WORLD METEOROLOGICAL ORGANIZATION

WMO INTEGRATED GLOBAL OBSERVING SYSTEM (WIGOS)

Workshop for Regional Association VI (RA-VI) with Focus on Marine Meteorological and Oceanographic Observing Requirements

(WIGOS/RA-VI/Ocean)

Split, Croatia, 5-7 September 2016

FINAL REPORT

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EXECUTIVE SUMMARY

The WIGOS Workshop for Regional Association VI (RA-VI) with Focus on Marine Meteorological and Oceanographic Observing Requirements was held from 5 to 7 September 2016 at the Campus of the University of Split, Faculty of electrical engineering, mechanical engineering and naval architecture. The workshop was hosted by the Institute of Oceanography and Fisheries (IZOR), and co-organized by the Croatian Meteorological and Hydrological Service (DHMZ). 43 participants from 8 Countries and 5 international organizations/programmes attended the workshop.

The workshop was organized in the framework of the development of the WMO Integrated Global Observing System (WIGOS) Pre-Operational Phase for 2016 to 2019 at the Regional Level (RA-VI) to follow up from WMO Congress and Executive Council decisions in this regard, particularly with regard to the development of Regional WIGOS Centres (RWCs) in RA-VI with focus on marine meteorological and oceanographic observing requirements at the regional level.

Noting that the Regional WIGOS Centres (RWCs) may be implemented either centrally, at an overall regional level where a Member or a consortium of Members provide support for the entire Region, or at sub-regional level, the workshop discussed the role of such centres with regard to marine meteorological and oceanographic (metocean) observing systems and investigate potential candidates for providing all or parts of the required functions (e.g. providing assistance to Members on what standards to follow, how to collect data using satellite data telecommunication systems, quality monitoring, collection and submission of observing platform metadata to the WMO Database OSCAR - oscar.wmo.int, vocabularies, etc.).

Another objective of the workshop for addressing the other priority areas of the WIGOS Pre-Operational Phase was to better understand regional and sub-regional requirements for metocean observations in support of various WMO Application Areas, including weather prediction, climate services, and ocean applications and marine services.

The workshop discussed how to enhance and develop partnerships nationally and in the region between national meteorological services and marine and/or oceanographic institutes in the view the further develop capacities in the region, and promote free and unrestricted data exchange in compliance with WIGOS standards and technical regulations.

Based on discussions, including through breakout groups, the workshop agreed on sets of actions (Annex 2) and recommendations (Annex 3). Some of the actions in Annex 2 are for the RA-VI Task Team on WIGOS Implementation to consider. Some of the recommendations of the workshop were proposed for inclusion in the RA-VI WIGOS Implementation Plan (Annex 4).

The workshop discussed the relevance of the workshop recommendations to the RA-VI Operating Plan and Regional WIGOS Implementation Plan for RA-VI (R-WIP-VI) and made some proposals in this regard. The discussion included topics relevant to the Adriatic, Key Performance Indicators, and will serve as input to the new Session of RA-VI in 2017.

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GENERAL SUMMARY

1. ORGANIZATION OF THE SESSION

1.1.Opening and keynote statements

1.1.1. The WIGOS Workshop for Regional Association VI (RA-VI) with Focus on Marine Meteorological and Oceanographic Observing Requirements opened at 09:00 hours on Monday 5 September 2016 at the Campus of the University of Split, Faculty of electrical engineering, mechanical engineering and naval architecture. The workshop was hosted by the Institute of Oceanography and Fisheries (IZOR), and co-organized by the Croatian Meteorological and Hydrological Service (DHMZ).

1.1.2. The meeting was chaired by the President of RA-VI, Mr Ivan Čačić (Croatia).

1.1.3. High level keynote and welcoming statements were given during the opening of the workshop as listed in the table below.

Name	***Title / Organization***	***Keynote***
Mr Ivan Čačić	President of RA-VI and Permanent Representative of Croatia with WMO	Welcome address Introduction of the workshop
Mr Goran Šarin	Assistant Minister, Ministry of Maritime Affairs, Transport and Infrastructure	Welcome address on behalf of the Ministry of Maritime Affairs, Transport and Infrastructure
Ms Nataša Strelec Mahović	Director of the Croatian Meteorological and Hydrological Service	Welcome address
Ninčević-Gladan, Skejić, Bužančić on behalf of Mr Nedo Vrgoč	Director, Institute of Oceanography and Fisheries, Croatia	Welcome address
Mr Lukša Čičovački	Head of Sector at the Maritime sector at the Ministry of Maritime Affairs, transport and Infrastructure	How should we see the sea and why?- a wider perspective on the use of meteorological and oceanographic data
Ms Dijana Klarić	Meteorological and Hydrological Service	Introduction of Regional collaborations regarding WIS DCPC and partnerships AMMC as DCPC WIS/WIGOS for the benefit of maritime services
Mr Ercan Büyükbaş (via teleconference)	RA-VI Task Team on WIGOS Leader, Turkish State Meteorological Service, Turkey	Regional WIGOS Centres
Mr Wenjian Zhang	Assistant Secretary General, WMO	Benefits of WIGOS and Introduction of differences between WIS and WIGOS

1.1.4. During the keynote addresses, the following points were made:

- JOZO[1]-1 and JOZO-2 collaboration Agreements under the auspices of the Croatian Ministry of Maritime Affairs, Transport and Infrastructure, which are regulating (i) the field of meteorological and marine observation infrastructure of common interest, and (ii) common numerical weather and oceanographic modelling respectively, are excellent examples for developing

1 In Croatian: Jadranska Operativna i Znanstvena Oceanografija, In English: Adriatic Operative and Scientific Oceanography

and enhancing collaborations and partnerships on marine meteorological activities, catalyzing national consolidation towards WIGOS environment.

- There is a need for more observational data in the Adriatic in support of marine meteorological forecast and services, including maritime safety. These have direct socio-economic benefits and support trade;
- The Regional WIGOS Centre(s) will play a key role for the efficient implementation of WIGOS at regional and national level, and will contribute the improvement of the cooperation between national meteorological services and marine and oceanographic community.
- This Workshop is expected to enable joint effort in planning, building up and functioning Regional WIGOS Marine and Ocean Centres in RA VI tracing, thus, Regional WIGOS Implementation Plan in the area of marine meteorology and oceanography. This activity is regarded as one of the strongest contributions to the technical backbone of all meteorological, hydrological, oceanographic and related activities, not only in the RA VI but on the global level.

1.1.5. The list of participants is given in Annex 1.

1.2. Adoption of the agenda

1.2.1. The Provisional Agenda, as contained in the WIGOS/RA-VI/Ocean/Doc. 1.2, was adopted by the workshop.

1.3.Working arrangements

1.3.1. The work of the Workshop was conducted as a committee of the whole. However, sub-groups were established as required to consider specific issues. The session and documentation was in English only.

1.3.2. The Team agreed on its working hours and adopted a tentative time table for consideration of the various agenda items.

1.3.3. The Secretariat introduced the documentation plan of the meeting, available at https://sites.google.com/a/wmo.int/wigos-ra6-ocean/.

2. PURPOSE OF THE WORKSHOP AND GUIDANCE FROM THE CHAIR OF THE RA-VI TASK TEAM ON WIGOS

2.1. Introduction of RA-VI WIGOS activities

2.1.1. The WMO Assistant Secretary General, Dr Wenjian Zhang provided an overview of the regional WIGOS activities in RA-VI in relation to the workshop's goals.

2.2. Outcome and recommendations of the RA-VI WIGOS workshop in Belgrade (Nov. 2015)

2.2.1. The WMO Representative for Europe, Mr Milan Dacić (WMO Secretariat) and Mr Ercan Büyükbaş, TSMS, RA VI TT-WIGOS Leader reported on the outcome and recommendations of the Regional Association VI WIGOS Workshop, which took place in Belgrade, Serbia from 24 to 27 November 2015. They also addressed the key outcome and recommendations of the workshop that are relevant to this workshop's objectives.

2.2.2. RA-VI WIGOS Workshop provided a unique opportunity to increase the awareness of WIGOS among the Members by bringing the experts together. The workshop discussed the status of the WIGOS implementation at national level in RA-VI, the needs of the Members for WIGOS implementation, the challenges encountered and proper solutions for them.

2.2.3. The workshop concluded that the overall success of the WIGOS implementation strongly depends on the efficient implementation at national level. This is why the required guidance and assistance should be provided for the Members by means of various tools such as guidance material, online WIGOS forum, and newsletter issued by WIGOS PO, TT-WIGOS, ROE.

2.2.4. The workshop agreed that a template National WIGOS Implementation Plan should be prepared by TT-WIGOS to assist the Members, and the Members should be encouraged to share their experiences regarding the WIGOS implementation at national level.

2.2.5. The workshop discussed the main tasks for RWCs including coordination between Members and WMO bodies, improved communication through provision of contact points and education and training concerning WIGOS implementation, as well as technical support in network design/management, data quality monitoring and meta data management, providing links to external entities and establishing of partnerships with different regional groupings (oceanography, climate, hydrology, instrument calibration).

2.2.6. The workshop, by considering difficulties to identify new resources for such entities of RWC, concluded that RWCs could be best use existing resources through implementation as virtual centers, where a group of NMHSs would share the relevant tasks between them under the overall coordination of one of them.

2.2.7. The workshop noted that RWCs need not cover the Region as a whole; tasks could be shared between Regional WIGOS Centers covering sub-regions, with areas of responsibility aligned with existing geographic or linguistic boundaries within the Region.

