding of the Earth system for enhanced services

*Long-term outcome:* Leveraged global research community resulting in fundamental advances in the understanding of the Earth system, leading to improved policy-relevant advice and predictive skill at all time scales in a seamless context. This will result in the strengthened forecast and warning performance of all Members as research and operations coalesce to apply the best science to all components of the service value chain.

### Objective 3.1 Advance scientific knowledge of the Earth system

WMO is uniquely placed to step up to the challenges and opportunities associated with fundamental Earth system science questions and will lead a global research effort that draws on the best expertise within NMHSs, academia and research institutes.

- Address overarching challenges in Earth system scientific research, modelling, analysis and observations, on topics such as atmospheric composition, the ocean/atmosphere/ land coupling, cryosphere, clouds and circulation, water availability and flooding, regional sea level and coastal impacts, high-impact weather, and climate variability and change.
- Prioritize research implementation plans and mobilize broad scientific community to help leverage global research potential to generate enhanced knowledge and understanding of the Earth system and related weather, water and climate linkages.
- Support advancement of WMO-coordinated priority scientific assessments and services.

<sup>&</sup>lt;sup>4</sup> "In the context of WMO, seamless prediction considers not only all compartments of the Earth system, but also all disciplines of the weather–climate–water–environment value chain (monitoring and observation, models, forecasting, dissemination and communication, perception and interpretation, decision-making, end-user products) to deliver tailor-made weather, climate, water and environmental information covering minutes to centuries and local to global scales" (WMO/WWRP, Catalysing Innovation in Weather Science: WWRP Implementation Plan 2016-2023, 2016).

# Objective 3.2 Enhance the science-for-service value chain ensuring scientific and technological advances improve predictive capabilities

WMO demonstrates the value of translating science into enhanced operational service delivery with societal benefits. Considering the exponential growth in the expectations of users and stakeholders in improved predictive capabilities and socioeconomic relevance, WMO will work to ensure an effective science-for-service transition by accelerated research to operations applications.

#### Focus in 2020-2023:

- Improve predictive capabilities in high-impact weather forecasting, seasonal to subseasonal to decadal prediction, polar prediction, urban and environment prediction and water cycle prediction.
- Enhance relevance and utility of products and services through broader engagement of social science expertise and closer collaboration between physical and social scientific groups.

### Objective 3.3 Advance policy-relevant science

In the next decade science is expected to provide tools and solutions for suitable use in the implementation of national and international policies and actions. WMO key research initiatives, working closely with its partners, will advance scientific assessments and climate projections, authoritative global reports on greenhouse gases and other atmospheric constituencies, and new technologies to better quantify the carbon, energy and water cycles.

#### Focus in 2020-2023:

- Implement an integrated global greenhouse gas information system to enable Members to improve the quality and confidence in national greenhouse gas emission inventories.
- Enhance the body of scientific knowledge assessed by IPCC and other global scientific reports.
- Improve the basis of understanding for water resource management decisions drawing upon improved capabilities, especially in sub-seasonal to seasonal range.

# Goal 4 Close the capacity gap on weather, climate, hydrological and related environmental services: Enhancing service delivery capacity of developing countries to ensure availability of essential information and services needed by governments, economic sectors and citizens

*Long-term outcome:* Improved access to regional and global monitoring and prediction systems and utilization of weather, climate and water information and services bringing tangible benefits to developing Members, in particular least developed countries, small-island developing states and Member island territories. This will be achieved through strategic investments, technology transfer, knowledge and experience sharing, and by taking due account of social inclusion and gender factors.

# **Objective 4.1** Address the needs of developing countries to enable them to provide and utilize essential weather, climate, hydrological and related environmental services

The increasing vulnerability of many societies and economies to natural hazards and extreme weather events and the gaps in the capabilities of NMHSs to deliver adequate services – particularly those of developing countries, least developed countries and small island developing States and Member island territories – require WMO to strengthen its capacity development efforts, building upon existing capacities in NMHSs, taking advantage of the capacity of developed country NMHSs in twinning and other arrangements, and leveraging the investments of the UN system and other development partners towards this goal.

#### Focus in 2020-2023:

- Improve understanding of the specific capacity needs of each developing country with respect to technical, institutional and human resources, to enable them to provide adequate weather, climate, hydrological and related environmental services, in particular for protection of life, property and economic productivity.
- Mobilize strategic resources involving development partners and national governments and assisting NMHSs to develop long-term strategies and operational plans to address the identified capacity needs.
- Increase visibility and sustainability of NMHSs in LDCs and SIDS by demonstrating, promoting and communicating the societal-economic value of their weather, climate, water and related environmental observations, research and services.

### Objective 4.2 Develop and sustain core competencies and expertise

There is a growing deficit in the capability and numbers of adequately educated and trained staff needed to provide weather, climate, hydrological and related environmental services in many countries and territories. Additionally, rapid advances in scientific innovation and technological developments require corresponding and continuous training of NMHS personnel. WMO will increase its training and long-term education activities to help Members to obtain and maintain needed competencies.

#### Focus in 2020-2023:

- Support Members to acquire the qualification and competencies required for effective service delivery through appropriate education and training programmes focused on WMO standards and recommendations.
- Support cooperation between developing and developed Members and full utilization of the WMO Regional Training Centres.

# Objective 4.3 Scale-up effective partnerships for investment in sustainable and cost-efficient infrastructure and service delivery

Enhance the full spectrum of the weather, climate and hydrological services delivery to support the protection of life, property and the environment and the security of food production, energy and water resources. Scale up partnership investments to minimize cost and maximize the opportunity for the networks to be sustainable long beyond the lifetime of donor funded projects.

- Strengthen partnerships and alliances among all Members to share knowledge, technology and expertise with particular emphasis on the use of twinning arrangements.
- Enter into strategic, functional and mutually beneficial development partnerships and alliances with the key relevant UN, intergovernmental and nongovernmental organizations, the private sector, and academia.
- Provide leadership in promoting the principles on which global meteorology is built, emphasizing authoritative voice, common standards, data and product sharing.

# Goal 5 Strategic realignment of WMO structure and programmes for effective policy- and decision-making and implementation

*Long-term outcome:* Improved relevance, effectiveness and efficiency of the constituent bodies and implementation of this Strategic Plan through closer alignment of structures and processes with the strategic goals of the Organization.

Objective 5.1 Optimize WMO constituent body structure for more effective decisionmaking

Ensure the effective and efficient use of resources, including those of Members, through a more strategic focus of the WMO action, and constituent body constructs, structures and processes adapted to implement the Strategic Plan.

### Focus in 2020-2023:

• Implement the decisions of Congress on optimized constructs, processes and duties of WMO constituent bodies and organs to enhance the efficiency and effectiveness of the Organization and good governance.

#### **Objective 5.2 Streamline WMO programmes**

WMO scientific and technical programmes need to be periodically reviewed by the Congress to ensure their relevance to the Strategic Plan of the Organization as well as their effectiveness and efficiency of delivery. This will be done based on the principles of quality management, cost-effectiveness, and optimal support by contributing experts and the Secretariat.

### Focus in 2020-2023:

 Streamline WMO scientific, technical and service programmes to enable the Organization to better achieve the goals and objectives set in the Strategic Plan, ensuring coherence and consistency between the strategic, programmatic and financial frameworks.

# Objective 5.3 Advance equal, effective and inclusive participation in governance, scientific cooperation and decision-making

Organizations that respect diversity and value gender equality demonstrate better governance, improved performance and higher levels of creativity. Gender equality and the empowerment of women are further key to scientific excellence and essential to meeting the challenges of climate change, disaster risk reduction and sustainable development, particularly Sustainable Development Goal 5.

- Advance gender equality across the Organization, especially in governance and decision-making, in implementation of SDG5 and the WMO Gender Equality Policy.
- Provide equitable access to, interpretation of and use of information and services to both women and men.
- Attract more women and girls to science and employment in NMHS through showcasing role models and investing in human capital.

### Implementation of the Strategic Plan

This Strategic Plan will guide the decisions and activities of WMO in helping to realize its 2030 vision, and will serve as the focus for the upcoming financial period 2020–2023, bringing the greatest benefits to Members.

The Strategic Plan takes into account strategic, operational, financial, compliance and reputational risks for the Organization and its Members as outlined in key drivers.

The integrated WMO Operating Plan 2020-2023 presents time-bound programme activities and projects, result-oriented budgets and success indicators (see Annex for a series of illustrative indicators). The Operating Plan forms the basis for resource allocation, and defines the risks and performance matrices against which to assess progress to achieve expected outcomes through the WMO Monitoring and Evaluation System.

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# **Monitoring indicators** Strategic objective Monitoring indictors 1.1 Strengthen national multi-hazard 1.1.1 Number of Members participating in a global alert system parly warning/alort systems to extend

reach and better enable effective decision response to the associated	1.1.2 Number of Members with a MHEWS integrated in a national DRR management system			
115K5	(TBD) Number of countries cataloguing high impact weather, weather and climate events using WMO standard unique identifiers			
1.2 Broaden the provision of policy-	1.2.1 Number of Members with basic system for climate services			
information and services at all levels	1.2.2 Number of Members with enhanced CSIS capacity			
	1.2.3 Number of Members offering tailored products within GFCS priority areas			
	1.2.4 Number of Members making use of RCCs and/or RCOFs			
	1.2.5 User/stakeholder assessment of the relevance, usefulness and timeliness of WMO flagship products (e.g. Statement of the Global Climate, El Niño Outlook, etc.)			
1.3 Further develop services in support of sustainable water	1.3.1 Number of Members participating in WMO status and outlook system			
management	1.3.2 Number of Members with operational flood forecasting			
	1.3.3 Number of Members with operational drought warning system			
1.4 Enhance the value and innovate the provision of decision-supporting weather information and services	1.4.1 Number of Members with QMS for selected services (aviation, marine, EWS)			
weather information and services	1.4.2 Number of Members with socioeconomic benefit analysis conducted in the past X years			
	1.4.3 Number of Members with signed agreements between NMHSs and private sector/academia actors on (a) service delivery and (b) maintenance of networks			
	1.4.4 Number of Members using (a) web applications and (b) social media in service delivery			
2.1 Optimize the acquisition of Earth system observation data through the	2.1.1 Percentage of the Earth system covered by observations (especially hydrosphere, cryosphere, developing and LDCs, SIDs)			
System (WIGOS)	2.1.2 Number of Members complying with WMO observation standards			
	2.1.3 Number of Members implementing national observing system WIGOS			
2.2 Improve and increase access to, exchange and management of current	2.2.1 Number of Members with national network monitoring and data management systems established			
data and derived products through the WMO Information System	2.2.2 Number of Members implementing data exchange policies, as per Resolutions 40, 25 and 60			
2.3 Enable access and use of numerical analysis and Earth system prediction products at all temporal and	2.3.1 Number of Members (a) accessing and (b) using quantitative numerical model fields in support of national product generation and service delivery			
Global Data Processing and Forecasting System	2.3.2 Number of Members providing verification data to the producing centres			
3.1 Advance scientific knowledge of the Earth system	3.1.1 Assessed value of WMO-led research to Members and the global UN agenda (measured in terms of excellence, relevance and impact)			

Strategic objective	Monitoring indictors
3.2 Enhance the science-for-service value chain ensuring scientific and technological advances improve predictive capabilities	3.2.1 Number of downloads of Sub-seasonal to Seasonal Prediction (S2S) database in Terabytes
3.3 Advance policy-relevant science	3.3.1 Number of Members with national greenhouse gas monitoring systems supporting climate action
	3.3.2 Number of Members with capability for decadal predictions
4.1 Address the needs of developing countries to enable them to provide and utilize essential weather climate	4.1.1 Number of NMHSs with strategic plans and legal basis for their operation
hydrological and related environmental services	4.1.2 Number of NMHSs with documented inputs to (a) NAPs and (b) NDCs
	4.1.3 Number of NMHSs with enhanced capacity to provide a range of services (based on CPDB self-assessment)
4.2 Develop and sustain core competencies and expertise	4.2.1 Number of NMHS staff trained at WMO training centres and/or fellowships
	4.2.2 Number of NMHSs whose staff have adequate (to be defined) level of core competencies to meet national mandate
4.3 Scale up effective partnerships for investment in sustainable and cost- efficient infrastructure and service	4.3.1 Number of NMHSs receiving international capacity development assistance through WMO technical advisory role and/or partnerships
delivery	4.3.2 Number of Members benefiting from WMO-catalyzed development projects
	4.3.3 Volume of development projects catalyzed through WMO (in CHF)
	4.3.4 Number of Members with legal basis for public-private partnerships
5.1 Optimize WMO constituent body structure for more effective decision- making	5.1.1 Members perceptions based on Stakeholder Survey (e.g. on structure, effectiveness and mode of operation of WMO Constituent Bodies) – see Section 3 of 2016 Survey
5.2 Align WMO programmes	5.2.1 Members perceptions based on Stakeholder Survey (e.g. value of WMO programmes to operational services provided by Members) – see Section 4 of 2016 Survey
5.3 Advance equal, effective and inclusive participation in governance,	5.3.1 Proportion of female and male delegates to WMO constituent body meetings
scientific cooperation and decision- making	5.3.2 Proportion of male and female members of constituent body working structures (working groups, expert teams)

