

**WORLD METEOROLOGICAL ORGANIZATION**

**EXECUTIVE COUNCIL WORKING GROUP  
ON WMO INTEGRATED GLOBAL OBSERVING SYSTEM  
(WIGOS)  
AND WMO INFORMATION SYSTEM (WIS)**

**SUBGROUP ON THE WMO INTEGRATED GLOBAL OBSERVING  
SYSTEM**

***First Session***

Geneva, Switzerland, 10-13 November 2008

**FINAL REPORT**



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## EXECUTIVE SUMMARY

The first session of the Subgroup on the WMO Integrated Global Observing System (EC-WG/SG-WIGOS-1) of the Executive Council Working Group on the WMO Integrated Global Observing System (WIGOS) and the WMO Information System (WIS) was held at the WMO Secretariat in Geneva, Switzerland, from 10 to 13 November 2008, and was chaired by Dr John Nash (UK), the President of the Commission for Instruments and Methods of Observation (CI MO) and Chair of the Subgroup.

Main attention of the SG-WIGOS was focused on the status of WIGOS Pilot and Demonstration Projects and their potential input for the update of WIGOS Concept of Operations (CONOPS) and WIGOS Development and Implementation Plan (WDIP); on the elaboration of the WIGOS Integration Levels; on a review of needs and potential problems of WMO co-sponsored observing systems; and update of CONOPS and WDIP.

SG-WIGOS discussed a scope, time frame and role of WIGOS Pilot Projects. When doing that, guidance from Cg-XV were taken into account that Pilot Projects should be designed to test concepts, identify problem areas and to help in elaborating WDIP by inputs from respective technical commission.

Concern was expressed that lack of funds would not allow for completion of some Pilot Projects as planned. In this regard, SG-WIGOS discussed legacy from the Pilot Projects, lessons learned, benefits of the Pilot Project (apart from testing the WIGOS concept and identification of problem areas), potential end users of data and deliverables of each Pilot Project. Clear answers to these questions would be beneficial to potential users and motivate them to support the Pilot Project. The summary of each Pilot Project is available at Appendices III-VII.

SG-WIGOS also discussed the role, scope, time frame and objectives of individual Demonstration Projects. It was observed that the scope of the Demonstration Projects was very different and varied from the arrangement for the basic operational problems dealing with traceability and building up calibration laboratories in Regional Instrument Centre (RA I) on one side to the implementation of a comprehensive Integrated Atmosphere / Composite Observing System addressing the requirements of the whole regional association Members (RA IV and RA V) on the other side.

It was noted that in some cases (Kenya and Morocco) extra funds, e.g. WMO VCP and WIGOS Trust Fund are needed for the successful implementation of the Demonstration Project in a full range.

SG-WIGOS underlined that all Demonstration Projects should address all areas (levels) of integration. In this regard, corresponding Data Collection or Production Centres (DCPC) should be developed and the relevant guidance from CBS and WIS as well as training on programming would be needed. For such training activities, it will be necessary to identify funds.

SG-WIGOS also considered the reporting mechanism for Demonstration Projects. It was agreed that the WIGOS Project Office (PO WIGOS) and WIGOS web site ([http://www.wmo.int/pages/prog/www/wigos/index\\_en.html](http://www.wmo.int/pages/prog/www/wigos/index_en.html)) should serve for this purpose as a web portal of updated information on the status of development and implementation of Demonstration Project as well as for establishing interlinks between Demonstration Projects contact points and relevant working bodies of the respective regional association or corresponding technical commission and its expert team(s) whenever guidance or advice are needed, problem appears. The summary of each Demonstration Project is available at Appendices VIII-XIII.

SG-WIGOS agreed that all WIGOS Demonstration and Pilot Projects required active coordination and support from the WIGOS Project Office and so a suitable project management function needed to be established. This will also allow for better interaction between the Project Team responsible for the Project and the Subgroup on WIGOS and the respective technical commission.

For each WIGOS Project, a detailed Implementation Plan and Project Team Work Plan should be available to the WIGOS Project Office for planning required support and resources, and monitoring activities planned.

It was recommended that details of the activities planned under each Project together with the action schedule should be specified and available at WIGOS web site.

SG-WIGOS recommended that the initial Pilot and Demonstration Projects phase should be regarded as a 'test-of-concept' phase of WIGOS concept; the later "implementation" phase will be developed in conjunction with the finalisation of, and feedback from, the Pilot and Demonstration Projects. WDIP was redrafted along those lines.