2.3. Outcome and recommendations of the RA-VI WIGOS Task Team meeting in Belgrade (June 2016)

2.3.1. Mr Dacić and Mr Büyükbaş also reported on the outcome and recommendations of the meeting of the RA-VI Task Team on WIGOS Implementation, which took place in Belgrade, Serbia from 6 to 7 June 2016. He addressed the key outcome and recommendations of the meeting that are relevant to this workshop's objectives.

2.3.2. They stressed that efforts are being made to bring meteorological services to a common service level. Some data are critical, e.g. weather radar and marine data. Members are encouraged to be part of the operational weather radar data exchange, and RWCs should be able to play a role in this regard.

2.3.3. TT-WIGOS reviewed and discussed the status of WIGOS implementation in RA-VI and related activities within the scope of R-WIP-VI.

2.3.4. There is an appreciated effort of RA VI Task Team TT-RIC in RA-VI for assisting Members to utilize the capabilities of Regional Instrument Centers (RICs).

2.3.5. The meeting reviewed, redefined and rescheduled the activities to update of R-WIP-VI, to develop a process to monitor and report on the level of regional compliance with WIGOS standards, to maintain up-to-date data and metadata to the WIR, to implement the concept for virtual RWC in RA-VI, to develop a general concept for RWC, to update the draft proposal prepared for radar data exchange, to prepare a proposal for Regional Basic Observing Network (RBON) concept to be submitted to RA-VI MG.

2.3.6. Mr Dacić and Mr Büyükbaş provided an overview of the role and benefits of Regional WIGOS Centres (RWCs) by highlighting the key role, which these centers will play for assisting the Members to implement the WIGOS.

2.3.7. It is expected from RWCs to act as a hub for maintaining the communication among the related entities for WIGOS implementation, and to organize, coordinate and support WIGOS related activities and develop necessary tools (e.g. newsletter, workshop, training, introductory videos, web pages, etc.) for raising awareness of WIGOS concept among the Members.

2.3.8. It is also proposed that RWCs should provide the guidance, assistance and information, e.g. a template for N-WIP, good practice examples, requested by Members to develop and implement their N-WIPs.

2.3.9. TT-WIGOS meeting in Belgrade noted that RWCs can also perform the function of radar data center of sub-regional radar network to generate and distribute composite products.

2.3.10. It was stressed that RWCs should have necessary resources and IT infrastructure to perform the required functions, and maintain its commitment for a certain time (e.g. for 5 next years).

2.4. Purpose of this workshop

2.4.1. Under this agenda item, Mr Čačić provided a brief overview of the purpose of the workshop and stressed on the following key points:

(i) The workshop outcome should be contributing to the WIGOS implementation process in RA-VI taking into account the global WIGOS Implementation requirements and the required complementarity with the existing WIS environment;
(ii) The workshop shall take into account the milestones towards the RA-VI Session in Croatia in 2017, in accordance with the RA VI Management Group decisions regarding the establishment ofa RA VI Regional WIGOS Centers (RWC) as a network of contributing NMHSs (virtual center structure). The Management Group also decided establishing a "proof of concept" phase in setting-up the RWC Network.
(iii) The workshop recommendations and proposed actions shall be consistent with the RA-VI Operating Plan 2016-2019, in particular for Regional WIGOS Centre development through virtual center structure assigned to Members / NMHSs represented in the RA VI Task Team on WIGOS (TT-WIGOS) that will start to work as a "nut shell" - with reduced set of functions and geographical coverage.
(iv) National WIGOS implementation is therefore important, and the following questions have to be addressed: what is (at the RA VI level) under responsibility of the RA VI Task Team on WIGOS, and what supervision should the RA VI Working Group on Technology Development and Implementation be providing.
(v) There should be kick-off activities for the consolidation of internal NMHSs disunite network starting with the marine and oceanographic monitoring, and consolidation of disunite marine and oceanographic monitoring networks of NMHSs and partner organizations on national and sub-regional level.
(vi) Integration and quality monitoring of marine and oceanographic measurement is also key through enhancement of the WIS-DCPC Marine Meteorological Centre for the Adriatic Sea Area. This can be realized by the upgrade to the RWC (Regional WIGOS Marine / Ocean Centre), and the strengthening of national boards on (i) marine meteorological and oceanic infrastructure of common interest (in Croatia started as JOZO 1), and (ii) marine / oceanographic modeling (in Croatia started as JOZO 2).
(vii) The development of a Regional Marine Instrument Centre (RMIC) is also a topic to be addressed by the workshop, together with the development of RWC for the Adriatic Sea Area also as a template for other regions (closed seas, gulfs ...).

3. WIGOS PRE-OPERATIONAL PHASE AND REGIONAL REQUIREMENTS

3.1. Introduction on WIGOS and the WIGOS Priority activities for the Pre-Operational Phase

3.1.1. Mr Zhang briefed the workshop participants about the WMO Integrated Global Observing System (WIGOS) and the five WIGOS priority activities decided by the Seventeenth World Meteorological Congress (Cg-17, Geneva, Switzerland, May / June 2015) as part of Resolution 23 (Cg-17), Pre-Operational Phase of WIGOS 2016-2016. The five priority areas for the pre-operational phase are:

(1) National WIGOS implementation;

(2) WIGOS regulatory material complemented with necessary guidance material to assist Members with the implementation of the WIGOS technical regulations;

(3) Further development of the WIGOS Information Resource (WIR), with special emphasis on the operational deployment of the databases of the Observing Systems Capability Analysis and Review (OSCAR) tool;

(4) Development and implementation of the WIGOS Data Quality Monitoring System (WDQMS);

(5) Concept development and initial establishment of Regional WIGOS Centres (RWCs);

3.2. The WMO Rolling Review of Requirements

3.2.1. Mr Etienne Charpentier (WMO Secretariat) provided an overview of the WMO Rolling Review of Requirements (RRR), including methodology for assessment the observational gap by using impact studies and comparing observing systems capabilities with the observational user requirements for the 14 WMO Application Areas. In particular, the RRR activities feed into the Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP), which is a key document providing Members with clear and focused guidelines and recommended actions in order to stimulate cost-effective evolution of the observing systems to address in an integrated way the requirements of WMO programmes and co-sponsored programmes.

3.3. WIGOS metadata and OSCAR

3.3.1. Mr Charpentier reported on the WIGOS metadata standard and explained about the need for Members to submit the WIGOS metadata to OSCAR. He also reported on the procedure for submitting such metadata.

3.3.2. It was stressed that the OSCAR/Surface National Focal Point is responsible for coordinating the collection at the national level of WIGOS metadata concerning surface-based observing systems operated by the country in support of WMO Application Areas, and for feeding them in OSCAR/Surface. However, for marine observing systems, as machine to machine interface was put in place between JCOMMOPS and OSCAR, WIGOS metadata for such observing systems shall be submitted by the platform operators directly via JCOMMOPS and not via the OSCAR/Surface Focal Point.

3.3.3. Participants expressed the wish to consider filtering observing stations displayed on the home page of OSCAR/Surface according to their operational status (i.e. display active or inactive stations).

3.3.4. The workshop invited JCOMM to consider transitioning WMO Publication No. 47 (i.e. voluntary observing ship metadata) to WIGOS Metadata Standard and to take action for their recording in OSCAR.

3.4. The WIGOS Data Quality Monitoring System

3.4.1. Mr Krunoslav Premec (WMO Secretariat) reported on the development of the WIGOS Data Quality Monitoring System (WDQMS).

3.4.2. He reported on the outcome of the 1st Workshop on Observational Data Quality Monitoring (Geneva, Switzerland, 10-12 December 2014), which was organised as a part of the ongoing revision of the performance monitoring for the Global Observing System (GOS) and the WIGOS Quality Management activities, with focus on (i) the modernisation of the NWP-based monitoring of data availability, (ii) observational data quality, and (iii) the development of a framework and procedures for the identification, documentation and rectification of various issues revealed by this type of monitoring.

3.4.3. The 2nd WIGOS Workshop on Quality Monitoring (QM) and Incident Management (IM) (Geneva, Switzerland,15 to 17 December 2015) discussed and refined the development of the Quality Monitoring and Incident Management pilot projects, and proposed (i) quality Evaluation to be added to QM and IM functions of WDQMS, and (ii) the detailed plans and recommendations for GOS implementation of WIGOS, including the plan for a Demonstration Project in RA I.

3.4.4. The 5th Session of the Inter-Commission Coordination Group on the WMO Integrated Global Observing System (ICG-WIGOS-5) (Geneva, Switzerland, 25 to 28 January 2016) then established a Task Team on WIGOS Data Quality Monitoring Systems (TT-WDQMS) in replacement of the former Task Team on WIGOS Quality Management.

3.4.1. Mr Premec explained that the key priority for the WIGOS Data Quality Monitoring System (WDQMS) will be the development of a modern and efficient performance monitoring and reporting system for observational data availability and data quality. By the time of Congress-18 in 2019, the WIGOS framework is expected to have been completed, encompassing (i) WDQMS concept tested and consolidated, (ii) observational data quality monitoring practices and procedures defined, incorporated in the WIGOS Regulatory Material, and (iii) the WIGOS Data Quality Monitoring System implemented.

3.4.2. The WDQMS will include the following functions: (i) WIGOS Quality Monitoring Function, (ii) the WIGOS Evaluation (and reporting) Function, and (iii) the WIGOS Incident Management Function.

3.5. The role of Regional WIGOS Centres

3.5.1. Dr Zhang reported on the role of the Regional WIGOS Centres (RWCs) and WMO plans to develop the network of such centres. This included information on the concept note (see Annex 5) on the establishment of RWCs recently approved by the Executive council at its Sixty-Eight Session (Geneva, Switzerland, June 2016).

