W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

WEATHER, CLIMATE AND WATER

COMMISSION FOR HYDROLOGY

FIRST SESSION OF THE ADVISORY WORKING GROUP

(Geneva, 27 February to 3 March 2017)

FINAL REPORT

1. OPENING OF THE SESSION

1.1 The first session of the Commission for Hydrology (CHy) Advisory Working Group (AWG) was held at WMO Headquarters in Geneva, Switzerland, from 27 February to 3 March 2017. Participants included all members of the AWG, representatives from the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Association of Hydrological Sciences (IAHS), and staff from the WMO Hydrology and Water Resources (HWR) Branch. The complete list of participants appears as Annex I.

1.2 Mr H. Lins, President of the Commission for Hydrology welcomed the participants, noting that the new AWG was comprised of experts ranging from very experienced veterans of WMO activities to a few who were new to the WMO family. He emphasized the importance of the meeting because, as the first one following the CHy-15 session, it was where the details of the work plans governing the activities of each AWG member would be defined.

2. ADOPTION OF THE AGENDA AND ORGANIZATION OF WORK

The meeting agenda (Annex II) was adopted without amendment. Participants were reminded that on the morning of 28 February a joint meeting with the Management Group of the Commission for Basic Systems was planned. The purpose of the joint meeting was to update the governing bodies of both Commissions on topics of common interest that each were addressing, and to identify areas and modalities for collaboration.

3. REVIEW OF ACTIVITIES SINCE CHY-15 (INCLUDING MEETINGS OF PRESIDENTS OF TECHNICAL COMMISSIONS AND PRESIDENTS OF REGIONAL ASSOCIATIONS)

PRA-PTC 2017

3.1 The president reported on the main outcomes of the joint meeting between Presidents of Technical Commissions and Regional Associations (PTC and PRA) held in January 2017. The primary topic discussed during the joint meeting was the review of the structure and governance of WMO, as requested by the Seventeenth Congress (Cg-17) in 2015. The review is aimed at improving the Organization's efficiency and effectiveness, including possibly restructuring Technical Commissions (TCs) and Regional Associations (RAs). He informed the meeting that later in the week the Executive Council Working Group on Strategic and Operational Planning (EC WG-SOP) would review various options for restructuring, including suggestions and recommendations made by PRAs and PTCs, and then prepare a draft proposal for submission to EC-69. Several Commissions have unique and critical missions (such as the Commission for Aeronautical Meteorology (CAeM), CHy, etc.) and the uniqueness of CHy as the only intergovernmental body representing National Hydrological Services within the UN system was fully acknowledged. The president also presented the findings of a SWOT (strengths, weaknesses, opportunities, and threats) analysis undertaken by each of the TCs, which were incorporated in a guidance document from the PTCs to the EC Working Group.

3.2 Other topics discussed at the Presidents joint meeting included:

- Public-Private Engagement: There was a recognized need for a WMO Policy on public-private engagement and to develop guidance for Members addressing issues such as the distinction between government responsibility and private business (especially in issuing warnings), and the role of WMO regulations that are applicable to state institutions but not to the private sector.

- GFCS: Concerns were voiced as to how TC and RA contributions and inputs get integrated into the activities of the Global Framework for Climate Services (GFCS). A recommendation was made to conduct a mid-term review that could identify potential corrective actions, including revising the GFCS governance structure (in parallel with the WMO governance review). The goal being to ensure better coordination of WMO programmes with GFCS, and to promote data sharing in the context of resolution 60 (Cg-17).

- Global Data Processing and Forecasting System (GDPFS): As the WMO Integrated Global Observing System (WIGOS) and the WMO Information System (WIS) advance toward their operational phase, the GDPFS development will receive higher priority. It will require linkages with the work of many TCs, as well as with the GFCS CSIS (Climate Services Information System). It should also address impact based forecasts, and the inclusion of non-traditional data.

- Global (Hydro-) Meteo-Alarm System (MeteoAlarm): The president reported that suggested that hydrology be represented in the development of this initiative, as the proposed presented to the PRAs and PTCs did not include hydrology. Although the meeting report included hydrology parenthetically, this activity will require continued monitoring to ensure that hydrology is adequately incorporated. The establishment of regional systems through RAs is also being promoted in connection with development of the Common Alerting Protocol (CAP). The MeteoAlarm system may eventually evolve into a common WMO technical platform.

PTC 2017

3.3 The president also reported on the outcomes of the PTC meeting held during the same week in January 2017. The meeting addressed the following topics:

- Big Data, crowd sourced data, social media - and how they could affect relationships between public and private sector service providers.

- Updating of Technical Regulations: This is a WMO priority activity and should be emphasized in the work plans of all TCs. The Commission for Instruments and Methods of Observations (CIMO) is developing an automated tool for helping members monitor their compliance with the Tech Regulations, and an event may be organized at the next Congress for the benefit of PRs, especially those who will be newly appointed.

- Constituent Body Reform: The Executive Council Working Group on Strategic and Operational Planning (EC WG-SOP) is preparing a proposal for presentation to EC-69 on options for restructuring Technical Commissions and Regional Associations. The meeting debated the value of improving the existing structure with respect to a radical change in its Constituent Bodies, and reasserted the value of the intergovernmental nature of some TCs. The creation of a WMO standard setting body to promote the culture of compliance was also considered.

3.4 Mr Pilon reported on outcomes of the recent Sixteenth session of Regional Association II (RA II-16) held in Abu Dhabi, United Arab Emirates of relevance to CHy. These included several requests for CHy to:

(1) Assess the dynamic water resources assessment software tool developed by the Republic of Korea, and to provide guidance to the RA II Working Group on Hydrological Services (WGHS) on its further development;

(2) Assess the utility and applicability of the software tool and its methods for measuring stream flow discharge under backwater and tidal influence using the index-velocity method; and
(3) Review and assess the global utility of the guidance material prepared by the Regional Association II Working Group on Hydrological Services entitled "Guidelines for verification of hydrological forecasts" as a potential contribution to the WMO Flood Forecasting Initiative.

4. MODES OF OPERATION OF THE AWG

4.1 The president recalled the document specifying the duties and responsibilities of AWG members that was sent to each AWG member in December 2016. He noted, in particular, that each member is responsible for **leading** the activities contained in his/her work plan; i.e., functioning as a project manager.

4.2 He explained that the main source of support for AWG members to utilize in managing their tasks is the Open Panel of CHy Experts (OPACHE), comprised of specialists who volunteered to assist in CHy work and have been endorsed by the respective Permanent Representative . An OPACHE database is available online and is fully searchable by keyword. It was emphasized that it is preferable to use OPACHE experts, as opposed to unaffiliated specialists, because it is administratively easier to justify and support their involvement in CHy activities. It also ensures a broader geographical representation in building teams of experts. New members can be added at any time should the need arise for specific skills that do not already exist in the OPACHE listing. The involvement of selected OPACHE members for any activities should be done in the least formal way possible but, when doing so, AWG members should always inform the president and Secretariat of such actions.

4.3 The Secretariat provides essential support to the AWG, particularly in organizing expert meetings and contracting consultants. However, these types of mechanisms are always subject to the availability and limits of financial resources. To facilitate efficient coordination of AWG member work with the Secretariat, especially where meeting organization, travel, consultancies and linkages with other WMO activities are involved, each focus area has an assigned contact person in the Secretariat as follows:

- Coordination and Implementation Support: Claudio Caponi
- Measurement, Monitoring and Infosystems: Dominique Bérod
- Hydrological Applications, Products and Services: Paul Pilon

It is essential that the contact person be copied on all correspondence related to project activities and informed when project actions are taken. The contact should also be informed of any requests sent to an AWG member from other Secretariat departments, especially when no member of the Hydrology and Water Resources Branch has been copied on the request. Contact persons shall, in turn, inform individual AWG members of any activities that they become aware of that is relevant to their work. Secretariat staff will provide support to specific activities as listed in the Work Plan tables (Annex IV).

4.4 The meeting was also informed that three face-to-face meetings will be held during the intersessional period: the present one occurring immediately after CHy-15 to plan and initiate the work; a second one approximately 18 months later (late 2018) to perform a mid-course evaluation, discuss problems and delays, and take corrective actions; and a third one approximately 10 months prior to the next CHy session (late 2019, early 2020) to develop proposed activities for the next intersessional period. Per tradition, Regional Hydrological Advisors (RHAs) will be invited to attend the third meeting to ensure that regional priorities, issues and concerns in the development of the

future programme. Videoconferences will also be organized, tentatively midway between physical meetings or as the need arises.

