

**WORLD METEOROLOGICAL ORGANIZATION**

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**COMMISSION FOR INSTRUMENTS AND  
METHODS OF OBSERVATION**

ITEM: 2

**Ad-Hoc WORKING GROUP ON WIGOS PILOT  
PROJECT  
*First Session***

Original: ENGLISH ONLY

GENEVA, SWITZERLAND,  
31 JANUARY – 1 FEBRUARY 2008

**Report of the Executive Council Working Group on the WMO Integrated Global Observing  
Systems (WIGOS) and the WMO Information System (WIS)**

*(Submitted by the Secretariat)*

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**Summary and Purpose of Document**

This document provides the report of the first meeting of the Executive Council Working Group on the WMO Integrated Global Observing Systems (WIGOS) that was held in December 2007. It provides guidance to the CIMO ad-hoc Working Group on the WIGOS pilot project on how to develop the CIMO pilot project, as well as an early draft of the project.

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**ACTION PROPOSED**

The meeting is invited to follow the guidance provided in this document in developing its pilot project and should particularly take into consideration section 3.4.3, as well as Appendix III and VI.

**Reference:** Report of the Executive Council Working Group on the WMO Integrated Global Observing Systems (WIGOS) and the WMO Information System (WIS)

# **WORLD METEOROLOGICAL ORGANIZATION**

**EXECUTIVE COUNCIL WORKING GROUP ON  
THE WMO INTEGRATED GLOBAL OBSERVING SYSTEMS (WIGOS)**

**AND**

**THE WMO INFORMATION SYSTEM (WIS)**

***FIRST SESSION***

**GENEVA, SWITZERLAND, 4 – 7 DECEMBER 2007**

**FINAL REPORT**



## **WMO General Regulations 42 and 43**

### **Regulation 42**

Recommendations of working groups shall have no status within the Organization until they have been approved by the responsible constituent body. In the case of joint working groups, the recommendations must be concurred with by the presidents of the constituent bodies concerned before being submitted to the designated constituent body.

### **Regulation 43**

In the case of a recommendation made by a working group between sessions of the responsible constituent body, either in a session of a working group or by correspondence, the president of the body may, as an exceptional measure, approve the recommendation on behalf of the constituent body when the matter is, in his opinion, urgent, and does not appear to imply new obligations for Members. He may then submit this recommendation for adoption by the Executive Council or to the President of the Organization for action in accordance with Regulation 9(5).

## EXECUTIVE SUMMARY

There is a broadly recognized need for a comprehensive, coordinated and sustainable global observing system. Many international agencies have to administer systematically these diverse sets of observations and have developed data policies to meet their needs. WIGOS is the organizational response of WMO to this need and therefore is committed to the very strong cooperation that is needed among all partners to accomplish the broad objectives.

WIGOS will respect the data policies of partner organizations and will adhere to the decisions of the Twelfth and Thirteenth World Meteorological Congress (1995, 1999) that adopted Resolution 40 (Cg-XII) "WMO Policy and Practice for the Exchange of Meteorological and Related data and products including Guidelines on Relationships in Commercial Meteorological Activities", and Resolution 25 (Cg-XIII) "Exchange of Hydrological Data and Products", respectively.

EC Working Group on the WMO Integrated Global Observing Systems (WIGOS) and the WMO Information System (WIS) held its first session from 4 to 7 December 2007 at the WMO Headquarters in Geneva, Switzerland. The Working Group reviewed the guidance and recommendations given by Cg-XV and EC-LIX towards implementation of the WIGOS concept. In accordance with their terms of reference, the Working Group discussed in detail various aspects of the development of an over-arching WIGOS Development and Implementation Plan. In particular, the Working Group discussed possible integration levels within WIGOS and agreed that as a system of observing systems, integration will be accomplished at three levels: observation standardization; a common information infrastructure, i.e. WIS; and end-product quality assurance. The Working Group agreed that helping Members to more fully understand WIGOS and keeping them current on its practical development should be considered as an essential component in WIGOS implementation. The Working Group agreed that this can be achieved through launching Demonstration Projects in selected NMHSs. The Working Group further discussed in detail conceptual aspects of WIGOS operations and expected benefits of integration to make them more clear and transparent for all NMHSs, partner organizations and also for policy makers. To best serve these purposes the Working Group developed an initial draft of the "WIGOS Concept of Operations" which contains goals, objectives, major characteristics, operational framework, data policy and benefits of WIGOS. Finally, the Working Group adopted the WIGOS Development and Implementation Plan (Version 1).

Taking into account that WIGOS development should be closely coordinated with implementation and institutional arrangements for overseeing WIS, the Working Group reviewed the experience gained in the WIS planning and implementation activities and developed specific recommendations for WIGOS implementation. It reviewed proposals for monitoring of the development and implementation of WIGOS and WIS plans through a "rolling review" mechanism successfully developed and implemented by CBS. The Working Group adopted this approach and felt that it would effectively steer and monitor integration activities. The Working Group also discussed the status of WIGOS Pilot projects identified by Cg-XV, including "Integration of WWW/GOS and GAW into WIGOS", "Initiation of a Global Hydrologic Network", "Integration of AMDAR into WIGOS", "Elaborating on the Underpinning/cross-cutting Role of the Instruments and Methods of Observation Programme and CIMO in the Context of WIGOS" and "Integration of Marine Meteorological and Other Appropriate Oceanographic Observation Systems into WIGOS". The Working Group reviewed activities on the planning and implementation of Pilot Projects and requested the Technical Commissions concerned to provide similar report on their progress towards implementation to the next session of the EC/WG/WIGOS-WIS. Based on the results of discussions, the Working Group developed its work programme for the forthcoming inter-sessional period. The Working Group also agreed to establish a Sub Group on WIGOS as authorized by EC-LIX as well as appropriate Terms of Reference. Finally, the Working Group developed the layout and possible content of the document on WIGOS-WIS to be submitted to EC-LX and requested the Secretariat to initiate appropriate actions to facilitate compilation of the material.

The final report of the first session of EC WG on WIGOS-WIS is available at:  
<http://www.wmo.int/pages/prog/www/reports.html>

## **EC-WG/WIGOS-WIS-1**

### **1. ORGANIZATION OF THE SESSION**

#### 1.1. Opening of the session

1.1.1 The EC Working Group on the WMO Integrated Global Observing Systems (WIGOS) and the WMO Information System (WIS) held its first session from 4 to 7 December 2007 at the WMO Headquarters in Geneva, Switzerland. The session was opened at 10.00 a.m. on Tuesday, 4 December 2007 by Dr A. Divino Moura, Chairman of the Working Group, who extended a warm welcome to all the participants at the session. He wished the Working Group success in the important tasks assigned to it and emphasised the importance of future informal contacts among its members and the Secretariat. The list of participants is given in Appendix I.

1.1.2 On behalf of the Secretary-General of WMO, the Assistant to Secretary-General, Mr J. Lengoasa welcomed the Working Group members. He recalled Congress and Executive Council decisions related to the WIGOS concept and underlined that their deliberations should be considered as one of the most challenging initiative of the Organization for the foreseeable future. Integration has to be regarded as a complex undertaking, which would comprise policy as well as technical issues, stretch over several years, and require the full support of all Members to be successful. He noted that the Working Group has an ambitious agenda comprising discussion of key components that make up the WMO Integrated Global Observing Systems. He expressed satisfaction that the Working Group would concentrate on the development of an over-arching WIGOS Development and Implementation Plan and also review the progress in the implementation of WIGOS/WIS "Pilot Projects", as identified by Cg-XV. He also underlined that in considering new and challenging tasks especially in the context of strategic planning, the Working Group should however, not lose sight of the need for continuing efforts to maintain and strengthen the existing WMO observational networks that will constitute future integrated global observing systems. He noted that the Working Group should develop recommendations on planning and development of WIGOS and WIS into recommendations for evaluation by EC-LX. He also noted that the Working Group consisted of distinguished experts having the ability to bring their high levels of expertise to the challenging requirements for the development and implementation of WIGOS, assuring therefore a constructive and comprehensive outcome from the meeting. He wished the participants well with their busy work schedule during the rest of the week.

#### 1.2. Adoption of the agenda

The meeting adopted the agenda as reproduced in Appendix II.

#### 1.3. Working arrangements for the session

The session agreed to its working hours and schedule. A list of acronyms is given in Appendix VIII.

### **2. REVIEW OF GUIDANCE AND RECOMMENDATIONS ADOPTED BY Cg-XV AND EC-LIX**

2.1 The Working Group was briefed by the Chairman on the guidance and recommendations given by Cg-XV and EC-LIX towards implementation of the WIGOS concept. He stressed the challenging tasks assigned to this Working Group to be accomplished during the short period preceding the Sixteenth Congress in 2011. He also underlined the importance of the input expected to be provided by Regional Associations, Technical Commissions and advisory bodies such as the SC for GCOS, JSC for GTOS, SC for GOOS and JSC for WCRP towards implementation of the WIGOS concept especially in terms of operations. Global change challenges certainly require internationally coordinated, world-wide efforts such as WIGOS. In this connection the Chairman

expressed satisfaction and gratitude to have representatives from related domains and their expertise to contribute to the integration process.

### **3. DEVELOPMENT OF AN OVER-ARCHING WIGOS DEVELOPMENT AND IMPLEMENTATION PLAN**

3.1.1 The secretariat presented three documents based on deliberations by EC-TT/WIGOS (Geneva, 31 January- 2 February 2007) and Cg-XV decisions. The Working Group reviewed policy and governance aspects, a possible strategic roadmap for the integration and agreed on the following layout and content of the WIGOS Development and Implementation Plan (WDIP):

- Introduction
- Planning and Implementation phases
- Pilot Projects
- Demonstration Projects
- WIGOS and WMO Technical Regulations
- WIGOS and WMO Technical Commissions
- Integration levels within WIGOS

3.1.2 The Working Group agreed to include into WDIP Demonstration Projects on the Development and Implementation of WIGOS at NMHSs, taking into account the following: "Cg-XV emphasized that support and involvement of NMHSs and Regional Associations in the implementation of WIGOS concept was a crucial factor for ensuring important benefits for all Members." Therefore, helping Members to more fully understand WIGOS and keeping them current on its practical development should be considered as an essential component in WIGOS implementation. The Working Group agreed that this can be achieved through launching Demonstration Projects in selected NMHSs. These NMHSs will be at the operational end of the WIGOS implementation demonstrating to all concerned how to initiate and keep WIGOS together with WIS components running at the required levels of performance. Feedback and lessons learnt from these NMHSs will be extremely beneficial in understanding expectations of WIGOS/WIS concept implementation. These projects will also have a high profile impact since they would include all observing systems, i.e. in addition to WWW/GOS, the Demonstration Projects would involve functions of other observing networks that provide the delivery of time critical data and products, as well as other information, underlying the basic operations of NMHS. In this context, the Working Group recommended that the Secretariat, working with appropriate working bodies of Regional Associations and Technical Commissions should ensure regular coordination and communication between Members involved in Demonstration Projects. It was underlined that the Demonstration Projects would complement the already agreed-upon Pilot Projects which focused on Technical Commission involvement while Demonstration Projects will be focused on NMHSs in Regional Associations. The Working Group welcomed the willingness of Kenya and Namibia (RA I), Republic of Korea (RA II), Brazil (RA III), United States of America (RA-IV), Australia (RA V) and the Russian Federation (RA VI) to carry out (host) "test-bed" Demonstration Projects in their Services.

3.1.3 The Working Group discussed possible integration levels within WIGOS. It agreed that as a system of observing systems, integration will be accomplished at three levels: observation standardization; a common information infrastructure, i.e. WIS; and end-product quality assurance.

3.1.4 The Working Group further discussed in detail conceptual aspects of WIGOS operations and expected benefits of integration to make them more clear and transparent for all NMHSs, partner organizations and also for policy makers. To best serve these purposes the Working Group developed an initial draft of the WIGOS Concept of Operations (CONOPS) which

contains goals, objectives, major characteristics, operational framework, data policy and benefits of WIGOS. The agreed text of CONOPS is presented in Appendix III.

3.1.5 The Working Group discussed management and coordination issues related to the implementation of WIGOS. Taking into account the experience gained during WIS development, and to provide overall technical guidance, assistance and support for the implementation of the WIGOS concept, the Working Group agreed to establish a Sub-group on the WMO Integrated Observing Systems (SG-WIGOS) with terms of reference reproduced in Appendix IV. In establishing the SG-WIGOS, the Working Group carefully considered an appropriate balance of expertise and appropriate participation from Technical Commissions and Regional Associations.

3.1.6 Finally, the Working Group adopted the WIGOS Development and Implementation Plan (Version 1) which is reproduced in Appendix V.