SG-WIGOS recast the "levels of integration" into "areas of standardisation" that are key features of an integrated system of systems, so as to clarify that the "integrated" is more about systems than data, and be more explicit about a systems of systems approach, underpinned by more coherent coordination, adherence to standards in measurement, metadata, data formats, quality control, documentation, etc.

SG-WIGOS considered in details the WIGOS Concept of Operations and the WIGOS Development and Implementation Plan and elaborated updated versions of these documents to be submitted to the second session of the EC WG on WIGOS and WIS for the consideration. The updated versions of CONOPS and WDIP are given in [Appendix XIV](#) and [Appendix XV](#) respectively.

In this regard, SG-WIGOS expressed its concern regarding time frame for testing the concept and very limited resources provided through secondments of experts and contribution to the WIGOS Trust Fund and/or redirection of existing WMO Secretariat resources in a contrast to the request of EC-LX emphasizing the need of an increased level of resources required in 2008-2011.

When considering WDIP, SG-WIGOS agreed that current process should be focused on test-of-concept phase, building on development and implementation of Pilot and Demonstration Projects initiated by technical commissions and NMHSs respectively.

SG-WIGOS finalized its draft Work Programme that is reproduced in the [Appendix XVI](#) and will be submitted to Chair of the EC WG on WIGOS and WIS for consideration and approval.

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## GENERAL SUMMARY

### 1. ORGANIZATION OF THE SESSION

#### 1.1 Opening of the meeting

1.1.1 The Meeting of the Subgroup on the WMO Integrated Global Observing System (EC-WG/SG-WIGOS-1) of the Executive Council Working Group on the WMO Integrated Global Observing System (WIGOS) and the WMO Information System (WIS) was opened by its Chairman, Dr J. Nash, president of CIMO, at 10:00 hours on Monday, 10 October 2008, at the WMO Headquarters in Geneva, Switzerland.

1.1.2 Following the opening of the session, Dr W. Zhang, Director Observing and Information Systems Department opened the meeting on behalf of the Secretary-General of WMO. He welcomed the participants to Geneva. He reiterated that integration is a complex and evolving process therefore there is a clear need to have detailed conceptual description of WIGOS operations and expected benefits of the integration to make them clear and transparent for all WMO Members as well as for partner organizations and policy makers.

1.1.3 He also underlined that integration should ensure the continued partnership and participation of the bodies responsible for those observing systems, as they become part of an integrated system of systems with a sustained sense of ownership. WIGOS will respect the data policies of partner organizations and will strive to ensure that the conditions placed by the originator on the additional data and products are respected.

1.1.4 He noted that the session was expected to address issues related to (a) the status of WIGOS Pilot and Demonstration Projects and their potential input for the update of CONOPS and WDIP; (b) to start elaboration of WIGOS Integration Levels; and (c) review of needs and potential problems of WMO co-sponsored observing systems.

1.1.5 In closing, Dr Wenjian Zhang wished for a successful and productive session and an agreeable stay in Geneva.

1.1.7 The list of participants is given in [Appendix I](#).

#### 1.2 Adoption of the agenda

The SG-WIGOS adopted the [Agenda](#) for the meeting, which is reproduced at the beginning of this report.

#### 1.3 Working arrangements

The SG-WIGOS agreed on its working hours and adopted a tentative work plan for consideration of the various agenda items.

### 2. REPORT OF THE CHAIRPERSON

2.1 The chair of the SG-WIGOS summarized the activities of the Sub-Group since its establishment in December 2007. He recalled the Terms of Reference (TOR) elaborated by EC WG on WIGOS and WIS and approved by EC-LX (TOR are given in Appendix II). In his report he mentioned issues relevant to the WIGOS concept and initiative. He pointed out that the Subgroup should be realistic when planning its activities taking into account resources available for the WIGOS at both NMHSs as well as the WMO Secretariat levels.

2.2 He pointed out that WIGOS implementation is a challenging task but is lacking in sufficient resources as requested by Cg-XV and EC-LX. At that time the Council strongly urged WMO Members,

and the Secretary-General, to provide adequate resources through secondment of experts, contributions to the WIGOS and WIS Trust Funds and/or redirection of existing WMO Secretariat resources. The Planning Office for WIGOS (PO WIGOS) was established but is yet to be fully staffed. Taking into account the role, responsibilities and scope of the work required, SG-WIGOS agreed that establishing a fully staffed WIGOS Project Office would be essential for accomplishing the requested tasks.