# Recommendation 21 (EC-70)

# Maximum expenditure for the eighteenth financial period (2020-2023)

THE EXECUTIVE COUNCIL,

### Recalling:

- (1) Article 23 of the Convention of the World Meteorological Organization,
- (2) Articles 3 and 4 of the Financial Regulations of the Organization,
- (3) Recommendation 20 (EC-70) WMO Strategic Plan,

**Having considered** the Secretary-General's proposal for the budget for the eighteenth financial period (2020–2023) (see EC-70/INF. 16.2 (2)), including a zero nominal growth scenario and additional resources, based on the draft Strategic Plan and the draft Operating Plan for 2020–2023 (see EC-70/INF. 16.2 (3)),

**Having further considered** the relevant recommendations of the thirty-seventh meeting of the Financial Advisory Committee (see EC-70/INF. 16.1 (1)), and those of the first 2018 session of the Working Group on Strategic and Operational Planning (see EC-70/INF. 16),

**Noting** that the Secretary-General's proposal is compliant with Decision 66 (EC-69) – Outline of the Operating Plan and budget 2020–2023,

### Noting further:

- (1) That financial requirements in the eighteenth financial period shall be funded from both assessed, at least at zero nominal growth, and voluntary contributions,
- (2) The Secretary-General's proposal for a financing modality of voluntary contributions from Members whereby they firmly commit themselves at Congress to funding additional initiatives and other WMO activities,
- (3) That the governance reform and transition process have been taken into account in the budget proposal,

**Invites** WMO Members to fund additional initiatives and other WMO activities through the new financing modality;

**Requests** the Secretary-General to ensure that the Operating Plan:

- (1) Indicates sources of funding (assessed and voluntary contributions with/without indication of commitments) for activities foreseen in the plan;
- (2) Provides clarity on the intended use of resources and added value to Members of both the zero nominal growth proposal and the additional initiatives;

**Further requests** the Secretary-General to monitor the implementation of the Operating Plan at both the outcome and output levels, in accordance with the WMO monitoring and evaluation system, in particular in relation to the use of budgetary resources;

**Recommends** to Congress draft Resolution XX (Cg-18) – Maximum expenditure for the eighteenth financial period (2020–2023), as provided in the annex to the present recommendation.

# Annex to Recommendation 21 (EC-70)

# Draft Resolution XX (Cg-18)

### Maximum expenditure for the eighteenth financial period (2020-2023)

THE WORLD METEOROLOGICAL CONGRESS,

### Noting:

- (1) Article 23 of the Convention of the World Meteorological Organization,
- (2) Article 4 of the Financial Regulations of the Organization,

**Considering** the long-term goals and strategic objectives set in the WMO Strategic Plan (Resolution XX (Cg-18)),

**Authorizes** the Executive Council during the eighteenth financial period from 1 January 2020 to 31 December 2023:

- (1) To incur maximum expenditures of 266,220,000 Swiss francs (... to be decided by Congress) to be funded through assessed contributions;
- (2) To distribute the regular budget resources by appropriation part as provided in the Annex 1 to this resolution; and
- (3) To approve the biennial appropriations for 2020–2021 and for 2022–2023 within these limits;

**Takes note** of the commitments made by Members for the funding of the additional initiatives aimed at accelerated, expanded and/or scaled up implementation of strategic objectives as indicated in Annex 2;

**Further authorizes** the Executive Council to incur other expenditure from voluntary resources contributing to enhanced implementation of programme activities in line with the Strategic Plan, including co-sponsored programmes and initiatives.

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# Annex 1 to draft Resolution XX (Cg-18)

Maximum expenditure for 2020–2023 by appropriation part (in Swiss francs)

Appropriation Parts		Budget 2020–2023
1.	Part I. Long-Term Goal 1	58,285,300
2.	Part II. Long-Term Goal 2	47,925,000
3.	Part III. Long-Term Goal 3	26,138,500
4.	Part IV. Long-Term Goal 4	52,891,600
5.	Part V. Long-Term Goal 5	2,982,900

	Appropriation Parts	Budget 2020-2023
6.	Part VI. Policy-Making Organs, Executive Management and Oversight	39,150,400
7.	Part VII. Language Services	38,846,400
Tot (to	al maximum expenditure: be decided by Congress)	266,220,100

(Minor adjustments could be introduced by the Secretary-General in the final budget proposal).

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### Annex 2 to draft Resolution XX (Cg-18)

### Voluntary contributions with commitment for the financing of additional initiatives for 2020–2023 (in Swiss francs)

Strategic Objective	Additional initiative by Long-Term Goal	<i>Contributors:</i> WMO Members	Total by Contributor
	LTG.1		
SO 1.1	Early warning services for international organizations		
SO 1.2	Climate Regional Forums		
SO 1.3	Water Regional Forums		
SO 1.3	Hydrological Status and Outlook System		
SO 1.4	Urban services: air quality, disasters, climate adaptation		
	LTG.2		
SO 2.1	WMO Hydrological Observing System member support capacity building		
SO 2.2	Leveraging the data revolution (WIGOS and WIS)		
	LTG.3		
SO 3.3	Integrated Global Greenhouse Gas Information System (IG3IS)		
	LTG.4		
SO 4.1	Country Profile Database operations		
SO 4.1	Regional MHEWS advisory systems for Africa, South America, Central Asia (GMAS)		
SO 4.2	Regionalizing WMO/Strengthening National Institutional Systems in NMHS for Weather Water Climate Services		
SO 4.2	Support and coordination of SIDS and MITs		

Strategic	Additional initiative by Long-Term Goal	Contributors:	Total by
Objective		WMO Members	Contributor
SO 4.3	Private sector engagement coordination		

(The list could be refined by the Secretary-General following consultations with Members).

# Recommendation 22 (EC-70)

# Officers of the Organization

THE EXECUTIVE COUNCIL,

**Having considered** the process of election to the positions of Vice-President of the Organization as they become vacant in between sessions of Congress,

**Recommends** to Congress draft Resolution XX (Cg-18) – Designation of acting Vice-Presidents in between sessions of Congress.

# Annex to Recommendation 22 (EC-70)

# Draft Resolution XX (Cg-18)

# Acting Vice-Presidents in between sessions of Congress

THE CONGRESS,

Having examined Recommendation 22 (EC-70) – Officers of the Organization,

**Convinced** of the need to ensure continuity in the offices of the Vice-Presidents;

**Decides** that in case the position of the Third Vice-President becomes vacant in between sessions of the Congress, the Executive Council shall designate an Acting Third Vice-President from amongst elected members of the Executive Council in accordance with the provisions of Article 13 of the Convention of WMO. The Acting Third Vice-President shall serve for a period not exceeding the remainder of the term of office of the Vice-President whom he replaces. The General Regulation 15 shall therefore be amended as follows:

If the position of the Third Vice-President of the Organization becomes vacant in between sessions of Congress, the Executive Council shall designate an Acting Third Vice-President from amongst elected members of Executive Council in accordance with the provisions of Article 13 of the Convention of the WMO. The Acting Third Vice-President shall serve for a period not exceeding the remainder of the term of office of the officer whom he/she replaces;

**Decides** further to clarify General Regulation 13 and 14 to indicate that in case of the Second or Third Vice-Presidents serve as Acting First or Second Vice-President respectively, he/she shall also continue serving in their original office. The General Regulations 13 and 14 shall therefore be amended as follows:

### Regulation 13

If the First Vice-President of the Organization resigns or is not able or eligible to carry out the functions of his office, for any cause, the Second Vice-President of the Organization shall also serve as Acting First Vice-President of the Organization for a period not exceeding the remainder of the term of office of the First Vice-President whom he/she replaces;

# Regulation 14

If the Second Vice-President of the Organization resigns or is not able or eligible to carry out the functions of his office, for any cause, the Third Vice-President of the Organization shall also serve as Acting Second Vice-President of the Organization for a period not exceeding the remainder of the term of office of the Second Vice-President whom he/she replaces;

**Decides** also to amend Regulation 16 (c) to reflect the election process that was previously detailed in Regulation 15 as follows:

Regulation 16 (c)

The elected president of the association or the commission shall arrange for election of the vice-president of that body if the vacancy is notified to the Secretary-General at least 130 days before the next ordinary session of the body concerned. This vice-president shall be elected to serve for a period not exceeding the term of office of the officer whom he replaces.

# Recommendation 23 (EC-70)

# WMO Executive Council

THE EXECUTIVE COUNCIL,

Having adopted Resolution 35 (EC-70) - WMO Executive Council structures,

**Recommends** to Congress draft Resolution XX (Cg-18) – WMO Executive Council, annexed to the present recommendation.

Annex to Recommendation 23 (EC-70)

Draft Resolution XX (Cg-18)

**WMO Executive Council** 

THE CONGRESS,

### Recalling:

- (1) That the Seventeenth Congress requested the Executive Council to provide recommendations to the Eighteenth Congress on constituent body constructs,
- (2) Decision 84 (EC-68) Governance review and Decision 68 (EC-69) WMO constituent body reform,

**Expressing appreciation** for the work carried out by the Executive Council concerning the construct of governance review of the Organization,

Having examined Recommendation 23 (EC-70) — WMO Executive Council,

**Reaffirms** the fundamental role of the Executive Council as established by the Convention and in particular its primary functions as defined by Article 14;

**Endorses** Resolution 35 (EC-70) — WMO Executive Council structures, by which the Executive Council has resolved to streamline the bodies reporting to it around two core bodies as well as the Science Advisory Panel addressing respectively policy, strategic, technical and scientific aspects in addition to the Audit Committee, Financial Advisory Committee and the Staff Pension Committee.

# Recommendation 24 (EC-70)

# **Review of the WMO regional associations**

THE EXECUTIVE COUNCIL,

### **Recalling**:

- (1) That the Seventeenth World Meteorological Congress had requested the Executive Council to provide recommendations to the Eighteenth Congress on constituent body constructs,
- (2) Decision 84 (EC-68) Governance review,
- (3) Decision 68 (EC-69) WMO constituent body reform,

**Having considered** the recommendations of the Working Group on Strategic and Operational Planning concerning the construct and functions of regional associations,

**Recommends** to Congress draft Resolution XX (Cg-18) – WMO regional associations, as provided in the annex to the present recommendation.