3.5.2. The workshop invited WMO Members and partner organizations to provide feedback on how they can benefit from the RWCs.

3.6. The role of the WMO-IOC Regional Marine Instrument Centres

3.6.1. Mr Charpentier reported on the role of the WMO-IOC Regional Marine Instrument Centres (RMICs) in the WIGOS framework. The RMICs were established by the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM). They provide a mean to integrate instrument best practices and related standards among the marine meteorological and oceanographic communities. The RMICs are expected to facilitate adherence of observational data, metadata, and processed observational products to higher level standards for instruments and methods of observation, by providing (i) facilities for the calibration and maintenance of marine instruments and the

monitoring of instrument performance; and (ii) assistance for instrument inter-comparisons, as well as appropriate training facilities complementing what the manufacturers are also providing. Two RMICs have been established in RA-II and RA-IV so far.

3.6.2. Mr Premec reported on challenges and opportunities for establishing an RMIC in RA-VI. The capabilities of already designated RMICs for RA-IV (North and central America) and RA-II (Asia) in USA and China respectively, Morocco as RMIC candidate for RA-I (Africa), and the Calibration laboratory of Meteorological and Hydrological Service of Croatia (DHMZ) were inter-compared and analysed in regard to the RMIC Terms of Reference. Based on the analysis, enhancement of calibration facilities, organization of regional training workshops and instrument inter-comparison of meteorological and related oceanographic instruments as well as advisory support on instrument performance and maintenance were identified as the major challenges for setting up RMIC in WMO-RA-VI. It was found that there is no one single institute within the Region that could address all Members' needs and requirements with respect to RMIC role. Therefore, enhanced cooperation between NMHSs, oceanographic institutes and other partners was recognised and stressed as a great opportunity for facilitating the establishment of RMIC in RA VI.

3.6.3. Additionally, facilities of the DHMZ Calibration laboratory such as calibration standards, traceability assurance and experiences with inter-laboratory comparisons were presented in more details.

3.6.4. The workshop noted that Germany, Turkey are candidate for Regional Instrument Centre (RIC), and that there may be opportunity for them to also provide the function of RMIC.

3.7. Relevant data policies

3.7.1. Dr Zhang reported on the following data policies which are relevant to WIGOS, and the workshop i.e.

- **WMO Resolution 40 (Cg-XII, 1995)**, which is securing free and unrestricted international exchange of real time meteorological data. The Resolution decides that Members shall provide on a free and unrestricted basis essential data and products… as, at a minimum, described in Annex 1 to this resolution (RBSN, Operational Satellite Data, etc). Members should also provide the additional data and products which are required to sustain WMO Programmes at the global, regional, and national levels to assist other Members in the provision of meteorological services. The distinction of "essential" and "additional" data in the sense of Res. 40 has helped that different data access and distribution policies could coexist among WMO Members.
- **WMO Resolution 25 (Cg-XIII, 1999)**, which is adopting a stand of committing to broadening and enhancing, whenever possible, the free and unrestricted international exchange of hydrological data and products, in consonance with the requirements for WMO's scientific and technical programmes. The Resolution decides that Members (i) shall provide on a free and unrestricted basis those hydrological data and products which are necessary for the provision of services in support of the protection of life and property and for the well-being of all peoples; (ii) should also provide additional hydrological data and products, where available, which are required to sustain programmes and projects of WMO, other United Nations agencies, ICSU and other organizations of equivalent status, related to operational hydrology and water resources research at the global, regional and national levels and, furthermore, to assist other Members in the provision of hydrological services in their countries; and (iii) should provide to the research and education communities,

for their non-commercial activities, free and unrestricted access to all hydrological data and products exchanged under the auspices of WMO.

- **WMO Resolution 60 (Cg-17, 2015)** for climate data (non-real time & historical data & products). The Resolution decides that the GFCS relevant data and products from the WMO World Data Centres (WDCs), the Global Producing Centers of Long-Range Forecasts (GPCLRFs), the Regional Climate Centres (RCCs), the Regional Climate Outlook Forums (RCOFs) and the ICSU World Data System (WDS), as well as from the framework of the Global Climate Observing System (GCOS)Essential Climate Variables (ECVs) (Atmospheric, Oceanic and Terrestrial), will constitute an essential contribution to the Framework and therefore should be made accessible among Members, in particular through the Global Framework for Climate Services (GFCS) Climate Services Information System (CSIS), on a free and unrestricted basis. The Annex to WMO Resolution 60 (Cg-17, 2015) specifies (i) historical climate time-series from the Regional Basic Climate Networks (RBCNs), the GCOS Upper-Air Network and GCOS Surface Network at a temporal and spatial resolution necessary to resolve the statistics of climate, including trends and extremes; (ii) Essential Climate Variables for the ocean (full depth) (as defined by the GCOS Implementation Plan); (iii)climate relevant coastal interface data, in particular sea level, waves and storm surges; (iv) data on the composition of the atmosphere including aerosols; (v) climate relevant satellite data and products; and (vi) climate relevant cryospheric data, in particular snow cover, snow depth, glacial monitoring, permafrost and lake and river ice.

3.7.2. It was stressed that over 60+ years, WMO Data Policies not only lead to increased quality of weather and climate services, but also lay critical foundation to the great success and achievements of all WMO Members and Programmes. The workshop agreed that Members should promote further free and open data exchange for the benefit of our nations, regions and the whole world.

3.7.3. The workshop recognized that in terms of data policies and in the framework of WIGOS Implementation at the national level, all countries are different. Each NMHS shall set goals & objectives for WIGOS according to national needs and partnership status with (i) critical analysis of capabilities and gaps of current services vs national social economic development, with a Vision for 2025; (ii) a clear view on the reliance on national WIGOS, observing gaps and overall plan and roadmap; and (iii) focus plan on priority areas, with achievable projects and phases. An important issue will be to establish governance within NMHSs and Coordination mechanisms with key partners & key relationships, addressing data policy. Applying WIGOS tools and guidance will be critical.

3.7.4. Regarding the exchange of WIGOS metadata, the workshop recognized that such exchange did not necessarily imply that the corresponding data are being exchanged free of charge, but that it at least provided visibility to thoseproducing such data. It was noted that in some cases it was difficult for ocean institute to exchange data in real-time, but that exchanging the metadata immediately was not a matter of concern in principle.

3.8. The WIGOS Identifiers

3.8.1. Ms Champika Gallage, Technical Coordinator of the Data Buoy Cooperation Panel (DBCP) provided an overview of the WIGOS Identifiers, covering technical requirements, and the implications for the allocation of such numbers to individual observing stations.

3.8.2. She explained that WIGOS station identifiers are intended to provide a link between observations and the metadata associated with the conditions under which the observations are made. Each WIGOS station identifier would only be associated with one station or platform (called an "observing facility" in WIGOS metadata terminology); unlike previous numbering schemes, if a land station was

relocated or a new drifting buoy deployed it would not be permissible to re-use the station identifier. However, in order to maintain a link with historic station identifiers it would be possible for a single observing facility to be associated with more than one WIGOS station identifier.

3.8.3. The form of WIGOS station identifiers was defined in Attachment 2.1 of the Manual on WIGOS. Provision had been made to map all known series of station identifiers onto WIGOS station identifiers, and draft guidance to Members on how to allocate WIGOS station identifiers to new observing facilities was being developed athttp://wis.wmo.int/page=WIGOS-Identifiers.

3.8.4. At its ninth Session (Geneva, Switzerland, 18-21 April 2016), the CBS Open Programme Area Group on Integrated Observing Systems (OPAG-IOS), Implementation-Coordination Team on Integrated Observing System (ICT-IOS) supported the recommendation in the guidance on allocating WIGOS station identifiers that Members should not create additional WIGOS station identifiers for stations that had already been allocated an identifier under a previous scheme (for example a World Weather Watch station five digit number). ICT-IOS also supported the recommendation that where an existing identifier had been issued to a station, that identifier should be recorded in Table Driven Code Form (TDCF) reports from that station using the data descriptor relevant to that type of identifier.

3.8.5. ICT-IOS-9 also recommended that Members should decide which of the WIGOS station identifiers associated with an observing facility should be considered as the primary identifier for that station and to include that identifier using the descriptor for WIGOS station identifiers in all reports in TDCF from that station. This dual reporting would provide continuity between historic and future reports.

3.8.6. To support these recommendations and the guidance that had been developed, ICT-IOS agreed that a more detailed policy and recommendations on the use of station identifiers by Members should be developed by the team and submitted to the Inter-Commission Coordination Group on the WIGOS (ICG-WIGOS) to consider for adoption as WIGOS guidance.

3.9. The RWCs as part of the Global Campus

3.9.1. Mr Dacić reported on the role of the Regional WIGOS Centres as part of the WMO Global Campus.The WMO Global Campus is a framework or concept (see website2), with the intention of assisting WMO Regional Training Centre's (RTC) and WMO affiliated Training Institutions to work together more collaboratively in order to help meet the growing range and depth of education and training demands of WMO Members.

3.9.2. The workshop noted that the Campus will help identify opportunities for RTCs, WMO affiliated Training Institutions or partners to develop and deliver training that they cannot do solely by themselves and therefore help meet these growing demands. Can be part of the WMO Global Campus any RTC or WMO affiliated Training Institution that wants to take part in this and benefit from increased collaborative working to meet Members demands and requirements is part of, as well as a contributor to, the WMO Global Campus.

3.9.3. The WMO Global Campus will provide complimentary services and support to the educational process currently applied in many of the current systems of university education by giving access of students to the open training materials, resources and professional expertise.