2.3 SG-WIGOS felt there was a lack of clarity in relation to the WIGOS Demonstration Projects, in particular what is likely to be learned from the proposed projects; what is their time frame for completion; are the NMHSs expected to do everything within their own resources or are the corresponding regional associations and relevant technical commissions to provide appropriate support?

2.4 The chairman's presentation provoked a very lively discussion concerning many aspects of the WIGOS concept and initiative, e.g. what can be achieved using resources available; how to adjust Demonstration and Pilot Projects to be feasible in the time frame specified by WDIP; how to incorporate activities of other observing systems outside WMO in the time scale of next 2-3 years; is the WIGOS about interoperability of data and products or about physical integration of observing systems; what approach should be chosen to standardize procedures? For the work of the Subgroup during the meeting and later on there is a need for clear understanding of the term "integration", the WIGOS concept and its time frame.

2.5 SG-WIGOS noted that for co-sponsored observing systems WIGOS can offer the WMO framework and its facilities to improve operations, data availability and quality by three integration areas (the SG-WIGOS preferred not to refer to "integration levels" since that seemed to imply integration of data at very specific and detailed levels). The intention is to build up, through this integration, "a system of systems" that would provide benefits to all partners and to provide improved observational data, products and services to meet evolving requirements of all end users. So, one of the keynotes for WIGOS Integration is that it should lead to improved partnerships between the systems and scientific communities.

2.6 SG-WIGOS was of the opinion that the WIGOS initiative should concentrate, in these early stage, on testing integration concepts with existing operational observing systems; however, the WIGOS concept should allow for incorporation of a new observing system and techniques for the benefit of end users and this should be examined in Pilot and Demonstration Projects.

2.7 The Chairman reported that he had attended the initial meeting for the GCOS Reference Upper-Air Network (GRUAN) (Lindenberg, Germany, February 2008) and also the Fourth meeting of the GSICS Executive Panel (Geneva, Switzerland, July 2008) for Global Space-Based Intercalibration System (GSICS) project. It was noted that these activities might be considered as additional Pilot Projects.

### **3. STATUS OF WIGOS PILOT PROJECTS**

3.1 The meeting was briefed on the status of five WIGOS Pilot Projects as identified by Cg-XV and EC Working Group on WIGOS and WIS.

#### **3.1 Pilot Project I: Improvement of Dissemination of Ozone (total column, profiles and surface) and Aerosol observations through the WIS (GAW-IDOA)**

3.1.1 Dr L. Jalkanen presented the summary of the relevant activities of GAW and the status of the Pilot Project.

3.1.2 The development of GOS-GAW WIGOS Pilot Project started during the OPAG-IOS ET-EGOS-3, July 2007. The project plan was discussed at the First session of the EC WG on WIGOS and



WIS in December 2007 and the proposal was finalized at the First Meeting of the ad-hoc CBS CAS Expert Group in March 2008.

3.1.3 This project aims to improve the collaboration between scientific research activities and relevant operational observing activities. It will also examine the problems in improving the availability of ozone and total aerosol observations for various user communities.

3.1.4 Dr Jalkanen highlighted that Pilot Project offered the potential for more data and products to be available in real or near-real time; on the other hand, she indicated that guidelines were needed on how to proceed with some specific problems encountered, e.g. access to data in the case of research institutes, how to submit data and then how to retrieve them. Therefore, the cooperation with WIS experts is needed.

3.1.5 SG-WIGOS requested that the activities within the Pilot Project which should be completed within two years should be specified so that progress could be monitored. The SG-WIGOS noted that the project implementation plan had not been prepared. There is also a need to specify in a more detailed way what the Pilot Project wants to achieve (goals, deliverables, and benefits of the Project).

3.1.6 It was agreed that another activity related to establishing the six GAW world data centres as Data Collection or Production Centres (DCPC) for WIS should also be included and a work schedule and estimates of resources for this activity should be elaborated as soon as possible.