4.5 The AWG also discussed the need to collaborate better with RA Working Groups on Hydrology (WGH), drawing upon their experience and utilizing the outcomes of their activities for implementing its work plan. AWG members from each Region were also requested to liaise regularly with their respective RA WGH, e.g. by actively participating in their electronic discussion fora, informing them of CHy activities of relevance to the region, and soliciting their inputs when required.

4.6 The list of AWG members responsible for liaising with the different RA WGH, as well as all CHy representatives in various groups both internal and external to CHy, is included in Annex III, and will be uploaded to the CHy website and kept up-to-date during the intersessional period. In this regard, the representatives to the Open Geospatial Consortium (OGC) Hydrology Domain Working Group (HDWG) are charged with sole responsibility for deciding whether or not to endorse OGC standards related to hydrology. These members can draw upon the OPACHE for assistance in review, particularly of the descriptive material in the standards but, for WMO purposes their decision is final.

5. REVIEW OF DECISIONS OF CHY-15

5.1 The AWG reviewed those CHy-15 decisions requiring action. Specific actions relevant to the focus area work plans are listed in Annex IV.

5.2 Additional actions, not covered in the workplans, included:

- Representation at the Multi-Hazard Early Warning System (MHEWS) Conference in Cancún in May 2017; for which the AWG decided to delegate its representation to Mr. J. Danhelka and possibly the Italian Civil Protection (to be contacted by S. Pecora) who were planning to attend as part of their national delegation.

- Designation of an expert to interact with the Satcom User Forum; for which Ms Janice Fulford will propose an expert who can address the issue of a WMO branded disaster alerting tariff and how best to establish a disaster alerting tariff test case on flood warnings.

- Identification of a GCOS liaison; for which Mr Marcelo Uriburu Quirno, after reviewing the GCOS Implementation Plan, will propose an expert who can ensure that CHy observing capabilities, particularly WHOS, are effectively communicated to GCOS for hydrology and water resources-related actions.

6. WORK PROGRAMME

6.1 The AWG recalled that CHy-15 had identified three generic themes (focus areas) for its work Programme, and decided to distribute its members among them as follows:

- *Coordination and Implementation Support*:
  Harry Lins, Silvano Pecora, Jan Danhelka

- *Measurement, Monitoring and Infosystems*:
  Jianqing Yang, Janice Fulford, Harry Dixon

- *Hydrological Applications, Products and Services*:
  Tom Kanyike, Marcelo Uriburu Quirno, Narendra Tuteja, Yuri Simonov, Hwirin Kim

6.2 Moreover, CHy-15 identified two additional sets of functions that would be achieved by:

- A set of activities to be supported by the Secretariat, with support of experts from the OPACHE, without direct involvement of AWG members; and

- A set of activities that, in light of limited resources, could be implemented only if one or more Members volunteer to lead their implementation.

7. COMPILATION OF WORKPLANS

Following comprehensive discussions in small groups, meeting participants agreed on the specific actions required to implement the CHy work programme, and identified the member(s) responsible for each action (see Annex IV). The president emphasized that the work plans are living documents, not static blueprints, and can be modified through time in response to difficulties or opportunities that may be encountered, or to new requirements that emerge from other programmes.

8. COOPERATION WITH OTHER INTERNATIONAL ORGANIZATIONS

8.1 Mr Abou Amani represented the UNESCO International Hydrological Programme (UNESCO-IHP) in the meeting as an observer. UNESCO-IHP and WMO Hydrology and Water Resources Programme (HWRP) have a long history of cooperation. The UNESCO-WMO Liaison Committee meeting will be held on Monday, 6 March and will provide an opportunity for a more comprehensive discussion of cooperative activities. As the current WMO Director of the Water and Climate Department was formerly Chair of the UNESCO-IHP Council, an excellent opportunity exists for deepening the cooperation between the two programmes.

8.2 Since 2014, UNESCO has been implementing the eighth phase of IHP under the overall theme of Water Security: Response to Local, National, Regional and Global Challenges. Within this framework, six priority areas of need have been identified by Member States:

- Water related disasters and hydrological change;
- Groundwater in a changing environment;
- Addressing Water scarcity and quality;
- Water and human settlements;
- Eco-hydrology; and
- Water Education at all levels.

8.3 The programme has been operating through the UNESCO water family including the national IHP committees, the UNESCO Water Chairs, the UNESCO Water Centres and oversight of the IHP Council and the IHP Bureau. Each programme is represented as an observer in the governance of the other programmes. Also WMO is a partner in the International Flood Initiative implemented by UNESCO, and UNESCO participates as a member of the Advisory Councils for the WMO Integrated Drought Management Programme and Associated Programme of Flood Management. Additional areas of potential cooperation include:

(1) Capacity building and joint events
   - Joint publication – hydrologist competencies (WMO-UNESCO-IAHS)
   - Joint training courses
   - Joint events

(2) Floods – Both the IHP Council and the Commission for Hydrology have endorsed the International Flood Initiative (IFI). WMO and IHP have been working together, under the leadership of the International Centre for Water Hazard

(ICHARM), on a revised version of the IFI strategy and on preparing the implementation plan. There is an opportunity to have more synergy between IFI and Associated Programme on Flood Management (APFM) and the WMO Flood Forecasting Initiative (FFI).

(3) Droughts – UNESCO has an International Drought Initiative (IDI) with a secretariat hosted at a UNESCO Water Centre in Iran. Under the framework of IDI and our programme on arid and semi-arid land, UNESCO has deployed Drought monitoring systems in regional centres in Africa. There is room for strengthening the cooperation between IDI and the Integrated Drought Management Programme (IDMP) in this effort.

(4) WINS – Water Information Network System (UNESCO-IHP) and WMO Helpdesks or other water and climate related WMO platforms.

(5) Climate and water management.

(6) Regional programme on the Review of Hydrological norms in West and Central Africa for the design of climate resilient hydraulic infrastructures.

8.4 UNESCO can contribute to various activities identified within the AWG work plan, and discussions during the subsequent liaison meeting will identify potential priority areas.

8.5 Christophe Cudennec, Secretary-General of the International Association of Hydrological Sciences (IAHS), reminded meeting participants that IAHS has been a strong partner of CHy since the Commission was established in 1959. IAHS is an observer at Commission sessions as well as at Advisory Working Group meetings. Many of its member scientists and academics are also contributing to CHy initiatives and programmes, such as Project X, APFM, and capacity building. This latter activity includes training events on stream gauging, the curriculum for training in the Philippines, and participation on the hydrologist competency working group. IAHS' spectrum of scientific topics is very consistent with CHy activities, as it covers all hydrological processes and disciplines, related methodologies, education and capacity building. Its cross discipline, agenda setting decade Panta Rhei is also of significant interest to CHy and many National Hydrological Services as it deals with hydrological change in general, with climatic variability and change, and with societal change. Some outcomes of the previous IAHS decade known as PUB (Prediction in Ungauged Basins) can continue to be utilized in forthcoming WMO tasks such as those related to the provision of guidance on hydrometric network optimization, or in making operational use of PUB methods in forecasts.

8.6 Conversely, WMO participates in several IAHS scientific events, especially biennial worldwide assemblies, through financial support to delegates from disadvantaged countries, and through co-convening scientific sessions. It was the case in 2013 in Gothenburg, Sweden (IAHS) and in 2015 in Prague, Czech Republic (the International Union of Geodesy and Geophysics (IUGG)). It will be the case again in Port Elizabeth, South Africa in July 2017 (IAHS) and hopefully in Montreal, Canada in 2019 (IUGG). An open access volume on extreme events has been co-edited and published in the Proceedings of the International Association of Hydrological Sciences (PIAHS) series as an outcome of a 2015 workshop. WMO secretariat also participated to the MOXXI (Measurements and Observations in the 21st Century) workshop organized 2 weeks ago with the European Space Agency (ESA), in Rome–Frascati, on innovative observation and measurement technologies.

8.7 Beyond these interactions in core functions, IAHS and WMO, often jointly with UNESCO, collaborate on other activities. In recent years, for example, the president of CHy has co-convened with IAHS an annual session at the European Geosciences Union (EGU) General Assembly in Vienna, Austria, on hydroclimatic variability and change; the vice-president of CHy contributed significantly to a conference held in Guangzhou, China on Hydroinformatics; IAHS and CHy have co-organized two sessions on freshwater at the

scientific conference *Our Common Future Under Climate Change* which took place in UNESCO headquarters in Paris in July 2015 prior to COP 21; and we have been co-authors of chapters of the World Water Development Report (WWDR) 2016 on Water and Jobs.