3.9.4. The existing formal and regulated processes for quality assurance,

2https://www.wmo.int/pages/prog/dra/etrp/documents/WMOGlobalCampusFAQAV2December2015.pdf

accreditations, examinations etc. are some examples of where Universities can share some of their best practice, where applicable, to other non-formal institutions via the WMO Global Campus. In addition, Universities can learn from the best practice approaches of non-formal education and training institutions, e.g. in the area of competency based training and assessments and end user training.

3.9.5. The workshop agreed that the Regional WIGOS Center should have a strong Education and Training component and collaborate with the WMO Global Campus, by providing technical but also scientific and research components expertise.

4. USER REQUIREMENTS FOR MARINE METEOROLOGICAL AND OCEANOGRAPHIC (METOCEAN) OBSERVATIONS

4.1. The workshop reviewed the observational user requirements for marine meteorological and oceanographic observations. These related essentially to those identified within the relevant application areas of the Rolling Review of Requirements: (i) Global Numerical Weather Prediction, (ii) High Resolution Numerical Weather Prediction, (iii) Sub-seasonal to longer predictions, (iv) Ocean Applications, (v) Climate Monitoring (GCOS) and climate services, and (vi) Climate Applications (Other aspects, addressed by the Commission for Climatology).

4.2. The following presentations were made:

- Dr Paul Poli, Meteo France, Using the WMO Rolling Review of Requirements for observing network design
- Mr Nenad Leder, Maritime Safety Information
- Mr Mirko Orlic, Storm surges in the Adriatic Sea and related data requirements

The workshop identified those observational user requirements, which are more relevant to the region in the WIGOS framework. These are reflected in the workshop's recommendations (Annex 3).

5. DEVELOPING PARTNERSHIPS

5.1. Presentation by participants on their respective activities and national capabilities

5.1.1. The workshop received series of presentations from the participants, focusing on opportunities, challenges, and existing and potential partnerships to be developed in the region. These are listed in the table below.

Country / Programme	***No.***	***Name, agency***	***Title of presentation***
Albania	1	Mr Metodi Marku Institute of GeoSciences, Energy, Water and Environment (IGEWE)	Marine observations in Albania
Croatia	3	Ms Dijana Klarić, Meteorological and Hydrological Service	Croatian marine meteorology from national to regional WIGOS Adriatic activities
	4	Mr Vlado Dadić, Institute of Oceanography and Fisheries	Croatian oceanographicmonitoring activitiesincluding planned activitiesfor the next period
	5	Mr. Plišić and Mr. Babic	Hydrology/Marine issues in the Adriatic

			region
Greece	6	Mr Antonis Chalkiopoulos, Hellenic Centre for Marine Research, Institute of Oceanography	Greece activities with regard to marine meteorological and oceanographic observations, opportunities and challenges: (i) HCMR's monitoring activities in NRT, opportunities and challenges, (ii) - HCMR's planned activities for the next period, and (iii) HCMR's involvement in Copernicus service and in MonGOOS as a data management and distribution center for the Mediterranean.
Italy	7	Mr Giovanni Coppini	Mediterranean oceanography Network for GOOS and the Italian Observing System
Slovenia	9	Ms Maja Jeromel	Operational marine monitoring system in Slovenia
Spain	10	Ms Marta de Alfonso, Puertosdel Estado	Spain and Puertos del Estado activities with regard to marine meteorological and oceanographic observations, opportunities and challenges
Turkey	11	Mr Ercan Büyükbaş, Turkey, TSMS Met Service (via teleconference)	Turkey activities with regard to marine meteorological and oceanographic observations, opportunities and challenges
European activities	12	Mr Vlado Dadić, Institute of Oceanography and Fisheries	SeaDataNet activities and opportunities for enhancing partnerships on marine data exchange
	13	Dr Paul Poli, Meteo France	E-SURFMAR activities and enhancing partnerships with oceanographic institutions
	14	Mr Henry Kleta, DWD	DWD and EUMETNET activities in marine meteorological observations
	15	Mr Pierre Poulain, OGS	MedOS activities and opportunities for enhancing partnership with oceanographic institutes and meteorological services
	16	Mr Giovanni Coppini	Copernicus Marine Environment Monitoring Service MED-MFC and *in situ* Tac: the data infrastructures and the use of data in the Med forecasting system
	17	Mr Patrick Gorringe	Euro-GOOS, facilitating the sharing of oceanographic observations from EMODnet through WIS
JCOMMOPS	18	Mr Mathieu Belbéoch	JCOMMOPS activities and support toward the implementation of marine observing systems, and opportunities and challenges for enhancing regional partnerships.

5.2. National implementation of WIGOS and potential synergies (plenary discussion)

5.2.1. Introduction

5.2.1.1. The Secretariat introduced the next agenda item, and explained about the need to develop national WIGOS implementation plan in line with the high priority areas of the WIGOS Pre-Operational Phase 2016-2019:

(1) National WIGOS implementation;

(2) Regulatory and guidance materials: WIGOS regulatory material complemented with

necessary guidance material to assist Members with the implementation of the WIGOS technical regulations;

(3) WIR and OSCAR: Further development of the WIGOS Information Resource (WIR), with special emphasis on the operational deployment of the databases of the Observing Systems Capability Analysis and Review tool (OSCAR);

(4) WDQMS: Development and implementation of the WIGOS Data Quality Monitoring System (WDQMS); and

(5) RWCs: Concept development and initial establishment of Regional WIGOS Centres.

5.2.2. Discussion on national WIGOS implementation and potential synergies

5.2.2.1. Under this agenda item, the workshop discussed national implications and possible contributions (priority 1) and potential synergies to be realized related to the implementation of the WIGOS pre-operational phase priority areas 2 to 5:

(1) Regulatory and guidance materials: The workshop reviewed some key elements of the Technical Regulations that Members are mandated by the WMO to undertake (i.e. use of the word *shall*), and identified those areas where guidance is particularly needed at the national level, in light of the latest developments of WIGOS guidance materials to be submitted to the Sixteenth Session of the Commission for Basic Systems (CBS-16, Guangzhou, China, 23 to 29 November 2016);

(2) WIR and OSCAR: The workshop focused on OSCAR and how to collect WIGOS metadata into OSCAR, in particular using the OSCAR/Surface national focal points, Machine to Machine Interfaces, and the JCOMM *in situ* Observations Programme Support Centre (JCOMMOPS) as possible mechanisms;

(3) WDQMS: The workshop discussed what tools are available, in particular with regard to marine observations (JCOMMOPS, RSMC Exeter, Météo France marine observation quality control tools), and how these could be integrated in the WDQMS; additional tools from regional partners could also be promoted.

(4) RWCs: This is a major topic for the workshop, and the participants provided feedback on the potential national contributions and candidates in light of discussions under agenda item 5.1.

5.2.2.2. The workshop's findings in this regard are reflected in the workshop's recommendations (Annex 3).

5.3. Areas where potential partnerships can be realized (plenary discussion)

5.3.1. The workshop discussed areas where potential partnerships can be realized, in particular with regard to:

- Sharing information on technology (P. Poli, P. Poulain). It was stressed that while technology changes are accelerating, coordination of efforts is key to keep up with such changes. Thankfully, the climate change monitoring agenda forces WIGOS to make sure that we do not lose homogeneity of time series as technology changes, and the continued use of some technologies with some overlap with new technologies is necessary.
- Sharing infrastructure resources (V. Dadić, M. de Alfonso). In face of lack or limited resources, and uneven geographical distribution of the observing systems, the optimization of use of existing resources is a key. Collaboration among institutions in the Adriatic region is necessary, e.g. with regard to the monitoring of the Adriatic Sea using research vessels. There is a MoU between Croatia and Italy but further efforts could be made. For example, one could establish a group of experts to investigate potential collaborations with regard to the use of different technologies, and standardization of harmonization of best practices (calibration, formats for data exchange), data exchange, instrument inter-comparisons, transfer of knowledge and education, and capacity development in

the region. The workshop agreed that assuring operations and long term maintenance of the observing systems is important, and that there are opportunities for sharing resources in this regard.

- Sharing data (how to bring partner together) (D. Klarić, P. Gorringe, V. Dadić). The workshop noted the demand from the oceanographic data to make meteorological data, including observations and model output available to them. The workshop noted that working with governments, there is a process to increasingly make NMHSs data openly available. Efforts should be made at the national level while finding regional partners. NMHSs should also be pro-active to collaborate with the ocean community and existing programmes and projects such as MonGOOS and EuroGOOS. In this framework, NMHSs are encouraged to share data with the ocean community.
- Contributing to international programmes and activities (H. Kleta, M. Belbéoch). While atmospheric and oceanographic phenomena have no border, demonstration of socio economical benefits of observing systems with governments helps making the case for these systems and getting them funded, including for the longer term. The following points were made: (i) share information and data with no restriction; (ii) not reinvent the wheel at start (e.g. data processing can be made by partners) – build capacity gradually; (iii) keep JCOMMOPS in the loop of your activities (international visibility); (iv) register deployment plans, platforms and metadata through JCOMMOPS website tools www.jcommops.org (WIGOS Ids); (v) apply for donor programmes to receive instruments to start contributing. Challenges: only bilateral means, limited international capacity to fund such programmes; (vi) communicate nationally/regionally on the importance to participate in such ocean observing programmes. (beached instruments, vandalism, data access, etc); and (vii) get involved in regional and international programmes to take benefit from the cooperative effort and enrich them with your perspectives.
- Contributing to RWCs and Regional Marine Instrument Centres (RMICs) (W. Zhang, E. Charpentier). The workshop agreed that new positions with new competencies should be opened in NMHSs to foster cooperation, collaborations, and sustainability of activities related to marine meteorology (and therefore oceanography) and that are increasingly becoming operational for the provision of services to society.