### Annex to Recommendation 24 (EC-70)

Draft Resolution XX (Cg-18)

### WMO regional associations

THE CONGRESS,

### Recalling:

- (1) That the Seventeenth Congress requested the Executive Council to provide recommendations to the Eighteenth Congress on constituent body constructs,
- (2) Decision 84 (EC-68) Governance review and Decision 68 (EC-69) WMO constituent body reform;

**Expressing appreciation** for the work carried out by the Executive Council concerning the review of the WMO regional associations;

**Expressing further appreciation** to the presidents of regional associations and experts who served in the regional associations subsidiary bodies during and before the eighteenth financial period, for their leadership, commitment and contribution to the work of the Organization;

Having examined Recommendation 24 (EC-70) — Review of the WMO regional associations;

**Recognizing** that establishment of infrastructures and the implementation of science activities and provision of services are undertaken at the national levels by Members, even those which are offered for the benefit of all Members through global or regional contributions;

**Recalling** the core functions of the regional associations established in Article 18 of the Convention.

[Article 18 (d) states: The functions of the regional associations shall be:

- *(i)* To promote the execution of the resolutions of Congress and the Executive Council in their respective Regions;
- (ii) To consider matters brought to their attention by the Executive Council;
- *(iii)* To discuss matters of general interest and to coordinate meteorological and related activities in their respective Regions;
- *(iv)* To make recommendations to Congress and the Executive Council on matters within the purposes of the Organization;
- (v) To perform such other functions as may be conferred on them by Congress;]

**Recognizing** that the regional associations make recommendations to Congress and the Executive Council on matters within the purposes of the Organization, and particularly in regard with:

- Assessing emerging needs and priorities to inform the Organization-wide strategic and operational planning processes and determining the activities and milestones needed to achieve goals and objectives of the Organisation in the respective regions as outlined in WMO Strategic Plan,
- (2) Identifying capacity development needs of its Members to support the fulfilment of their NMHS national mandates and achieve compliance with WMO adopted policies, technical regulations and guidelines,
- (3) Defining regional requirements for modernization of systems and services based on collective needs of their Members;

**Recognizing further** that the requirements and expertise of regional associations should be better utilized in the establishment of the tasks and plans of the technical commissions as well as other bodies of the Organization;

### Acknowledging:

- One of the key roles of Regional Associations is to encourage its Members' cooperation and collaborative activities that result in more effective regional, inter-regional and sub-regional partnerships,
- (2) The existence of many sub-regional groupings within or across the geographical, political and economic domains of the current regional associations which provide for closer

collaboration and cooperation among Members at sub-global and sub-regional levels based on various commonalities (language, technological level, inter-governmental agreements etc.),

(3) That such cooperative and collaborative approaches should be strongly encouraged and should be more effectively utilized within the current geographical construct of WMO regional associations including through cross-regional cooperation;

**Considering** the need to improve the working mechanisms, in particular the complementary roles of regional associations and technical commissions in the development and implementation of global regional and national systems and services, including in the capacity development, monitoring and evaluation activities;

**Considering further** that the effectiveness of regional associations activities and their contribution to the WMO's strategic objectives is dependent on the available secretariat support through adequately resourced and properly geographically located WMO regional offices and field (sub-regional offices);

### Decides:

- That the current geographical scope of the regional associations as defined in Regulation 162 would continue to be reviewed during the nineteenth financial period with the aim of optimizing their efficiency and performance,
- (2) To amend the General terms of reference of the regional associations in Annex II to the General Regulations as provided in Annex,
- (3) That the regional association should meet as often as necessary, and the plenary session should continue to be organized following a 4-year cycle better aligned to support the WMO Congressional meeting and planning cycles and shall be more productive and useful for its Members, aimed at advancing regional priorities and producing clear action-oriented outcomes,
- (4) That the regional associations should be encouraged to influence and fully align with the relevant structures of the technical commissions and with the strategic goals of the WMO Strategic Plan. Furthermore, pursuing harmonized structures among all regional associations would promote common approaches and better cross-regional cooperation;

### Requests the Executive Council:

- (1) To oversee the continued review of the regional associations with the aim of making recommendations on their form and function to Congress-19,
- (2) To report on the implementation of this resolution at the nineteenth session of Congress;

**Requests** the presidents of the regional associations, supported by the respective management groups, to lead a comprehensive review of the activities and working mechanisms of their associations and report to the Executive Council with recommendations for improved processes and mechanisms for enhanced regional and inter-regional cooperation and partnerships, resource mobilization and plans for resolving existing capacity gaps and deficiencies;

**Requests further** the presidents of the regional associations:

 To coordinate with the presidents of technical commissions in nomination of experts by members to ensure synergies with the respective regional bodies, better leverage the resources and communicate regional requirements,

- (2) To work with the other relevant bodies and the Secretariat towards establishing and operating an effective performance monitoring and evaluation process that will provide an objective assessment of attained capacity and performance of each Member and also highlight critical deficiencies to be addressed as a matter of urgency,
- (3) In addition to the above, coordinate closely with the presidents of the technical commissions and the Secretariat in conveying regional priorities and requirements to be considered in the work of technical commissions, as well as carrying out scheduled performance monitoring and evaluation of the regional centres and facilities serving Members,
- (4) To strengthen their resource mobilization efforts with regional development agencies, as well as their advocacy role with Members' governments with regard to the needed financial support to the NMHSs as the main providers of vital meteorological, climatological hydrological and other related environmental information and services;

**Invites** the Members of the Organization to be proactive in their support and participation in the regional cooperation activities that build the individual and collective capacity to provide high quality services to the society, including through bilateral and multilateral agreements for cost-effective service delivery, sharing experience and transfer of knowledge and know-how;

**Requests** the Secretary-General to take the required steps which will ensure adequate resources for effective operation of the regional associations during the nineteenth financial period.

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### Annex to draft Resolution XX (Cg-18)

### Amendments to the general terms of reference of the regional associations (Annex II to the General Regulations)

In carrying out the functions specified in Article 18 (d) of the Convention within the allotted geographical areas defined in this Annex, under the general guidance of Congress and the Executive Council and with support from the Secretariat, each regional association, in close coordination and collaboration with other bodies concerned, shall:

- 1. Coordinate and organize its Members' activities related to the planning, implementation and evaluation of agreed programmes, strategies and activities, at the regional and subregional levels;
- 2. Ensure that WMO is visible and recognized in its Region, and engage stakeholders in regional initiatives and projects related to the strategic priorities of the Organization; promote visibility and institutional capacity-building of its Members and subregions, and identify and address critical deficiencies for long-term sustainable modern meteorological services through the development of national strategic plan on meteorological services; facilitate the exchange the best practices to communicate the societal-economic benefits of meteorological services;
- 3. Identify requirements amongst members and regional bodies and communicate them to technical commissions and impediments to the timely implementation of planned programmes and activities; collaborate with Members, technical commissions and other bodies, as necessary, to support, monitor and regularly review all the regional centers established by WMO bodies, ensuring excellent performance, sustainable operation and effective services to regional Members; consult with technical commissions on the identification of common experts to assist with sharing of regional priorities and requirements and implementation of technical priorities and associated capacity building activities; identify technical gaps and promote training to develop future experts;

- 4. Promote cooperation and efficiency by establishing regional networks and facilities based upon identified regional needs, in close coordination with the technical commissions concerned; monitor the performance of regional networks and facilities, and the open sharing of data and technical expertise, and require corrective measures, as necessary;
- 5. Contribute to the WMO operating plan and other implementation plans, as necessary, to reflect agreed strategic priorities from a regional perspective and ensure the engagement of Members in focused activities aimed at achieving the expected results of the WMO Strategic Plan;
- 6. Structure its work to address regional priorities and make the best use of the expertise of its Members to provide guidance and assistance, in accordance with the needs of the Region;
- Build and promote cooperation and partnerships with relevant regional organizations, including the United Nations Regional Economic Commissions, other United Nations bodies, subregional organizations, development partners, non-governmental organizations and professional associations;
- Advocate, through the presidents, with regional political and economic entities and Members for the needed political and financial support to Members' capabilities to ensure provision of and access to vital meteorological, climatological hydrological and other related environmental information and services.

### Recommendation 25 (EC-70)

### WMO technical commissions and other bodies

### THE EXECUTIVE COUNCIL,

### **Recalling**:

- (1) That the Seventeenth World Meteorological Congress had requested the Executive Council to provide recommendations to the Eighteenth Congress on constituent body constructs,
- (2) Decision 84 (EC-68) Governance review,
- (3) Decision 68 (EC-69) WMO constituent body reform,

### Having considered:

- (1) The functions of technical commissions as defined by Article 19 of the WMO Convention and WMO General Regulations 180 to 196,
- The recommendations of the first 2018 session of the Working Group on Strategic and Operational Planning concerning the construct of technical commissions (see EC-70/INF. 16),
- (3) The concept of a revised system of technical commissions, as provided in Annex 1 to the present recommendation,
- (4) The importance of having effective mechanisms to strengthen scientific development for the provision of better weather, climate and related environmental services,
- (5) The importance for the Organization of benefitting from independent, high-level scientific advice on global societal trends and challenges,

### Having further considered:

- (1) The alternative proposal by the fourteenth meeting of the Conference of Directors of the Ibero-American Meteorological and Hydrological Services (CIMHET), advocating three commissions for services and applications,
- (2) The success of the Open Science Conferences,
- (3) The outcomes of the Global Conference: Prosperity through Hydrological Services, held in Geneva from 7 to 9 May 2018, and of the Executive Council Special Dialogue on Water, held on 25 June 2018, which encouraged WMO to take on a stronger role in the evolving global water agenda in order to realize opportunities and benefits for Members,
- (4) That the extraordinary session of the Commission for Hydrology (December 2018) has been charged (Resolution 18 (EC-70) – Outcomes of the Special Dialogue on Water) with engaging the hydrological community in: (a) suggesting optimal solutions for effective participation of WMO in the global water agenda, and (b) providing recommendations to Congress on ways to integrate hydrological activities into the new WMO structure,
- (5) That the specific conditions under which the national hydrological services currently operate and the new direction WMO will take with regard to strengthening its hydrological profile may require specific organizational structures and working mechanisms to enable WMO to effectively promote and integrate activities in operational hydrology, and contribute effectively to, and benefit from, the integrated Earth system approach embraced by WMO in the new Strategic Plan,

### Recommends to Congress:

- Draft Resolution XX/1 (Cg-18) Establishment of WMO technical commissions and other bodies for the nineteenth financial period, as provided in Annex 1 to the present recommendation;
- (2) Draft Resolution XX/2 (Cg-18) Research Board, as provided in Annex 2 to the present recommendation;
- (3) Draft Resolution XX/3 (Cg-18) Joint WMO-IOC Committee for Oceanography and Meteorology, as provided in Annex 3 to the present recommendation;
- (4) Draft Resolution XX/4 (Cg-18) Scientific Advisory Panel, as provided in Annex 4 to the present recommendation.

### Annex 1 to Recommendation 25 (EC-70)

### Draft Resolution XX/1 (Cg-18)

### Establishment of WMO technical commissions and other bodies for the nineteenth financial period

THE CONGRESS,

### Recalling:

(1) That the Seventeenth Congress requested the Executive Council to provide recommendations to the Eighteenth Congress on constituent body constructs,
- (2) Decision 84 (EC-68) Governance review, and Decision 68 (EC-69) WMO constituent body reform,
- (3) Resolution 43 (Cg-XVI) Terms of reference of the technical commissions,

**Expressing appreciation** for the work carried out by the Executive Council and its Working Group on Strategic and Operational Planning concerning the construct of technical commissions,

**Having examined** Recommendation 25 (EC-70) – WMO technical commissions and other bodies,

#### Recognizing:

- (1) That in accordance with the Convention, Congress has established and reviewed from time to time commissions consisting of technical experts to study and make recommendations to Congress and the Executive Council on subjects within the purpose of the Organization,
- (2) That the technical commissions, as per their general terms of reference (Annex III to the General Regulations) have been tasked:
  - (a) To study and review advances in science and technology, keep Members informed and advise Congress, the Executive Council and other constituent bodies on these advances and their implications,
  - (b) To develop, for consideration by the Executive Council and Congress, proposed international standards for methods, procedures, techniques and practices in meteorology and operational hydrology including, in particular, the relevant parts of the Technical Regulations, guides and manuals,
- (3) That the Congress had classified the technical commissions into two groups:
  - (a) Basic commissions dealing with basic operations and facilities, and research in atmospheric sciences,
  - (b) Application commissions dealing with applications to economic and social activities,
- (4) That the technical commissions have played a major role in engaging the collective expertise of Members in coordinating the design and development of globally harmonized systems and services operated by Members, development of related standards and guidance, which have contributed to the achievement of the purposes of the Organization and bringing benefits to its Members,

#### **Recognizing further:**

- (1) That the rapidly changing technological and institutional environment and the growing societal demand for information and services in all WMO business areas will require a holistic and integrated approach along the service delivery value chain,
- (2) That such holistic approach would be achieved through consolidation and streamlining of expertise and normative work in major organizational domains covering: (a) the integrated infrastructure and methodology for Earth system observations, information management, and generation of forecasts and products, and (b) the development of applications and services, and related methodologies for service delivery to governments, citizens and economic sectors, and c) focused scientific research and capacity development,