3.2 Prof. G. Hoffmann, in his capacity as the Chair of the WMO Intercommission Coordination Group on WIS (ICG-WIS), presented a comprehensive overview of the WMO Information System project plan, implementation schedule and current status. The Working Group reviewed the experience gained in WIS planning and implementation activities and supported the following implementation activities to ensure coordination between WIGOS and WIS plans towards achieving an integrated WMO end-to-end system of observing systems:

- As well as being a mechanism for collecting and distributing data under WIGOS, WIS is also dependant on some key components of WIGOS. Volume A (WMO - No.9) exemplifies this through providing a catalogue of observation stations that includes critical information such as location, elevation, observation program and so on essential for users of WIGOS data. By keeping such information in accessible catalogues, WIS can be far more efficient in collecting and distributing data by only sending those elements of the data that are regularly changing. This information can be recombined by users, or by the Discovery, Access and Retrieval (DAR) services through which WIGOS data is made available.
- Congress has identified a number of centres outside of WMO that through international agreements provide data or products to WMO. As such, it is crucial for the proper integration of these observation systems in WIGOS that specialized data collection systems be interfaced with WIS and the associated data collection centres (e.g. GAW, Argo) be designated as Data Collection or Production Centres (DCPCs).
- Similarly, WIS is reliant on WIGOS to provide DAR metadata for WIGOS data and products. This metadata is necessary for aiding DAR and for informing WIS on how to handle WIGOS messages and files. The metadata will tell WIS what the WIGOS files are and link them to the Volume A catalogues. It will also link them to WIS distribution catalogues. To facilitate the linking of files to metadata and to avoid having to open each file or message to understand its content, WIS developers have recommended a file naming convention that ensures data and product families have unique file names. This filename convention is based on the present GTS message headers and has incorporated the needs of all WMO Programmes by allowing existing unique filenames used outside of the GTS to be incorporated into the filename.
- As with the GTS and the use of Table Driven Code Forms, all Programmes are encouraged to utilize WIS data representation conventions to ensure they also benefit. However, the minimum requirement of WIS on WIGOS is for WIGOS to provide information as uniquely named files, and associated metadata compliant with the WMO profile for ISO 19115. The files containing metadata, as with changes to the present Volume A, should precede the message files, and only need to be sent when there is a change to the metadata. In order to facilitate implementation of WIS, Meteo - France has developed a system for creating metadata files for information already circulating

on the GTS as a part of the European VGISC project. Also EUMETSAT is investigating the adaptation of their file naming conventions to the recommended practices as a part of the IGDDS implementation plan. Similar pilot work would be necessary in other WIGOS themes.

- A common area of confusion with WIS and WIGOS is the use of the word metadata. For the sake of clarity in the technical specifications under preparation for WIS, the metadata that is used to identify messages and files is referred to as DAR metadata. Metadata that describes the distribution of information is referred to as dissemination or service metadata, and the metadata such as Volume A is referred to reference information. Of these forms of metadata, only DAR need be compliant with the WMO profile of ISO19115.
- Because of the reliance of WIS on DAR metadata, a part of WIGOS implementation should ensure that metadata will be generated by observation systems and centres using appropriate tools. The Working Group noted that the CBS Inter-Programme Expert Team on Metadata Implementation is carrying out the task of identifying the appropriate tools among de facto standard applications for the generation of metadata; CBS has also emphasized the requirement for capacity building measures in this regard, especially training activities.
- CBS-Ext.(06) has identified a desire to be able to access station history along with the data, Development of such station history should be included in the WIGOS implementation plan.
- The development of regulatory documentation is a key activity in WIS implementation and will need to be coordinated in WIGOS and WIS implementation schedules. Similarly, it can be seen that the bulk of implementation of WIS should be completed by 2011 which is when the WIGOS implementation plan will be placed before Congress. Thus, as experienced in the WIS project and implementation plan, WIGOS development and implementation plan will need to ensure certain non-controversial and time critical activities necessary to support WIS are identified and addressed well ahead of the WIGOS plan's final approval in 2011. It is recommended the Chair of the EC WG WIGOS-WIS be able to approve actions as appropriate.

3.2.1 The Working Group also stressed the importance of supplying WIGOS data exchange requirements to WIS including volume, priority, timeliness and access policy. This information could be included alongside other data requirements in the WIGOS requirements. There was also discussion on data availability as several research groups have had difficulty obtaining meteorological data. This situation could hopefully be remedied with participation in WIGOS and WIS. There is also in some cases the problem of reaching out to other communities, institutes, e.g., between NMHSs and environmental institutes, universities.

3.2.2 The Working Group noted that in order to implement WIGOS and WIS an increased level of resources would be required during the implementation phases (2008-2011). In particular, four task areas for WIGOS and four task areas for WIS were reviewed and supported especially for capacity building and outreach in order to inform WIGOS participants and end-users of its benefits and activities. Thus, the Working Group strongly urged WMO Members, and the Secretary-General to provide resources through secondments, WIGOS and WIS Trust Funds and/or redirection of existing WMO Secretariat resources.

3.3 The Working Group reviewed proposals for monitoring of the development and implementation of WIGOS and WIS plans through a "rolling review" mechanism presented by the Secretariat. The Working Group agreed that this approach would contribute to the establishing of an effective mechanism to steer and monitor integration activities. The Working Group agreed to



the continued development of the observations RRR and data base with the addition of information on data volumes and timeliness requirements required for WIS.

3.4 The Working Group was briefed on the status of possible Pilot projects as identified by Cg-XV, namely. "Integration of WWW/GOS and GAW", "Initiation of a Global Hydrologic network addressing a GCOS requirement", "Elaborating the underpinning/crosscutting role and responsibilities of the Instruments and Methods of Observation Programme", "Integration of AMDAR into the WMO global observing systems" and "Integration of marine meteorological and other appropriate oceanic observations into the WMO global observing systems". The Working Group agreed to proposed changes in the names of Pilot Projects as follows:

- *Pilot Project I:* Joint GOS-GAW Pilot Project to accelerate implementation of WIGOS/WIS;
- *Pilot Project II:* *Initiation of Global Hydrological Network addressing a GCOS Requirement;*
- *Pilot Project III:* *Integration of AMDAR into WIGOS;*
- *Pilot Project IV:* Elaboration of the underpinning/crosscutting role and responsibilities of the Instruments and Methods of Observation Programme in the context of WIGOS;
- *Pilot Project V:* Integration of Marine Meteorological and other appropriate Oceanic Observations into the WMO Global Observing Systems.

The reports on status of the above Pilot Projects are reproduced in Appendix VI. The major outcome of the discussions are summarized in paragraphs below.

3.4.1 ***With regard to the Pilot Project on AMDAR integration***, the Working Group appreciated the concise presentation by the AMDAR Panel chairman, Mr Frank Grooters. The Working Group discussed the potential implications of wider availability of AMDAR data for areas such as Africa, where the upper air network was sparse, and was informed on plans to support an expansion of regional programs into RA I. The Working Group was informed of the important role that these data could play in the monitoring and mitigation of climate change by providing the basis for improved aviation forecasts leading to a more efficient air traffic system with lower fuel burn and CO<sub>2</sub> emissions as well as by helping to identify layers of supersaturation that could be avoided by air traffic management in order to reduce radiational forcing from persistent contrails and cirrus. Finally, by equipping some aircraft with aerosol and chemical sensing devices, new data could be made available through IAGOS-ERI as part of the GAW. On the question of the rationale and practical aspects of the integration of AMDAR into WIGOS, it was explained that the programme needed to be lifted from its current status with a limited number of participating Members to an integral part of the WIGOS, so that its potential for optimization by flexible targeting can be used to improve the cost-benefit ratio of the global observing system. The Working Group noted that AMDAR data was primarily in the troposphere, whereas the GOS also provided information for the stratosphere in support of NWP and GCOS requirements.

3.4.2 ***With regard to the Pilot Project on GAW integration***, the Working Group reviewed the status of the joint GOS-GAW Pilot Project to accelerate implementation of WIGOS/WIS. The status commenced with an overview of the GAW programme by C/ENV followed by the "Status of the joint GOS-GAW Pilot Project to accelerate implementation of WIGOS/WIS". Finally, Prof. Øystein Hov, Chair of CAS/OPAG-EPAC, presented some views on GAW and WIGOS and gave a presentation focusing on data assimilation. The GAW structure and programme can be found in the WMO Global Atmosphere Watch (GAW) Strategic Plan: 2008-2015, GAW Report No. 172 (2007). It was noted that GAW is very different from operational weather service. GAW is a voluntary programme and it operates on many different timeframes. There is a growing need to

deliver ozone and aerosol products in near real time (NRT). On the other hand, many of the issues that GAW deals with, such as acidification and greenhouse gases, are relevant on a longer time frame. The question of concentrations of the atmospheric chemical constituents is very different from meteorology as emissions are at core, making inverse modelling a useful tool. It was felt that practical benefits of WIGOS need to be clearly stated in general, and in particular so that the institutions contributing to GAW will feel motivated to contribute to WIGOS. There are needs to be a sense of ownership. In addition, small concrete steps might lead to a better system. It was also noted that several European projects exist that could contribute into WIGOS/WIS, especially GMES, and GEMS within it.

3.4.2.1 It was further noted that GAW is a combination of operational and research areas and there is a need to support both. One of the participants noted their efforts for years to incorporate their global GAW station into their operational network. It was suggested that a necessary first step would be accomplished on the national level integration of GAW stations to the operational network and only then can NRT data delivery be achieved. It was recognized that making GAW data available to the national community would benefit both GAW and the community. It was also noted that there maybe data policy issues as GAW data can in some cases be a sensitive issue. Thirdly, it was noted that more attention should be paid to combining satellite and in situ measurements and this could provide in 5-10 years a powerful network for, e.g., air quality.

3.4.2.2 Finally, it was agreed to submit this report to the newly established ad-hoc CBS & CAS Experts Group on WIGOS and finalize the ideas on the existing pilot projects.

3.4.3 ***With regard to the Pilot Project on IMOP role in WIGOS***, the Working Group noted that CIMO, being responsible for matters related to international standardization and compatibility of instruments and methods of observation of meteorological, and related geophysical and environmental variables; its involvement in the development of WIGOS is crucial. However, the role of CIMO is not limited to the development and maintenance of observing standards and the traceability of observations to SI units, but also includes, among others, matters related to instrument intercomparisons, interoperability of instruments and observing systems, and capacity building activities.

3.4.3.1 The Working Group recognized that the CIMO activities were at the heart of the WIGOS concept (see Figure 1 in the Appendix V) and that CIMO should in the future coordinate the development and the maintenance of observing standards for all types of observations carried out within WIGOS, in collaboration with the “owners” of the various systems. It is envisioned that all observing standards relevant to WIGOS be collectively kept at one location, the CIMO Guide, presently the case for a portion of the global networks. The Working Group welcomed the great benefits that had been achieved through the close collaboration of CIMO and CAS experts in the development of chapters of the CIMO Guide addressing atmospheric composition and ozone measurements that had enabled to remove the divergence of the practices formerly published more independently by the CIMO and CAS. The Working Group also noted the positive collaboration that CIMO had with the hydrological community which had asked CIMO to conduct an instrument intercomparison, but that had not been conducted to date due to the very limited funds allocated to CIMO for such activities. It was agreed that these positive experiences would provide a starting point for future efforts with GAW, hydrological and oceanographical standards, and should be taken into account in developing the future role of CIMO and its interaction mechanisms with the various systems being part of WIGOS.

3.4.3.2 The Working Group supported the proposal of CIMO to establish an ad-hoc working group to refine the CIMO pilot project and felt that the expertise of members from the GAW, JCOMM and hydrological communities would be needed to participate in the ad-hoc group.

3.4.3.3 The aim of the pilot project is to determine what the role of CIMO will be in the context of WIGOS and how it might differ from its present role. The output of the pilot project will consequently be a proposal for a revised set of terms of reference for CIMO that would provide

appropriate support to the goal of WIGOS in the domain of instruments and methods of observations.

3.4.3.4 The Working Group recognized that it was important for the ad-hoc working groups that will develop the pilot projects, such as the ad-hoc working group on the CIMO Pilot Project Plan, to have an appropriate interface with whom to communicate that would have the required observing system and technical knowledge relevant to WIGOS.

3.4.4 ***With regard to the Pilot Project on Integration of Marine Observations***, the Working Group noted the report provided by Mr Robert Keeley, Chairperson of the JCOMM Data Management Coordination Group. He presented the current status of the ocean observing system as well as the multi-year phased implementation plan coordinated by JCOMM for the period 2000 to 2012 and indicated that the plan was now about 60% completed while most of the components were still funded through research activities and sustainability was still a challenge.

3.4.4.1 He explained that the Pilot Project was being developed in a way consistent with IOC data policy as well as WMO Res. 40 (Cg. XII). While a substantial volume of the data are distributed in real time on the GTS, there is the potential to make extra data, both in real-time and delayed mode, available from parallel distribution systems that have been developed in the ocean community for specific components (e.g. Argo, Tropical moorings, GOSUD, OceanSITES). These systems now provide for better quality and higher precision data than available on the GTS.

3.4.4.2 The oceanographic community has developed the so called end-to-end (E2E) data management system to improve access to marine data. This has been developed at the Russian NODC in Obninsk. This NODC has also contributed to a prototype WIS DCPC to test the interoperability. The IODE is now developing the Ocean Data Portal, underpinned by the E2E technology with the intent of being a web based interface to all of the ocean data collections in IODE.

3.4.4.3 Another relevant initiative that is jointly organized by JCOMM and IODE is a meeting, called the Standards Forum, to begin the agreement of the community on widely accepted standards and best practices and continue the process afterwards. This meeting will take place in Oostende in January, 2008.

3.4.4.4 The proposed Pilot Project will be promoting (i) interoperability of ocean data systems with the WMO Information System (WIS) in close cooperation with the ocean community, and (ii) the documentation and integration of best practices and standards being used amongst the meteorological and oceanographic communities. In tackling the latter, progress will also be made in achieving compliance with the WMO Quality Management Framework (QMF).