5.4. Proposed recommendations for consideration by the workshop

5.4.1. In preparation of the discussion under items 7.1, 7.2, and 7.3, the workshop synthetized the previous discussion under agenda items 4 and 5, and identified some recommendations to be made through Technical Commissions and Regional Association VI, and other groups or expert teams. These were then consolidated as part of the workshop's recommendations (Annex 3).

6. BREAKOUT GROUP DISCUSSION

6.1. Distribution of the work (plenary)

6.1.1. At this point, the workshop organized itself in breakout groups. Under this agenda item, the workshop discussed in plenary the composition of the breakout groups, and provided them with guidance on the topics to be discussed and the need for them to report back to plenary on their findings. The following breakout groups were established:

1. User requirements for ocean observations, regional/sub-regional metocean observing capabilities and gaps*(Group lead by P. Poli);*
2. Enhancing metocean data exchange at the regional and sub-regional level (at the technical level) *(Group lead by D. Klarić));*

3. Improving metocean data quality monitoring, and Collaboration in capacity developmentfor Regional WIGOS Centres, Regional Marine Instrument Centre in the Adriatic, and potential national contributions *(Group lead by V. Dadić).*

6.2. Breakout group discussion

6.2.1. The breakout groups met under this agenda item. The leaders of each group then synthetized the discussion, including findings and recommendations.

6.3. Drafting of findings and recommendations by the breakout groups

6.3.1. The leaders of the breakout groups prepared written reports on the groups findings and their recommendations.

6.4. Plenary discussion on the outcome of the breakout groups

6.4.1. The leaders of the breakout groups reported back to plenary on the groups findings and their recommendations. The workshop decided on the recommendations to be promoted with the Technical Commissions and Regional Association VI, and other groups or expert teams. The workshop recommendations are provided in Annex 3.

7. FUTURE WORKPLAN AND RECOMMENDATIONS OF THE WORKSHOP

7.1. Recommendations of the workshop feeding into the RA-VI WIGOS Implementation Plan

7.1.1. The workshop reviewed the recommendations proposed under agenda items 5.3 and 6.4 and other agenda items discussed so far, and agreed on those to be proposed for inclusion in the RA-VI WIGOS Implementation Plan (and R-WIP-VI). The relevant topics are listed in Annex 4.

7.2. Recommendations to the RA-VI Task Team on WIGOS Implementation concerning marine meteorological and oceanographic observations requirements with regard to the potential contribution of identified partners to the Regional WIGOS Centre (RWC) Pilot

7.2.1. The workshop reviewed the recommendations proposed under agenda items 5.3 and 6.4 and other agenda items discussed so far, and agreed on those to be submitted to the RA-VI Task Team on WIGOS Implementation concerning marine meteorological and oceanographic observations. The relevant topics are listed in Annex 2.

7.3. Relevance of the workshop recommendations to the RA-VI Operating Plan (incl. elements relevant to Adriatic, key performance indicators, and input to RA-VI Session) (I. Čačić)

7.3.1. The workshop discussed the relevance of the workshop recommendations to the RA-VI Operating Plan and R-WIP-VI. The discussion included topics relevant to the Adriatic, Key Performance Indicators, and input to the new Session of RA-VI.

7.4. Required immediate post-meeting actions (I. Čačić)

7.4.1. The workshop reviewed the list of action items arising from the meeting discussion, and agreed on the immediate post-meeting actions. These are recorded in Annex 2.

8. CLOSURE OF THE SESSION

8.1. Mr Ercan Büyükbaş (via teleconference) thanked the participants for their valuable contributions to the workshop. He recalled that thanks to the workshop outcome, the RA-VI WIGOS Implementation Plan will be substantially updated, and the recommendations of the workshop will be reflected to the RA-VI Task Team on WIGOS workplan. Some important activities initiated by the workshop will be discussed at next RA-VI Session.

8.2. The workshop also thanked Mr Büyükbaş for having participated during the full duration of the workshop via teleconference. The workshop also thanked the RA-VI Task Team on WIGOS for its support.

8.3. The Chair of the workshop, Mr Ivan Čačić thanked the Institute of Oceanography and Fisheries (Croatia) and its Director, Mr Nedo Vrgoč, for hosting the workshop, as well as the Croatian Meteorological and Hydrological Service and its Director, Ms Nataša Strelec Mahović, and staff for organizing it. He noted that this was his first experience of a WMO meeting where the oceanographic community was larger than the meteorological community and welcomed the strong cooperation that has been engaged with them. He wished to express his special thanks to the Permanent Representative of Italy with the WMO, Mr Silvio Cau, for the support of Italy in this collaborative approach with the ocean community that was promoted at the workshop. He also thanked theMinistry of Maritime Affairs, Transport and Infrastructure. Finally, Mr Čačić thanked all the participants and the Secretariat for contributing to the successful outcome of the workshop and wished everyone a safe trip back home.

8.4. The workshop agreed that this has been a very useful and productive meeting.

8.5. The meeting closed at 15:00 on Thursday 7 September 2016.

ANNEX 1

LIST OF PARTICIPANTS

(WIGOS/RA-VI/Ocean workshop, Split, Croatia, 5-7 September 2016)

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Invited participants		
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ANNEX 2

ACTION SHEET RESULTING FROM THE WORKSHOP

(WIGOS/RA-VI/Ocean workshop, Split, Croatia, 5-7 September 2016)

No.	Action	By	Deadline
1	The TT-WIGOS is invited to consider approaches for enhancing the integration and qualification of marine meteorological and oceanographic data (e.g., if not exchanged in real-time) and the harmonization of best practices;	RA-VI TT-WIGOS	End 2016
2	The TT-WIGOS to investigate how to further develop storm surge prediction in the Mediterranean Sea in collaboration with MonGOOS, and by integrating local predictions such as those performed by the Istituzione Centro Previsioni e Segnalazioni Maree (Tidal Forecasting and Early Warning Center) (ICPSM) for the whole sub-region, and integrating observations and models, including multi-model approaches; an expert may have to be nominated in the TT-WIGOS in this regard	RA-VI TT-WIGOS	End 2016
3	The TT-WIGOS is invited to liaise with the WMO Secretariat (Regional Office for Europe) and nominate someone to attend the next MonGOOS meeting in 2 months, and present about WIGOS, WIS, and JCOMMOPS. MonGOOS community should be a testbed for OSCAR update. OSCAR will be introduced to MONGOOS to set up OSCAR/surface review and propose adaptation (if any) related to better fit of oceanographic. (preparatory steps with WMO/ JCOMMOPS). WIS abilities will be introduced to MONGOOS. It will be follow up by similar actions at EuroGOOS level.	RA-VI TT-WIGOS	30 Sep. 2017
4	The TT-WIGOS to prepare a template National WIGOS Implementation Plan to assist the Members, and the Members should be encouraged to share their experiences regarding the WIGOS implementation at national level	RA-VI TT-WIGOS	End 2016
5	TT-WIGOS to consider setting up a project based on the experiences from the existing applications to deliver and share monitoring systems, software and tools to those not having such facilities (e.g. for real time monitoring of the status of the network, following and carrying out the maintenance and calibration activities, and managing the spare part inventory).	RA-VI TT-WIGOS	End 2016
6	TT-WIGOS to facilitate establishing a Regional WIGOS Centre (RWC) for the Adriatic Sea area as a virtual centre, and refine the functionalities of this centre. The proposed RWC will complement existing WIS DCPC for the Adriatic Sea area; Croatia will be leading in this regard.	RA-VI TT-WIGOS	RA-VI Session 2017
7	The TT-WIGOS to include in its membership representatives of the oceanographic community, of JCOMM and JCOMMOPS.	RA-VI TT-WIGOS	ASAP
8	The TT-WIGOS to invite NMHSs and their partner organizations to provide feedback on how they can benefit from the Regional WIGOS Centres (RWCs). For example	RA-VI TT-WIGOS	RA-VI Session 2017

No.	Action	By	Deadline
	verification of the observational data from different observing systems can be realized by cooperation among the Members (may be coordinated by RWCs).		
9	The TT-WIGOS to investigate with Germany, Turkey who are candidate for hosting a Regional Instrument Centre (RIC), how they could also provide the function(s) of WMO-IOC Regional Marine Instrument Centre (RMIC). The two Countries should also be invited to discuss the issue with Croatia in the view to elaborate RMIC proposal(s).	RA-VI TT-WIGOS	End 2016
10	The group recommends a review of the current metocean observing capacity in the Adriatic and the Ionian Sea and of its recording in the JCOMMOPS metadata database	JCOMMOPS	End 2016
11	Efforts must be made to better coordinate and develop common vocabularies and/or translators interfacing vocabularies in the WIGOS framework, and in cooperation with partners (e.g. SeaDataNet via JCOMMOPS). JCOMMOPS to assist with regard to referring and mapping existing vocabularies within WMO and with partner Organizations	JCOMMOPS	End 2016
12	JCOMM to investigate developing and proposing common data format for the exchange of marine meteorological and oceanographic data in the WIS and WIGOS frameworks. A tool should also be proposed for translating other existing formats to the common data format. For example, formats similar to those used in aviation meteorology or hydrology (WaterML2) could be developed	JCOMM TT-MOWIS & DMCG	Mar. 2017
13	JCOMM is invited to promote development and establishment of a WIS DCPC for oceanographic data in collaboration with NMHS (could also be a regional DCPC promoted by EuroGOOS)	JCOMM TT-MOWIS & DMCG	End 2016
14	JCOMM is invited to consider and take action for transitioning WMO Publication No. 47 (i.e. voluntary observing ship metadata) to WIGOS Metadata Standard and their recording in OSCAR	JCOMM SOT then OCG	Mar. 2017
15	JCOMM is invited to engage in HF radar activities and coordinate with EuroGOOS HF radar Task team, MONGOOS, and other groups involved in such activities, with the goal to better standardize practices and data exchange protocols and formats, and promote cross-boundary data exchange	JCOMM OCG	Mar. 2017
16	JCOMM to facilitate establishment of a WMO-IOC Regional Marine Instrument Centre (RMIC) for the Adriatic Sea as a distributed centre, whereby oceanographic institute(s) would be providing service for ocean instruments and measurements, and NMHS(s) involved in the making of marine meteoroliogical observations would be providing service for such measurements and the required instruments. Costs will have to be estimated	JCOMM OCG	Mar. 2017
17	Participants of the workshop involved in storm surge prediction are invited to	Workshop participants	ASAP & Ongoing