- (3) That the restructuring of the technical commissions is intended to support the Strategic Plan, which aims to support the development of:
  - (a) An Earth system science approach to seamless prediction from climate scales down to the mesoscale that is built upon the concept of the weather, water, ocean and climate linkage,
  - (b) An integrated approach to weather, water, ocean and climate linkages supporting Members' effort to ultimately unify operational prediction systems using a fully coupled Earth system model approach, concerned with changes in the ocean that have a direct influence on the atmosphere and other elements of the Earth system across all time scales,
  - (c) A holistic, interdisciplinary approach to services and applications with a strong focus on users and use cases, promoting impact-based approach and supporting common development of standards and methodologies for generic service attributes like quality, competence, fitness for purpose, accessibility, as well as innovation in service delivery (e.g. through social media),
- (4) That, given the capacity development needs of Members, the efficiencies and savings gained from the restructuring of technical commissions will be re-aligned to support activities aimed at enhancing the capacity of Members;

**Considering** the need to maintain and strengthen the leadership of the Organization in the domains of weather, climate, water and related environmental aspects;

**Considering further** the review and recommendations of the extraordinary session of the Commission for Hydrology (CHy-Ext) by the EC Working Group on WMO Strategic and Operational Planning (WG/SOP);

**Recognizing** that, in view of the scale of the restructuring, which is unprecedented in the WMO history, the transition from the existing to the new structure should be realized through a transparent and well-managed process encompassing proactive change management with special focus on communication with all stakeholders, in particular, the regional associations and their Members;

### Decides:

- (1) To establish, in accordance with Article 8 (g) of the Convention, the following technical commissions for the nineteenth financial period:
  - (a) Commission for Observation, Infrastructure and Information Systems (COIIS), with terms of reference provided in Annex A; and
  - (b) Commission for Weather, Climate, Water and Related Environmental Services and Applications (CSA), with terms of reference provided in Annex B;
- (2) That the fundamental working principle of the new commissions should be the inclusiveness of the weather, climate, water and other relevant environmental areas covered by the WMO constitutional purpose;
- (3) That, due to the multidisciplinary nature and increased work volume the composition and working arrangements of the new commissions should be elaborated to ensure balanced representation of relevant disciplines, active and balanced regional engagement and gender considerations;
- (4) That the two technical commissions shall commence their work as early as possible in accordance with the Transition Plan as provided in Resolution 36 (EC-70)) – WMO Constituent Bodies ReformTransition Plan and Communication Strategy;

- (5) That, in accordance with final paragraph of Article 8 of the Convention, the president of each new commission and their vice-presidents will be elected by Congress, from amongst current presidents and vice-presidents of technical commissions, as one-time measure aimed at expediting the transition to the new structure of the technical commissions,
- (6) Upon completion of the transition period, to disband the existing technical commissions that have been active during the eighteenth financial period, as follows:

Commission for Basic Systems (CBS);

Commission for Instruments and Methods of Observation (CIMO);

Commission for Hydrology (CHy) (pending CHy-Ext recommendations);

Commission for Atmospheric Sciences (CAS);

Commission for Aeronautical Meteorology (CAeM);

Commission for Agricultural Meteorology (CAgM);

Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM);

Commission for Climatology (CCI);

**Expresses appreciation** to the presidents and experts who served in the technical commissions during and before the eighteenth financial period for their leadership, commitment and contribution to the work of the Organization;

Elects ... [names] to serve as president and [three names] as vice-presidents of ...;

**Adopts** the amendment to the General Regulations related to the work and specific terms of reference of the technical commissions as presented in the Annex to this Resolution;

**Requests** the Executive Council to oversee the transition to the new technical commissions and report on the implementation of this resolution at the nineteenth session of Congress;

**Requests** the presidents of the new technical commissions to ensure establishment of optimum subsidiary structures as needed to implement the Strategic Plan in the most efficient and effective manner;

**Requests** further the presidents of the new technical commissions:

- (1) To endeavour to maximize efficiency and synergy through establishing strong liaison with relevant internal and external bodies, including, where appropriate, joint bodies and/or inter-agency bodies as well as relevant global and regional partnerships;
- (2) To report on the subsidiary structure and the working plans of the commissions at the seventieth-second session of the Executive Council (2020);
- (3) To establish working mechanisms and processes that will respond to the priorities and requirements set by Members by developing technical solutions to meet those priorities and requirements in consultation with regional associations, to ensure the solutions are feasible, affordable and implementable at the regional and national levels;

**Requests** Members to support the establishment of a solid community of expertise that will underpin the technical commissions by nominating knowledgeable, experienced and motivated professionals in the related technical fields and to support their work in the commissions, in terms of adequate working time and financial commitment, in order to ensure the leadership role of the commissions in the development of global standards, applying innovation and building national, regional and global technical capacity needed to achieve the purposes of the Organization;

**Requests** the presidents of regional associations to work actively with their Members to ensure that nominated experts are representative of geographic, gender and technical diversity, in

order to facilitate comprehensive input on regional needs and issues, as well as to facilitate implementation and uptake of evolving technical systems, standards and regulations at national and regional levels;

**Requests** the Secretary-General to take the required steps that will ensure the smooth transition to the new arrangement of technical commissions in accordance with the transition plan.

**Note:** This resolution replaces Resolution 43 (Cg-XVI) – Terms of reference of the technical commissions, Resolution 4 (EC-LX) – Role and terms of reference of the Meetings of Presidents of Technical Commissions, Resolution 3 (EC-66) – Coordination between regional associations and technical commissions, and Resolution 14 (Cg-XIII) – Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), which are no longer in force.

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### Annex 1 to draft Resolution XX/1 (Cg-18)

#### Terms of reference of the technical commissions

Note: The General Terms of Reference of Technical Commissions provided in Annex III to the General regulations will remain unchanged.

### A. Commission for Observation, Infrastructure and Information Systems (COIIS)

#### General mandate

The overall scope and specific terms of reference for the Commission for Observation, Infrastructure and Information Systems (COIIS) shall be in accordance with the purposes of Organization defined in Article 2 of the Convention, in particular, items (a) through (c) and (e), and Regulations 180 to 196 and Annex III (as amended by this resolution) of the General Regulations.

The Commission shall contribute to: development and implementation of globally coordinated systems for acquiring, processing, transmitting and disseminating Earth system observations, and related standards; coordination of the production and use of standardized analysis and model forecast fields; and development and implementation of sound data and information management practices for all WMO Programmes and their associated application and services areas.

The work of the Commission shall encompass all approved WMO application areas, as listed in the Rolling Review of Requirements, as well as updated and emerging observing, information and infrastructure requirements.

The Commission shall promote the development of integrated systems to cover all application areas wherever possible, and shall ensure that these systems:

- (a) Are user-driven and provide earth system observations, processed data and relevant services products and information to Members;
- (b) Are applicable, accessible and with life-cycle management across the full range of WMO Members;
- (c) Are built on a modular and scalable principle to the extent possible;
- (d) Make full use of existing WMO and other relevant standards and regulations;

- (e) Make use of and promote public-private engagement where advantageous;
- (f) Incorporate state-of-art optimal and fit-for-purpose technology;
- (g) Are based on user requirements developed in coordination with CSA and the Research Board;
- (h) Are building upon existing partnerships and networks among communities of practice within the service areas, which are beneficial for WMO Members.

The activities of the Commission shall be guided by the WMO Strategic Plan.

#### Specific terms of reference

- (a) Development and maintenance of WMO normative material related to integrated observing systems, data transmission and dissemination systems, data management systems, and data processing and forecast systems as specified in WMO Technical Regulations – the Commission shall:
  - (i) Coordinate development of new systems and infrastructure-related regulatory material in application areas of its scope;
  - (ii) Promote and pursue integration of existing regulatory material;
  - (iii) Keep regulatory material up-to-date through regular amendments, as necessary;
  - (iv) Ensure the consistency of the new and amended regulatory material across the application areas;
  - (v) Consider relevant scientific and technological developments to ensure the currency of the regulatory material;
  - (vi) Accompany recommendations for new and amended regulatory material with related impact, cost-benefit, and risk analysis;
- (b) Common infrastructure and systems attributes the Commission shall:
  - (i) Promote a culture of compliance with standards and relevant regulatory material among all Members;
  - (ii) Further develop and promote the use of the Rolling Review of Requirements (RRR) for the assessment of user requirements, the assessment of available capabilities, and the development of gap mitigation strategies in to further improve the overall systems capabilities of WMO;
  - (iii) Develop and promote a unified approach to data management across all disciplines and WMO applications areas;
  - (iv) Develop common methodologies for quality assurance of observations and other data products across all application areas;
  - Actively seek engagement of Earth system observational data providers from all relevant government entities, international organizations, private sector, and academia.

- (c) Assistance to Members to enhance systems capabilities and enable effective implementation and compliance the Commission shall:
  - Consult with regional associations and Members to identify needs for improvements in observing, data transmission and data management capabilities services and develop the required implementation strategies;
  - (ii) Consult with regional associations to identify experts who can participate in technical commission teams, to facilitate implementation and uptake of evolving technical systems, standards and regulations at national and regional levels;
  - (iii) Facilitate the regional and national implementation of systems under its remit by developing guidance material aligned with new and amended regulatory material;
  - (iv) In consultation with the regional associations, identify needs for assistance to Members to improve their capabilities and provide relevant guidance and capacity building, including training;
  - (v) Propose pilot and demonstration projects as necessary;
  - (vi) Facilitate transfer of knowledge by supporting relevant events and through communication and outreach activities;
  - (vii) Providing standards and regulations for the basic measurement of variables characterising water quantity, quality and sediments; (pending CHy-Ext recommendations)
  - (viii) Support the technical aspects of the Hydrological Status and Outlook System and the state of the water report; (pending CHy-Ext recommendations)
- (d) Cooperation and partnership the Commission shall:
  - Establish close coordination and efficient working mechanisms with the Commission for Weather, Climate, Water and Related Environmental Services and Applications (CSA), relevant international organizations in the area of meteorological, hydrological, climatological and other environmental observations, information and infrastructure;
  - Establish and maintain close collaboration and coordination with WMO co-sponsored system and programmes, and other major international observing programmes and initiatives;
  - (iii) Establish in the collaboration with the Research Board consultative mechanisms with relevant scientific and operational user organizations to receive feedback and advice (e.g. ECMWF, EUMETSAT, EUMETNET, UNFCCC, FAO) on systems capabilities;
  - (iv) Consider opportunities for leveraging resources through establishment of joint, including inter-agency, bodies and projects addressing common areas of system development.

#### Composition

The composition of the Commission shall be in accordance with General Regulation 183.

Participation of leading technical experts in Earth system observations, information management and predictions in the fields of meteorology, hydrology, climatology, oceanography, atmospheric environment and other fields covered by the terms of reference shall be ensured by Members.

UN and international organizations partners, private partners of WMO may be invited to nominate technical experts in their areas of expertise to participate in the work of the Commission in accordance with General Regulation 184.

### Working procedures

The Commission shall elect a president and vice-president(s) among the experts on the Commission.

The Commission shall establish effective and efficient working mechanisms and related necessary time-limited subsidiary bodies:

- (a) Establish a work programme with concrete deliverables and timelines, aligned with the Organization-wide Strategic and Operating Plan and monitor progress on annual basis by reporting to the Executive Council and Congress;
- (b) Use effectively electronic forms of coordination and collaboration;
- (c) Establish effective coordination with other technical commissions, the Research Board, JCOM and other relevant bodies in particular through the Executive Council's Technical Coordination Committee, as appropriate;
- (d) Organize communication and outreach to inform the WMO community of ongoing work, achievements and opportunities;
- (e) Apply a system for recognition of achievements, promotion of innovation and include young professionals;
- (f) Ensure regional and gender balance and inclusiveness in all its structures and work plans;
- (g) Ensure adequate representation and consultation with communities of practice among the service areas.
- B. Commission for Weather, Climate, Water and Related Environmental Services and Applications (CSA)

### General mandate

The Commission for Weather, Climate, Water and Related Environmental Services and Applications (CSA) scope and specific terms of reference shall be in accordance with the purposes of Organization defined in Article 2 of the Convention, in particular, items (d) and (e); Regulations 180 to 196 and Annex III (as amended by this resolution) of the General Regulations.