8.8 Knowing that many individuals are active in both organizations, it is possible to target some additional cooperation actions in the coming years, as identified in the work plan of the AWG, and elsewhere. For example, linkages between the IAHS MOXXI working group and the WMO HydroHub could be very constructive. Opportunities exist for HydroHub participation in the MOXXI community paper under preparation; in the articulation of the next MOXXI topical conference; as well as for IAHS participation in the HydroHub workshop planed for December 2017. Another key tangible target could be a co-edited special issue in IAHS' Hydrological Sciences Journal on "collaborative hydroinformatics", together with third parties such as GRDC or consortia of related international research projects. IAHS membership can also be screened when expertise is needed beyond the OPACHE database and IAHS e-tools can be used for dissemination of WMO highlights. Finally the teaching expertise of some IAHS academics can be mobilized to work on the training-education-capacity building side of the CHy AWG work plan.

9. COOPERATION WITH THE MANAGEMENT GROUP (MG) OF THE COMMISSION FOR BASIC SYSTEMS (CBS) (JOINT MG/CBS – AWG/CHy MEETING)

9.1 A joint session of the Management Group of CBS and the Advisory Working Group of CHy was organized on 28 February 2017 from 09:00 to 11:00, and opened by the Assistant Secretary-General, Dr Wenjian Zhang. He welcomed the two Commissions working on establishing better synergies, in particular in the framework of the development of the new Strategic Plan 2020-2023.

9.2 The Group noted that collaboration in areas of interest of the two Commissions has increased in recent years due to evolution of technology and common use of technology. The Group agreed that collaboration between the two Commissions is, indeed, likely to increase in the future. The joint meeting welcomed increased engagement of CHy in the activities of CBS.

9.3 The joint Session discussed topics of common interest, and in particular:

An update on Phase II of the WMO Hydrological Observing System (WHOS)

9.4 The meeting noted that WHOS Phase II is a complex system intended for operational hydrology. It can be used at the global level but is targeted to be used at the basin and national level as well. WHOS is facilitating interactions between data users and data providers. Ontology is used to describe how the water cycle is observed and is facilitating data discovery.

9.5 Users of the hydrological server can register end points, according to their profiles, including agreed standards, and provide their observing systems to WIGOS for water management activities. Users can also create catalogues by selecting data sets on the basis of their needs, e.g. selecting specific variables, geographical region, and observational period.

9.6 Cloud technology and big data are also planned to be used, and CHy is looking at how to address the “five Vs” of big data.

9.7 WHOS will also provide mechanism for quality assurance to be part of the global focus. Compliance with Res. 25 (Cg-13), Res. 60 (Cg-17) and Res. 40 (Cg-12) is essential to implement WHOS as a part of future GDPFS/WIGOS/WIS. Cooperation in motivating Members to respect these data resolutions is needed.

9.8 There is a great diversity and ability to engage in a process like WHOS. Countries are already making their data available but the system is incomplete, and there is a need to reach out to enhance engagement of Members in this regard. The Inter-Commission Coordination Group (ICG)-WIGOS co-Chair also welcomed the contribution of CHy in the development of the WIGOS Pre-Operational Phase. WIGOS and WIS will have also to evolve, and take into account developments in hydrology. The Management Group welcomed the CHy plan to use the WIGOS Metadata Standard to describe hydrological observations. Web services are also planned to be used to feed such metadata in the Observing Systems Capability Analysis and Review (OSCAR). The meeting noted that some mechanism could be developed for the two Commissions to be working on common projects and activities related to WIS 2.0 and WIGOS 2.0, and development of the Seamless GDPFS.

9.9 The Management Group invited CHy to consider proposing and presenting CHy WIGOS related Pilot Project in La Plata river basin to the next ICG-WIGOS meeting (***action: CHy; end 2017***). The meeting invited the Management Group to identify a prioritized list where CHy engagement is needed (***action: CBS MG; asap***). It was noted that the CBS MG welcomes prototyping of projects affiliated to CBS. The meeting proposed establishing a Joint Task Team under the CBS MG and the CHY Advisory Working Group leveraging on existing members of CHy and CBS engaged in joint activities, and invited the CBS President and CHy President to discuss the details and the way forward (***action: M. Jean & H. Lins; end 2017***).

9.10 The meeting noted that there will be no CHy session before Cg-18, and CHy is investigating what mechanism to use in order to propose new technical regulations through an intergovernmental mechanism.

Representation of CHy in relevant Inter Programme Expert Teams (IPETs) and other CBS and CHy groups

9.11 The Chair of the Open Programme Area Group on Integrated Observing Systems (OPAG-IOS), Dr Anthony Rea (Australia) explained that CHy has been engaged in ICG-WIGOS. There would be benefits in having CHy to engage in OPAG-IOS and in ICT-IOS and Inter Programme Expert Team on the Observing System Design and Evolution (IPET-OSDE) e.g. as Associate Members. The Inter-Programme Expert Team on Satellite Utilization and Products (IPET-SUP) would also benefit from increased engagement in this team with regard to Satellite Utilization and Products.

Engagement of CHy in the Rolling Review of Requirements (RRR), and development of Statement(s) of Guidance for Hydrology

9.12 The Group noted that Decision 4.1(3)/1 (CHy-15) requested the AWG to prepare a new version of the observational requirements and the Statement of Guidance for the Application Area « Hydrology », taking into consideration the implementation plan of WHOS Phase II, to be presented to IPET-OSDE in the second half of 2017 and made available to the National Hydrological Services (NHSs) through the WHOS web page. It was noted that the next meeting of the IPET-OSDE will take place in early 2018, and that such materials should be provided by then.

Contribution/participation of CHy in the new Seamless Data-Processing and Forecasting System

9.13 The CBS President introduced the new Seamless GDPFS to the joint meeting, and the activities of the Steering Group on the Seamless GDPFS. CHy has initiated consultation in this regard, and some support was noted. The meeting noted that the CHy Resolution 4.2(1)/1 (CHy's contribution to the future GDPFS) had requested in particular the president of CHy or delegated AWG members to ensure that all hydrological aspects and specifics and in particular the needs and concerns of NHSs are properly reflected in the development of the new Seamless Data-processing and Forecasting System. They were also requested to develop a proposal of a comprehensive structure for hydrology within the new Seamless Data-processing and Forecasting System that would encompass hydrological data, analysis and forecasting and could include new entities such as World, Regional, and National Hydrological Centres, with clearly defined roles and responsibilities.

9.14 The Joint meeting further noted the following:

- The new revised GDPFS Manual (WMO-No.485) is more understandable. CBS/OPAG-DPFS will offer the support to develop the draft text for the new Manual when CHy establishes new types of Centres for hydrology;
- The collaborative activity with the Severe Weather Forecasting Demonstration Project (SWFDP) might be useful for establishing GDPFS for hydrology; and
- The role and responsibility of National Meteorological Centres are removed from the new revised Manual on GDPFS. In this regard, the Open Programme Area Group on Data Processing and Forecasting System (OPAG-DPFS) will address a task to renew the Guide on GDPFS (WMO-No.305) for this intersession period. Since the scope of GDPFS is expanded beyond WWW in the new Manual, it needs to be decided whether the scope of the Guide covers other application areas such as hydrological services.

9.15 The Group welcomed the Participation of CHy in the Steering Group, and thanked CHy for its contribution in this regard. The meeting noted with appreciation that there is a strong desire of the CHy community to be engaged in the development of the S/GDPFS.

CHy's contribution to the CBS initiative on Multi-hazard Impact-based Forecast and Warning Services

9.16 Mr Pilon, Chief of the Hydrological Forecasting and Water Resources Division indicated that he had had discussions with Ms H. Kootval concerning the CBS strategy for impact-based forecasting systems and services. Following those discussions, it was thought that the joint CHy AWG - CBS MG meeting would be an opportunity to share views and develop a common strategy for addressing this area. Mr Pilon recounted that impact-based warnings is not new to the area of hydrology and water resources, and he noted that the results of weather and climate can be floods and droughts. It was noted that setting of thresholds is sometimes a subject of legislative definition and might be the responsibility of civil protection agencies. This implies a need for substantial coordination efforts, and adopting a user centric approach is important.

9.17 CHy expressed its desire to work closely with CBS on developing the hydrological aspects of multi-hazard impact based forecast and warning systems and their capabilities.

9.18 The Management Group recognizes that there is a huge gap for Public Weather Services in the area of Multi-hazard Impact-based Forecast and Warning Services, and the CBS Management Group welcomed the contribution of CHy for addressing such gap.

9.19 It was noted that South-East Europe has a project, the South-East European Multi-Hazard Early Warning Advisory System-A (SEE-MHEWS-A) supported by the World Bank and the US Agency for International Development (USAID), which includes severe weather and flood forecasting component.