3.1.7 The Pilot Project summary is reproduced in the Appendix III.

## **3.2 Project II: Hydrological Applications Runoff Network (HARON)**

3.2.1 Dr W. Grabs presented the summary of the activities and status of the Pilot Project as follows.

3.2.2 In response to the Cg-XV request of including WIGOS activities in Technical Commission work programmes, and the subsequent request at the first meeting of EC WG on WIGOS and WIS, the Commission for Hydrology (CHy) considered the request to undertake the Pilot Project on "Initiation of Global Network addressing a GCOS requirement" and decided to identify a package of approaches to address this requirement. The presented proposal for HARON as a potential WIGOS Pilot Project is one components of such a package.

3.2.3 Recognizing that the Pilot Project would have to deliver outputs in a fairly short time frame, the issue of delivery of first results even on the basis of zero additional funding will shortly be taken up by the Panel for the Global Terrestrial Network Hydrology (GTN-H) that is undertaken by the Hydrology and Water Resources branch of WMO and GCOS. The prospects of having first products in a timely manner were considered fairly positive.

3.2.4 In its current form, the next milestone of the Pilot Project will be a meeting of the project consortium in the first half of 2009 to discuss and agree on the further planning and implementation of the project, in particular in the light of the envisaged re-submission of the project within the 7<sup>th</sup> Framework Programme of the European Commission in January 2010.

3.2.5 In the presentation it was reiterated that the Pilot Project followed a phased approach with a first phase focusing on aligning selected terrestrial hydrological stations to enable them reporting in an institutionalized manner with clear time intervals of at least one month. 22 out of 84 WMO Members have meanwhile expressed their willingness to share hydrological data in this context. Thus, sharing of hydrological data in near-real time is not straightforward and it will take a large effort to overcome the initial reluctance to share data.

3.2.6 The chairman noted that the planning of this Pilot Project was not at an advanced stage; it was noted that the Project had not progressed at all in the last year and it was not clear what results could be expected by the end of 2010.

3.2.7 The Pilot Project summary is reproduced in the Appendix IV.

### **3.3 Pilot Project III: Integration of AMDAR into WIGOS (WIGOS-PP-AMDAR)**

3.3.1 Mr F. Grooters presented the summary of the activities and status of the Pilot Project.

3.3.2 He reported on the latest developments on the integration of AMDAR into the WMO Global Observing System. As part of the report he noted that the ad-hoc Steering Group met in its first session in July 2008. As was discussed at that meeting, the WIGOS Pilot Project for AMDAR would focus on the practices impacting AMDAR data collection, processing, archiving and dissemination.

3.3.3 Technical issues were discussed at the Ad Hoc Steering Group relevant to all three areas (levels) of WIGOS integration. Among the several components of the AMDAR System that require immediate action are the standardization of a BUFR template, standardization of QA/QC requirements for AMDAR data, standardization of instruments and the standardized generation of data for all types of data. Six Pilot Project aims and objectives were developed to assist with the integration of AMDAR into WIGOS.

3.3.4 The four short-term deliverables are as follows: the development of a standardized BUFR template for AMDAR, application of WMO metadata relevant to AMDAR, development of a standardized Quality Management Framework for AMDAR data and validation and preparation for inter-comparison of available Water Vapour sensor performance.

3.3.5 The two long-term deliverables are as follows: Update of the AMDAR Reference Manual (WMO-No. 958) and Development of the framework for generic software specification for AMDAR. A business case will also be explored, ideally together with the airline industry, for the development of the AMDAR software, based on a generic software specification.

3.3.6 Chairman of the AMDAR Panel noted there is no provision in the AMDAR Panel Trust Fund for the support of the four short-term deliverables for the Pilot Project; therefore, this project requires funding from the WIGOS Trust Fund as specified in the project summary. It was also noted that the two remaining long-term deliverables are not designed to be completed by the end of 2010.

3.3.7 SG-WIGOS noted that this project would provide a good example of integrating a new observing system into WIGOS, with establishing the measurement quality of new water vapour sensors required for future operations.

3.3.8 SG-WIGOS discussed governance and technical issues, including the transfer of the Technical Coordinator into the newly structured Observing Systems Division and the recommendation made by ICT-IOS-5 (September 2008) to establish a CBS Expert Team on Airborne Observations and anchor the WMO AMDAR Panel to CBS. However, this proposal is subject to the approval of the AMDAR Panel at its Eleventh Session (November 2008).