The Commission shall contribute to the development and implementation of globally harmonized weather, climate, water, ocean and environment related services and applications to enable informed decision making and realization of socioeconomic benefits by all user communities and society as a whole.

The Commission shall encompass application areas with substructures as needed to implement the strategic plan including, but not limited to:

- (a) Regulated and existing meteorological services (covered by WMO *Technical Regulations* (WMO-No. 49), in accordance with General Terms of Reference 2):
  - (i) aeronautical meteorological services;
  - (ii) marine and oceanographic meteorological services;
  - (iii) agrometeorological services;
  - (iv) public weather services;

- (v) climatological services;
- (vi) hydrological services; (pending CHy-Ext recommendations)
- (b) Emerging services under development (currently subject of studies and evaluation for possible inclusion in regulated services, in accordance with General Terms of Reference 1):
  - (i) urban services;
  - (ii) environmental services;
  - (iii) multi-hazard early warning services;
  - (iv) polar and mountain area services;
  - (v) health;
  - (vi) energy;
  - (vii) water management (pending CHy-Ext recommendations)
  - (vii) land transportation;
  - (viii) other, as may become necessary.
- (c) Potential category for hydrological services (pending CHy-Ext recommendations)

The Commission shall promote a holistic approach to services and service delivery and assist Members to apply:

- (a) Risk-based decision-making in support of disaster risk preparedness and reduction;
- (b) A service-oriented culture;
- (c) A strong user focus with 'fit-for-purpose' services;
- (d) Quality management in service delivery;
- (e) Standards for competence and qualification of personnel;
- (f) Mutually-beneficial public-private engagement providing optimized service delivery and added value to the society;
- (g) Accelerated uptake of advanced technology for service delivery;
- (h) Systematic evaluation of socio-economic benefits and other relevant market-oriented evaluations of products and services.

The activities of the Commission shall be guided by the WMO Strategic Plan and the WMO Strategy for Service Delivery.

#### Specific terms of reference

- (a) Development and maintenance of WMO normative material related to service delivery, as specified in WMO Technical Regulations, Volume I and its relevant Annexes, the Commission shall:
  - (i) Coordinate development of new service-oriented regulatory material in all application areas of its scope based on identified needs of Members;
  - (ii) Keep the service-related regulatory material up-to-date through regular amendments, as necessary;
  - (iii) Ensure the consistency of the new and amended regulatory material across the application areas;

- (iv) Enhance capacity for prediction and service delivery;
- (v) Consider relevant scientific and technological developments to ensure the currency of the regulatory material;
- (vi) Together with the COIIS and the Research Board, coordinate linking science, infrastructure and services interactively;
- (vii) Accompany recommendations for new and amended regulatory material with related impact, cost-benefit, and risk analysis.
- (b) Common service delivery attributes the Commission shall:
  - (i) Promote service-oriented culture in all relevant application areas including a customer focus, quality management, understanding of the value and socioeconomic benefits;
  - (ii) Share best practices and develop harmonized methodologies for user engagement including identification of requirements and establishment of feedback mechanisms with users necessary for continuous improvement of services;
  - (iii) Develop methodologies for impact-based products and services in all application areas, innovative service delivery methods and integrated platforms;
  - (iv) Ensure harmonization of requirements for competency and qualification of personnel involved in service delivery;
  - (v) Develop common methodology for verification and validation of information and service delivery as part of quality management;
  - (vi) Build through appropriate studies and projects a better understanding of the economics of service delivery, cost-recovery mechanisms, commercial and market elements, and develop respective guidance to Members;
  - (vii) Seek the engagement of service providers from private sector and academia.
  - (viii) Promote global and regional partnerships, including building upon existing partnerships and networks among communities of practice among the service areas, which are beneficial for WMO Members.
- (c) Assistance to Members to enhance service delivery capabilities and enable effective implementation and compliance the Commission shall:
  - (i) Consult with regional associations and Members to identify needs for new and improved services and analyse related capabilities, and best practices;
  - (ii) Consult with regional associations to identify experts who can participate in technical commission teams, to facilitate implementation and uptake of evolving services and applications, standards and regulations at national and regional levels;
  - (iii) Facilitate the implementation by developing guidance material aligned with the promulgation of new and amended regulatory material;
  - (iv) In consultation with the regional associations, identify needs for assistance to Members and provide relevant guidance and capacity development activities including training;
  - (v) Propose pilot and demonstration projects as necessary;
  - (vi) Facilitate transfer of knowledge and best practices by supporting relevant events and through communication and outreach activities.

- (d) Cooperation and partnership the Commission shall:
  - (i) Establish close coordination and efficient working mechanisms with relevant international organizations such as ICAO, IMO, FAO in the area of service delivery;
  - (ii) Establish consultative mechanisms with user organizations to receive feedback and advice on services;
  - (iii) Consider opportunities for leveraging resources through establishment of joint, including inter-agency, bodies and/or projects addressing common areas of service delivery.

#### Composition

The composition of the Commission shall be in accordance with General Regulation 183.

Participation of leading technical experts in services and applications in the field of meteorology, climatology, hydrology, ocean and the other fields covered by these terms of reference, shall be ensured by Members.

UN, international organizations and private sector partners of WMO may be invited to nominate technical experts in their areas of expertise to participate in the work of the Commission in accordance with General Regulation 184.

#### Working procedures

The Commission shall elect a president and three vice-presidents among the experts on the Commission.

The Commission shall establish effective and efficient working mechanisms and related necessary time-limited subsidiary bodies:

- (a) Establish effective and efficient working mechanisms through an adequate number of subsidiary bodies;
- (b) Make an effective use of a broad community of practice encompassing Members collective expertise, including the private and academia sectors;
- (c) Establish a work programme with concrete deliverables and timelines, aligned with the Organization-wide Strategic and Operating Plan and monitor progress regularly appropriate performance indicators and targets;
- (d) Use effectively electronic forms of coordination and collaboration;
- (e) Establish effective coordination with other technical commissions, the Research Board, JCOM and other relevant bodies, in particular through the Executive Council's TCC, as appropriate;
- (f) Organize effective communication and outreach to inform community of ongoing work, achievements and opportunities;
- (g) Apply a system for recognition of achievements, promotion of innovation and the participation of young professionals;
- (h) Ensure regional and gender balance and inclusiveness in all its structures and work plans;
- (i) Ensure adequate representation and consultation with communities of practice among the service areas.

### Annex 2 to Recommendation 25 (EC-70)

#### Draft Resolution XX/2 (Cg-18)

#### **Research Board**

#### THE CONGRESS,

### Recalling:

- Decision 50 (EC-69) An integrated research and development approach, which includes the main principles to fill the gap between research and operations and to better integrate science in WMO activities,
- (2) Decision 52 (EC-69) Early career research scientist involvement in WMO activities, which requested all Members to promote and support the early career scientist activities and make them beneficial and accessible to young researchers in their own countries and worldwide,
- (3) Recommendation 1 (CAS-17) The role of science in serving society, which requested the Executive Council Working Group on Strategic and Operational Planning to take into account the need for a stronger WMO leadership in science and research and to strengthen the integrated role of research in the "science-for-services" context,
- (4) Recommendation 2 (CAS-17) Seamless prediction systems, which recommended strengthening partnerships with the United Nations system and other international organizations to promote the WMO research agenda towards seamless prediction, and promoting innovation across the WMO technical programmes and activities to ensure the co-design of new and improved services and products,

**Considering** that the implementation of the WMO Strategic and Operating Plans will benefit significantly from effective uptake of research into operational systems and political decision making needs a solid scientific foundation,

**Considering further** the need for a mechanism to coordinate the implementation of the research programmes of the Organization to deliver on the long-term goals and strategic objectives of the Strategic Plan, assisted by the guidance provided by the Scientific Advisory Panel established by Resolution 35 (EC-70),

**Decides**, according to article 8(h) of the Convention, to establish the Research Board on Weather, Climate, Water and the Environment with the terms of reference as given in the Annex to this Resolution.

**Note:** This resolution replaces Resolution 43 (Cg-XVI) – Terms of reference of the technical commissions, Resolution 4 (EC-LX) – Role and terms of reference of the Meetings of Presidents of Technical Commissions, Resolution 3 (EC-66) – Coordination between regional associations and technical commissions.

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#### Annex to draft Resolution XX/2 (Cg-18)

Terms of reference of the Research Board on Weather, Climate, Water and the Environment

**Research Board on Weather, Climate, Water and the Environment** 

#### Mandate

The Research Board translates the strategic aims of WMO and decisions of the Council and Congress into overarching research priorities, and ensures the implementation and coordination of the research programmes to achieve these priorities in accordance with the purposes of Organization defined in Article 2(f) of the Convention.

The Board shall coordinate implementation and resourcing of WMO research programmes taking into account the advice of the Executive Council Scientific Advisory Panel (SAP). The Board shall address Members' needs and support implementation of the WMO Strategic Plan based on science and implementation plans approved by the Executive Council and any co-sponsor governing bodies, as appropriate, for WMO research programmes and activities.

#### Specific terms of reference

The Board specifically shall:

- (a) Promote convergence and integration between the various research programmes inside of and external to WMO, where appropriate,
- (b) Initiate, coordinate and promote research activities in weather, climate, water and related environmental aspects through the WMO and co-sponsored research programmes (WCRP, GCOS, GOOS, WWRP, GAW and possible future research programmes) taking into account the advice provided by SAP and taking into consideration different needs amongst members,
- (c) Guide the implementation of WMO research programmes and act as the primary point of contact related to weather, climate, water and related environmental research aspects in WMO,
- (d) Ensure close coordination and cooperation between the WMO research programmes and eliminate duplication in structures and bodies,
- (e) Maintain an optimal balance between weather, climate, water, ocean and environmental research initiatives and promote the synergies among such initiatives,
- (f) Ensure that the research programmes are implemented according to agreed implementation plans and that such plans are current,
- (g) Promote the co-design of research initiatives aimed at strengthening the 'science-toservice' link between user needs and research project design and between research and operations, to benefit service delivery to Members,
- (h) Promote activities to strengthen scientific development in relevant areas for the benefit of all Members and particularly for developing countries and SIDS,
- (i) Ensure close coordination among the physical and social sciences,
- (j) Promote the science to service and applications,
- (k) Establish effective coordination with technical commissions, JCOM and other relevant bodies, as appropriate,
- (I) Organize effective communication and outreach to inform community of ongoing work, achievements and opportunities,
- (m) Apply a system for recognition of achievements, promotion of innovation and the participation of young professionals.

#### Composition

The Board shall be composed of an optimum number of leading research scientists and research funding managers active in the fields of weather, climate, water, ocean and related environmental and social sciences, taking into account geographical balance and reflecting the WMO gender equality policy, including:

- (a) The chairs of the scientific oversight/steering committees of the WMO research programmes (WCRP, WWRP, GAW) as ex officio members,
- (b) Representatives from IOC and ICSU and major global and regional research funding organizations based on the Research Board chair and SAP advice,
- (c) One representative from each regional association based on their capacity to connect with regional scientific institutions and activities.

The term of engagement shall be of four years with the possibility to renew once for a further four years; for ex officio members the duration shall be based on that of their term.

#### Working procedures

The Board will have a chair and a vice-chair, appointed by Congress. The members will be appointed by the EC.

The Research Board chair, based on recommendations from IOC, ICSU, other relevant international research initiatives, and SAP will propose the three chairs of the research programmes (WWRP, GAW and WCRP), who will be appointed by Executive Council. In case of co-sponsored research programmes, the chair shall be selected by mutual agreement between co-sponsoring organizations.

The chair of the Research Board has the responsibility to ensure coordination of the work in the Research Board with the presidents of the TCs and RAs, who similarly shall coordinate their work with the Research Board chair.

The Board shall meet in principle once per year.

The Board may establish time-bound substructures for the discharge of specific tasks during an intersessional period. Such temporary substructures shall be discontinued at the end of every intersessional period.

The Board shall ensure regional and gender balance and inclusiveness in all its structures and work plans.