9.20 SWFDP is another example where joint action could be developed. Support from Members is needed in any case.

Efforts to advance operational sub-seasonal to seasonal prediction

9.21 Mr Pilon recounted that over the last few years there have been Regional Climate Outlook Forum's (RCOFs) with subsequent Water User Forums held in South Asia. There is the need from the Hydrology and Water Resources Programme for quantitative, objective, systematic seamless gridded forecasts/predictions of weather and climate for use in hydrological forecasting for water resources management purposes. The intent would be to develop seamless zero day to seasonal hydrological forecasts/predictions that can be used for planning purposes by governments to advert losses from flooding or droughts. Given the strong role that water availability has on society's prosperity (e.g., agricultural productivity, energy production, navigation, water availability for domestic use), developing a seamless system would be most beneficial. It was suggested that use be made of pilot to demonstrate the utility of technological advances in seamless prediction to water resource practitioners and disaster management agencies, for instance in the Brahmaputra-Ganges Rivers. This demonstration project will need linkages to WHOS for access to real time data. Mention was also made that there were a number of activities underway in different programmes and Commissions in this area, and it would be beneficial to bring the developments and advances together within the pilot. (**action; M. Jean to liaise with CCl and WWRP on this matter and subsequently follow-up with H.Lins; Sep. 2017**).

Conclusion of joint meeting

9.22 The joint meeting agreed that this had been a fruitful discussion. It requested to circulate the report of the CBS Management Group meeting with the CHy Advisory Group (***action: Secr.; Mar. 2017***). The two Presidents will keep discussing issues of common interest, and make proposals to their respective Commissions on how to further develop joint activities (***action; M. Jean & H. Lins; ongoing***).

10. OTHER BUSINESS

Meetings of the Working Groups for Hydrology in RA II and RA III were planned for late 2017 and the president or vice-president was encouraged to attend.

11. ADOPTION OF THE REPORT

The meeting adopted the draft report and asked the president to finalize it.

12. CLOSURE OF THE SESSION

The meeting was closed at 16:55 on Friday, 3 March 2017.

_____

ANNEX I

LIST OF PARTICIPANTS

President of CHy

Dr Harry F. LINS
2617 Mountain Laurel PL.
RESTON, VA 20191
USA

Tel: +1 703 620 9240
Mobile: +1 571 218 5077
E-mail: chy.president@gmail.com

Vice-president

Dr Silvano PECORA
ARPAE SIMC - AREA IDROLOGIA
Via Garibaldi, 75
43121 PARMA
Italy

Tel.: +39 0521 274378
E-mail: specora@arpae.it

AWG Members

Dr Jan DANHELKA
Czech Hydrometeorological Institute (CHMI)
Na Sabatce 2050/17
14306 PRAHA
Czech Republic

Tel: +420 244 032 300
Mobile: +420 724 10 8009
E-mail: danhelka@chmi.cz

Dr Harry DIXON
Centre for Ecology and Hydrology
Maclean Building, Benson Lane
Crowmarsh Gifford
WALLINGFORD Oxfordshire, OX10 8BB
United Kingdom of Great Britain and Northern Ireland

Tel: +44 (0)1491 692254
E-mail: harr@ceh.ac.uk
Mobile: +44 (0) 7590 80 7849

Ms Janice FULFORD
U.S. Geological Survey
Stennis Space Center, MS
United States of America

Tel: +1 228 688 1501
E-mail: jfulford@usgs.gov

Eng. Tom KANYIKE
Ministry of Water and Environment
P.O.Box 30098
KAMPALA
Uganda

Tel: +256 392 549 214
E-mail: shukar@techie.com

Dr Hwirin KIM (Ms)
Han River Flood Control Office
Ministry of Land, Infrastructure and Transport
Dongjakdaero 328
Seocho-Gu
SEOUL 06501
Republic of Korea

Tel: + 82 2 590 9973
E-mail: Hydro@korea.kr
Mobile: +82 10 934 5080

Dr Yuri SIMONOV
Hydrometeorological Research Centre of Russian Federation
11-13, B Predtechensky Per
MOSCOW 123242
Russian Federation

Tel: +7 916 828 6404
E-mail: Simonov@mail.ru

Mr Narendra TUTEJA
Bureau of Meteorology
GPO Box 2334 Canberra ACT 2601/
Treasury Building, B Block Level 2
Parkes Place West, Parkes
CANBERRA ACT 2600
Australia

Tel: +61 2 6232 3518
E-mail: N.Tuteja@bom.gov.au

Eng. Marcelo URIBURU QUIRNO
Argentine Space Agency
(Comision Nacional de Actividades Espaciales)
Marcelo T. de Alvear 2065 3°A
1122 BUNEOS AIRES
Argentina

Tel : +54 11 482 53 131
E-mail : muriburu@conae.gov.ar
Mobile : +54 11 647 71 491

Dr Jianging YANG
Bureau of Hydrology of Ministry of Water Resources
2 Lane2, Baiguang Road, Xicheng District
Beijing 100053
China

Tel: +86-13811986055
E-mail: jianqing.yang@mwr.gov.cn

IAHS

Prof. Christophe CUDENNEC
Secretary-General
IAHS
Agrocampus Ouest – INRA
UMR 1069 Sol – AgroHydrosystème – Spatialisation (SAS)
65, rue de St Brieuc – CS 84215
35042 RENNES Cedex
France

Tel: +33 2 23 48 55 58
E-mai: cudennec@agrocampus-ouest.fr

UNESCO

Mr Abou AMANI
Title?
Division of Water Sciences
Natural Sciences Sector
UNESCO

Tel: +33 (0) 1 45 68 xx xx
E-mail: aamani@unesco.org

7, place de Fontenoy
F-75352 Paris 07 SP
France

WMO SECRETARIAT

Mr Tommaso ABRATE
Scientific Officer
Basic System in Hydrology Division
Hydrology and Water Resources Branch
Climate and Water Department
WMO
7 bis avenue de la Paix
1211 Geneva 2
Switzerland
Tel: +41 22 730 8338
E-mail: tabrate@wmo.int

Mr Dominique BEROD
Chief
Basic System in Hydrology Division
Hydrology and Water Resources Branch
Climate and Water Department
WMO
(same address as above)
Tel: +41 22 730 8330
E-mail: dberod@wmo.int

Mr Claudio CAPONI
Chief, Capacity Building in Hydrology and Water Resources Management Office
Hydrology and Water Resources Branch
Climate and Water Department
Same address as above)
Tel: +41 22 730 8407
E-mail: ccaponi@wmo.int

Dr Johannes CULLMANN
Director, Climate and Water Department
(same address as above)
Tel: +41 22 730 8355
E-mail: jcullmann@wmo.int

Ms Iwona PIECHOWIAK
Support Officer
Global Hydrometry Support Facility (HydroHub)
Basic System in Hydrology Division
Hydrology and Water Resources Branch
Climate and Water Department
(Same address as above)
Tel: +41 22 730 8483
E-mail: ipiechowiak@wmo.int

Dr Paul PILON
Chief, Hydrological forecasting in Hydrology and Water Resources Division
Hydrology and Water Resources Branch
Climate and Water Department
Same address as above)
Tel: +41 22 730 8358
E-mail: ppilon@wmo.int

Ms Maud POISSONNIER
Junior Professional Officer
Associated Flood Programme Management
Hydrology and Water Resources Branch
Climate and Water Department
Same address as above)
Tel: +41 22 730 8277
E-mail: mpoissonnier@wmo.int

Mr Nirina RAVALITERA
Scientific Officer
Climate and Water Department
Same address as above)
Tel: +41 22 730 8508
E-mail: nravalitera@wmo.int

Ms Sophia SANDSTRÖM
Project Coordinator
Global Hydrometry Support Facility (HydroHub)
Basic System in Hydrology Division
Hydrology and Water Resources Branch
Climate and Water Department
(Same address as above)
Tel: +41 22 730 8501
E-mail: ssandstrom@wmo.int

Mr Ayhan SAYIN
Scientific Officer
Hydrological Forecasting in Hydrology and
Water Resources Division
Hydrology and Water Resources Branch
Climate and Water Department
(Same address as above)
Tel: +41 22 730 8331
E-mail: asayin@wmo.int

Mr Daniel SIGHOMNOU
Scientific Officer
Basic System in Hydrology Division
Hydrology and Water Resources Branch
Climate and Water Department
WMO
(same address as above)
Tel: +41 22 730 8310
E-mail: dsighomnou@wmo.int