3.3.9 SG-WIGOS noted that the development of a standardized Quality Management Framework for AMDAR data would require cooperation with CIMO in order to better integrate AMDAR as a basic system under CBS.

3.3.10 The project includes the establishment of a quality management system for AMDAR measurements, and it was agreed that in the long-term this should also be linked to the management of other upper-air observing systems, e.g. radiosondes and or wind profilers.

3.3.11 The Pilot Project summary is reproduced in the Appendix PV.

### **3.4 Pilot Project IV: Elaboration of the underpinning / crosscutting role and responsibilities of the Instruments and Methods of Observation Programme in the context of WIGOS**

3.4.1 Mr R. Dombrowsky presented the project, the summary of the activities and status of the CIMO Pilot Project.

3.4.2 The first session of the ad-hoc working group (January 2008) developed the framework for conducting its project. The session also developed a proposal for new CIMO Terms of Reference (TORs) within the WIGOS Framework as the first phase of the Project.

3.4.3 The second phase of the Project required a participation of the CIMO representative at each of the initial meetings of the remaining Pilot Projects to present the draft CIMO Pilot Project and discuss areas where CIMO could assist, such as providing guidance on standardisation, traceability, comparisons, and capacity building as it relates to instrumentation deployment, maintenance and calibration.

3.4.4 Mr Dombrowsky indicated that CIMO participation in support of other Pilot Projects varied across the remaining four pilots. He informed members on the outcomes of each Pilot Project meeting attended and gave a brief summary on how CIMO could be supporting each Pilot Project. The next phase of the CIMO Pilot Project is to meet the expectations of each Pilot Project requesting appropriate CIMO support.

3.4.5 The deliverables associated with each phase were described in the following way: Phase 1 - reaching out to partners; Phase 2 - the active participation of CIMO in Pilot Projects planning; Phase 3 - meeting partner expectations through the implementation of CIMO related activities associated with partner Pilot Projects.

3.4.6 The activities included providing assistance in resolving standardisation differences within a particular program area, updating documentation of standards and best practices into the CIMO Guide as appropriate. Some external partners, such as the IOC/UNESCO will retain their "best practices" guide and standards documents related to ocean monitoring. In addition, CIMO could assist in planning and conducting instrument intercomparisons and in capacity building. This will entail providing guidance materials, assisting in setting performance specifications, promoting technology transfer and training.

3.4.7 SG-WIGOS was informed about the upcoming second meeting of the CIMO ad-hoc working group (St. Petersburg, Russia, 24-25 November 2008). This meeting will have to validate Phase 3 described above and finalise the project and its implementation plan. Additional activities necessary to demonstrate enhanced roles of CIMO for the future will be considered.

3.4.8 SG-WIGOS suggested that it may be necessary to help in establishing documentation related to the compatibility of satellite-based and ground-based atmospheric observing systems.

3.4.9 The Pilot Project summary is reproduced in the Appendix PVI.

### **3.5 Pilot Project V: JCOMM Pilot Project for WIGOS**

3.5.1 Mr G. Reed presented the summary of the activities and status of the Pilot Project.

3.5.2 Cooperation with the ocean community is the key to success of the Pilot Project, in particular with the Intergovernmental Oceanographic Commission's International Oceanographic Data and Information Exchange (IODE) Programme and its system of National Oceanographic Data Centres (NODC). Access to ocean datasets will be facilitated through the IOC Ocean Data Portal (ODP) connectivity to the WIS. Due to the strong potential synergies between the ODP and the Pilot Project, a joint Steering Group has been established with balanced representation from the Intergovernmental Oceanographic Commission (IOC) and WMO communities.

3.5.3 This Pilot Project will be implemented jointly by WMO and IOC through JCOMM and has identified three key deliverables:

- Documenting and integrating instrument best practices and related standards;
- Build marine data systems that are interoperable with the WIS; and
- Implementing quality management and standards.

3.5.4 The Pilot Project will address instrument best practices and traceability to agreed standards through enhanced cooperation with CIMO. Efforts are being made to updating the WMO Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8) and other appropriate WMO and IOC documentation, establishing regional marine instrument centres, and conducting instrument intercomparisons.

3.5.5 The Pilot Project objective is to make appropriate datasets available in real time and delayed mode to WMO and IOC applications through interoperability arrangements with the WMO Information System (WIS) and the IOC Ocean Data Portal.