3.4.4.5 The Working Group welcomed the JCOMM initiative, praised the approach of the proposal which clearly showed:

- (i) the benefits for both the ocean and meteorological communities;
- (ii) the need to follow specific data policies; and
- (iii) required funding to coordinate the development of the Pilot Project.

3.4.4.6 The Working Group recommended that other Pilot Projects should use this approach as a model. In particular, the Working Group recommended that:

- JCOMM coordinate with CIMO on matters related to Best Practices during the implementation of the Pilot Project.
- the Pilot Project be developed gradually in order to immediately show the benefits to both communities and reassure the IOC of its full partnership in its development.

3.4.4.7 The Working Group expressed the view that data ownership will be respected as well as the IOC data policy and agreed that Representatives of the co-sponsored programmes such as GOOS should participate as Members in the proposed Inter Commission Working Group for WIGOS.

3.4.4.8 The Working Group expressed strong support for this project and asked the Secretariat to consider the proposed budget for the JCOMM Pilot Project in its development of programmatic aspects to support the required resources.

3.4.4.9 The Working Group welcomed statement of IOC related to integration process addressed to the session by Mr Keith Alverson, which is reproduced in Appendix VII.

3.4.5 ***With regard to the Pilot Project on integration of Hydrological Observations***, the Working Group noted that a Hydrological Applications and Run-Off Network Project (HARON) had been developed during the last six months by the WMO Secretariat, jointly between HWRP and the GEO Secretariat which in effect addressed the GCOS requirements and could be considered as a Pilot Project in the Context of WIGOS. The Secretariat informed the Working Group that, to ensure sustainability and countries ownership, the proposal of HARON would be presented to the CHy Advisory Working Group in February 2008 for their comments and subsequently forwarded to CHy-XIV in November 2008 for consideration.

3.4.5.1 The issue of obtaining hydrological data from NHSs was discussed as well as the cooperation between NMSs and NHSs. The session noted the differences between the Hydrological and Meteorological communities in handling the data issue. It was recognized that there was a need to have NHSs on board and to emphasize the importance of integrating the hydrological observing systems into WIGOS. The Working Group requested the Secretariat to provide more detailed information about HARON and to communicate the outcome of the CHy AWG meeting to the EC WG on WIGOS-WIS.

3.4.5.2 The Vice President of CHy explained some specific features of Hydrological network integration into WIGOS and informed the Working Group of difficulties encountered with previous implementation of global hydrological networks. The Vice President noted that CHy recommended to the Working Group to:

- (a) Note the support of CHy for the WIGOS Initiative and in particular the Congress endorsed broad objectives (a) and (b);
- (b) Note the fundamental requirement to both justify the need for a global hydrological network and to adequately define the purposes for which it is to be used and the specific characteristics for the hydrological information required;
- (c) Note that the full support of the NHSs will be essential for any pilot project to be successful;
- (d) Note that past attempts to establish global hydrological networks have, in large, met with failure; and
- (e) Note that in order to meet the above broad objectives, test the integration concept and identify the problem areas so that a correct assessment of the feasibility of hydrological networks in the Integrated WMO Observing Systems can be made, it would be useful to adopt a project that is developed jointly and not separately by various programs.
- (f) Agree to the HWRD progressing the HARON proposal through the CHy AWG and CHy-XIV as the response to the request for a "possible candidate Pilot Project" under the over-arching Development and Implementation Plan; and
- (g) Agree to assist with the mobilisation of resources to support the initiatives planned under the over-arching Development and Implementation Plan.

3.4.5.3 The Working Group noted the fundamental requirement to justify both the need for a global hydrological network and to adequately define the purposes for which it would be used and the specific characteristics for the hydrological information required. The NHSs' involvement was discussed and it was agreed that the full support of the NHSs would be essential for any pilot project to be successful.

3.4.5.4 The Working Group discussed and agreed to the HWRD progressing the HARON proposal through the CHy AWG and CHy-XIV as the response to the request for a "possible candidate Pilot Project" under the over-arching WIGOS Development and Implementation Plan.

3.4.5.5 On the issue of funding, CHy agreed to assist with the mobilization of resources to support the initiatives planned under the over-arching WIGOS Development and Implementation Plan.

3.4.6 The Working Group reiterated that progress in the implementation of the Pilot Projects would be of great importance to the overall WIGOS implementation and requested Technical Commissions concerned to carry out the monitoring of these activities on a regular basis and provide status reports on the Pilot projects to the next session of the EC/WG/WIGOS-WIS.

#### **4. FUTURE WORK PROGRAMME**

Based on the results of discussions, the Working Group agreed to the following major tasks for its work programme during the forthcoming inter-sessional period. The Working Group agreed that it was necessary to develop timetables for each of the below tasks to be approved by the Chairman and promulgated to the Working Group as a matter of urgency:

- Develop a detailed description of Demonstration Projects in coordination with NMHSs and Presidents of RAs concerned and requested support of the Secretariat to develop an outline and template to guide the development and implementation of the Demonstration Projects;
- Prepare the report to the EC-LX;
- Identify a Rapporteur to initiate a review of relevant parts of the WMO Technical Regulations to introduce WIGOS and WIS concepts and structures;
- Establish and initiate the work of Sub-group on WIGOS in accordance with its TOR;
- Monitor the progress of the implementation of the Pilot Projects through application of agreed monitoring mechanism;
- Review and update the WIGOS Concept of Operations and the WDIP on a recurring basis;
- Convene the second session of the Working Group in time to provide input to Technical Commission meetings in 2008.

#### **5. EC WG WIGOS-WIS REPORT TO EC-LX**

The Working Group discussed the document on WIGOS-WIS to be submitted to EC-LX. It agreed that the EC document should refer to the WDIP Version 1.0, the WIGOS Concept of Operations, the Terms of Reference for the SG-WIGOS as well as a synopsis, funding requirements for the coordination, implementation and progress of the initial Pilot Projects.

**6. ANY OTHER BUSINESS**

The session had no other business to discuss.

**7. CLOSURE OF THE SESSION**

In closing the meeting, the Chairman congratulated the participants on accomplishing a remarkable amount of work in a very short time and wished them all well in their future endeavours. He also thanked the Secretariat both for excellent documents prepared and very efficient in-session support. The meeting closed at 13:22 p.m. on Friday, 7 December 2007.

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## **AGENDA**

- 1. ORGANIZATION OF THE SESSION**
    - 1.1. Opening of the session
    - 1.2. Adoption of the agenda
    - 1.3. Working arrangements for the session
  
  - 2. REVIEW OF GUIDANCE AND RECOMMENDATIONS ADOPTED BY Cg-XV AND EC-LIX**
  
  - 3. DEVELOPMENT OF AN OVER-ARCHING WIGOS DEVELOPMENT AND IMPLEMENTATION PLAN**
    - 3.1 Preparation of the over-arching WIGOS Development and Implementation Plan
    - 3.2 Refinement of the WIS Development and Implementation Plan
    - 3.3 Proposals for monitoring of the development and implementation of WIGOS and WIS plans through a “rolling review” mechanism
    - 3.4 Status of WIGOS/WIS “Pilot Projects”, as identified by Cg-XV
  
  - 4. FUTURE WORK PROGRAMME**
  
  - 5. EC WG WIGOS-WIS REPORT TO EC-LX**
  
  - 6. ANY OTHER BUSINESS**
  
  - 7. CLOSURE OF THE SESSION**
-

## **WMO INTEGRATED GLOBAL OBSERVING SYSTEMS (WIGOS)**

### **CONCEPT OF OPERATIONS (CONOPS)**

#### **Foreword**

There is a broadly recognized need for a comprehensive, coordinated and sustainable global observing system. Many international agencies have to administer systematically these diverse sets of observations and have developed data policies to meet their needs. WIGOS is the organizational response of WMO to this need and therefore is committed to the very strong cooperation that is needed among all partners to accomplish the broad objectives.

The following Concept of Operations describes the end state for a fully operational WIGOS; it establishes the overall goals for WIGOS. In order to achieve the goals, a detailed WIGOS Development and Implementation Plan (WDIP) will be developed in order to provide for a logical transition from initial to full operational capabilities. To fully understand WIGOS, the Concept of Operations must be considered in the context of the WDIP.

The WMO Integrated Global Observing Systems (WIGOS) is a comprehensive, coordinated and sustainable system of observing systems. WIGOS is based on all WMO Programmes' observational requirements. It ensures availability of required data and information and facilitates access through the WMO Information System (WIS) according to identified temporal, geographical and organizational requirements, including those for real, near-real time and delayed modes to all required information and in doing so it respects data sharing policies. Additionally, it helps ensure high data quality standards and benefits from archival and technological innovations.

The components of WIGOS (surface and space-based) include: weather observing networks (e.g. WWW/GOS, AMDAR, ASAP etc); atmospheric composition observing networks (e.g. GAW); radiation observing networks (e.g. BSRN); marine meteorological networks and arrays (e.g. VOS, drifting and moored buoy arrays etc.); hydrological observing networks (e.g. observing components of WHYCOS etc.); and the various atmospheric, hydrologic, oceanographic and terrestrial observing systems contributing to GCOS. Improved monitoring through the integration of surface- and space-based observations is essential in understanding global climate change, including all sub-systems of the global climate system: atmosphere, hydrology, ocean, land surface and cryosphere.

WIGOS development and implementation will proceed in parallel with the planning and implementation of the WMO Information System (WIS). The combination of both efforts will allow for an integrated WMO end-to-end system of systems designed to improve Member's capability to effectively provide a wide range of services and to better serve research programme requirements.

#### **WMO INFORMATION SYSTEM (WIS)**

- Will be used in the collection and sharing of information for all WMO and related international programmes;
- Will provide a flexible and extensible structure that will allow participating centres to enhance their capabilities as their national and international responsibilities grow;
- Implementation will build upon the most successful components of existing WMO information systems in an evolutionary process;
- Development will pay special attention to a smooth and coordinated transition;
- Communication network will be based on communication links used within the World Weather Watch (WWW) for distribution of high priority real-time data;
- Will utilise international agreed-upon standards for protocols, hardware and software.

## **1. INTRODUCTION**

### **1.1 Purpose**

The purpose of WIGOS is to create an organizational, programmatic, procedural and governance structure that will significantly improve the availability of observational data and products and which will provide a single focus for the operational and management functions of all WMO observing systems as well as a mechanism for interactions with WMO co-sponsored observing systems. Integration will lead to efficiencies and cost savings that can be reinvested to overcome known deficiencies and gaps in the present structure and working arrangements.

### **1.2 Objectives**

The integration process should encompass four broad objectives:

- (a) Improving WMO management and governance (use of resources, planning, institutional and programme structures, and monitoring);
- (b) Increasing interoperability between systems with particular attention given to space-based and *in-situ* components of the systems;
- (c) Addressing the needs of the atmospheric, hydrologic, oceanographic, cryospheric and terrestrial domains within the operational scope of a comprehensive integrated system;
- (d) Ensuring that broader governance frameworks (e.g. inter-agency co-sponsorship of systems) and relationships with other international entities are sustained and strengthened.

## **2. OVERVIEW**

### **2.1 Aim**

WIGOS is aiming to:

- (a) Address in the most cost-effective approach to meet WMO Programme requirements with a view toward reducing the financial burden on Members; while maximizing administrative and operational efficiencies;
- (b) Ensure the availability of all required information produced within the various WMO observing systems (e.g. GOS, GAW, WHYCOS, etc.), and WMO components of co-sponsored systems (e.g. GCOS, GOOS, GTOS, etc.) with particular emphasis on information generated by satellite, RADAR, wind-profilers, airborne systems, in situ ocean platforms, and other next generation observing systems;
- (c) Facilitate the access, in real/near-real time and delayed mode, of observations required for WMO and WMO co-sponsored programmes as well as relevant international conventions which are generated by systems implemented and managed by cooperating agencies, organizations and programmes;
- (d) Ensure required data quality standards are met and sustained for all programme requirements;
- (e) Facilitate improved data management including archival and data retrieval capabilities;
- (f) Facilitate technological innovation opportunities;
- (g) Continue on-going coordination with instrument manufacturers and scientific institutes in the development and testing of next generation observation instruments;

- (h) Develop appropriate regulatory documentation including organization and recommended practices and procedures;
- (i) Link existing technologies in an integrated manner to provide societal benefits.

## **2.2 Characteristics**

2.2.1 The concept of WIGOS is based on the premise that the general standards and recommended practices, as agreed-upon for WIGOS, will apply to all WMO and sponsored observing systems and Programmes. WIGOS characteristics include:

- All WIGOS observational data and metadata and processed observational products which will:
  - be exchanged via WIS using agreed upon data and metadata representation forms and formats;
  - use WIGOS compatible hardware and software;
  - adhere to WIGOS standards for instruments and methods of observation as well as standard observing network practices and procedures; and
  - be archived in WIGOS approved forms and resolutions at WMO agreed upon archival centers.
- WIGOS will:
  - develop strategies to satisfy observational requirements from WMO Programmes and international partners through the WMO Rolling Requirements Review Process;
  - develop strategies to guarantee system interoperability, including data quality of observing systems and instruments;
  - evaluate existing WIGOS capabilities before developing, acquiring, and or deploying new observing systems or sensors;
  - exploit existing platforms and employ multi-sensor platform concepts to the maximum possible extent;
  - coordinate requirements, plans and activities with all appropriate Technical Commissions, Regional Associations and Programmes;
  - be built upon existing observing systems/networks as a system of observing systems.