Mr Florian TEICHERT
Innovation Officer
Global Hydrometry Support Facility (HydroHub)
Basic System in Hydrology Division
Hydrology and Water Resources Branch
Climate and Water Department
(Same address as above)
Tel: +41 22 730 8455
E-mail: fteichert@wmo.int

Mr Giacomo TERUGGI
Scientific Officer
Hydrological Forecasting in Hydrology and
Water Resources Division
Hydrology and Water Resources Branch
Climate and Water Department
(Same address as above)
Tel: +41 22 730 8354
E-mail: gteruggi@wmo.int

Mrs Caroline WITTWER
Project Officer
Associated Flood Programme Management
Hydrology and Water Resources Branch
Climate and Water Department
Same address as above)
Tel: +41 22 730 8263
E-mail: cwittwer@wmo.int

ANNEX II

TENTATIVE WORK PLAN

TIME	AGENDA ITEM
Monday 27 February 9:00 – 12:00 13:30 – 17:00	**1. Opening of the session** **2. Adoption of the agenda and organization of work** **3. Review of activities since CHy-15 (including meetings of Presidents of Technical Commissions and Presidents of Regional Associations)** **4. Modes of operation of the AWG**
	5. Review of decisions of CHy-15 **6. Work Programme** Distribution of AWG members to the 3 Focus Areas
19:30	Dinner (details tbc)
Tuesday 28 February 9:00 – 11:00 11:00 – 12:00	**9. Cooperation with the Management Group of CBS (Joint MG/CBS – AWG/CHy meeting)** **6. Work Programme** 6.1 Coordination and Implementation Support (start)
13:30 – 17:30	**6. Work Progamme** 6.1 Coordination and Implementation Support (cont.) 6.2 Measurement, Monitoring and Infosystems (start)

Wednesday 1 March 9:00 – 12:00	**6. Work Programme** 6.2 Measurement, Monitoring and Infosystems (cont) 6.3 Hydrological Applications, Products and Services (start)
13:30 – 17:00	**6. Work Programme** 6.3 Hydrological Applications, Products and Services (cont)
Thursday 2 March 9:00 – 12:00	**6. Work Programme** Consideration of additional activities (to be supported by the Secretariat + OPACHE, or by volunteering Members) **7. Compilation of workplans (start)**
13:30 – 17:00	**7. Compilation of workplans (cont)** **8. Cooperation with other international organizations**
Friday 3 March 9:00 – 12:00	**7. Compilation of workplans (cont)**
13:30 – 17:00	**10. Other business** **11. Adoption of the report** **12. Closure of the session**

ANNEX III

CHY REPRESENTATIVES

HWR Related Groups		CHy Representative/s
1	Management Committee - Assessment of the Performance of Flow Measurement Instruments and Techniques	Chair: J.Fulford Vice-chair: RA representative:
2	GHSF Advisory Council	Chair: President of CHy H.Dixon
3	GHSF InnoC	H.Dixon (Chair) J. Fulford
4	Flood Forecasting Initiative Advisory Group (FFIAG)	Chair: President of CHy Y. Simonov
5	Associated Programme on Flood Management (APFM) Management Advisory/Management Committee	President of CHy Representative of Regional Associations: H.Kim
6	Integrated Drought Management Programme (IDMP) Advisory/Management Committee	President of CHy H.Kim
7	International Flood Initiative (IFI) Advisory Committee	TBD electronically
8	Global Runoff Data Center Steering Committee (GRDC)	AWG Member: S.Pecora
AWG liaisons with RA WGHs		
	RA I	T. Kanyike
	RA II	H.Kim (supported by J.Yang)
	RA III	M.Uriburu
	RA IV	H.Lins
	RA V	N.Tuteja
	RA VI	J.Danhelka

Congress and Executive Council Groups		
1	Executive Council Task Team on WMO Policy for International Exchange of Climate Data and Products to Support the Implementation of the Global Framework for Climate Services	President of CHy
2	Executive Council Panel on Education and Training	Z. Liu/C.Cudennec
3	Presidents of Technical Commissions	President of CHy
4	EC WG-SOP	President of CHy
5	EC Panel of Experts on Capacity Development	TBD on a case to case basis
6	CBS-LR on emerging data issues	S.Pecora
Joint Commission Working Groups		
1	Joint Expert Group on Climate, Food and Water	J. Danhelka, D. Jayasuriya
2	CIFDP Steering Group (PSG)	Y. Simonov (Co-chair) Member: G.Smart
3	CIFDP-C (Y. Simonov, E. Planos to nominate)	If necessary
4	CIFDP-B (Y. Simonov, S. Kim to nominate)	
5	CIFDP-I (Y. Simonov, J. Fenwick to nominate)	
6	CIFDP-F (Y. Simonov, J. Fenwick to nominate)	
WIS-WIGOS		
1	Inter-Commission Group on WIGOS (ICG WIGOS)	S.Pecora
2	Sub-group on Regulatory Material CBS Inter Programme Expert Team on WIGOS Framework Implementation Matters (IPET WIFI)	TBD
3	Sub-group on Metadata CBS Inter Programme Expert Team on WIGOS Framework Implementation Matters (IPET WIFI)	TBD
4	Sub-group on QM CBS Inter Programme Expert Team on WIGOS Framework Implementation Matters (IPET WIFI)	TBD

5	Sub-group on Information resource CBS Inter Programme Expert Team on WIGOS Framework Implementation Matters (IPET WIFI)	TBD
6	WIGOS Editorial Board (WEdB)	S.Pecora (need to forward email to Secretariat)
7	IPET-MDRD	S.Pecora
8	IPET-DRMM	Focal point: S.Pecora Day to day: Secretariat (T.Abrate)
9	IPET-OSDE	S. Pecora
10	IPET-SUP	M.Uriburu
Disaster Risk Reduction		
1	DRR CHy Focal Point	M.Uriburu (supported by J.Danhelka)
2	Expert Advisory Group on Hazard/Risk Analysis	J. Danhelka
Other		
1	GFCS TT ORP	J.Danhelka
2	SG SDPFS	J.Danhelka
3	OGC HDWG	T. Boston, S. Pecora (until Dec 2017)
4	Joint Task team on BIP	Z. Liu, C. Pearson

ANNEX IV

WORKPLAN: ***Focus Area: Coordination and Implementation Support***

Activities	Actions	AWG Member	Outputs	Resources	Milestones	Linkages
RAs: ensure that the activities of regional associations, and, in particular, the Regional Association Working Groups on Hydrology (RA WGHs) are coordinated within overall Commission activities and that there is effective communication between the Commission and the RA WGHs;	• Establish direct communication with Chairs of RA WGsH; • Liaise with PRAs; • Transmit work plan of CHy, when finalized, to Chairs of RA WGsH, to consider when planning and implementing RA WGsH activities; • Obtain programme of activities/work plans and progress reports from Chairs of RA WGsH for feedback into CHy activities; • Participate in RA WGsH Meetings, where possible;	• President • Vice-President	• Improved coordination and cooperation with the Regional Associations	• Resources are provided on a case to case basis.	• Involvement in meetings, workshops and conferences as determined in consultation with the Secretariat. • Report at AWG meetings • Report at EC Sessions • Report to CHy-16	• PRAs • RA HAs • RA Subsidiary bodies

Activities	Actions	AWG Member	Outputs	Resources	Milestones	Linkages
	• Report to each AWG Session on activities of RA WGsH; • Provide information on AWG decisions and recommendations that relate to or impact on RA WGsH activities;					
Capacity Development: identify and lead actions with regard to the education and training requirements of Commission activities under the adopted Strategy on Education and Training for HWR and the QMF–Hydrology. Consider developing open source and community of practice solutions to promote the transfer of	• Review of the WMO Strategy on Education and Training in HWR for the period of 2017-2020 • Implement identified actions based on review • Represent or nominate a representative in EC Panel on ETR	• Vice-President a)Z. Liu b)C.Cudennec	• Organized education and training activities	• CHy-AWG members • Consultants (subject to resources)	• Variable and as appropriate	• ETR; • IHP/HWRP Office in Germany • UNESCO, IHE, COMET program