### Annex 3 to Recommendation 25 (EC-70)

### Draft Resolution XX/3 (Cg-18)

### Joint WMO-IOC Committee for Oceanography and Meteorology

#### THE CONGRESS,

#### Recalling:

(1) Resolution 14 (Cg-XIII) – Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM),

 IOC Resolution XX-12 – Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM),

**Considering** the revision of the system of technical commissions as decided by this resolution,

**Considering also** the expanded collaboration between WMO and IOC of UNESCO in marine meteorology and oceanography, including in services, observation and information management, research and capacity building,

**Considering further** the evolving needs of a coordinating mechanism between WMO and IOC of UNESCO to support such collaborative activities,

**Considering** the work of the Joint WMO-IOC Consultation Team on the reform of JCOMM established by Decision 58 (EC-70),

Decides, according to article 8 (h) of the Convention:

- (1) To integrate JCOMM components on observation, data management, and processing and forecasting systems into the Commission for Observation, Infrastructure and Information Systems, recognizing IOC co-sponsorship by relevant structures;
- (2) To integrate JCOMM component on services into the Commission for Services and Applications, recognizing IOC co-sponsorship by relevant structures;
- (3) To establish the Joint WMO-IOC Committee for Oceanography and Meteorology (JCOM), as a high-level coordination mechanism with broader engagement of the key relevant bodies of the WMO and IOC, with the terms of reference as given in the Annex to this Resolution;

**Invites** the Assembly of IOC to reflect in its decisions the content of this Resolution as it applies to the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology;

- **Instructs** the Secretary-General to consult with the Executive Secretary of the IOC on the further definition of the working arrangements of the Joint WMO-IOC Committee for Oceanography and Meteorology and its substructures and to report on implementation at the seventy-second session of the Executive Council.
- **Note:** This resolution replaces Resolution 43 (Cg-XVI) Terms of reference of the technical commissions, Resolution 4 (EC-LX) Role and terms of reference of the Meetings of Presidents of Technical Commissions, Resolution 3 (EC-66) Coordination between regional associations and technical commissions, and Resolution 14 (Cg-XIII) Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), which are no longer in force.

### Annex to draft Resolution XX/3 (Cg-18)

### Terms of reference of the Joint WMO-IOC Committee for Oceanography and Meteorology

#### Joint WMO-IOC Committee for Oceanography and Meteorology

The terms of reference of the Joint WMO-IOC Committee for Oceanography and Meteorology (JCOM) shall be:

### Mandate

- (a) To provide guidance on the coordinated or collaborative development, integration and implementation of the activities related to oceanographic, meteorological, hydrological and climatological observation, data and information management, and services and forecasting systems as well as research carried out by WMO and IOC subsidiary bodies:
  - (i) For WMO, the Commission for Observation, Infrastructure and Information Systems, the Commission for Services and Applications and the Research Board,
  - (ii) For IOC, the Committee on International Oceanographic Data and Information Exchange (IODE), the Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG) and the Intergovernmental Panel on Harmful Algal Blooms (IPHAB),
  - (iii) The co-sponsored entities: Global Climate Observing System (GCOS), Global Ocean Observing System (GOOS) and World Climate Research Programme (WCRP);
- (b) To report to WMO and IOC governing bodies on these activities, propose new action, as required, and advise them regarding:
  - (i) Instructions to the relevant subsidiary bodies,
  - (ii) Any liaison or consultation required with relevant intergovernmental and international stakeholders.

#### Membership

The membership of JCOM shall be constituted by:

- (a) Representatives from WMO and IOC subsidiary bodies:
  - (i) For WMO, two members of the Commission for Observation, Infrastructure and Information Systems, covering observation, data and information management, and data processing and forecasting systems, two members of the Commission for Services and Applications, covering services, appointed by the respective presidents, and a member of the Research Board appointed by the chair,
  - (ii) For IOC, the chairpersons of the IODE Committee, the TOWS-WG and IPHAB;
- (b) The chairs of the steering committees of entities jointly sponsored by WMO and IOC:<sup>1</sup>
- (i) Global Climate Observing System,
- (ii) Global Ocean Observing System,
- (ii) World Climate Research Programme;
- (c) Members of the WMO and IOC governing bodies:
  - (i) Three members of the WMO Executive Council appointed by the President, taking into account geographical distribution and gender balance,
  - (ii) Three members of the IOC Executive Council appointed by the Chairperson, taking into account geographical distribution and gender balance;
- (d) One representative of the International Maritime Organization;

<sup>&</sup>lt;sup>1</sup> GOOS-SC being already represented under (a) (ii).

(e) No more than four experts appointed by the co-chairs.

#### Working procedures

The Committee shall be co-chaired by two co-chairs, one for oceanography and one from meteorology, elected among the members.

The co-chairs shall hold their office for one intersessional period, with the possibility to be reelected for a second term.

The members elected in WMO and IOC governing and subsidiary bodies and co-sponsored programmes shall also hold their office based on the duration of their term; the experts shall hold their office for one intersessional period, with the possibility to be re-confirmed for a second term.

The co-chairs shall represent the Committee in the sessions of the WMO and IOC governing and subsidiary bodies.

The Committee shall meet in principle in person every two years, in conjunction with the sessions of the WMO and IOC governing bodies, alternating with the WMO Congress and the IOC Assembly. Intersessional work should be carried out by correspondence or virtual means.

The Committee may establish time-bound substructures for the discharge of specific tasks during an intersessional period, provided that this is at no cost for the parent bodies. Such temporary substructures shall be discontinued at the end of every intersessional period.

For the first intersessional period following the adoption of this Resolution, the Committee shall be co-chaired by the current co-presidents of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology.

Chairs of other relevant WMO and IOC working groups, panels and expert teams may be invited by the co-chairs to attend meetings of the Committee as required by the agenda.

Representatives from other United Nations or international organizations may be invited as members of or observers to the Committee as deemed appropriate.

The WMO Secretary-General and the IOC Executive Secretary shall evaluate the financial and secretariat support requirements for the Committee and make adequate provisions in their budget proposals to the respective governing bodies.

 Note: Article 26 of the Convention refers to relations with other organizations. Regulations 38–45 refer to joint working groups in principle of the duration of one intersessional period. Regulation 181 refers to joint technical commissions.

#### Annex 4 to Recommendation 25 (EC-70)

### Draft Resolution XX/4 (Cg-18)

#### **Scientific Advisory Panel**

#### THE CONGRESS,

**Recalling** the global societal challenges underlying the 2030 Agenda for Sustainable Development, the Paris Agreement on climate change and the Sendai Framework for Disaster Risk Reduction and the resulting demand for multi-disciplinary scientific foresight;

**Considering** that benefiting from independent scientific advice would strengthen the ability of the WMO to gain from scientific and technological breakthroughs in order to lead advancements in weather, climate, water and related environmental fields to address the above challenges;

**Decides**, according to article 8(h) of the Convention, to establish the Scientific Advisory Panel with the terms of reference as given in the Annex to this Resolution.

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### Annex to draft Resolution XX/4 (Cg-18)

#### Terms of reference of the Scientific Advisory Panel

#### **Scientific Advisory Panel**

#### Mandate

The Scientific Advisory Panel (SAP) shall be the scientific advisory body of the Organization, drawing up opinions and recommendations to Congress and to the Executive Council on matters concerning WMO research strategies and the optimal scientific directions to support the evolution of its mandate in weather, climate, water and related environmental and social sciences. The Panel shall provide forward-looking strategic advice on emerging challenges and opportunities, and in particular:

- (1) Advise on areas in which, on the basis of available evidence, new technological and scientific advancement would open to new applications related to WMO core activities,
- (2) Promote the global standing and visibility of WMO as a leading scientific organization in the fields of weather, climate, water and related environmental and social sciences within the UN and otherwise, and enhance the WMO role as facilitator of international cooperation in weather, climate, water, ocean and environmental sciences among all role players,
- (3) Promote science vision, and its downstream trends, with WMO and among its Members as the primary driver for innovation, understanding and the development of new and improved weather, climate, water, ocean and related environmental services and know-how,

#### Composition

The Panel shall be composed of maximum fifteen independent leading internationally recognized experts coming from the fields of weather, climate, water, ocean and related environmental and social sciences.

The opportunity to become a member of the Panel shall be announced publicly for individuals to put their name forward. The members of the Panel shall be appointed by the Executive Council, taking into account regional and gender balance and representation of academia, research bodies, the private sector and user communities reflecting the breadth of engagement in WMO Research Programmes. The selection of the names to be proposed to the Executive Council to be appointed as Panel members shall be done by the Secretariat in consultation with the chair of the Research Board. The term of engagement for members shall be for four years with a possibility to be renewed for a second term.

A WMO Vice-President shall act as an Executive Council focal point for the Panel to ensure cross-communication.

The chair of the Research Board and a representative of the Secretariat shall take part in the meetings of the Panel.

### Working procedures

The Panel shall select a chair and a vice-chair.

The Panel shall meet in principle once per year prior to a session of Executive Council.

The chair of the Research Board together with the Secretariat shall support the chair of the Panel in setting up and executing the meetings. The chair of the Panel may invite experts and/ or representatives from partner organizations to attend meetings of the Panel as observers.

#### Recommendation 26 (EC-70)

### Extraordinary session of the World Meteorological Congress in 2021

THE EXECUTIVE COUNCIL,

#### **Recalling:**

- (1) Resolution 35 (EC-70) WMO Executive Council structures,
- (2) Resolution 36 (EC-70) WMO Constituent Bodies Reform Transition Plan and Communication Strategy,
- (3) Recommendation 22 (EC-70) Officers of the Organization,
- (4) Recommendation 23 (EC-70) WMO Executive Council,
- (5) Recommendation 24 (EC-70) Review of the WMO regional associations,
- (6) Recommendation 25 (EC-70) WMO technical commissions and other bodies,

**Considering** the high expectations placed on the National Meteorological and Hydrological Services of WMO Members, together with their various international and national partners from public, private and academic sectors, to provide vital support in the pursuit of the global goals established by the United Nations Sustainable Development Goals, the Paris Agreement and the Sendai Framework, and that these expectations require a new level of dynamic consultation and coordination between Members,

**Stressing** the need to enhance and strengthen institutional arrangements to deliver on the WMO mandate related to provision of information and services for sustainable management of water resources,

**Cognizant** of the rapid progress in science and technology which constantly brings opportunities for improvements in the quality of services with benefits to society,

**Recognizing** the need to ensure a similarly rapid uptake of innovation in the evolution of the Organization's main systems for the collection and exchange of observations and predictions, and for service provision, which necessitate expeditious amendments to the framework of the WMO Technical Regulations, development of guidance and capacity-development activities,

**Recommends** that an extraordinary session of Congress be called in June 2021 (duration five days) to: (a) take stock and provide direction to the reform process, (b) strengthen institutional arrangements to deliver on WMO mandate related to provision of information and services for sustainable management of water resources, and (c) determine and maintain a highly relevant Technical Regulations framework;

**Further recommends** considering the feasibility of two Congress sessions in the fouryear period, which would offer benefits of more frequent gathering of Members (of a shorter duration) for an effective and inclusive governance and greater engagement of Members in advancing the technical progress and policy-making of the Organization. The first session in the four-year cycle would be dedicated to decisions on strategy, policy, budget, structure and elections; a second (extraordinary session) would focus on normative and regulatory issues, progress on strategic objectives and capacity development, and other selected topics, as necessary.

**Note:** This recommendation concerns Article 10 (b) of the WMO Convention, which states that "an extraordinary Congress may be convened by decision of the Executive Council", as well as Regulations 129 and 137 of WMO General Regulations.

### Recommendation 27 (EC-70)

### Amendments to the Financial Regulations of the World Meteorological Organization

THE EXECUTIVE COUNCIL,

Noting Article 8(d) of the Convention of the World Meteorological Organization,

**Having considered** the Secretary-General's proposals for the operating plan and budget for the eighteenth financial period,

**Noting further** the amendments made by the Secretary-General to the Financial Rules of the Organization (for more information, see EC-70/INF. 17.1(2)),

**Recommends** to Congress that Financial Regulations under Article 3 (Maximum expenditures for the financial period), Article 6 (The biennial budget) and Article 7 (Appropriations) be amended as shown in the annex to the present recommendation.