No.	Action	By	Deadline
	participate in the WMO Coastal Inundation Forecasting Demonstration Project (CIFDP[1]);		
18	Participants at the workshop are invited to discuss at the national level in the view to have their home institution/agency to (i) participate and contribute to WIGOS implementation at the national level, and propose nominations in the national WIGOS committees; (ii) strengthen existing partnerships among Members of RA-VI, or (iii) have them to consider becoming partners through either existing or proposed or new mechanisms (e.g. JOZO, national board, EuroGOOS, MedGOOS, E-SURFMAR, EMODnet, MedOS, Copernicus).	Workshop participants	ASAP & ongoing
19	Secretariat to invite ECMWF and NWP centres to make impact studies and provide information on the causes of forecasting errors and what observations are needed to minimize them (see item 2 above);	Secretariat (OSD)	ASAP
20	Secretariat to relay the workshop recommendations that the ETMSS should consider the issue of harmonizing small craft warnings, with a view of possibly discussing the topic at the next WMO-IMO meeting. Participation of RA-VI Members in the JCOMM ETMSS should be reinforced.	Secretariat (OSD)	ASAP
21	WMO is invited to introduce an optional filter on OSCAR/Surface so that users may select only active observing platforms on the home page.	Secretariat (OSD)	Mid-2017
22	RA VI Members should make efforts to better collaborate at the European level, particularly with Copernicus. WMO and its RA-VI should reach out and make the case with the European Commission in this regard.	Secretariat (RA-VI office)	RA-VI Session 2017
23	Secretariat to relay this workshop's relevant actions to the chair of the RA-VI Task Team in WIGOS	Secretariat (RA-VI office)	ASAP
24	Secretariat to relay this workshop's relevant actions and recommendations to the appropriate JCOMM groups	Secretariat (OSD)	ASAP

1http://www.jcomm.info/index.php?option=com_content&view=article&id=167

ANNEX 3

WIGOS Workshop for Regional Association VI (RA-VI) with Focus on Marine Meteorological and Oceanographic Observing Requirements (Split, Croatia, 5-7 September 2016)

WORKSHOP RECOMMENDATIONS

Note: Recommendations to feed into the RA-VI Operating Plan, the RA-VI WIGOS Implementation Plan, and the RA-VI Task Team on WIGOS (TT-WIGOS) workplan.

OBSERVATIONAL USER REQUIREMENTS AND GAPS FILLING

1. Additional marine meteorological and oceanographic observations are needed as compared to present coverage to support WMO Application Areas, in particular Maritime Safety. Efforts are being made to bring marine meteorological and oceanographic (metocean) services of National Meteorological and Hydrological Services (NMHSs) and their partner (including oceanographic) organizations to a common service level. It is critical to collect more data, especially in real time but also to assure continuity long time-series, in particular in the Adriatic and Ionian sea and using different types of observing stations such as drifting buoys, gliders, tide gauges, weather radar, HF radars, moored buoys (incl. wave buoys), voluntary observing ships, oceanographic vessels, profiling floats (Argo), river discharge hydrological observing platforms, satellites and their sub-regional products.
    a. A comprehensive modernization national plan for coastal observing systems in the Adriatic Sea has been drafted in Croatia; The group supports this inter-disciplinary approach;
2. For storm surge and coastal inundation prediction and services in the sub-region,
    a. there is a need to better observe and predict wind (both direction and speed), air pressure, and sea level in particular using well-positioned tide gauges where data are needed;
    b. there is a need to better observe and predict river flows;
    c. all countries in the sub-region should report flood and coastal warnings to Meteoalarm;
    d. efforts should be made to enhance exchange of tide gauge data between countries and between oceanographic and meteorological institutes/agencies around the Adriatic;
    e. there is a need to better understand the causes of the noted forecasting errors and what observations are needed for improving storm surge forecasting; forecasters are encouraged to make use of all available products such as ensemble predictions. Secretariat is to invite ECMWF and NWP centres to make impact studies and provide information on the causes of forecasting errors and what observations are needed to minimize them (see item 2 above);
    f. participants of the workshop involved in storm surge prediction are invited to participate in the WMO Coastal Inundation Forecasting Demonstration Project (CIFDP4);
    g. MonGOOS is working on storm surge prediction in the Mediterranean Sea; there is a need to further develop such activities, integrating local ones such as Istituzione Centro Previsioni e Segnalazioni Maree (Tidal Forecasting and Early Warning Center) (ICPSM), for the whole sub-region, integrating also observations and models, including multi-model approaches;

4http://www.jcomm.info/index.php?option=com_content&view=article&id=167

h. there is a need to review the legal framework and clarify responsibilities for implementation of measures for protection from storm surge and coastal inundation.

3. Maritime traffic is growing in RA-VI, involving a mix of an increasing number of recreational small crafts not subject to the SOLAS convention, increasingly larger container ships, and increasingly larger cruise passenger ships. Especially important to these warnings are observations from voluntary observing ships, drifters, HF radars, satellite products, and systems that can be deployed on demand.

    a. The number of voluntary observing ships is steadily declining. RA-VI members with registered vessels and/or coastal responsibilities are invited to take action to invert this decline and benefit from new opportunities and partnerships in RA-VI (noting EUMETNET modernization program for Ship Automated Weather Stations).

    b. ETMSS is to consider the issue of harmonizing small craft warnings, with a view of possibly discussing the topic at the next WMO-IMO meeting

    c. Participation of RA-VI Members in the JCOMM ETMSS should be reinforced

DATA AND METADATA EXCHANGE

1. There is a need to better communicate with the oceanographic communities about WIS and WIGOS and explain how they complement each other.

    a. Participants are invited to consider attending the MonGOOS meeting (Split, Croatia, 16-17 November 2016) meeting ????DATE????, and present about WIGOS, WIS, and JCOMMOPS.

2. The workshop encourages exchange of data in real-time, near real time and delayed mode between all actors in the region and above all sub-region, in particular where gaps exist. Oceanography data for RA VI should enter into the system at the proper level, to be efficient.

    a. Data formats: common format for the exchange of marine meteorological and oceanographic data in the WIS and WIGOS frameworks should be investigated, and tool to be provided for translating other existing formats to the common data format. For example, formats similar to those used in aviation meteorology or hydrology (WaterML2) could be developed.

    b. Efforts must be made to better coordinate and develop common vocabularies and/or translators interfacing vocabularies in the WIGOS framework, and in cooperation with partners (e.g. SeaDataNet via JCOMMOPS). JCOMMOPS to assist with regard to referring and mapping existing vocabularies within WMO and with partner Organizations.

    c. Members are encouraged to be part of the operational weather radar data exchange, and RWCs should be able to play a role in this regard.

    d. WMO and NMHSs should take steps to facilitate access to marine meteorological and oceanographic data from WIS by the oceanographic community and vice versa; beyond obligation of Members per existing data policies such as Res. 40 (Cg-12).

    e. JCOMM is invited to promote development and establishment of a WIS DCPC for oceanographic data in collaboration with NMHS (could also be a regional DCPC promoted by EuroGOOS).

3. WIGOS Metadata: The workshop noted that the Members should review and update the information of their observing systems on OSCAR/Surface. NMHSs and their partner organizations making marine meteorological observations using data buoys, ships, profiling floats, and tide gauges are urged to provide the WIGOS metadata about these observing systems to OSCAR via JCOMMOPS (exchanging metadata does not

necessarily mean that the observational data are exchanged in real-time, but gives visibility to the activities of the data producers, and helps WMO to identify potential partnerships and take action).

a. MonGOOS community should be a testbed for OSCAR update. OSCAR will be introduces to MONGOOS in (November 2016) to set up OSCAR/surface review and propose adaptation (if any) related to better fit of oceanographic. (preparatory steps with WMO/ JCOMMOPS). WIS abilities will be introduced to MONGOOS.

b. It will be follow up by similar actions at EuroGOOS level.

c. WMO is invited to introduce a filter on OSCAR/Surface so that only active observing platforms are displayed on the home page.

d. JCOMM is invited to consider and take action for transitioning WMO Publication No. 47 (i.e. voluntary observing ship metadata) to WIGOS Metadata Standard and their recording in OSCAR.

4. JCOMM is invited to engage in HF radar activities and coordinate with EuroGOOS HF radar Task team, MONGOOS, and other groups involved in such activities, with the goal to better standardize practices and data exchange protocols and formats, and promote cross-boundary data exchange.