2.2.2 It must be emphasized that observing programmes of the WMO are actually carried out by WMO Member States, either individually, or in some instances (notably for some satellite systems) cooperatively with consortia of countries operating a system jointly. Integration therefore has direct relationship to national programmes and activities as well as on coordination through the international organization.

## **3. ASSUMPTIONS**

### **3.1 General**

This Concept of Operations provides a framework for the improvement of operations towards an integrated approach in support of WMO Members national mandates including response to natural hazards, environmental monitoring, adaptation to climate change and man-

made environmental impacts. It is consistent with the decision of the Fifteenth WMO Congress concerning enhanced integration between WMO Observing Systems and the WMO Strategic Plan.

### 3.2 Levels of Integration

As a system of observing systems, integration will be accomplished at three levels. The three levels of integration for WIGOS are shown schematically in Figure 1:

- Standardization of instruments and methods of observations (instruments and methods of observation level);
- Common information infrastructure, (WIS data level);
- End-product quality assurance (QM/QA/QC product level).

#### 3.2.1 Coordination of WIGOS development and implementation through standardization at the observation level

A sustained, optimized, end-to-end WMO Integrated Global Observing System should encompass homogeneity, interoperability, compatibility of observations from all WIGOS constituent observing systems. This should be based on guidance and studies and achieved through implementation of recommendations on methods of observations by IMOP within WIGOS constituent networks including tests, calibration and intercomparisons. This would be an **“instruments and methods of observation level of integration.”**

#### 3.2.2 Coordination of WIGOS development and implementation with WIS

3.2.2.1 The planning and implementation of WIGOS should proceed in parallel to the planning and implementation of WIS. It is therefore crucial that as from its early planning stages the WIGOS activities be coordinated with WIS. This will be accomplished through:

- Activities of the EC WG on WIGOS&WIS;
- EC WG on WIGOS&WIS Sub-Group on WIGOS (SG-WIGOS);
- Participation of representatives of RAs and Technical Commissions concerned;
- Coordination role of the Secretariat.

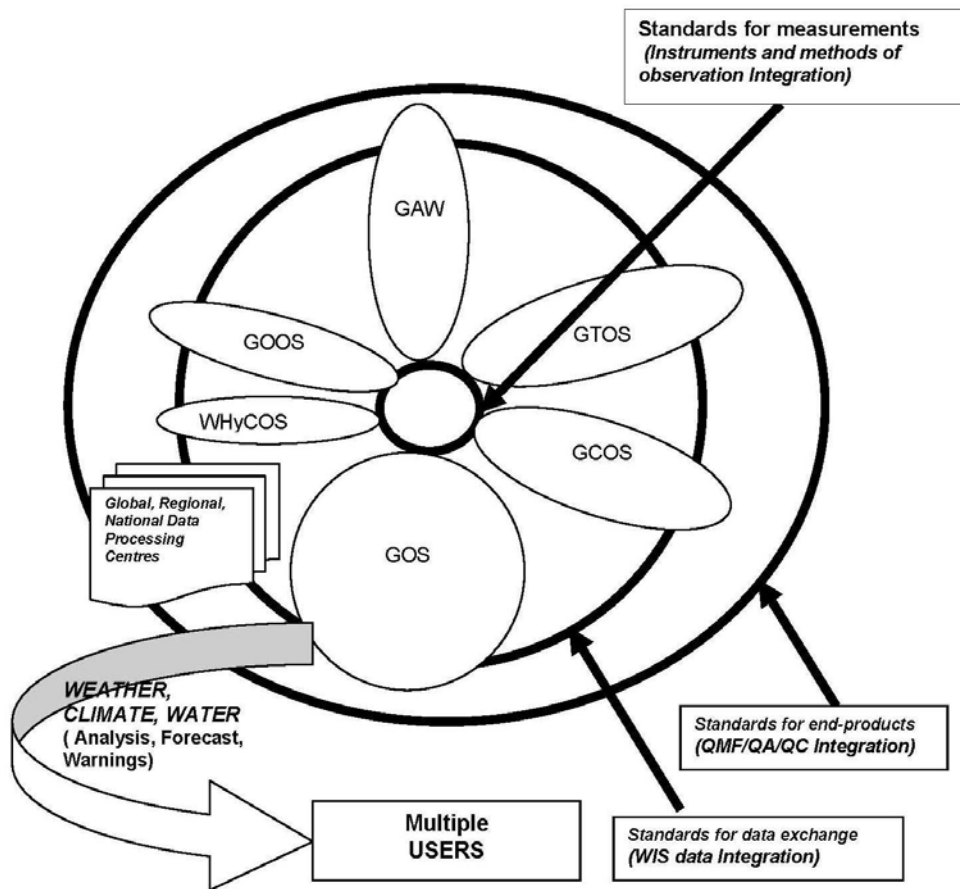
3.2.2.2 Technologically, the key action leading to the desired integrated networks will be the generation of data and information from WIGOS constituent networks using a comprehensive, standardized data presentation in compliance with WIS information exchange requirements for all WMO Programmes. This would be **“WIS data level of integration”**.

#### 3.2.3 Coordination of WIGOS development and implementation with end-product quality assurance

The third level of standardization for a sustained, optimized, end-to-end WMO Integrated Global Observing System should embrace a quality management framework to ensure the best possible products to be delivered to end users. This should be based on agreed-upon quality assurance and control standards. This would be **“Quality Management/Quality Assurance/Quality Control end-product quality assurance of integration”** with the following goals:

- To ensure integrated/coordinated data acquisition efforts among NMHSs and other operators to minimize duplication
- To reduce costs and maximize data and products availability and quality
- To develop an integrated management system which delivers reliable and timely data streams with adequate quality control.





**Figure 1:** The three WMO Integrated Global Observing Systems (WIGOS) levels of integration are: standardization of instruments and methods of observation, common information infrastructure; and end product quality assurance. In particular, within the 1<sup>st</sup> level of integration (*inner circle*): a sustained, optimized, end-to-end WMO Integrated Global Observing System should encompass homogeneity, interoperability, compatibility of observations from all WIGOS constituent observing systems. This should be achieved through meeting the requirements on instruments and methods of observations established by CIMO/networks including tests, calibration and intercomparisons. In the 2<sup>nd</sup> level of integration (*middle circle*): Data and information generated by all WIGOS constituent networks should meet a comprehensive, standardized set of WIS data presentation and exchange requirements for all WMO Programmes. In the 3<sup>rd</sup> level of integration (*outer circle*): Various end-products generated on the basis of observations/measurements by all WIGOS constituent observing systems and exchanged through WIS should meet quality management framework requirements to ensure the best possible products to be delivered to end users.

## **4. RESPONSIBILITIES**

4.1 In order to commence efforts towards achieving full WIGOS operations, the following entities are considered to have essential responsibilities:

- Observing and information systems sponsors;
- EC WG on WIGOS and WIS;
- SG WIGOS;
- Inter-Commission Coordination Group on WIS (ICG WIS).

4.2 It is expected in the transition phase (2008-2011) towards full operational capabilities that additional participants will commit appropriate resources, efforts and activities.

## **5. OPERATIONAL FRAMEWORK**

### **5.1 Overall Approach**

This concept of operations covers the full spectrum of management and integration for WIGOS. In order for WIGOS to effectively and efficiently respond to user data needs, WIGOS will employ WIS as the data transmission and exchange mechanism.

### **5.2 WIGOS Components**

The WIGOS components are:

- (a) The Global Observing System (GOS) of the World Weather Watch;
- (b) Regional, river basin and global hydrological networks;
- (c) The Global Atmosphere Watch (GAW) networks and systems for observations of atmospheric chemical composition and related environmental parameters;
- (d) The various radiation networks both observing solar and net radiation (e.g. the BSRN);
- (e) Marine meteorological and oceanographic observations from ships including the Ship Observations Team (SOT);
- (f) Moored and drifting buoy arrays developed as research arrays during GARP and WCRP related research projects, and which are now operational networks and arrays supporting weather and climate as well as oceanographic objectives;
- (g) The climate component of atmospheric, oceanographic and terrestrial observing systems contributing to GCOS observing requirements (e.g. Argo floats, sea level observations etc.);
- (h) Aircraft Meteorological Data Relay (AMDAR) systems initially developed and implemented under the GARP project and subsequently expanded to an operational status including expansions of aircraft measurement capabilities for atmospheric composition constituents;
- (i) Space-based observing systems that are currently a major component of virtually all WMO observing programmes including the geostationary meteorological satellite constellation, the core polar-orbiting meteorological constellation, and the other components of the space-based observing system serving the needs of operational and research applications;
- (j) The observing component of the Cryosphere Watch approved by the fifteenth WMO Congress;
- (k) Other possible components yet to be defined.

### 5.3 Purposes and Goals of the Integration

It is envisioned that the integration process will bring about architectural and governance structures as well as a processes for WIGOS development, implementation and sustainability. Standardization and interoperability, including data compatibility, are primary factors for enabling integration. WIGOS will meet several sub-goals as follows:

- Improve the production, use and application of data and information from across all WMO and sponsored observing systems, in a seamless way, to satisfy user requirements;
- Be designed to accommodate the diversity among Members with respect to their capabilities and needs;
- Strengthen the ability of all Members to access and utilize observations and analysis products from all WMO and sponsored observing systems;
- Ensure compatibility, connectivity and interoperability including interface arrangements within and among all WMO and sponsored observing systems components and externally with other users;
- Allow for the continuous review of the requirements placed on the integrated system and have the capability to effectively adjust and respond to changing requirements;
- Ensure the continuing sense of ownership by the various groups that have initiated and developed the individual observing system components through directly involving these groups in the planning and implementation of the WIGOS;
- Promote the development, testing and comparison of new observing capabilities and provide mechanisms to easily integrate them into WMO and sponsored operational observing systems;
- Ensure the optimum integration of the various components of all observing programmes;
- Increase efficiencies by reducing as far as possible redundancies and overlaps of systems and the management activities supporting them;
- Facilitate more rapid and efficient assimilation of technological advances and apply them as far as possible across all observing programmes;
- Foster co-location of observing sites of complementary systems as far as practical thereby reducing redundancies; and
- Ensure the involvement of the various scientific and user communities in the activities of setting requirements, and monitoring and assessing system performance.

## 6. DATA POLICY

6.1 WIGOS will respect the data policies of partner organizations and will adhere to the decisions of the Twelfth and Thirteenth World Meteorological Congress (1995, 1999) that adopted **Resolution 40 (Cg-XII)** "WMO Policy and Practice for the Exchange of Meteorological and Related data and products including Guidelines on Relationships in Commercial Meteorological Activities", and **Resolution 25 (Cg-XIII)** "Exchange of Hydrological Data and Products", respectively.

6.2 WIGOS will strive to ensure that the conditions placed by the originator on the additional data and products are respected and made known to initial and subsequent recipients for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological and hydrological activities;

## **7. BENEFITS**

Benefits of WIGOS to Members and partner organizations of WIGOS include the following:

- Improved services including those in support of disaster preparedness and adaptation to climate change;
- Increased quality and consistency and access to multi disciplinary observations;
- More efficient use of resources; and
- Better preparedness to incorporate new observing systems.

## **8. CHALLENGES**

Challenges associated with embarking upon integration of WMO observing systems include:

- The cross cutting nature of WIGOS will require significant cooperation and coordination efforts by all concerned;
- Time will be a critical risk factor. The development of a detailed, comprehensive Implementation Plan and the elaboration of meaningful Pilot Projects need to be addressed early in the period; and
- Effective and constructive coordination and collaboration with co-sponsoring and cooperating Organizations is a sensitive issue that must be carefully undertaken to avoid misunderstandings.
- Differences in levels of development of national and regional systems and services among Members and partner organizations.

## **9. RESOURCES**

Implementation of the concept of operations for WIGOS will require significant resources on the national, regional and global levels as well as within the WMO Secretariat during the transition phase (2008-2011).

**EXECUTIVE COUNCIL WORKING GROUP ON WIGOS AND WIS  
SUB-GROUP ON THE WMO INTEGRATED OBSERVING SYSTEMS (SG-WIGOS)**

**Terms of Reference**

- 1) To provide overall technical guidance, assistance and support for the implementation of the WIGOS concept based on strategic directive of the Fifteenth WMO Congress;
- 2) To elaborate in detail the three levels of integration of WIGOS including standard practices to be applied at the different levels of WIGOS integration; integration levels being as follows and further described in the WIGOS Concept of Operations:
  - Standardization of instruments and methods observations (instruments and methods of observation level);
  - Common information infrastructure, (WIS data level);
  - End-product quality assurance (QM/QA/QC product level).
- 3) To work with each WIGOS component, propose new components and coordinate agreed inter-actions with other partners (e.g. co-sponsored systems, international initiatives' systems, etc.);
- 4) To refine the concept of WIGOS operations, including its basic definitions;
- 5) To address major issues identified by the EC Working Group on WIGOS and WIS;
- 6) To develop a mechanism for the inclusion of the regional aspects of WIGOS through involvement of the Presidents of Regional Associations;
- 7) To coordinate the WIGOS planning phases (including the Pilot Projects) according to the over-arching WIGOS Development and Implementation Plan;
- 8) To coordinate WIGOS implementation with the planning and implementation of the WMO Information System (WIS);
- 9) To advise the EC Working Group on WIGOS and WIS on aspects related to management, governance and interoperability;
- 10) To report to the EC Working Group on WIGOS and WIS.