### Annex to Recommendation 27 (EC-70)

### Draft Resolution XX (Cg-18)

### **Revisions of the Financial Regulations of the World Meteorological Organization**

#### THE WORLD METEOROLOGICAL CONGRESS,

**Noting** that Article 8(d) of the Convention of the World Meteorological Organization authorizes Congress to determine regulations prescribing the procedures of the various bodies of the Organization and, in particular, the Financial Regulations,

**Considering** that Financial Regulations under Article 3 (Maximum Expenditures for the Financial Period), Article 6 (The Biennial Budget) and Article 7 (Appropriations) require revision,

**Decides** that the Financial Regulations as set out in the Annex to this resolution shall apply effective 1 January 2020.

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### Annex to draft Resolution XX (Cg-18)

### Revisions of the Financial Regulations of the World Meteorological Organization

Financial regulation	Current text	Revised text	Reason for change
3.3	The estimates shall be presented in a results-based budget format and shall be accompanied by such informational annexes and explanatory statements as may be requested by, or on behalf of, Congress and such further annexes or statements as the Secretary-General may deem necessary and useful.	The estimates shall be made by appropriation parts corresponding to the Long-Term Goals and presented in a results-based budget format based- on the Long Term Goals and shall be accompanied by such informational annexes and explanatory statements as may be requested by, or on behalf of, Congress and such further annexes or statements as the Secretary-General may deem necessary and useful.	To reflect the format of the proposed budget for the 18th financial period.
6.3	The biennial budget estimates shall be presented in a results-based format and shall be accompanied by such informational annexes and explanatory statements as may be requested by, or on behalf of, the Executive Council and such further annexes or statements as the Secretary-General may deem necessary and useful.	The biennial budget estimates shall be presented in a results-based format based on the Long-Term Goals at the level of Strategic Objectives and shall be accompanied by such informational annexes and explanatory statements as may be requested by, or on behalf of, the Executive Council and such further annexes or statements as the Secretary-General may deem necessary and useful.	To reflect the format of the proposed budget for the 18th financial period. Performance will be managed at a Strategic Objective level.

<i>Financial</i> regulation	Current text	Revised text	Reason for change
7.7	A transfer between appropriation sections of the results-based budget format may be made by the Secretary-General subject to confirmation by the Executive Council.	A transfer between appropriation parts sections of the results based- budget format-may be made by the Secretary-General subject to confirmation by the Executive Council.	To reflect the format of the proposed budget for the 18th financial period.

## Recommendation 28 (EC-70)

### Enhanced framework for the WMO Technical Regulations

THE EXECUTIVE COUNCIL,

**Recalling** Decision 93 (EC-68) – Roadmap to an enhanced framework for WMO Technical Regulations,

**Taking note** of the progress in the implementation of the Roadmap to an Enhanced Framework for WMO Technical Regulations, as provided in Annex 1 to the present recommendation,

**Recommends** that Congress adopt draft Resolution XX (Cg-18) – Enhanced framework for WMO Technical Regulations, as contained in Annex 2 to the present recommendation.

**Note:** This recommendation replaces Decision 93 (EC-68), which is no longer in force.

# Annex 1 to Recommendation 28 (EC-70)

# Timeline for review and updating of governance publications

			P	Prima	ry re	spor	sible	e bod	y					
WMO- No.	Title	C Ae M	C Ag M	C A S	C B S	C CI	C Hy	C I M O	J C O M M	E T R/ P	Latest edition/ update	Next edition or update	Comment	Responsible department
TR VOI	UMES													
49, Vol I	General Meteorological Standards and Recommended Practices	x	x	x	x	x	х	x	x	x	2015/2017	2019	2015 edition introducing partly new structure; 2019 edition: new structure finalized; Climate service section	OBS, WDS, CLW, RES
49, Vol II	Meteorological Service for International Air Navigation	x									2016	2018	ICAO amendment cycle changing from 3 to 2 years	AEM
49, Vol III	Hydrology						х				2006	2019	Under progress	CLW
<del>49,</del> <del>Vol IV</del>	Quality Management										<del>2011</del>		Discontinued; replaced by a chapter in Vol. I	
ANNEX	XES													
407, Annex 1	International Cloud Atlas, Volume I – Manual on the Observation of Clouds and Other Meteors (in part)							x			2016 electronic version		New edition published in English; translation into the other WMO official languages underway	OBS

	Primary responsible body													
WMO- No.	Title	C Ae M	C Ag M	C A S	C B S	C CI	C Hy	C I M O	J C O M M	E T R/ P	Latest edition/ update	Next edition or update	Comment	Responsible department
	Manual on Codes, Vol. I.1 (Part A – Alphanumeric Codes):									I.1: 2011/2017	Annual update	The future form		
306, Annex	Vol. I.2 (Part B – Binary Codes, Part C – Common Features to Binary and Alphanumeric Codes) Vol. I.3 (Part D – Representations derived from data models)				х						I.2: 2015/2016	Annual update	of publication of these detailed	OBS
2											I.3: 2015/2017	Annual update	is needed	
386, Annex 3	Manual on the Global Telecommunication System				x						2015/2017		Need to plan future merging with Annex 7 (WIS); still needed probably by Cg-19	OBS
485, Annex 4	Manual on the Global Data-processing and Forecasting System,				x						2017			WDS
544, Annex 5	Manual on the Global Observing System,				x						2015/2017		To be terminated beginning of 2020 (merged with Annex 8)	OBS
558, Annex 6	Manual on Marine Meteorological Services, Volume I								x		2012	2018		WDS
1060, Annex 7	Manual on the WMO Information System				x						2015/2017	2019		OBS
<del>1083</del>	Manual on the Implementation of Education and Training- Standards in Meteorology and Hydrology									×	<del>2012</del>	<del>2016</del>	Transformed into a Guide No. 1083	
1160, Annex 8	Manual on the WMO Integrated Global Observing System		x	x	x	x	x	x	x		2015/2017	2019		OBS
GUIDE	S													
8	Guide to Meteorological Instruments and Methods of Observation (CIMO guide)							x			2014/2017	2018	Restructuring of CIMO Guide (CIMO-17; 2018)	OBS

			P	Prima	ry re	espor	isible	e boc	ly					
WMO- No.	Title	C Ae M	C Ag M	C A S	C B S	C Cl	C Hy	C I M O	J C O M M	E T R/ P	Latest edition/ update	Next edition or update	Comment	Responsible department
100	Guide to Climatological Practices					x					2011	2018		CLW
134	Guide to Agricultural Meteorological Practices (GAMP)		x								2010/2012	2020- 2023		CLW
168	Guide to Hydrological Practices, Volume I, Hydrology – From Measurement to Hydrological Information; Volume II, Management of Water Resources and						x				2008	2018	-	CLW
	Application of Hydrological Practices													
305	Guide on the Global Data-Processing System (GDPS)				x						1993	2018	Update coming	WDS
471	Guide to Marine Meteorological Services								х		2001	2018		WDS
488	Guide to the Global Observing System				x						2010/2017			OBS
636	Guide on the Automation of Data-Processing Centres				x						1998		To be discontinued by Cg-18	OBS
702	Guide to Wave Analysis and Forecasting								х		1998	2019		WDS
731	Guide on Meteorological Observing and Information Distribution Systems for Aviation Weather Services	x									2014	2019	To be discontinued, the content to be merged with WMO- No. 732	WDS, OBS
732	Guide to Practices for Meteorological Offices Serving Aviation	x									2003	2018		WDS
781	Guide to Applications of Marine Climatology					x			x		1994	2020- 2023		WDS
788	Guide on WWW Data Management				x						1993		To be discontinued by Cg-18	OBS
834	Guide to Public Weather Services Practices				x						1999	2018		WDS
904	Guide to Aeronautical Meteorological Services Cost Recovery	x									2007	2020- 2023		WDS
1001	Guide on the Quality Management System for the Provision for Meteorological Service for International Air Navigation	x									2011/2014		To be discontinued; guidance provided in WMO-No.1100	

	Primary responsible body													
WMO- No.	Title	C Ae M	C Ag M	C A S	C B S	C Cl	C Hy	C I M O	J C O M M	E T R/ P	Latest edition/ update	Next edition or update	Comment	Responsible department
1044	Manual on Stream Gauging (OHR)						х				2010	2018		CLW
1061	Guide to the WMO Information System				х						2015/2017			OBS
1165	Guide to the WMO Integrated Global Observing System		х	х	х	x	х	х	x		2017/2018	2018		OBS
1076	Guide to Storm Surge Forecasting								x		2011	2020- 2023		WDS
1083	Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology, Volume I – Meteorology										2015			ETR
1100	Guide to the Implementation of a Quality Management System for National Meteorological and Hydrological Services										2017		English edition issued	Officer in Charge QMF
1205	Guide on Competency										2018			ETR, WDS
680	Manual on Quality Monitoring (Operational Hydrology Report - OHR)						x				1988		Will be removed after new edition of WMO-No. 49, Vol. III is issued	CLW
948	Manual on Sediment Management and Measurement (OHR)						x				2003		Will be removed after new edition of WMO-No. 49, Vol. III is issued	CLW

### Annex 2 to Recommendation 28 (EC-70)

### Draft Resolution XX (Cg-18)

### Enhanced framework for WMO Technical Regulations

THE WORLD METEOROLOGICAL CONGRESS,

#### Recalling:

(1) Decision 93 (EC-68) - Roadmap to an enhanced framework for WMO Technical Regulations,

(2) Recommendation 28 (EC-70) - Enhanced framework for WMO Technical Regulations,

**Noting with appreciation** the significant progress that has been made towards the enhanced framework of WMO Technical Regulations under guidance of the Executive Council,

**Noting further** the prime role of the technical commissions in reviewing and updating WMO Technical Regulations and their relevant Manuals and Guides,

**Recognizing** that the WMO role in setting international standard and recommended practices, supplemented by relevant implementation guidance, will become even more important in the context of a multi-sector multi-stakeholder Global Weather Enterprise,

**Acknowledging** that the enhancement of the normative work carried out by the WMO is one of the main rationales for the constituent bodies reform with expected positive impact on the overall quality and relevance of the WMO Technical Regulations, including their broader recognition and acceptance by stakeholders from private and academic sectors,

**Requests** technical commissions to cooperate closely to ensure continuity and consistency of the normative work, including throughout the transition the new constituent bodies structure;

**Requests** the Executive Council to ensure the sustainability and continuity of the Technical Regulations framework;

**Requests** the Secretary-General to establish the necessary supporting processes and mechanisms of the Secretariat to ensure further the implementation of the framework in the next financial period.

# **APPENDIX 5. LIST OF PARTICIPANTS**

#### 1. Officers of the session

David GRIMES Andrea Celeste SAULO (Ms)

#### 2. Ex officio members

Daouda KONATE Abdullah A. ALMANDOUS Guillermo NAVARRO Juan Carlos FALLAS SOJO Andi Eka SAKYA Michael STAUDINGER

#### 3. Elected members

Ahmed ABDELAAL Gerhard ADRIAN Mamadou Lamine BAH Silvio CAU Francisco DE ASSIS DINIZ Phil EVANS Ayman Salem GHULAM Ismail GUNES Agnes KIJAZI (Ms) Ravind KUMAR Jean-Marc LACAVE Arlene LAING (Ms) Jerry LENGOASA Yaming LIU (Ms) Albert MARTIS Sani Abubakar MASHI Jaecheol NAM **Richard PHILIPPE** Kanduri Jayaram RAMESH Arni SNORRASON Ken TAKAHASHI GUEVARA Fetene TESHOME Louis UCCELLINI Chin Ling WONG (Ms) Maxim YAKOVENKO

### 4. Alternates and Advisers

#### **ABDELAAL Ahmed**

Abdalla Abdelrahman BALIGH Mohammad ELSHAHED

#### **ADRIAN Gerhard**

Axel THOMALLA Siegfried DEMUTH Ingeborg DETTBARN (Ms) Jochen DIBBERN Karolin EICHLER (Ms) Tobias FUCHS Sarah JONES (Ms) Harald KOETHE Claudia RUBART (Ms) President Second Vice-President and Acting First Vice-President

Acting president of RA I President of RA II President of RA III President of RA IV President of RA V President of RA VI

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Alternate Adviser Adviser Adviser Adviser Adviser Adviser Adviser