Activities	Actions	AWG Member	Outputs	Resources	Milestones	Linkages
technology and knowledge management;						
APFM and IDMP: represent CHy, in concert with the relevant AWG member for hydrological applications, products and services, on the Advisory and Management Committees of APFM; and represent CHy on the Advisory Committee of the IDMP, as per the operational guidelines of the two programmes;	• Provide advice to APFM and IDMP from a CHy perspective;	• President	• The role of CHy in APFM and IDMP	• AWG Members responsible for Floods and Droughts Management • WMO Secretariat • OPACHE	• Involvement in meetings, workshops and conferences as determined in consultation with the Secretariat. • Report at AWG meetings • Report at EC Sessions • Report to CHy-16	• WMO Secretariat
WIS/WIGOS: represent CHy in ICG-WIGOS and coordinate the participation of relevant CHy experts in WIGOS	• Ensure timely and accurate CHy response to WIS/WIGOS requests;	• Vice-President	• The role of hydrology in WIS\WIGOS	• AWG Members responsible for Data Management • WMO Secretariat • OPACHE	• Involvement in meetings, workshops and conferences as determined in consultation with the Secretariat.	• CBS • PRAs • RA Has

Activities	Actions	AWG Member	Outputs	Resources	Milestones	Linkages
and WIS expert teams;					• Report at AWG meetings • Report at EC Sessions • Report to CHy-16	
GFCS: liaise as necessary with the GFCS Secretariat (in cooperation with APFM/IDMP Technical Support Units) in matters relevant to hydrological contribution to/benefit from GFCS;	• Ensure timely and accurate CHy response to GFCS requests; • Represent CHy in the Task Teams on Operational and Resource Plan and Monitoring & Evaluation • Contribute to the UIP	• J. Danhelka	• The role of hydrology in the GFCS	• AWG Members responsible for Applications • WMO Secretariat • OPACHE	• Involvement in meetings, workshops and conferences as determined in consultation with the Secretariat. • Report at AWG meetings • Report at EC Sessions • Report to CHy-16	• PTC • IBCS • APFM, IDMP
• GDPFS: contribute to the development of WIPPS (aka GDPFS) reflecting the hydrological aspects and specifics and in particular the needs and concerns of NHSs in the development of	• interact with various global and regional forecasting initiatives making them aware of this ongoing process; • To develop a proposal of a comprehensive structure for	• J. Danhelka	• The role of hydrology in the evolution of WIPPS • Proposal for changes of the GDPFS Manual	• AWG Members for Applications • WMO Secretariat • OPACHE	• Involvement in meetings, workshops and conferences as determined in consultation with the Secretariat. • • First draft of proposal – Dec 2017 • Report at AWG meetings	• WMO Secretariat

Activities	Actions	AWG Member	Outputs	Resources	Milestones	Linkages
the WIPPS	hydrology within WIPPS; • To develop the procedures for the designation, mandatory functions, and activities of new centers; • oversee the process of designating global and regional hydrological centres (including negotiation and liaison with GloFAS/EFAS, UNESCO-IHP, GFP and others);				• Report at EC Sessions • Report to CHy-16	
Data Centres: establish a small task team to prepare a report with regard to the evolving role of GRDC, IGRAC and HYDROLARE, and liaise with the	• Establish direct communication with Data Centres; • Review the evolving role of the Data Centres; • Implement	• President • Vice-President	• Improved coordination and cooperation with the Data Centres	• AWG Members responsible for Data Management • WMO Secretariat	• Final Report to be presented at Cg-18 in 2019 • Involvement in meetings as determined in consultation with the Secretariat. • Report at AWG	• GRDC • IGRAC • HYDROLARE • GPCC • WMO Secretariat

Activities	Actions	AWG Member	Outputs	Resources	Milestones	Linkages
president of CCl with respect to the involvement of GPCC.	identified actions based on review				meetings • Report at EC Sessions • Report to CHy-16	

WORKPLAN: ***Focus Area: Measurement, Monitoring and Infosystems***

Activities	Actions	AWG Member	Outputs	Resources	Milestones	Linkages
WHOS: development and implementation of WHOS phase II, offering standardized web services, data hosting, archival, data rescue and dissemination, and relevant training, based upon data policies and adopted standards, and provide support to the HydroHub functions related to WHOS;	Establish user requirement (data providers and data consumers), Definition of WHOS architecture Implementation Plan Development Develop new Statement Of Guidance (SOG) and requirements ---------- TBD once plan approved: Pilot Training Communication to Members	• S. Pecora • T. Kanyike	• WHOS Implementation Plan Technical documents SOG and contribution to RRR	• WHOS focal points in each RWGH, NHSs • HydroHub (F. Teichert)	• User requirements defined – Sept 2017 • Definition of WHOS architecture – Dec 2017 • Draft Plan presented to EC-70 - June 2018 • SOG Q1 2018	• RAs, Global Centers, other observations and information systems, CBS,
GHSF (newly called HydroHub, including WHYCOS): serve as a member of the GHSF advisory council; provide technical guidance on WHYCOS activities to the	• Populate and organize meetings the Advisory Council and the InnoC • Help implement the approved HydroHubstructure and activities to ensure it is fully		• Fully operation HydroHubin 2018. • Sustainable operational & funding model established for HydroHubbeyond 2018. • Continued implementation of	• Hydrohub (Sophia Sandström for preparing baseline docs and day to day activities, Iwona for HISP and HelpDesk) • OPACHE	• AC populated by June 2017; 1st AC meeting – before Sep 2017 • -WHYCOS draft strategy June 2017, final August 2017 • Milestones to be agreed by Advisory Council	• World Bank / GFDRR • UNESCO IHP (including HOPE Initiative) • RAs • CBS • WMO Secretariat

Activities	Actions	AWG Member	Outputs	Resources	Milestones	Linkages
HydroHub; support the hydrological services information platform and liaise with AWG members responsible for WHOS, Project X and Innovation and new data;	operational in 2018. • Serve as Chair and members of GHSF Advisory Council • Help develop the new WHYCOS strategy (including funding and communication), help existing and new HYCOS projects, including integrating them into HydroHub --- • Review, revise and add information needed to transform INFOHYDRO into HISP. • Recruit organisations to provide help via the Help Desk • Ensure adequate links with other CHy (and wider) activities as appropriate – including WHOS, Project X and Innovation • Ensure HydroHublinks with RA priorities	H.Lins and H.Dixon (both in the Advisroy Council)	existing and new HYCOS projects (Senegal and IGAD transitional phase). • Conversion of INFOHYDRO into HISP. • Active and fit-for-purpose Help Desk.	AWG members • Regional HAs and relevant WGs	• Dec 2018: Fully operation HydroHub • June 2018: Sustainable operational & funding model established	

Activities	Actions	AWG Member	Outputs	Resources	Milestones	Linkages
	and RAWG Hydrology. • Promote the development and use of free and open source software for hydrology (such as MCH).					
Project X: Chair the Management Committee, finalize and test basic uncertainty analysis (UA) software, develop UA capacities for ADCP, including standardization of computation of discharge, discharge estimation via various techniques, and produce guidance documentation for calibration and performance testing, design of “regattas” for intercomparison of flow measurement instruments and techniques, ultimately supporting quantification of discharge uncertainties (with error bands at stated confidence levels)	• Update Management group Membership • Conduct meetings with committee via phone/internet/face to face • Finalize the first module of UADAT • Comparison Test ADCP software • Compare point meter UA softwares • Support HydroHubgoal of free and open software for hydrology UA methods. • Interface with HMEI and ISO to promote vendor and NHS adoption of best UA practices	• J.Fulford (Chair)	• Finalize contract with Qualisyst (support: Claudio) • work plan for next period. • At least 6 per year (one face-to-face a year) • Hereafter: depending on workplan to be adopted Software distribution • Field Discharge Survey 2018 • Guidance conducting ADCP regattas for QA and recommendations • Repository of Instrument test	• WMO secretariat (Dom, Tommaso) • OPACHE members • ISO rep • HMEI rep • IAHS rep • IAHR rep • RAII WGHS • HydroHub 1 f2f meeting in 2017	• April 2017 • • • • • AWG Review, revise and adopt work plan for next period: July 2017 • Hereafter: depending on Work plan • Revise previous survey & conduct survey • Request updating of NHSs Q standards • Regatta guidance doc completed/finalized • ADCP dataset(s) to conduct software comparisons collected • Other meter	• Innovation Hub • Manufacturers (HMEI) • Others as appropriate

Activities	Actions	AWG Member	Outputs	Resources	Milestones	Linkages
			reports • Guidance for ADCP & point meter UA standards • Guidance for UA methods for discharge ratings • Technical report of developing rating curves with various field conditions • Free, Open and easy Software for developing index rating		discharge datasets to conduct UA schemes/software comparisons collected • Datasets collected & selected for comparison of rating UA schemes. • Conduct ADCP UA software tests w/datasets • Conduct other meter UA tests w/ datasets • Conduct comparison of rating UA schemes with datasets	
Networks: further develop guidance on hydrometric network optimization and prioritization of stations taking into account all users' needs, including the modelling community; update recommendation on station density; also consider the possibility of promoting the concept of hydrological "heritage" stations.	• Establish expert task team taking into account RAs experts to support the initiative; • Collect case studies of existing hydrological networks developments • Review of the existing WMO recommendation on station density, and network optimization principle • Propose new guidance material	Y. Jianqing	• Task team established • Report on case study • outline of the guidance • The guidance	• OPACHE • RAs WGH • Expert Task Team • WMO Secretariat (lead Iwona)	• List of expert task team–June 2017 • Report on case study– September 2018 • outline of the guidance - September 2019 • the guidance – December 2020	• UNESCO IHP • ISO-TC113, CEN • RAs • WMO Secretariat • Research institutes • ?