**Membership:**

- A representative from each WIGOS Pilot Projects;
- A representative from each WMO observing system not represented in a Pilot Project;
- A representative from each co-sponsored observing system;
- Chairman, ICG-WIS

CIMO President will chair the IGC-WIGOS.

## INITIAL WIGOS DEVELOPMENT AND IMPLEMENTATION PLAN

*(Version 1.0)*

### **I Introduction**

The top-level and detailed descriptions for WMO Integrated Global Observing Systems (WIGOS) are foundational documents and identify the urgent need for WIGOS implementation. The following document describes an initial WIGOS Development and Implementation Plan as mandated by the Fifteenth WMO Congress (Cg-XV).

### **II. Strategic Roadmap for Integration**

2.1 Cg-XV agreed that planning and implementation of the WIGOS integration process should proceed in phases defined by the annual meetings of the WMO Executive Council in order to assure oversight, review and direction. To that end, Cg-XV requested EC-LIX to appoint a Working Group to oversee WIGOS and WIS. The process foreseen was one where planning and implementation of WIGOS and of WIS would culminate with Cg-XVI (2011) adopting improvements towards strengthening the WMO programme structure and the system of technical commissions, which would be positioned to extend the benefits of the integration into the service and application components of the overall WMO Programmes at both the national and international levels.

2.2 EC-LIX, in its Resolution 2/4 (EC-LIX), established the EC Working Group on WMO Integrated Global Observing Systems and WMO Information System (EC-WG WIGOS/WIS) with the following TOR:

- (1) Provide advice and guidance in the preparation of an over-arching WIGOS Development and Implementation Plan;
- (2) Refine the WIS Development and Implementation Plan and ensure coordination between WIGOS and WIS plans to allow for an integrated WMO end-to-end system of systems;
- (3) Monitor the development and implementation of WIGOS and WIS through a “rolling review” mechanism; and
- (4) Monitor WIGOS/WIS “Pilot Projects”, as identified by Cg-XV, to test concepts, identify problem areas, and to help in elaborating the Development and Implementation Plan.

2.3 Preparation of the overarching WIGOS Development and Implementation Plan (WDIP) closely coordinated with the WIS Development and Implementation Plan will be a critical ongoing activity during the four-year period 2008-2011. WDIP will be a “living” document. A draft Version 1.0 of this document was reviewed and updated at the first session of the EC-WG WIGOS/WIS. Subsequent reviews and updates will be done at least annually as the planning proceeds and experience is gained from the various Pilot Projects and inputs from the Technical Commissions, Regional Associations and the advisory/steering bodies of WMO co-sponsored programmes are received. Meetings of EC-WG WIGOS/WIS will provide oversight and guidance regarding the evolution of the plan, which subsequently would be considered at each session of EC. While further evolution of the plan will occur, it is anticipated that it should include an assessment of all observational requirements for all WMO Programmes and co-sponsored programmes and identify those (including characteristics such as observational accuracy and resolution) that are needed to service all programmes or applications. It would also include implementation details for the various Pilot Projects and their results, details of actions required to address revisions of the TR of the Technical Commissions, the WMO Programme structure, and WMO Secretariat budgetary, personnel and organizational implications. Many observation systems are outside of the remit of Member NMHSs however their data provides a valuable contribution to WMO Programmes and Member NMHSs. Additionally observational data from WMO Programmes and co-sponsored

programmes is of value to organizations outside of WMO. The WIGOS plan needs to address this from the aspect of improving data access across these boundaries. Data dissemination practices must be capable of respecting the data policies as designated by the “owners of the observation systems including authorization of users.

2.4 The “Roadmap” or schedule below is broken into annual “Phases” timed according to sessions of EC. The items listed under each Phase required further elaboration since the dates of various events (e.g. Commission Meetings) are not yet confirmed, but they should be incorporated as the information becomes available. For historical purposes as well as further elaboration of the plan, a description is provided of the Preparatory Phase that occurred prior to Cg-XV. The preparation of Version 1.0 of WDIP (WDIP V-1.0) that can be endorsed by the EC in June 2008 will be a crucial first step. WDIP V-1.0, and its subsequent revisions, will be important for informing the Technical Commissions, Regional Associations and the steering committees of GCOS, GOOS and WCRP of WIGOS and WIS planning activities and to encourage their input into the process. Scheduling of as many regular sessions as possible of Technical Commissions and Regional Associations before 2010 would be most useful in obtaining their input in the planning process. EC-LXII (2010) marks the end of the active planning period since during its session the basic proposals to Cg-XVI will be prepared.

### **III. Preparatory Phase - December 2006 – Cg-XV (May 2007)**

- (1) Document prepared for the EC Task Team on the WMO Integrated Global Observing Systems (EC-TT/WIGOS) Feb. 2007;
- (2) Report of EC-TT/WIGOS submitted to Cg-XV. This report to address the decision of EC-LVIII as contained in Resolution 13 (EC-LVIII);
- (3) Formation of an internal Interim WMO Secretariat WIGOS Team under the chairmanship of a Director with participation from all relevant WMO Programmes. The Interim Secretariat WIGOS Task Team to address follow-up actions as required according to proposals by the EC-TT/WIGOS in preparation for presentation to Cg-XV.

### **IV. Implementation Phase I. Cg-XV (May 2007) – EC-LX (June 2008)**

- (1) Establish and update as appropriate the WIGOS Concepts of Operations;
- (2) Cg-XV through the EC-LIX establishes the EC-WG/WIGOS-WIS to oversee the development of WIGOS and WIS;
- (3) Full time WIGOS Planning Unit organized in the WMO Secretariat (June 2007);
- (4) Coordinate with IOC regarding the WIGOS-WIS initiatives;
- (5) Initiate the preparation of the draft WDIP v.1.0 (completion by Dec. 2007). Present the draft WDIP v.1.0 to EC-WG/WIGOS-WIS;
- (6) Initiate first Pilot Projects (see paragraphs below):
  - (a) Integration of WWW/GOS and GAW into WIGOS;
  - (b) Initiation of Global Hydrological Network in context of WIGOS;
  - (c) Integration of AMDAR into WIGOS;
  - (d) Elaborating the underpinning/crosscutting role and responsibilities of the Instruments and Methods of Observation Programme in the context of WIGOS;
  - (e) Integration of marine meteorological and other appropriate oceanic observations into WIGOS.

- (7) Adjust draft WDIP v.1.0 as guided by EC-WG/WIGOS-WIS and present draft WDIP v.1.1 to EC-LX;
- (8) The agendas of Technical Commissions and Regional Associations should include an item relating to the Integration of WMO Observing Systems and should seek their “consensus inputs” to the WDIP to which the EC WG WIGOS-WIS would provide an input;
- (9) At meetings of Presidents of Technical Commissions a major agenda item should be the WDIP to which the EC WG WIGOS-WIS would provide input.

**V. Implementation Phase II. EC-LX (June 2008) - EC-LXI (June 2009)**

- (1) Review and update as appropriate the WIGOS Concepts of Operation;
- (2) EC-LX reviews draft WDIP v.1.1 and provides guidance to issue the WDIP v1.1;
- (3) The Pilot Projects begun in Phase I implemented and evaluated; adjustments to the WDIP may arise from the evaluations;
- (4) Initiate planning for Pilot Project concerning the integration of marine meteorological and oceanographic observations with WIGOS-WIS (see paragraph below);
- (5) Additional Pilot Projects may be identified;
- (6) Schedule possible concurrent sessions of CAS and CBS with joint agenda items regarding WIGOS-WIS and the integration of GAW and GOS into WIGOS (see paragraph below);
- (7) Initiate work on the proposed revisions to the WMO Technical Regulations;
- (8) Revise the WDIP v.1.1 as appropriate with guidance from EC-WG/WIGOS-WIS – issue WDIP v. 1.2 and submit to EC –LXI for review and guidance;
- (9) The agendas of Technical Commissions and Regional Associations should include an item relating to the Integration of WMO Observing Systems and should seek their “consensus inputs” to the WDIP to which the EC WG WIGOS-WIS would provide input.

**VI. Implementation Phase III. EC-LXI (June 2009) - EC-LXII (June 2010)**

- (1) Review and update as appropriate WIGOS Concepts of Operation;
- (2) EC-LXI provides guidance for this year (note this is the last period for active planning before specific proposals are prepared to submit to CG-XVI);
- (3) Pilot Projects begun in Phase I and II should be completed and evaluated. Results to be appropriately incorporated into the WDIP V.2.0;
- (4) EC-WG/WIGOS-WIS meets to review in detail the WDIP that is nearing completion at this stage;
- (5) The agendas of Technical Commissions and Regional Associations should include an item relating to the WIGOS-WIS and should seek their “consensus inputs” to the WDIP;
- (6) Matters relating to the revision of the Technical Regulations, the TORs of Technical Commissions, and proposals regarding WMO Programme structure and content and Secretariat structure will be addressed in this Phase;
- (7) The final preparations for the presentation of the overall WMO structure and function that reflects the WIGOS-WIS should be prepared for EC–LXII. The action of EC at this time will consist of the details that will be presented to Cg-XVI to which the EC WG WIGOS-WIS would provide input.



**VII. Implementation Phase IV. EC-LXII (June 2010) - Cg-XVI (May 2011)**

- (1) Review and update as appropriate WIGOS Concepts of Operation;
- (2) WDIP (final version) is completed;
- (3) EC-LXII to agree on the content of the submission to Congress regarding the implementation of WIGOS-WIS. This will include the proposed changes to the Technical Regulations, the revised roles and TORs of the various Technical Commissions, the adjustments to the WMO Programme structure, and the impact on Secretariat budgets and personnel. Proposed actions of Cg-XVI to implement the programme;
- (4) EC-WG/WIGOS-WIS submits its final report and recommendations to Cg-XVI.

**VIII. Pilot Projects**

While the preparation of an over-arching WIDP will be the crucial centerpiece of the planning and implementation of WIGOS, Cg-XV felt that undertaking at the earliest possible stage several WIGOS Pilot Projects would be useful to address major issues in the integration process and would help in elaborating the WIDP. Pilot Projects will emphasize the role and contributions to be made by the Technical Commissions. In accordance with recommendations by Cg-XV, Technical Commissions had identified the following Pilot Projects in the context of WIGOS:

- *Pilot Project I:* Joint GOS-GAW Pilot Project to accelerate implementation of WIGOS/WIS;
- *Pilot Project II:* Initiation of Global Hydrological Network addressing a GCOS Requirement;
- *Pilot Project III:* Integration of AMDAR into WIGOS;
- *Pilot Project IV:* Elaboration of the underpinning/crosscutting role and responsibilities of the Instruments and Methods of Observation Programme in the context of WIGOS;
- *Pilot Project V:* Integration of Marine Meteorological and other appropriate Oceanic Observations into the WMO Global Observing Systems.

**IX. Demonstration Projects on the Development and Implementation of WIGOS at NMHSs**

9.1 Cg-XV emphasized that support and involvement of NMHSs and Regional Associations in the implementation of WIGOS concept was a crucial factor for ensuring important benefits for all Members. Helping Members to more fully understand WIGOS and keeping them current on its practical development should be considered as an essential component in WIGOS implementation. This can be achieved through launching Demonstration Projects in selected NMHSs. These NMHSs will be at the operational end of the WIGOS implementation demonstrating to all concerned how to initiate and keep WIGOS together with WIS components running at the required levels of performance. Feedback and lessons learnt from these NMHSs will be extremely beneficial in understanding others' expectations of WIGOS/WIS concept implementation. These projects will also have a high profile impact since they would include all observing systems, i.e. in addition to WWW/GOS, the Demonstration Projects would involve functions of other observing networks that provide the delivery of time critical data and products, as well as other information, underlying the basic operations of NMHS. The Secretariat working with appropriate working bodies of Regional Associations and Technical Commissions would ensure regular coordination

and communication between Members involved in Demonstration Projects. The Demonstration Projects would complement the already agreed-upon Pilot Projects. The Pilot Projects focus on Technical Commission involvement while the Demonstration Projects focus on NMHSs in Regional Associations.

9.2 Candidates for "test-bed" Demonstration Projects include the following NMHSs: Kenya, Namibia (RA I), Republic of Korea (RA II), Brazil (RA III), United States of America (RA-IV), Australia (RA V) and the Russian Federation (RA VI).

#### **X. Develop and maintain WIGOS web page**

It would be essential to have an effective website containing current information about WIGOS roles and tasks, related upcoming events and background information. The WMO Secretariat, in coordination with Members concerned, relevant focal points for WIGOS in RAs and Technical Commissions, should establish and update of a WIGOS web page on the WMO Web site by publishing information about WIGOS, including general information on the current status of implementation of Pilot and Demonstration Projects, providing a condensed information to various WIGOS user communities.