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Adviser

ALMANDOUS Abdullah A.Omar A. AL YAZEEDI Jaser RABADIAlternate AdviserBAH Mamadou LamineAdviserAminata KEBE (Ms)AdviserCAU SilvioIternate Alternate Adviano RASPANTIAlternate AdviserAgela Chiara CORINA (Ms) Leone MICHAUD Silvano PECORAAdviserBINAND PECORAAdviserJane WARDLE (MS) Paul DAVIESAlternate AdviserStephanie DAVIES (Ms) Harry DIXONAdviserAlen SEMPLE (MS) Silvano PECORAAdviserAlen JENKINS Alan JENKINSAdviserAlan EINKINS Alan JENKINS AdviserAdviserAlan EINKINS Alan SIMONAdviserAlen SEMPLE (MS) Peremy TANDY Fiona TOVEY (MS) Bruce TRUSCOTT Fiona TOVEY (MS) AdviserAlternate AdviserMohammed BABIDHAN Maha ZEDAN (MS)Alternate AdviserGRIMES David Dilhari FERNANDO (MS) Jamie SMITH AdviserAlternate AdviserGURES Ismail Ercan BUYUKBAS MatiserAlternate AdviserJitsuko HASEGAWA (MS) Yasuo SEKITA Jitsuko HASEGAWA (MS) AdviserAdviser AdviserYasua SEKITA Satoshi OGAWA Yasua BARRELL (MS) Ben CHURCHILLAlternate AdviserMibert Timiza MURUKE Ben CHURCHILLAlternate AdviserYoshihiko TAHARA MitserAlternate AdviserYoshihiko TAHARA MitserAlternate AdviserYoshihiko TAHARA MitserAlternate AdviserYoshihiko TAHARA MitserAlternate AdviserYoshihiko TAHARA MitserAlternate Adviser<	Dieter SCHROEDER	Adviser
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GUNES IsmailErcan BUYUKBASAlternateHASHIDA ToshihikoYasuo SEKITAAlternateJitsuko HASEGAWA (Ms)AdviserYasutaka HOKASEAdviserYasutaka HOKASEAdviserFumihiko KANEKOAdviserSatoshi OGAWAAdviserYoshihiko TAHARAAdviserMiho TANAKA (Ms)AdviserJOHNSON AndrewSusan BARRELL (Ms)AlternateBen CHURCHILLAdviserKIJAZI AgnesWilbert Timiza MURUKEAdviserKONATE DaoudaYeboua Ko i Thomas ADAMAdviserBernard Kouakou DJEAdviserLACAVE Jean-MarcCatherine BORRETTI (Ms)AlternateMatteo DELL'ACQUAAlternate	Jamie SMITH	Adviser
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Miho TANAKA (Ms)AdviserJOHNSON AndrewAlternateSusan BARRELL (Ms)AlternateBen CHURCHILLAdviserKIJAZI AgnesKilbert Timiza MURUKEWilbert Timiza MURUKEAdviserKONATE DaoudaAdviserYeboua Ko i Thomas ADAMAdviserBernard Kouakou DJEAdviserLACAVE Jean-MarcAlternateCatherine BORRETTI (Ms)AlternateMatteo DELL'ACQUAAlternate	Yoshihiko TAHARA	Adviser
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Bernard Kouakou DJEAdviserLACAVE Jean-MarcAdviserCatherine BORRETTI (Ms)AlternateMatteo DELL'ACQUAAlternate	Yehoua Ko i Thomas ADAM	Advicar
LACAVE Jean-MarcCatherine BORRETTI (Ms)AlternateMatteo DELL'ACQUAAlternate	Bernard Kouakou DJE	Adviser
Catherine BORRETTI (Ms) Alternate Matteo DELL'ACQUA Alternate		
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	Matteo DELL'ACOUA	Alternate

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LAING Arlene	
Tvrone SUTHERLAND	Alternate
Glendell DE SOUZA	Adviser
David FARRELL	Adviser
LIU Yaming	
Xiaonong SHEN	Alternate
Zhenlin CHEN	Adviser
Yan DONG (Ms)	Adviser
Jianwei HU	Adviser
Xiaodan NA (Ms)	Adviser
Shien WANG	Adviser
Xianghua XU	Adviser
Jun YANG	Adviser
Jun YU	Adviser
Yang YU (Ms)	Adviser
Qin ZENG	Adviser
Zhongfeng ZHANG	Adviser
Xing ZHAO	Adviser
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Seungkyun PARK	Adviser
Jieun SEO (Ms)	Adviser
	Adviser
RAMESH Kanduri Jayaram	A   + + -
	Alternate
	Auvisei
SAKYA Andi Eka	A du lio o r
SAKYA Andi Eka Anni Arumsari FITRIANY (Ms) Dwikorita KARNAWATI (Mc)	Adviser
SAKYA Andi Eka Anni Arumsari FITRIANY (Ms) Dwikorita KARNAWATI (Ms) Mulyono Rabadi PRABOWO	Adviser Adviser Adviser
SAKYA Andi Eka Anni Arumsari FITRIANY (Ms) Dwikorita KARNAWATI (Ms) Mulyono Rahadi PRABOWO Bagus R. RIEVAN	Adviser Adviser Adviser Adviser
<b>SAKYA Andi Eka</b> Anni Arumsari FITRIANY (Ms) Dwikorita KARNAWATI (Ms) Mulyono Rahadi PRABOWO Bagus R. RIEVAN Ardhasena SOPAHELUWAKAN	Adviser Adviser Adviser Adviser Adviser
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Caroline CORVINGTON (Ms)	Adviser
Mary GLACKIN (Ms)	Adviser
Adriana GONZALEZ (Ms)	Adviser
Richard JEFFERIES	Adviser
Robert MASON	Adviser
Daniel MULLER	Adviser
Mark PAESE	Adviser
Scott RAYDER	Adviser
WONG Chin Ling	
Sok Huang TAN (Ms)	Adviser
YAKOVENKO Maxim	
YAKOVENKO Maxim Alexander NURULLAEV	Alternate
<b>YAKOVENKO Maxim</b> Alexander NURULLAEV Ilia DEMIDOV	Alternate Adviser
YAKOVENKO Maxim Alexander NURULLAEV Ilia DEMIDOV Tatiana DMITRIEVA (Ms)	Alternate Adviser Adviser
YAKOVENKO Maxim Alexander NURULLAEV Ilia DEMIDOV Tatiana DMITRIEVA (Ms) Alexander GUSEV	Alternate Adviser Adviser Adviser
YAKOVENKO Maxim Alexander NURULLAEV Ilia DEMIDOV Tatiana DMITRIEVA (Ms) Alexander GUSEV Vladimir KATTSOV	Alternate Adviser Adviser Adviser Adviser
YAKOVENKO Maxim Alexander NURULLAEV Ilia DEMIDOV Tatiana DMITRIEVA (Ms) Alexander GUSEV Vladimir KATTSOV Dmitry KIKTEV	Alternate Adviser Adviser Adviser Adviser Adviser
YAKOVENKO Maxim Alexander NURULLAEV Ilia DEMIDOV Tatiana DMITRIEVA (Ms) Alexander GUSEV Vladimir KATTSOV Dmitry KIKTEV Ivan NOVIKOV	Alternate Adviser Adviser Adviser Adviser Adviser Adviser
YAKOVENKO Maxim Alexander NURULLAEV Ilia DEMIDOV Tatiana DMITRIEVA (Ms) Alexander GUSEV Vladimir KATTSOV Dmitry KIKTEV Ivan NOVIKOV Marina PETROVA (Ms)	Alternate Adviser Adviser Adviser Adviser Adviser Adviser Adviser
YAKOVENKO Maxim Alexander NURULLAEV Ilia DEMIDOV Tatiana DMITRIEVA (Ms) Alexander GUSEV Vladimir KATTSOV Dmitry KIKTEV Ivan NOVIKOV Marina PETROVA (Ms) Denis POPOV	Alternate Adviser Adviser Adviser Adviser Adviser Adviser Adviser Adviser

#### 5. Presidents of technical commissions

Sergey VASILIEV

Roman VILFAND

Manola BRUNET (Ms)	President of CCI
Bertrand CALPINI	President of CIMO
Oystein HOV	President of CAS
Michel JEAN	President of CBS
Harry LINS	President of CHy
Chi Ming SHUN	President of CAeM
Johan STANDER	Co-president of JCOMM
Roger STONE	President of CAgM

Adviser

Adviser

#### 6. Regional hydrological advisers

Cristina ALIONTE EKLUND (Ms)	Adviser
John FENWICK	Adviser
Dora GONIADZKI (Ms)	Adviser
Sung KIM	Adviser
Ashraf ZAKEY	Adviser
José Alberto ZÚÑIGA MORA	Adviser

#### 7. Representatives of WMO Members

#### Algeria

Samir RAHEM

#### Benin

Chite Flavien AHOVE Jean-Pierre AYENA Eloi LAOUROU

#### Brazil

Péricles CARDIM Nero CUNHA FERREIRA Marcelo Jorge MEDEIROS Ivan SARAIVA

#### **Burkina Faso**

Rufine Caroline BONKOUNGOU (Ms)

#### Colombia

Luis Antonio DIMATE CARDENAS

### Finland

Juhani DAMSKI Maria HURTOLA (Ms)

### Iran, Islamic Republic of

Ebrahim MIRZAEI HAJI BAGHLOU Davood PARHIZKAR

### Lao People's Democratic Republic

Bounphady INSISIENMAY (Ms)

# Niger

Moussa LABO

Nigeria

Ibrahim Shehu TURAKI

### Qatar

Abdulla Mohammed AL MANNAI Mohammad ALKUBAISI

#### South Sudan

Isaac MAKER AJIEC

#### Switzerland

Peter BINDER Fabio FONTANA Valentin GRAF Manuel KELLER Caroline LEHNER (Ms) José ROMERO Susanne ROSENKRANZ (Ms)

#### Togo

Latifou ISSAOU

#### Ukraine

Denys BORDIIAN Yurii KLYMENKO Taras POPELNIUK

#### **United States of America**

Mary Ann KUTNY (Ms)

#### 8. Invited experts

Guy BRASSEUR Armstrong Y.C. CHENG Philip Lawrence DE COLA Laure DESMAIZIERES (Ms) Detlev FROMMING Eric GEANNET Fleming GERALD John HIRST Jack KAYE Gordon MCBEAN Tillmann MOHR Didier MONNOT Laxman Singh RATHORE Toste TANHUA Stewart TURNER Felix VOGEL Bryony WORTHINGTON (Ms)

# 9. Representatives of international organizations and other bodies

Agence pour la Sécurité de la Na	avigation aérienne en Afrique et à Madagascar
Mahfoud MOCTAR	Observer
Association of Hydro-Meteorolo	gical Equipment Industry
Brian DAY	Observer
Andy MCDONALD	Observer
Ashish RAVAL	Observer
ECOMET	
William A. MCCAIRNS	Observer
European Centre for Medium-Ra	nge Weather Forecasts
Andy BROWN	Observer
European Organization for the E	xploitation of Meteorological Satellites
Paul COUNET	Observer
Alain RATIER	Observer
Anne TAUBE (Ms)	Observer
Food and Agriculture Organizati	on of the United Nations
Wirya KHIM (Ms)	Observer
Intergovernmental Oceanograp	hic Commission
Peter M. HAUGAN	Observer
Emma HESLOP (Ms)	Observer
International Institute for Appli	ed Systems Analysis
Pavel KABAT	Observer
International Mobile Satellite O	rganization
John SHAW	Observer
International Telecommunicatio	n Union
Nikolai VASSILIEV	Observer
International Union of Geodesy	and Geophysics
Arthur ASKEW	Observer
United Nations Framework Conv	vention on Climate Change
Florin VLADU	Observer
World Bank	
Vladimir TSIRKUNOV	Observer
World Bank Group/Global Facilit	y for Disaster Reduction and Recovery
Thomas FREI	Observer
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Daniel KULL	Observer
Christoph RAMSHORN	Observer
David ROGERS	Observer
Makoto SUWA	Observer
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Massimiliano CAPEZZALI	Observer

Yvette RAMOS (Ms)

Observer

### 10. Visitors

Sabino Tom AKONYDIT Farukh Akhter AMIL Kofi ANNAN Günter BLÖSCHI Ehsan FAZLI Simon Otoung KODING Fabian LANGE Sally MANSFIELD (Ms) Rosemary MCCARNEY Sophia PAL GAI (Ms) Danilo TURK

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Linda MAKULENI (Ms)

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