Activities	Actions	AWG Member	Outputs	Resources	Milestones	Linkages
Innovation and new data: advise on calls for proposals and assess existing hardware and software issued by the Global Innovation Hub and other developers, with a view to their operational use in NHSs, including non-traditional data sources such as citizen observations, and remote sensing technologies including satellites. In this regard consider new developments and applications with respect to big data.	• Serve as member of GHSF Innovation Hub Committee. • Help design and implement innovation calls. • Promote the update of Innovation Hub outputs within NMHSs. • Establish links with other similar initiatives outside of WMO • Develop links with the private sector regarding monitoring and data technologies	• H.Lins • J.Fulford (both in the InnoC)	• Innovation Hub calls successfully designed and implemented. • Some of the outputs of the Innovation Hub applied within NMHSs.	• OPACHE • Regional HAs and relevant WGs (for input on priorities) • HydroHub (Florian)	• Milestone to be agreed by Innovation Hub Committee. • Innovation workshop by Dec 2017 • Innovation call prepared by Dec 2017, depending on opportunities and funding	• World Bank / GFDRR • UNESCO IHP • RAs • CBS, CIMO • WMO Secretariat • IAHS+IAHR • ISO • Private Sector • Others as appropriate

WORKPLAN: Focus Area: *Hydrological Applications, Products and Services*

Activities	Actions	AWG / OPACHE Member	Outputs	Resources	Milestones	Linkages
A) APFM: 1) work with APFM on provision of guidance and training material on E2E EWSs for Flood Forecasting through the IFM HelpDesk, and other topics such as preparation of guidelines on how to formulate numerical weather prediction information for use in flood forecasting, consistent with the FFI-AG Work Plan of 2016-2019. 2) Represent CHy on the APFM AC/MC meetings.	A1 • provide reliable and easy access to E2E EWS for FF products (linked to E3 mentioned below); A2 • represent CHy AWG on the APFM AC/MC meetings (together with the President of CHy); A3 • implementation of new APFM strategy on project development;	A1 • H. Kim A2 • H. Lins • H. Kim A3 Link to E4	• web portal (possibly using the IFM Helpdesk) for the CoP with easy access to available materials and technologies, and communica-tion means with end users;	• Secretariat support in web-portal development;	• APFM AC/MC meeting; • web portal;	• GWP • FFI-AG; • CHy AWG President; • Secretariat
B) WMO Hydrological Status and Outlook (Including Sub-seasonal to Seasonal Hydrological Prediction): 1) Oversee the establishment and work of the expert Task Team coordinating the pilot phase of the initiative; 2) Improve the utility of sub-seasonal to seasonal	B1 • Establish Expert Task Team (ToR and Membership). B2 • Establish the necessary links between this	B1 Task Team (Chair: A. Jenkins) overseen by AWG Members: N. Tuteja T. Kanyike H. Dixon B2 N. Tuteja and Task	• Technical specification reports assessing: a) Target users and their require-ments. b) data specifica-tions c) modelling approaches d) dissemina-	• Lead AWG Members and Expert Task Team (Chair: A. Jenkins) • Secretariat support for organising the Task Team's work and meetings • Secretariat support for	• Expert Task Team established – September 2017 • Short progress reports every year • Reports on system requirements – December 2018 • Product delivery web portal – December 2018	• GDPFS • WIGOS / WHOS • GFCS • Related external scientific initiatives • IAHS

Activities	Actions	AWG/ OPACHE Member	Outputs	Resources	Milestones	Linkages
forecasts for hydrological and water resources management applications;	initiative and other related activities, including: a) WMO activities such as GFCS, WIGOS and GDPFS. b) external scientific initiatives and include outcomes from hydrological testbeds currently under development. B3 • Technical scoping of the initiative, including: a) Specifications of climate and hydrological data required for service development and delivery. b) Specification of the status, sub-seasonal and seasonal approaches to be used in the initiative based on the existing WMO material on SHP. B4 • Monitor and support the Expert Task Team's work establishing reliable and routine data	Team B3 Task Team monitored by N. Tuteja B4	tion methods e) capacity development needs related to the project. • A WMO web portal for the system. • Two demonstration pilot projects describing hydrologic status, sub-seasonal and seasonal prediction performance providing regular openly accessible assessment of regional hydrological status and (if possible) outlook via a central WMO website. • An implementa-	establishing a WMO website and publication material for the initiative. • Side events at external conferences • Resourcing for demonstration projects	• Staged completion of Pilot Projects: a) Pilot Project established – December 2017 b) Pilot Project providing status assessments – June 2020 • Seasonal Hydrologic Prediction Guidelines published (12 months) • Hydrologic Community Requirements document for Seasonal to Sub-Seasonal predictions	

Activities	Actions	AWG/ OPACHE Member	Outputs	Resources	Milestones	Linkages
	streams for: a) Observation monitoring information b) Hindcast and forecast information B5 • Design and develop an operationally ready seamless water status and forecasting system. B6 • Development of at least two demonstration pilot projects in significant water supply regions around the world. B7 • Provide input to the Task Team's work developing an implementation plan for the System beyond 2020 and present to CHy-16 B8 • Complete related WMO Guidelines. including: a) Reviewing the Seasonal Hydrological Prediction Guidelines. b) Completing the Downscaling	Task Team monitored by N. Tuteja B5 Task Team monitored by N. Tuteja B6 Task Team monitored by T. Kanyike B7 Task Team monitored by Lead AWG Members B8 a) CHy	tion plan for submission to CHy-16 detailing the potential development into an operational system after 2020. • Related WMO Guidelines and other documents (outlined in Actions) published.			

Activities	Actions	AWG/ OPACHE Member	Outputs	Resources	Milestones	Linkages
	Guidelines. c) Developing sub-seasonal and seasonal hydrological verification guidelines to enhance end-user confidence (link with E5).	Review process and undertake necessary revisions b) Jan D. c) N. Tuteja				
D) DRR: 1) contribute to the development of identifiers for cataloguing of hazardous events (promote hydrological perspective) and 2) lead the finalization of the Manual on Flood Risk Mapping, including 3) investigating the applicability of Common Alerting Protocols (CAP);	• ACTIVITY D1 • Contribute to DRR Programme including representing CHy on DRR FP RA-TC-TP and EAGs • Contribute to the catalogue ACTIVITY D2 • Finalize the manual • form a drafting team with new members (CHy-15 meeting volunteers M. Bussetini (Italy), Mexico – contact delegate for OPACHE member); ACTIVITY D3 • collect material on alerting protocols used in operational hydrology including CAP • develop recommendations on	D1 • Marcelo (lead) • Yuri (assist) D2 • Marcelo (lead) • Tom D3 • Jan D. (lead)	D1 • Appropriate representation of hydrological aspects within DRR • Revised hydrological hazard definitions; D2 • Manual on FRM; D3 • material and recommended alerting protocol for operational hydrology;	• AWG members • OPACHE • APFM	D1 • Review of draft catalogue - TBD • proposed new hydrological hazard definitions to AWG (input to review of Technical Regulatory Materials); D2 • New Draft of Manual – AWG-2; • Finalized Flood Risk Mapping Manual – CHY-16; D3 • List of alerting protocols used – AWG-2; • Evaluation of protocols – AWG-2; • recommendations for alerting protocol use in operational hydrology – Cg-18;	• OPACHE; • DRR programme; • PWS • Members • International Basin Authorities • RAs