#### **XI. Policy and Governance Aspects**

To accomplish the goals above regarding the development of a truly integrated WMO global observing systems, adjustments must be made in the WMO Technical Regulations, the WMO Programme structure, the working structure and function of the Technical Commission, and of the WMO Secretariat. The motivations for WIGOS are focused; i.e. to the objective of instituting a truly integrated end-to-end system - comprised principally of the WIGOS and WIS. The development of an effective and efficient system of governance to guide and implement it, arrangements for effective scientific and technical advisory mechanisms to develop, monitor and evaluate it, and an appropriate WMO Programme and WMO Secretariat structure to support it, will all be important and essential components of the systems into system integration.

#### **XII. WMO Technical Regulations (TR)**

12.1 One of the principal strengths of WMO is the organizational and operational backbone provided by the *WMO Basic Document Series No. 2, Technical Regulations (WMO- No.49)*. The three volumes of the WMO Basic Document Series are supplemented by Annexes called Manuals, which have the same status as the Basic Documents and are aimed at facilitating cooperation between WMO Members, specifying their obligations and ensuring adequate uniformity and standardization in the practices and procedures employed. In addition to the Manuals, there is a class of WMO documentation, not part of the technical regulations, usually called *Guides* (e.g. the *Guide to the Global Observing System, WMO No. 488*). The purpose of the *Guides* is to provide practical information on the development, organization, implementation and operation of the system, subsystem(s) or service in order to enhance both the participation of individual WMO Members in the activity and the benefits they may obtain from it. The *Guides* often supplement the regulatory material contained in the *TR* and their *Annexes*.

12.2 The present structure of the Technical Regulations (TR) Volume I centers around the WWW/GOS, GDPFS, and GTS with other components of the overall WMO programmes or systems distributed within the GOS or simply added on as they evolved. In order to effectively approach the integration of WMO Global Observing Systems (WIGOS), and to incorporate WIS, a fundamental reorganization and approach to the WMO TR is required. Undertaking this task early in the WIGOS and WIS planning activity will provide structure and organization to the overall effort, and will help in organizing the work programme required to implement WIGOS and WIS. In this regard, CBS-Ext(06) (Seoul, Republic of Korea, November 2006) has already noted that the implementation of the WIGOS and WIS will ultimately require a major revision of the TR.

12.3 Space based observing and communications systems are becoming more and more central to the over-all WMO system operations. In fact, many future applications will often rely on space-based sensors as the primary source of data, and require surface based or *in situ* observations for calibration or “ground truth” purposes, thus changing the operational requirements placed on the integrated system substantially. The present set of TR often treats the satellite systems as entities separate from the surface based networks and systems.

12.4 The revised structure of the TR should provide a foundation for WIGOS. It should document the structure of a system of systems based on interoperability and compatibility among all its elements and with the user community. The revised TR would need to be comprehensive and reflect all of the component systems. It would allow room to address, the wide ranging multi-discipline issues and requirements for observational resources from all domains (atmosphere, ocean, and terrestrial) facing WMO today (weather monitoring and prediction, atmospheric composition monitoring, climate monitoring and change, disaster risk reduction and mitigation, water resources etc.); it should also build on and amplify the integration across surface-based and space-based sources of observations.

12.5 In undertaking such a revision, a clearer vision for the purpose, scope, content and a process for continuous review and updating of the various elements that make up the TR, including the Guides, should be developed.

12.6 There is also an opportunity to make the TR easier to access, update and use. The application of electronic access through the Internet or similar technology for technical regulatory information should be considered as part of the integration activity. The role of WIS as the vehicle for this function may be a viable option.

### **XIII. WMO Programmes and Technical Commissions**

13.1 One single WMO Programme should be assigned the responsibility to lead the planning of WIGOS and WIS and with its ultimate implementation and operation. Participation during the integration by the other Programmes which currently have responsibility for components of the total WMO observation system will be crucial in this transition.

13.2 Likewise WIGOS and WIS should fall under a revised Commission for Basic Systems. The revised CBS TOR would be designed to reinforce its 'basic systems' responsibilities while building in stronger mechanisms for assessing and meeting the needs of the different applications sectors and programmes. The revised CBS would be focused on operational systems issues including planning and implementation across the full spectrum of observing domains and disciplines. Scientific research, system requirements, service provision etc would be the prerogatives of other Commissions, WMO Programmes or the various Advisory/Steering bodies.

13.3 As recognized in Resolution 7.4/1 (Cg-XV), the process leading to WIGOS and WIS would have a wide ranging impact on the structure and functions of WMO including the WMO Technical Regulations, data policy, roles, terms of reference, and working arrangements of the technical commissions, the WMO Programme structure and the WMO Secretariat. Initially what is needed to effectively proceed is the decision to focus the WIGOS and WIS within a single Programme and associated Commission. Given that decision, proposals with regard to how to organize and adjust the rest of the WMO Programme structure and Technical Commission TOR can be developed as an early step in the planning and implementation process.

13.4 Cg-XV agreed further that the integration process would centre initially upon the preparation of an over-arching WIGOS Development and Implementation Plan (WDIP). The plan should be kept up-to-date through a “rolling review” mechanism. It should also serve as the source of information on the integration initiative for all WMO Members and in particular developing countries. Several “Pilot Projects”, as approved by Cg-XV, should be designed to test concepts, identify problem areas, and to help in elaborating WDIP. The possible candidate Pilot Projects

approved by Cg-XV include those mentioned above under “Phase I. Cg-XV (May 2007) – EC-LX (June 2008)”.

#### **XIV. Jointly Sponsored Observing Systems**

In progressing toward enhanced integration of, and interoperability amongst, WMO observing systems, it will be especially important that this be carried out in close consultation with WMO’s partner organizations that co-sponsor some of those systems. This will apply particularly to:

- the joint WMO-IOC-UNEP-ICSU Global Climate Observing System (GCOS);
- the WMO contribution to the joint IOC-UNEP-WMO-ICSU Global Ocean Observing System (GOOS); and
- those terrestrial/hydrological observing systems which serve as part of the FAO-UNEP-WMO-ICSU Global Terrestrial Observing System (GTOS).

#### **XV. Integration levels within WIGOS**

15.1 As a system of observing systems, integration will be accomplished at three levels: observation standardization; a common information infrastructure, i.e. WIS; and end-product quality assurance.

*Coordination of WIGOS development and implementation through standardization at the observation level*

15.2 A sustained, optimized, end-to-end WMO Integrated Global Observing System should encompass homogeneity, interoperability, compatibility of observations from all WIGOS constituent observing systems. This should be achieved through implementation of guidance and studies on methods of observations by IMOP within WIGOS constituent networks including tests, calibration and comparisons. Schematically, it could be defined as an “instruments” level of integration.

*Coordination of WIGOS development and implementation with WIS*

15.3 Cg XV emphasised that the planning and implementation of WIGOS should proceed in parallel to the planning and implementation of WIS. It is therefore crucial that as from its early planning stages the WIGOS activities be coordinated with WIS. This will be accomplished through activities of the EC WG on WIGOS&WIS, with active participation of representatives of RAs and Technical Commissions concerned and coordination role of the Secretariat. Technologically, the key action leading to the desired integrated networks will be the generation of data and information from WIGOS constituent networks using a comprehensive, standardized data presentation in compliance with WIS information exchange requirements for all WMO Programmes. This may be considered as “WIS” integration.

*Development of WMO Regulatory material related to WIGOS, including QMF aspects*

15.4 To ensure integrated/coordinated data acquisition efforts among NMHSs and other operators to minimize duplication, reduce costs and maximize data and products availability and quality, the development of an integrated management system to secure sustained, timeliness data streams and adequate quality control, there is the need for appropriate regulatory documentation including organization and recommended practices and procedures so that Members can proceed adequately with WIGOS development and implementation taking into account QMF aspects. This will constitute an “end-products” integration.

## Status of WIGOS Pilot Projects

### PILOT PROJECT 1 - Joint GOS-GAW Pilot Project to accelerate implementation of WIGOS/WIS

#### 1. Background

As part of its WIGOS decision, Cg XV requested several pilot projects: – one for CBS and CAS to undertake a joint pilot project to enhance coordination of GOS and GAW in WIGOS/WIS. The high level WIGOS/WIS goal is to establish a comprehensive, coordinated and sustainable system of observing systems with ensured access to its component observing systems' data and products through interoperable arrangements. WIGOS is the system of observing systems and WIS provides the access through the interoperable arrangements. WIGOS/WIS will address all WMO Programme requirements, ensure availability of required information, meet data quality standards, and facilitate access in real/quasi-real time as well as to archived information. The CBS/CAS Joint Pilot Project will make an important contribution in the development of WIGOS/WIS.

Factors bearing on planning:

- CAS MG meeting held 24-26 Sept 2007, Oslo and planned for Geneva in Sept 2008;
- CBS MG meeting in July 2008;
- EC WIGOS/WIS Working Group Meeting Dec 2007 or January 2008;
- CAS OPAG EPAC Meeting March 2009.

#### 2. Joint GOS-GAW Pilot Project Development

To accelerate implementation of WIGOS/WIS, the GOS-GAW pilot project (including relevant WIS items) mandated by CG-XV should, as a first step, develop a draft project plan through an “ad-hoc CBS & CAS experts group on WIGOS”. Follow-on steps envision joint meetings of CAS and CBS management groups (MGs) and appropriate OPAGs to finalize the project plan and implement it as well as reporting to the MGs and the EC WIGOS/WIS Working Group.

#### 3. Proposed Schedule and Actions:

- (i) **Early August 2007**, D/AREP and D/WWW consulted by email with the CAS and CBS Presidents, OPAG chairs, explaining the proposal and assigning responsibilities for a joint document to be submitted to the CAS MG meeting jointly by AREP and WWW;
  - (ii) **24-26 September 2007** at CAS MG Meeting Oslo. CBS MG was represented by President of CBS and AD/WWW. It initiated development of a draft project plan by approving terms of reference of the “ad-hoc CBS & CAS Experts Group on WIGOS” and approved a joint CAS/CBS MG meeting to be held in 2008, possibly July;
  - (iii) **February 2008** - Geneva 1<sup>st</sup> Meeting of “ad-hoc CBS & CAS Experts Group on WIGOS”. Complete the joint CBS-CAS Project Plan for GAW-GOS for EC WG WIGOS/WIS review and EC-LX guidance (June 2008);
  - (iv) **July 2008**: Joint meeting of CBS & CAS MG (accordance with item ii) Purpose: Incorporate EC LX guidance and decisions into final joint Project Plan;
  - (v) **Implement the project by November 2010**\_reporting to CAS and CBS and EC WG on WIGOS/WIS and finally Cg-XVI (May 2011).
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## **PILOT PROJECT 2 - Initiation of Global Hydrological Network addressing a GCOS Requirement**

### **Introduction**

1. In accordance with the decision taken during the Cg–XV, five pilot projects were identified by the EC Task Team to test the concepts of integration of WMO Observing Systems, identify the problem areas and to help elaborate the WIGOS Development and Implementation Plan. No specific activities to initiate a possible pilot project have been started as the CHy as a body is yet to discuss the same.

2. One of the Pilot Projects identified is *“Initiation of Global Hydrological Network addressing a GCOS Requirement”*. The following paragraphs describe a project proposal that has been developed during the last 6 months, jointly between HWRP and GEO Secretariat which in effect addresses the GCOS requirements and could be considered for a **Pilot Project in the Context of WIGOS**.

### **The HARON Project**

3. The GCOS Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (2004), by its Action T4, includes calls for a joint initiative with the WMO/HWRP and GRDC for the development of a baseline observing network, the Global Terrestrial Network – Rivers (GTN-R) as a subset of the Global Terrestrial Network for Hydrology (GTN-H).

4. Accordingly, a Hydrological Applications and Run-Off Network (HARON) Project has been developed by the Hydrology and Water Resources Department (WMO-HWRD), jointly with GEO Members and Participating Organizations. Such a proposal may also address the needs of the Global Climate Observing System (GCOS).

5. The main goal of HARON is to improve and support the closure of the global water budget in line with requirements of GCOS and the Global Water Cycle Experiment (GEWEX) and will promote the free and unrestricted international exchange of hydrological data, in consonance with the needs of the global hydrological community.

6. Its objective is to integrate, in a phased approach, dedicated river gauging networks of existing hydrological stations on a global scale into a global runoff observation network. The project will be carried out in a phased approach, gradually linking other global networks related to freshwater observations into the integrated observing system.

7. The project will be in three phases. The first Phase will be dedicated to upgrading and (re-) connecting the 380 major global river discharge stations that are part of the Global Terrestrial Network for river discharge (GTN-R). The proposed duration of this phase will be 15 months and could be considered as the pilot project. (The second phase will link this network with the WHYCOS while the third phase will concentrate on modelling and user specific products). The project will be funded through extra-budgetary resources on the lines of WHYCOS component.

8. It will mainly encompass the technical upgrade of the stations, ensuring their maintenance and operations over the years of the HARON project duration. The project proposal envisages financial support to the developing countries for such an upgrade and in turn will include the commitment of the national organizations operating the station(s) to extend and maintain station operations under prescribed standards, as well as share the data in an agreed format and temporal sampling with the entity hosting the global dataset (e.g. the Global Runoff Data Centre [GRDC]). The data and metadata formats would be compliant with the ISO 19115 standard.

9. In addition, an upgrade of the terrestrial telecommunication infrastructure to ensure near real-time transmission of data, data management, and availability of information for global services is seen as a vital component of Phase 1. This will include the transmission and dissemination of data as required through various means of telecommunication such as the GEO's GEONETCAST and the WMO Information System (WIS).