PARTNERSHIPS AND REGIONAL WIGOS CENTRES (RWCS) AND WMO-IOC REGIONAL MARINE INSTRUMENT CENTRE (RMIC)

1. Some NMHSs have been operating well developed systems/software for the real time monitoring of the status of the network, following and carrying out the maintenance and calibration activities, and managing the spare part inventory. In order to help reaching a common level of service among all actors, and to provide a common platform for the exchange of data and metadata, it is recommended to share experiences with all partners and to set up a WMO coordinated project to deliver and share monitoring systems, software and tools to those not having such facilities.
2. The workshop recommends establishing a Regional WIGOS Centre (RWC) for the Adriatic Sea area as a virtual centre and refine the functionalities of this centre. The proposed RWC will complement existing WIS DCPC for the Adriatic Sea area; Croatia will be leading in this regard.
3. The workshop recommends exploring possibilities to establish an WMO-IOC Regional Marine Instrument Centre (RMIC) for the Adriatic Sea as a distributed centre, whereby oceanographic institute(s) would be providing service for ocean instruments and measurements, and NMHS(s) involved in the making of marine meteorological observations would be providing service for such measurements and the required instruments. Costs will have to be estimated.
4. In terms of participation in the activities related to the implementation of the WIGOS pre-operational phase, Members in RA-VI are urged to nominate national focal points, including national focal points representing the oceanographic community in their country. The RA-VI Task Team on WIGOS (TT-WIGOS) should also include in its membership representatives of the oceanographic community, of JCOMM and JCOMMOPS. Members should be motivated to contribute in the process of establishing RWC in RA-VI, leading to benefits to the region. In particular, each member in the Adriatic Sea is invited to establish national committees for WIGOS tasked in particular to decide on the country contribution to the RWC for the Adriatic.
5. Participants at the workshop are invited to discuss at the national level in the view to have their home institution/agency to

a. participate and contribute to WIGOS implementation at the national level, and propose nominations in the national WIGOS committees;

b. strengthen existing partnerships among Members of RA-VI, or

c. have them to consider becoming partners through either existing or proposed or new mechanisms (e.g. JOZO, national board, EuroGOOS, MedGOOS, E-SURFMAR, EMODnet, Med_{OS}, Copernicus);

d. consider the cooperation with the other Members for the verification of the observational data from different observing systems such as buoys, HF radars, etc.; and

e. get benefit from the experiences and facilities of each other for testing, calibration and traceability of observing systems used for the marine observations.

6. RA VI Members should make efforts to better collaborate at the European level, particularly with Copernicus. WMO and its RA-VI, including EUMETNET should reach out and make the case with the European Commission in this regard.

7. NMHSs and their partner organizations are invited to provide feedback on how they can benefit from the Regional WIGOS Centres (RWCs). For example verification of the observational data from different observing systems can be realized by cooperation among the Members (may be coordinated by RWCs).

8. Germany, Turkey are candidate for hosting a Regional Instrument Centre (RIC), and there may be an opportunity for them to also provide the function of WMO-IOC Regional Marine Instrument Centre (RMIC). They are invited to discuss the issue with Croatia in the view to elaborate proposal(s). It is noted that the experiences from existing RMICs can be benefited for adding the functions of RMIC to the RICs.

ANNEX 4

TOPICS TO BE CONSIDERED FOR THE RA-VI WIGOS IMPLEMENTATION PLAN

a. RA-VI is invited to take action regarding enhancing the making and exchange of metocean observations in the Adriatic and Ionian Sea (and possibly other seas) in support of WMO Application Areas and Maritime Safety, storm surge and coastal inundation prediction and services in the sub-region in particular, and to initiate a strategy and work plan (to feed into the RA-VI WIGOS Implementation Plan), in particular for:
    1. RA-VI Members to enhance their marine observing capacities in the Adriatic and Ionian Sea, according to workshop's recommendations (Annex 3, section on Observation User Requirements and Gaps Filling), and RA-VI to coordinate their efforts in this regard.
    2. RA-VI Members with registered vessels and/or coastal responsibilities are invited to take action to invert the decline of the VOS fleet and benefit from new opportunities and partnerships in RA-VI (noting EUMETNET modernization program for Ship Automated Weather Stations).
    3. Adriatic countries with modernization plans to be encouraged to regularly gather and update requirements from users (including partner organizations and international data platforms and infrastructures), share their plans, and provide an updated plan to feed the WMO Rolling Review of Requirements for the sub-region;
    4. Sub-regional partners to be encouraged to seek committments to sustain this infrastructure and take actions to limit vandalism;
    5. All countries in the sub-region should report flood and coastal warnings to Meteoalarm;

b. NMHSs should take steps to facilitate access to marine meteorological and oceanographic data from WIS by the oceanographic community and vice versa; beyond obligation of Members per existing data policies such as Res. 40 (Cg-12).

c. Members are encouraged to be part of the operational weather radar data exchange, and RWCs should be able to play a role in this regard.

d. In terms of participation in the activities related to the implementation of the WIGOS pre-operational phase, Members in RA-VI are urged to nominate national focal points for (a) WIGOS, (b) OSCAR/Surface, and the (c) EGOS-IP, including national focal points representing the oceanographic community in their country.

e. NMHSs and their partner organizations making marine meteorological observations using data buoys, ships, profiling floats, and tide gauges are urged to provide the WIGOS metadata about these observing systems to OSCAR via JCOMMOPS (exchanging metadata does not necessarily mean that the observational data are exchanged in real-time, but gives visibility to the activities of the data producers, and helps WMO to identify potential partnerships and take action).

f. Members will collaborate at sub-regional and regional levels to establish a Regional WIGOS Centre (RWC) for the Adriatic Sea area as a virtual centre, and refine the functionalities of this centre. The proposed RWC will complement existing WIS DCPC for the Adriatic Sea area; Croatia will be leading in this regard.

g. RA-VI Members should be motivated to contribute in the process of establishing RWC in RA-VI, leading to benefits to the region. In particular, each member in the Adriatic Sea is invited to establish national committees for WIGOS tasked in particular to decide on the country contribution to the RWC for the Adriatic Sea.

h. Members, assisted by the Secretariat will assist JCOMM with regard to exploring opportunities for establishing a WMO-IOC Regional Marine Instrument Centre (RMIC) for the Adriatic Sea as a distributed centre, whereby oceanographic institute(s) would be providing service for ocean instruments and measurements, and NMHS(s) involved in the making of marine meteoroliogical observations would be providing service for such measurements and the required instruments. Costs will have to be estimated.

i. RA VI Members, including EUMETNET should make efforts to better collaborate at the European level, particularly with Copernicus. WMO and its RA-VI should reach out and make the case with the European Commission in this regard.

ANNEX 5

CONCEPT NOTE ON ESTABLISHMENT OF WMP REGIONAL WIGOS CENTRES

(Annex to draft Decision 5.1(1)/1 (EC-68))

Background

Many WMO Members are already now requesting guidance and support for their WIGOS implementation efforts. It is clear that such support can be provided more efficiently and effectively via a regional support structure rather than through direct interaction between the WMO Secretariat and individual Members. A network of Regional WIGOS Centres (RWCs) is needed to assist WMO Members in their endeavour to successfully implement WIGOS at the national and regional levels.

There is a clear understanding that the Regions differ and that the generic concept described below will have to be adjusted further in order to address specific needs, priorities, challenges and available technical and human resources of the respective Region.

Purpose

Under the governance and guidance of the management group of the respective regional association and with the support of relevant regional working bodies, the overall purpose of the RWCs is to provide support and assistance to WMO Members and Regions for their national and regional WIGOS implementation efforts.

Basic Principles

WMO should encourage wherever possible that the existing WMO regional centres to carry out the new activities, thus ensuring optimization of technical and human resources. Already existing structures and mechanisms should be considered when implementing WIGOS at the regional and national levels, including their potential roles in RWCs. Every effort must be made to avoid any duplication with responsibilities and functionalities of already existing WMO Regional Centres; instead, possible synergies with them must be exploited.

Existing geographic, cultural and linguistic differences within each WMO Region must be taken into account in determining the appropriate establishment and models of operation of RWCs. Therefore, the respective regional association must decide on its own mechanism for how to establish its RWCs with clearly specified Terms of Reference,reflecting its needs, priorities and existing capabilities and facilities. The relevant WIGOS working body in the Region (generally the Regional Task Team on WIGOS) should be involved in the process of establishing the RWC and have general oversight once it has become operational.

Links to other WMO entities

The RWCs will work closely both with the WMO Secretariat (including Regional Offices) and with their respective regional working bodies to ensure efficient and effective implementation of WIGOS. The RWCs will liaise with relevant existing WMO Centres, in particular with the Regional Instrument Centres (RICs), Regional Climate Centres (RCCs) and Regional Training Centres (RTCs) regarding all WIGOS related activities in the Region.

Functionalities

Basic functions of the RWC must be regional coordination, guidance, oversight and support of WIGOS implementation and operational activities at the regional and national levels (day-to-day level of activities). A number of mandatory and optional functions are specified.

Mandatory functions

The proposed mandatory functions are directly linked with two of the priority areas of the WIGOS Pre-operational Phase (2016-2019):

1. Regional WIGOS metadata management (work with data providers to facilitate collecting, updating and providing quality control of WIGOS metadata in OSCAR/Surface);
2. Regional WIGOS performance monitoring and incident management (WIGOS Data Quality Monitoring System) and follow-up with data providers in case of data

availability or data quality issues.

Optional functions

Depending on available resources and regional needs, one or more optional functions may be adopted, e.g.: (a) assistance with the coordination of regional/sub-regional and national WIGOS projects; (b) assistance with regional and national observing network management; and (c) support for regional capacity development activities.