Activities	Actions	AWG/ OPACHE Member	Outputs	Resources	Milestones	Linkages
	use of alerting protocols in operational hydrology;					
E) Implementation Strategy for the End-to-End Early Warning Systems (E2E EWS) for flood forecasting (using the Community of Practice approach): 1) develop assessment guidelines for NHSs to evaluate their E2E EWS for flood forecasting, furthering the earlier work on "Efficiency of flood forecasting services" (including testing developed procedures) possibly through the establishment of a Task Team/Working Group, consistent with the FFI-AG Work Plan of 2016-2019, 2) develop access to the interoperable technologies including platforms and models for use in flood forecasting; 3) provide access to training and guidance material, in conjunction with item 1.4(g) below, on the aforementioned items; and 4) assist in the development of projects;	ACTIVITY E0 • Establish CoP approach for FF ACTIVITY E1 • develop generic and living list of requirements/best practices in E2E EWS for FF (based on existing materials); • prepare assessment guidelines making use of existing material including assessment instructions E2 • inventory and assessment of capabilities of existing platforms and hydrological forecast models; • inventory of existing guidance material (what is available and what is missing), including river-ocean modelling and forecasting; • inventory of existing training material (what is available and what is	• Marcelo Uriburu – Activity Lead • Contributors -Y. Simonov, H. Kim, T.Kanyike, N.Tuteja E0 Marcelo (lead), Tom (assist) E1 Yuri (lead) E2 Hwirin Kim (lead) Y. Simonov (assist) E3 Hwirin Kim (lead) E4 E-team E5 N. Tuteja (lead)	ACTIVITY E1 • List of best practices (YS); • NHSs assessment guidelines (YS); E2 • Guidance material on platforms and models; • Guidance material (e.g. NWP formulation for FF); • training material needed to support CoP; E3 • web portal of the CoP with easy access to available materials and technologies, and communicatio n means with end users;	• OPACHE; • TT • Secretariat to develop web portal HelpDesk; • Financial budget (place holder) • One joint face-to-face meeting of key contributors (within 9 months from now)	• Task team (TT) (work group) is formed to oversee development and implementing of the CoP approach in E2E EWS in FF; • • meeting to develop CoP (ToR) approach 2017?; • E1 teleconferences/ meeting to finalize NHSs assessment guidelines in advance of FFI-AG3; • E2 guidance and training material are available for CHy-16; • E2 inventory and guidance material on interoperable platforms and models for CHy-16; • E3 Launching of CoP and web portal HelpDesk in 2018; • E4 3 pilot projects established CHy16; • E5 Reviewed RA II document 2018	• OPACHE; • FFI-AG; • CHY-AWG; • CREWS; • IFI; • Members;

Activities	Actions	AWG/ OPACHE Member	Outputs	Resources	Milestones	Linkages
	missing) E3 • design (assemble content) web portal (using existing IFM Helpdesk capabilities) allowing access to technologies (e.g. models), guidance and training material; E4 • seek opportunities for implementing CoP approach using pilot projects based on countries' requests; E5 • Review guidelines for verification of hydrological forecasts (RA II) consistent with product requirements – coastal hydrologic services, very short range high temporal resolution hydrologic forecasts for flash flood guidance (link to B3 c).		E4 3 Members have progressed from assessment to filling identified gaps using CoP approach E5 Develop hydrological flood forecast verification guidelines for contribution to Hydrologic Forecast Verification Guidelines at multiple time scales.			
F) FFI: ensure that all major projects under FFI (CIFDP, FFGS, SWFDP) include the requirements and reflect best practices for effective	ACTIVITY F Hold FFI-AG3 • Provide advice and guidance on	• F Y. Simonov (President Chairs FFI-AG)	• CIFDP sub-projects implemented; • Independent assessment	• G. Smart	• CIFDP-C review of existing forecasting capabilities – July 2017; • CIFDP-B status review – November 2017;	• OPACHE • JCOMM • CBS • WDS • GDPFS • GFCS

Activities	Actions	AWG/ OPACHE Member	Outputs	Resources	Milestones	Linkages
and sustainable flood forecasting, including urban areas, consistent with the FFI-AG Work Plan of 2016-2019. 1) Co-chair the Project Steering Group (PSG) of CIFDP, participate in CIFDP sub-projects, coordinate closely with OPACHE member(s) participating in CIFDP and similarly contribute to the SWFDP and other projects/activities, ensuring improved flood forecasting early warning systems;	implementation of the CIFDP and its subprojects according to the CIFDP-PSG work plan; • develop hydrological aspects of new or existing CIFDP proposals • support the independent review/assessment of the CIFDP for the development of a sustainable coastal/riverine forecasting programme; • support FFGS implementation and training including mudflow/debris flow • preparation and provision of hydrological forecasting requirements on how to formulate numerical weather prediction information for use in flood forecasting to the SWFDP Steering Group; • provide advice and guidance to major projects (e.g., CREWS funded) on ensuring	N. Tuteja to contribute to hydrological forecast requirements for NWP	of CIFDP • guidance material on riverine-ocean modelling and forecasting;		• proposal is developed and seeking funding for the CIFDP-C riverine component – March 2018; • Shanghai proposal is received and reviewed – 2018; • CIFDP-C status review – April 2018; • CIFDP-F hydrological forecasting approach is assessed – June 2017; • new governance structure of CIFDP is proposed jointly with JCOMM MC;	

Activities	Actions	AWG/ OPACHE Member	Outputs	Resources	Milestones	Linkages
	use of best practices for effective and sustainable flood forecasting;					
G) WRM and drought: develop and/or recommend tools for water resources assessment and planning to assist decision-making including under climatic variability and change, such as preparing guidelines for assessing hydrological drought severity and impacts for water resources management, possibly through the use of hydrological drought indicators. This could be achieved through the establishment of a Community of Practice on Droughts;	G1 Tools • Enhance Dynamic Water Resources Assessment Tool (DWAT): develop water resources assessment tool and manual; also apply the DWAT to various WMO member countries • Prepare brief report on available assessment tools (inventory) for national/basin scale application G2 Guidance material for indicators • Broader in scope than drought (sector indicators dependent on water resources) G3 CoP Drought • Develop CoP Drought • Review of available documentation	G1 • H. Kim (DWAT) • N. Tuteja to provide OPACHE member to undertake assessment report G2 • Tom • N. Tuteja G3	G1 DWAT Application and manual Brief report of assessment tools G2 Guidelines including methods for assessment of hydrological indictors for IWRM At least one demonstration case study	•	G1 • Draft manual of DWAT - September 2017 • DWAT workshop – October 2017 • Development of snowmelt function - September 2018 • DWAT webpage - December 2018 • Brief report on available assessment tools – AWG-2 G2 • Guidance material prepared – Draft by 2018; final document by AWG - 3 G3 • E0 completed	G2 • GWP • IDMP

Activities	Actions	AWG/ OPACHE Member	Outputs	Resources	Milestones	Linkages
					and used as possible example • Possible G2-G3 meeting in 2018	

WORKPLAN: ***Activities to be supported by the Secretariat, with support of experts from the OPACHE, without direct involvement of AWG members***

Activities	Actions	AWG Member	Outputs	Resources	Milestones	Linkages
APFM: implement activities identified as priority by the Advisory Committee/ Management Committee (AC/MC);	• Covered under WP 3	•	•	•	•	•
IDMP: liaise with AgMP to ensure hydrological input to the Programme, assisting in the implementation of activities to bring them in line with APFM;	• Covered under WP 3			•	•	•
Develop a statement on the definition of hydrological normals;	• Draft the statement	• President	•	•	•	•
Develop a manual on sediment transport measurements (suspended and bedload) and prepare related training material;	• Review existing material of WMO and other, and propose a way forward	• S. Pecora	•	• D. Berod • M. Busettini		•
Prepare guidance on conveying probabilistic forecasting to different users of the water community;	• ..	• N. Tuteja	•		•	•
Review of CHy regulatory material hierarchy and style of documents, including reallocation of contents	• Prepare one-page proposal for a way forward	• H. Dixon • J. Danhelka	•	• T. Abrate		•

Activities	Actions	AWG Member	Outputs	Resources	Milestones	Linkages
to different categories, in the context of WMO effort toward improved consistency and liaise with the AWG as required;						
Public Private Partnership: Respond to request of Resolution 67 (Cg-17) and liaise with the AWG as required;	• ..				•	
Complete the guidelines on environmental flows: hydrological processes, management and ecological response.	•				•	

WORKPLAN: ***Activities to be implemented if one or more Members volunteer to lead their implementation***

Activities	Actions	AWG Member	Outputs	Resources	Milestones	Linkages
Operational guidelines that represent water availability and water supply reliability (including indicators);	• ..	•	•	•	•	•
Evaluation of hydrological aspects of rainfall harvesting and potential products;	• ..			• T. Kanyike	•	•
Data rescue, including guidelines for filling in missing data;	• ..	•	•	•	•	•
Evaluation of methods for design discharge estimation in consideration of climate variability and change;	• Review A. Cardoso's report	• Secretariat	•	•		•
Organizing technical training and data exchange tools to support IWRM.	• Proposal once WHOS Phase II concept is prepared	• S. Pecora	•	H. Nacken	•	•