10. A HARON website will be established during this Phase, jointly with GRDC, to serve as a communication platform for the exchange of global and regional data and information generated by GTN-R stations, using the GTN-H as a coordination platform. The catalogues of HARON would be accessible through the GEO Clearing House.

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### **PILOT PROJECT 3 – Integration of AMDAR into WIGOS**

1. The AMDAR Panel at its 10<sup>th</sup> meeting fully supported the further integration of the AMDAR programme into the WMO WIGOS, considering the Final Report of the seventh session of CBS Management Group, the need to see AMDAR as a complementary data source to existing surface and space based observing programmes, and the need for increased efforts to include water vapour sensors to provide a full set of parameters for both profile data and en-route data sets.

2. The Panel further endorsed the transfer of the AMDAR Technical Coordinator function into a WMO staff position, providing the funding from the AMDAR Trust Fund at least for the initial biennium of 2008/2009, with a high probability to maintain that funding for the full 4-year budget cycle.

3. The Panel Management Group is proposing to establish an Ad-hoc Steering Group composed of the AMDAR Panel Chair, the Panel Technical Coordinator, a US representative, and the CBS Rapporteur on AMDAR activities with the task to facilitate the implementation of a Project Plan during the 2008/2009 time frame, to enhance delivery of aeronautical data from AMDAR platforms for to user communities. This Steering Group will also address the special nature of the AMDAR data being owned by the aviation industry partners, and the planned addition of humidity sensors to selected aircraft. The Project plan will include the following essential elements:

- Design a business case in cooperation with the aviation industry for the inclusion of humidity sensors (after successful completion of tests) with a generic software and hardware for all major aircraft types, but special emphasis on short-haul and commuter planes.
- Contacts at the working level have been established with Airbus and Boeing, but it is seen as essential to involve also other major manufacturers such as Bombardier, Saab or Embraer. In the specifications for the generic software solution, parameters such as turbulence and icing will be incorporated.
- This business case will compare the cost of the generic software and hardware development, certification for sensor installation and the cost of installing, maintaining and calibrating the sensors to the cost of conventional profile data, the impact of a widespread availability of such profile data on VSRF and Nowcasting, and the potential savings by optimizing the ground-based upper-air network.

4. Considering that the project depends on the full cooperation of the aviation industry, it is difficult to define firm timelines. It is expected, however, that first tangible results should become available by the end of 2008/beginning of 2009.

5. A further aspect of the business case will include expected benefits of AMDAR data for aviation met service delivery in the light of new ATM concepts such as NextGen and SESAR.

6. The ICAO Assembly resolution A 36/17 of Sept. 2007 is requesting an aggressive approach to reduce aviation emissions by new operational measures, to which aviation meteorology will contribute in a significant way. AMDAR data are expected to form an essential input to any improved weather service delivery to aviation.

7. Further steps towards a full integration will be developed by the Ad-Hoc Steering Group based on the results of the business case and further agreements with the aviation industry.

8. The transfer of the AMDAR Technical Coordinator position to the WMO secretariat will ensure close coordination with the relevant new and dedicated WMO secretariat departments.



9. The Panel reminds the EC Working Group that a long-term funding of the Technical Coordinator position or an equivalent staff position needs to be foreseen in the following budget cycle for 2012-2015.

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## **PILOT PROJECT 4 – Elaboration of the underpinning/crosscutting role and responsibilities of the Instruments and Methods of Observation Programme in the context of WIGOS**

### ***Background***

1. Assisted by Cg-XV, the high level WIGOS/WIS goal is to establish a comprehensive, coordinated and sustainable system of observing systems with ensured access to its component observing systems' data and products through interoperable arrangements. WIGOS is the system of observing systems and WIS provides the access through the interoperable arrangements. WIGOS/WIS will address all WMO Programme requirements, ensure availability of required information, meet data quality standards, and facilitate access in real/quasi-real time as well as to archived information. The CIMO Pilot Project will make an important contribution in the development of WIGOS/WIS.

### ***Factors bearing on planning:***

- EC WIGOS/WIS Working Group Meeting Dec 2007;
- CIMO MG meeting to be held in early 2008;
- TECO-2008 (27-29 Nov. 2008);
- Ad-hoc (reduced) CIMO MG meeting, in conjunction with TECO-2008.

### ***Elaboration of the underpinning/crosscutting role and responsibilities of the Instruments and Methods of Observation Programme***

2. To accelerate implementation of WIGOS/WIS, the CIMO pilot project (including relevant WIS items) mandated by Cg-XV should, as a first step, develop a draft pilot project plan through an "ad-hoc CIMO expert group on WIGOS". Follow-on steps envision meetings of the CIMO Management Group (MG) and appropriate OPAG ETs to finalize the project plan and facilitate its implementation as well as reporting to the MG and the EC WIGOS/WIS Working Group. The project plan should result in the elaboration of the "cross-cutting role and responsibilities of the IMOP Programme in WIGOS."

### ***Proposed Schedule and Actions:***

- (i) November 2007: Nomination proposal for members of the "ad-hoc CIMO Expert Group on WIGOS" by CIMO President;
- (ii) December 2007: Meeting of the EC WIGOS-WIS Working Group to support establishment of "ad-hoc CIMO Expert Group on WIGOS" and provide additional guidance;
- (iii) Mid-December 2007-Mid-January 2008: Development of a preliminary draft Pilot Project Plan by the Expert Group and submission to CIMO MG for consideration;
- (iv) Late January 2008: CIMO MG meeting to approve preliminary draft plan and provide additional guidance to "ad-hoc CIMO Expert Group on WIGOS";
- (v) Q1 2008: Meeting of CIMO Expert Group to develop Project Plan;
- (vi) June 2008: EC-LX to give guidance on WIGOS/WIS further development and project, and approve CIMO Pilot Project Plan;
- (vii) July-August 2008: The "ad-hoc CIMO Expert Group on WIGOS" finalizes the Pilot Project Plan according to guidance from EC-LX;
- (viii) September-October 2008: The "ad-hoc CIMO Expert Group on WIGOS" develops detailed lists of responsibilities and, as far as possible, a mechanism that would be needed to implement proposed responsibilities within WIGOS/IMOP/CIMO;

- (ix) November 2008: Wide consultation of CIMO Members during TECO-2008 and CIMO MG meeting to endorse the outcomes of the Pilot Project;
  - (x) 2009: Finalization of outcomes of the Pilot Project and submission to EC-WIGOS-WIS Group.
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## **PILOT PROJECT 5 - Integration of Marine Meteorological and other appropriate Oceanic Observations into the WMO Global Observing Systems**

(JCOMM Pilot Project for WIGOS)

### **1. Background**

Assisted by Cg-XV, the high level WIGOS/WIS goal is to establish a comprehensive, coordinated, and sustainable system of observing systems with ensured access to its component observing systems' data and products through interoperable arrangements. WIGOS is the system of observing systems and WIS provides the access through the interoperable arrangements. WIGOS/WIS will address all WMO Programme requirements, ensure availability of required information, meet data quality standards, and facilitate access in real/quasi-real time as well as to archived information. The JCOMM Pilot Project for WIGOS will make an important contribution in the development of WIGOS/WIS.

### **2. Scope and deliverables**

#### **2.1 Scope**

2.1.1 The JCOMM Management Committee, following guidance from the WMO Executive Council Working Group on the WMO Integrated Global Observing System and the Information System (WIS) (EC-WG/WIGOS-WIS), will draft and finalize the Pilot Project plan and establish a Steering Team for coordinating and facilitating the development and implementation of the JCOMM Pilot Project for WIGOS (including relevant WIS items).

2.1.2 This will of course require coordination with appropriate WMO Programmes (MMOP, IMOP, WWW) and Technical Commissions (CBS, CIMO).

2.1.3 In addition, this will require coordination between (i) JCOMM, its Observations Programme Area (OPA), its Data Management Programme Area (DMPA), the JCOMM Management Committee, and their Expert Teams and Panels, and the IOC of UNESCO through (ii) the International Oceanographic Data and Information Exchange (IODE).

2.1.4 Coordination with the IOC-WMO-ICSU-UNEP Global Ocean Observing System and its GOOS Scientific Steering Committee (GSSC) will also be required.

2.1.5 Progress will be reported to the JCOMM Management Committee and to the WMO EC Working Group on WIGOS-WIS.

#### **2.2 Deliverables**

2.2.1 The Pilot Project will promote (i) interoperability of marine data systems with the WMO Information System (WIS) in close cooperation with the IOC ocean community, and (ii) the documentation and integration of best practices and standards being used amongst the meteorological and oceanographic communities, and (iii) establish compliance with the WMO Quality Management Framework (QMF).

2.2.2 The first activity will provide access to meteorological and oceanographic data to serve a number of applications, including climate in an integrated way via the WIS; hence facilitating access to well documented and standardized data.

2.2.3 The second activity will define common standards for instruments and methods of observations as well as subsequent organization and handling of the data to serve the applications with consistent and better quality data being fed into models.

2.2.4 The third activity will result in the coordinated development of cost-effective Quality Management Systems by Members. At different levels of the data production line, there will be better, timelier data, minimized duplication, and an operational data delivery system. This will be achieved through the compilation of regulatory documentation.

### **3. Pilot Project approach, roles and responsibilities**

#### **3.1 Cooperation with the ocean community**

3.1.1 Operational models of the interior of the oceans have been significantly improved with the success of the Argo Pilot Project deploying an increasing number of instruments and having lately attained the 3000 float target. A number of countries are now engaged in combining multi-level atmospheric and oceanographic models and installing real-time modelling functions. With this ability, the oceanographic community is seeing important advantages to becoming involved in making, reporting and using ocean observations in real-time. The ocean observing components of JCOMM that are not currently reporting onto the GTS will be encouraged to submit their data in real time through the WIS (this should be easier to realize than with the current GTS because of a more variety of available formats and the possibility of the WIS to consider specific data exchange policies). As well, we can expect the importance of historical data to modelling will increase since it is through these that studies can be made of past conditions. As well, the high resolution, high quality delayed mode data reach data centres in the ocean community and these data will be important for hindcasting conditions or improving the forecasts of operational models that used real-time data only.

3.1.2 The following aspects will have to be considered for the Pilot Project:

- 1) Providing access through the WIS to historical and recent data holdings in ocean data centres. This links to the JCOMM End to End Data Management (E2EDM) effort and one could consider that this has already started. However, substantial effort remains to integrate the various sources of *in situ* and satellite data (e.g. Argo, OceanSITES, GHRSSST, XBT, Ocean carbon, sea level stations, satellite altimetry data, etc.).
- 2) The ocean community will contribute to the Pilot Project through interoperable arrangements with the WIS but at the same time may develop specific data systems under the auspices of the IOC.

#### **3.2 Benefits**

3.2.1 There are clear advantages for the ocean community to participating in the Pilot Project and providing interoperability with the WIS by:

- Improving their visibility with the National Meteorological and Hydrological Services (NMHS) while keeping their independence regarding parallel data systems their put in place;
- Gaining better access to meteorological and climate data thanks to direct WIS access. It would have been very difficult to access some of these data outside of the scope of the Pilot Project;
- Solidifying the links between meteorological and oceanographic data centres;
- Accessing more, and better data of known quality obtained through consistent instrumentation meeting standards agreed upon between both the meteorological and oceanographic communities.

3.2.2 At the same time, there will be advantages for the WMO and NMHS:

- Gaining better access to oceanographic data to feed into operational and research applications;
- WIS will provide for multi-disciplinary access to data;
- Enhancing NMHS cooperation with the oceanographic centres nationally or worldwide.

### 3.3 ***Pilot Project Steering Team***

3.3.1 The development of the Pilot Project will be coordinated by a Steering Team, providing liaison with appropriate WMO Programmes (IMOP, WWW, GOS) and Technical Commissions (CBS, CIMO), with the JCOMM Observations Coordination Group and appropriate expert teams, the JCOMM Data Management Coordination Group and appropriate expert teams, the JCOMM Management Committee, the WMO EC-WG on WIGOS-WIS, and the IOC and IODE. It will be responsible for:

- a) Producing/refining the Pilot Project Plan;
- b) Promoting the continued development and implementation of a sustained and coordinated global ocean observing system;
- c) Coordinating and promoting the development, documentation, and integration of best practices for the different components of the marine observing and data systems;
- d) Coordinating and promoting the development of interoperability arrangements between different components of the marine data system, and the provision of the real time and delayed mode observational data through the WIS;
- e) Coordinating and promoting the development, documentation, and integration of QMS at the required levels of the data production line from marine observations to the delivery of data and products;
- f) Seeking resources to be committed to the Pilot Project;
- g) Guiding the implementation of the plan and working with the WMO and IOC Secretariats to facilitate its implementation.