Implementation options and roadmap

In principle, each Member of any given Region should be covered by an RWC which will be responsible for providing WIGOS support. The RWCs may be implemented either centrally, at an overall regional level where a Member or a consortium of Members provide support for the entire Region, or at sub-regional level, e.g. aligned with the natural geographic or linguistic boundaries existing within the Region.

RWCs may be implemented either as monolithic entities, with a single Member taking on the responsibility for the entire set of required functionalities, or as virtual Centres, in which a consortium of Members share these responsibilities between them under the overall coordination of a lead organization.

The following key items with milestones are proposed in the Plan for the WIGOS Preoperational Phase:

(a) Establishment of one or more Regional WIGOS Centres in pilot mode from 2017,

(b) Operational phase of initial Regional WIGOS Centres beginning mid-2018,

(c) Establishment of Regional WIGOS Centres covering all WMO Regions by 2019.

ACRONYMS

AA	Application Area
AMDAR	Aircraft Meteorological Data Relay
AntON	Antarctic Observing Network
AOPC	GCOS Atmospheric Observation Panel for Climate
asap	As soon as possible
ASAP	Automated Shipboard Aerological Programme
AWS	Automatic Weather Station
CAeM	Commission for Aeronautical Meteorology
CAgM	Commission for Agricultural Meteorology
CAS	Commission for Atmospheric Sciences
CBS	Commission for Basic Systems
CCl	Commission for Climatology
CD	Capacity Development
CEOS	Committee on Earth Observation Satellites
Cg	Congress
CGMS	Coordination Group for Meteorological Satellites
CHy	Commission for Hydrology
CIMO	Commission for Instruments and Methods of Observation
CM	Climate Monitoring
CMA	China Meteorological Administration
CryoNet	Core network of GCW surface measurement sites/stations
DAOS	Data Assimilation and Observing Systems working group
DPFS	Data Processing and Forecasting System
DRR	Disaster Risk Reduction
E-AMDAR	EIG EUMETNET AMDAR programme
E-ASAP	EIG EUMETNET Automated Shipboard Aerological Programme
EC	Executive Council
ECMWF	European Centre for Medium-Range Weather Forecast
EC-PORS	Executive Council Panel of Experts on Polar Observations, Research and Services
ECV	Essential Climate Variable
EGOS-IP	Implementation Plan for the Evolution of Global Observing Systems
E-GVAP	EIG EUMETNET GNSS water vapour programme
EIG	Economical Interest Group
E-PROFILE	EIG EUMETNET Radar Wind Profilers and Backscatter Lidars programme
E-SURFMAR	EIG EUMETNET Surface Marine observation programme
ET-ABO	OPAG-IOS Expert Team on Aircraft Based Observing Systems
ET-AO	CIMO Expert Team on Aircraft Based Observations
ET-EGOS	Former OPAG-IOS Expert Team on the Evolution of Global Observing Systems
ET-ODRRGOS	Former OPAG-IOS Expert Team on Observational Data Requirements and Redesign of the Global Observing System
ET-OPSLS	CBS/CCl Expert Team on Operational Predictions from Sub-Seasonal to Longer-Time Scales
ET-SAT	OPAG-IOS Expert-Team on Satellite Systems
ET-SBO	OPAG-IOS Expert Team on Surface-Based Observing Systems
EUMETNET	EIG Grouping of European Meteorological Services
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
E-WINPROF	EIG EUMETNET Operational Networking of Wind Profilers in Europe
FAO	Food and Agriculture Organization of the United Nations
FSO	Forecast Sensitivity to Observation
GAW	Global Atmosphere Watch
GAWSIS	GAW Station Information System
GCOS	WMO-IOC-UNEP-ICSU Global Climate Observing System
GCOS-IP	GCOS Implementation Plan
GCW	Global Cryosphere Watch
GCW-IP	GCW Implementation Plan

GEO	Group on Earth Observations
GEO	Operational geostationary satellites
GFCS	Global Framework for Climate Services
GHGs	Greenhouse gases
GLAS	GEWEX Global Land/Atmosphere System Study
GNSS	Global Navigation Satellite System
GNSSRO	GNSS for Radio Occultation
GNWP	Global NWP
GOOS	IOC-WMO-UNEP-ICSU Global Ocean Observing System
GOS	Global Observing System
GPCs	Global Producing Centres of Long-Range Forecasts
GPS	Global Positioning System
GPSRO	GPS Radio Occultation
GRUAN	GCOS Reference Upper Air Network
GSG	GCW Steering Group
GSICS	Global Space-Based Inter-Calibration System
GSN	GCOS Surface Network
GSNMC	GSN Monitoring Centre
GTN-P	Global Terrestrial Network for Permafrost
GTS	Global Telecommunications System
HR	Horizontal Resolution
HRNWP	High Resolution NWP
IBCS	Intergovernmental Board on Climate Services
ICAO	International Civil Aviation Organization
ICG-WIGOS	Inter-Commission Coordination Group on WIGOS
ICSU	International Council for Science
ICT-IOS	CBS Implementation Coordination Team on Integrated Observing Systems
ICT-SW	WMO Inter-Programme Coordination Team on Space Weather
ID	Identification Number
IGOS	Integrated Global Observing Strategy
IMOP	Instrument and Methods of Observation Programme
IOC	Intergovernmental Oceanographic Commission (UNESCO)
IPET	Inter-Programme Expert Team
IPET-OSDE	OPAG-IOS IPET on the Observing System Design and Evolution
IPET-SUP	OPAG-IOS IPET on Satellite Utilization and Products
IPET-WIFI	OPAG-IOS IPET on WIGOS Framework Implementation Matters
IPT-SWISS	Inter-Programme Team on Space Weather Information, Systems and Services
IPWG	International Precipitation Working Group
ITU	International Telecommunication Union
IWWG	International Winds Working Group
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
JMA	Japan Meteorological Agency
KAA	Key Activity Area
KNMI	Royal Netherlands Meteorological Institute
LAM	Limited Area Model
LEO	Operational low-Earth orbit satellites
MHEWS	Multi-Hazard Early Warning Systems
MoU	Memorandum of Understanding
NASA	National Aeronautics and Space Administration
NCEP	NOAA National Centers for Environmental Prediction
NFP	National Focal Point
NMHSs	National Meteorological and Hydrological Services
NOAA	US National Oceanic and Atmospheric Administration
NVSRF	Nowcasting and Very Short Range Forecasting
NWP	Numerical Weather Prediction
OC	Observing Cycle
OCG	JCOMM Observations Coordination Group

OND	Observing Network Design
OPA	JCOMM Observations Programme Area
OPACE	Open Panel of CCl Experts
OPAG	Open Programme Area Group
OPAG-DPFS	CBS OPAG on DPFS
OPAG-IOS	CBS OPAG on Integrated Observing Systems
OPERA	EIG EUMETNET Operational Programme for the Exchange of Weather Radar Information
OSCAR	Observing System Capability Analysis and Review tool
OSCAR/Requirements	Observational user requirements component of OSCAR
OSCAR/Space	Space-based observing systems capabilities component of OSCAR
OSCAR/Surface	Surface-based observing systems capabilities component of OSCAR
OSDW	IPET-OSDE Observing System Design Workshop
OSE	Observing System Experiment
OSND	Observing system network design
OSSE	Observing System Simulation Experiment
PoC	Point of Contact
QM	Quality Management
R&D	Research and Development
RA	Regional Association
RBCN	Regional Basic Climatological Network
RBON	Regional Basic Observing Network
RBSN	Regional Basic Synoptic Network
R-MAR	OPAG-IOS Rapporteur on Marine Observing Systems
RRR	Rolling Review of Requirements
R-SEIS	OPAG-IOS Co-Rapporteur on Scientific Evaluation of Impact Studies undertaken by NWP centres
RTH	Regional Telecommunication Hub
R-WIP	Regional WIGOS Implementation Plan
SAG	Scientific Advisory Groups
SAON	Sustained Arctic Observing Network
SG-OD	IPET-WIFI Sub-Group on OSCAR Development
SG-RFC	OPAG-IOS Steering Group on Radio-Frequency Coordination
SIAF	Seasonal to Inter-Annual Forecasting
SLWC	Super Cooled Liquid Water Content
SOC	Science Organizing Committee
SoG	Statement of Guidance
TAMDAR	Tropospheric Airborne Meteorological DAta Reporting
TAO	Tropical Atmosphere Ocean
TBD	To be defined
TC	Technical Commission
TDCF	Table Driven Code Form
TECO	Technical Conference
TOPC	GCOS Terrestrial Observation Panel for Climate
ToR	Terms of Reference
TPOS	Tropical Pacific Observing System project
TRITON	Triangle Trans-Ocean Buoy Network
TT-SOGON	CCl Task Team on the Statement of Guidance on Observational Needs
U	Uncertainty
UK	United Kingdom of Great Britain and Northern Ireland
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UR	User Requirement
USA	United States of America
VCP	Voluntary Cooperation Programme
VolA	WMO No. 9, Weather Reporting, Volume A, Observing Stations and WMO Catalogue of Radio-sondes
VR	Vertical Resolution

WAM	West African monsoon
WCRP	WMO-IOC-ICSU World Climate Research Programme
WDQMS	WIGOS Data Quality Monitoring System
WG-GRUAN	Working Group on GRUAN
WHOS	WMO Hydrological Observing System
WIGOS	WMO Integrated Global Observing System
WIP	WIGOS Framework Implementation Plan
WIR	WIGOS Information Resource
WIS	WMO Information System
WMO	World Meteorological Organization
WPP	WIGOS Pre-operational Phase
WRF	Weather Research and Forecasting
WWW	World Weather Watch

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