3.3.2 Possible Members of the Steering Team are (for discussion by JCOMM MAN-VI):

- JCOMM OPA Coordinator - *Mike Johnson*
- JCOMM DMPA Coordinator - *Bob Keeley*
- JCOMM ET-DMP Chair - *Nick Mikhailov*
- IODE Co-Chair - *Greg Reed, or his representative*
- IODE Representative - *(Ms) Lesley Rickards*
- SISMER and SeaDataNet - *Loic Petit de la Villeon*
- JCOMM DBCP Chairperson - *David Meldrum*
- JCOMM SOT Chairperson - *Graeme Ball*
- Representative from WMO Secretariat
- Representative from IOC/UNESCO Secretariat
- Representative of CBS
- Representative of CIMO
- Other Members as required

### 3.4 Roles

The role of bodies and expert teams as well as those of the Members and the Secretariat are defined in the table below:

Body	Role(s)
EC-WG/WIGOS-WIS	Overall vision and guidance
JCOMM MAN	Guidance to the PP Steering Team
JCOMM OCG	Coordinate and promote the development, documentation, and integration of best practices and QMS Ensure the flow of the data to the WIS
JCOMM DMCG	Coordinate and promote development of interoperability arrangements Coordinate and promote development, documentation, and integration of data management best practices and QMS
JCOMM ETDMP	Propose practical steps regarding the development of interoperability arrangements and implementation of QMS
JCOMM ETMC	Coordinate and promote development, documentation, and integration of QMS regarding delayed mode marine data and Marine Climatological Summaries
Observing Panels (DBCP, SOT, GLOSS, Argo)	Draft/update/compile best practices Promote best practices and QMS Provide for observational data to the WIS
GOOS	Assist in the integration of best practices and QMS
GSSC	Assist in the integration of best practices
IOC IODE	Assist in the development of interoperability arrangements Assist in the integration of best practices Assist in the development and integration of QMS
Secretariat	Commit resources to the Pilot Project Support the Steering Team Follow up implementation of the project plan
Members	Provide expertise Commit resources to the Pilot Project Continue to develop, implement, and sustain the observing systems in a coordinated way and following recommended best practices Implement QMS at required levels of the data production line Provide the observational data through the WIS

### 4. Schedule

#### Proposed Schedule and Actions (depending on resources allocation):

- (i) Sixth Session of the JCOMM Management Committee, 3-6 December 2007. Draft proposal presented for discussion;
- (ii) IODE/JCOMM Forum on Oceanographic Data Management and Exchange Standards, Ostend, Belgium, 21-25 January 2008. Draft proposal presented for discussion;

- (iii) Third session of the JCOMM Data Management Coordination Group, Ostend, 26-28 March 2008. Draft proposal presented for discussion;
- (iv) March/April 2008. Consultations with the steering teams and reports on progress and proposed strategy by the pilot project. Consolidated report by the Secretariat for review by the EC WG WIGOS/WIS and guidance by EC LX (June 2008);
- (v) July 2008: Consultations with the Management Committee and the pilot Project steering team to incorporate EC LX guidance and decisions into their final plans;
- (vi) Oct/Nov 2008: discussion with the Data Buoy Cooperation Panel at its Twenty-fourth Session (South Africa). Expected outcome: progress regarding integration of best practices and standards regarding buoy observations;
- (vii) End 2008: discussion with the JCOMM Ship Observations Team at its fifth Session. Expected outcome: progress regarding integration of best practices and standards regarding ship observations;
- (viii) Third Session of JCOMM, fall 2009. Expected outcome: formal endorsement from JCOMM and Resolution;
- (ix) Twentieth Session of IODE, mid 2009. Expected outcome: formal endorsement from IODE and Resolution;
- (x) Implement the projects by November 2010 reporting to the JCOMM Management Committee and EC WG and finally Cg-XVI (May 2011).

## 5. Estimated Costs

5.1 The Pilot Project Steering team will have to meet at least once a year during three years. Experts will have to attend specific meetings in order to promote the Pilot Project (e.g. SeaDataNet, DMAC, IODE). Experts will have to visit key data centres in order to explain the Pilot Project requirements and provide assistance regarding the implementation of the interoperable arrangements. A consultant will be required to assist in the production of relevant documentation for the Pilot Project.

**No funds have been allocated yet.**

**Resources will have to be identified to meet the costs. Below are initial estimates**

Item	Yearly	Total 3 years
Meetings of the Steering Team (10 people meeting once a year)	CHF 20 000	CHF 60 000
Experts attending specific meetings or visiting data centres on behalf of the Pilot Project (5 missions per year)	CHF 10 000	CHF 30 000
Consultant (one person x month per year)	CHF 15 000	CHF 45 000
<b>Total</b>	<b>CHF 45 000</b>	<b>CHF 135 000</b>

5.2 It is important to note that the costs outlined above do not cover the costs of software or hardware that will be required by individual contributors. In the end, it is the identification and use of such funds that will allow the linking of data collections across organizations to accomplish the goals of the Pilot.



## **IOC Statement**

**by Mr Keith Alverson  
Chief of Ocean Observations and Services  
IOC/UNESCO, Director, Global Ocean Observing System**

Thank you for the opportunity to attend this meeting on the behalf of the Executive Secretary of IOC, as a representative of IOC's ocean observations and services section, and its co-sponsored programs including the Joint Commission for Oceanography and Marine Meteorology (JCOMM), International Oceanographic Data and Information Exchange (IODE) and Global Ocean Observing System (GOOS). The IOC is pleased to participate in this Working Group and intends to follow up with a written communication from IOC Executive Secretary Patricio Bernal to the Secretary General of WMO, Michel Jarraud formalizing some of the points in this intervention.

IOC is very positive about the proposed improvements that will become available through the development of the WMO Information System (WIS). The ocean observing system has long been a user and beneficiary of the GTS. Due to the rapidly increasing density of in-situ observation platforms as well as increasing need for near real time data transmission, the community has at times been frustrated with limited capacity for data transmission over the GTS and the lack of long term stewardship of and open access to data that goes out over the GTS. These weaknesses will be improved through the development of WIS and WIGOS. IOC also strongly supports the development of WIGOS, though with a small caveat regarding perception of ownership.

Developing a comprehensive ocean observing system is substantially more challenging than the analogous atmospheric problem, for both political and scientific reasons. On the political level, there is a relative lack of empowerment of national institutions analogous to national met services with a clear ocean-observing mandate. On a technical level, the opacity of seawater to electromagnetic radiation inhibits the effectiveness of both remote sensing from satellites and communications with and amongst in-situ observing system platforms, requiring maintenance of a diverse, remote and extensive array of satellites as well as Eulerian and Lagrangian in-situ monitoring platforms. Furthermore, the majority of observations continue to be funded and conceived in a hypothesis driven, process oriented, research funding driven mode with few truly operationally funded and operated observing system components. To help ameliorate these weaknesses, the oceanographic community stands to gain enormously from participating fully in the development of an integrated global observing system. This said, the IOC is somewhat concerned that the 'W' in WIGOS may be perceived as an assertion of ownership by WMO, either of the system or the underlying data. Such a perception may jeopardize a true sense participation, through community ownership, amongst the diverse oceanographic interests represented by the IOC. IOC thus encourages WMO to ensure a sense of broad community ownership of the integrated global observing system, and thereby also benefit from broad responsibility for ensuring its success.

Finally, with regard to the reorganization of the WMO secretariat IOC recognizes that this is an internal WMO matter. Nonetheless, IOC notes that joint activities of IOC and WMO – including but not limited to our joint sponsorship of GOOS, GCOS, WCRP and JCOMM and our joint participation in the Interagency Coordination and Planning Committee for Earth Observations (ICPC) - have benefited greatly over the past years from the existence of relatively high level clearly defined contact point(s) for ocean affairs in the WMO secretariat and we trust that this cooperation will not be hindered through potential multiplication of, downgrading of, or lack of clarity related to point(s) of contact for ocean affairs across future structures of the WMO secretariat in observations, services, climate and research.

Thank you again on behalf of the Executive Secretary of the IOC for the opportunity to participate in this Working Group.

**LIST OF ACRONYMS**

4DVAR	Four-Dimensional Variational Assimilation
ADM	Atmospheric Dynamics Mission (ESA)
AES	Atmospheric Environment Service (Canada)
AFIRS	Automated Flight Information Reporting System
AIRS	Advanced Infra-red Sounder
AMDAR	Aircraft Meteorological Data Delay
AMSU	Advanced Microwave Sounding Unit
AMV	Atmospheric Motion Vector
AOPC	Atmospheric Observation Panel for Climate
Argo	Array for Real-time Geostrophic Oceanography
ASCAT	Advanced Scatterometer
ASAP	Automated Shipboard Aerological Programme
ATOVS	Advanced TIROS Operational Vertical Sounder
AVHRR	Advanced Very High Resolution Radiometer
AWS	Automatic Weather Station
BUFR	Binary Universal Form for the Representation of Meteorological Data
CALIOP	Cloud Aerosol LIDAR with Orthogonal Polarization
CAS	Commission for Atmospheric Sciences
CBS	Commission for Basic Systems
CGMS	Coordination Group for Meteorological Satellites
CHAMP	Challenging Minisatellite Payload
CIMO	Commission for Instruments and Methods of Observation
CMA	China Meteorological Administration
COSMIC	Constellation Observing System for Meteorology, Ionosphere and Climate
COSNA	Composite Observing System for the North Atlantic
CREX	Character Form for the Representation and Exchange of Data
DIAL	Differential Absorption LIDAR
E-AMDAR	EUMETNET-AMDAR
EARS	EUMETSAT ATOVS (now Advanced) Retransmission Service
ECMWF	European Centre for Medium-Range Weather Forecasts
EGPM	European (contribution to) Global Precipitation Measurement
ERB	Earth Radiation Budget
ESA	European Space Agency
ET-EGOS	Expert Team on the Evolution of the Global Observing System
ET-SUP	Expert Team on Satellite Utilization and Products
EUCOS	EUMETNET Composite Observing System
EUMETNET	European Meteorological Services Network
FASTEX	Fronts and Atlantic Storm Track Experiment
FY-4	Feng Yun-4 (Chinese geostationary satellite series)
GAW	Global Atmosphere Watch
GCOS	Global Climate Observing System
GEF	Global Environment Facility
GEO	Geostationary Orbit Satellite
GIFTS	Geosynchronous Imaging Fourier Transform Spectrometer
GLAS	Geoscience Laser Altimeter System
GMES	Global Monitoring of Environment and Security
GNSS	Global Navigation Satellite System

GOES	Geostationary Operational Environmental Satellite
GOME	Global Ozone Monitoring Experiment
GOS	Global Observing System
GPM	Global Precipitation Measurement
GRAS	GNSS Receiver for Atmospheric Sounding
GSICS	Global Space-based Inter-Calibration System
GSN	GCOS Surface Network
GTS	Global Telecommunication System
GUAN	GCOS Upper-Air Network
HIRDLS	High Resolution Dynamic Limb Sounder
HIRS	High Resolution Infra-red Sounder
IASI	Infra-red Atmospheric Sounding Interferometer
IGDDS	Integrated Global Data Dissemination Service
IGEOLab	International Geostationary Laboratory for demonstration missions
IGOSS	Integrated Global Ocean Services System
IMD	India Meteorological Department
IOC	Intergovernmental Oceanographic Commission
IOS	IGOSS Observing System
IP	Implementation Plan
ISRO	Indian Space Research Organization
JASON	Ocean Surface Topography Mission (OSTM)
JAXA	Japan Aerospace Exploration Agency
JCOMM	Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology
JMA	Japan Meteorological Agency
LEO	Low Earth Orbit
LIS	Lightning Imaging Sensor
MDS	Meteorological Data System
MERIS	Medium Resolution Imaging Spectrometer
METOP	Meteorological Operational Satellite (EUMETSAT)
MIPAS	Michelson Interferometer for Passive Instrument Sounding
MLS	Microwave Limb Sounder
MODIS	Moderate Resolution Imaging Spectroradiometer
MTG	Meteosat Third Generation
MTSAT-FO	Multi-purpose Transport Satellite Follow-On
NAOS	North Atlantic Ocean Stations
NASA	National Aeronautics and Space Administration
NESDIS	National Environmental Satellite, Data and Information Service
NMHSs	National Meteorological and Hydrological Service(s)
NOAA	National Oceanic and Atmospheric Administration
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NPP	NPOESS Preparatory Program
NRT	Near-Real Time
NWP	Numerical Weather Prediction
OPAG	Open Programme Area Group
OSE	Observing System Experiment(s)
OSSE	Observing System Simulation Experiment(s)

PUMA	Preparation for the Use of Meteosat Second Generation (MSG) in Africa
R&D	Research and Development (satellite)
RAOB	Radiosonde Observations
RBCN	Regional Basic Climatological Network
RBSN	Regional Basic Synoptic Network
RRR	Rolling Review of Requirements
SAC	Satelite de Aplicaciones Cientificas (CONAE, Argentina) <i>Earth-observation satellite</i>
SAR	Synthetic Aperture Radar
SCIAMACHY	Scanning Imaging Absorption spectroMeter for Instrumental Cartography
SEG	Scientific Evaluation Group of COSNA
SEVIRI	Spinning Enhanced Visible and Infrared Imager
SMOS	Soil Moisture and Ocean Salinity satellite
SVPB	Surface Velocity Program Barometer drifter
TAMDAR	Tropospheric Airborne Meteorological Data Reporting
THORPEX	The Observing System Research and Predictability Experiment
TRMM	Tropical Rainfall Measuring Mission
UAV	Unmanned Aerial Vehicle
VCP	Voluntary Co-operation Programme
VIIRS	Visible Infrared Imager Radiometer Suite
WIGOS	WMO Integrated Global Observing Systems
WMO	World Meteorological Organization
WOTAN	Wind Observation through Ambient Noise
WVSS	Water Vapour Sensing System
WWWW	World Weather Watch
XBT	Expendable Bathythermograph
ZTD	Zenith Tropospheric Delay

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