3.5.6 In terms of quality management, the Pilot Project will assist in the production of the JCOMM Catalogue of Best Practices and Standards for those standards of interest to WIGOS, and is promoting the joint IODE-JCOMM Standards process. The Pilot Project will be inviting partners, who agreed to participate in the Pilot Project as data providers, to carefully document quality management procedures they now utilize in the view to achieving higher levels of standards.

3.5.7 Details of the work expected to be carried out to meet these deliverables and a proposed schedule and actions can be found in the Project Plan and Implementation Plan available at [http://www.wmo.int/pages/prog/www/wigos/marine\\_pp.html](http://www.wmo.int/pages/prog/www/wigos/marine_pp.html).

3.5.8 Capacity Building is an important component of the Pilot Project and will focus on the cooperation of developing countries in the Ocean Data Portal project, the promotion of WIGOS at the national level, and the organization of training courses in topics relevant to the WIGOS Pilot Project for JCOMM.

3.5.9 A number of organizations and programmes have been identified as potential partners and will be formally approached to confirm their commitment to the Pilot Project. Development and implementation costs will be met by the participating partners; however the Steering Group considered that the Pilot Project could not achieve success without appropriate funding for such coordination. The Steering Group urges the WMO and IOC to commit CHF 50000 and CHF 30000 in 2009 respectively, and CHF 30000 and CHF 20000 in 2010 respectively, to support the management of the Pilot Project.

3.5.10 SG-WIGOS noted that this was the most mature Pilot Project in terms of planning and of establishing collaborative links between different agencies. The representative of the IOC emphasised that the proposed work plan would only be related to standards for the observations being considered. SG-WIGOS agreed that the WIGOS proposal had no intention to address any other standardisation issues which IOC deals with.

3.5.11 The representatives of IOC as well as WMO commended the pilot team on excellent progress. IOC representative noted the budget request to IOC and, based on past and expected continued success in obtaining extra budgetary funding for this purpose, the IOC anticipated no problem meeting the request from its side.

3.5.12 At the same time IOC points out that the WIGOS JCOMM Pilot Project standard setting activities comprise a subset of IOC's activities in this regard, specifically those directly related to Marine Meteorology. The equation of state of seawater provides one example of an IOC normative, standard setting activity not within the remit of JCOMM or this WIGOS pilot.

3.5.13 The Pilot Project summary is reproduced in the Appendix VII.

## **3.6 Proposals for new potential Pilot Projects**

### **3.6.1 GRUAN Pilot Project**

3.6.1.1 The CBS Implementation Coordination Team on the Integrated Observing System (ICT-IOS) in September 2008 noted that a GRUAN Pilot Project could make a significant contribution to the development of WIGOS, and suggested that a new Pilot Project might be appropriate. On the other hand, the ICT-IOS concluded that it was premature for CBS to endorse the implementation of GRUAN before GCOS provided clarification of how the GRUAN would be established in the context of the GOS.

3.6.1.2 The first GCOS Reference Upper Air Network (GRUAN) Implementation and Coordination Meeting (ICM-1) is scheduled for 2-4 March 2009. ICM-1 will discuss mainly the mode of operation of GRUAN (e.g. GRUAN data policy and dissemination; relationship to other networks) and the status of GRUAN initial sites. It will also discuss in detail the issues raised by ICT-IOS-5, namely specifying GRUAN implementation, or part thereof (e.g. integrated analysis of *in-situ* and space-based observations; development of a GRUAN manual) as a WIGOS Pilot Project.

3.6.1.3 For this purpose, the Chair of the CBS ICT-IOS as well as a representative of an ongoing WIGOS Pilot Project have been invited to the meeting. Further, the meeting will see participation by members of the GCOS Atmospheric Observation Panel for Climate (AOPC) Working Group on Atmospheric Reference Observations and representatives from GRUAN initial candidate sites. The majority of GRUAN initial sites is collocated with existing GCOS Upper-Air Network (GUAN), Baseline Surface Radiation Network (BSRN), Network for the Detection of Atmospheric Composition Change (NDACC), Southern Hemisphere Additional Ozonesondes (SHADOZ) and Global Atmospheric Watch (GAW) sites, for maximum synergy with these networks. The Working Group also includes the President of CIMO, representatives of the space agencies through Global Space-based Inter-calibration System (GSICS), and of the WMO Observations and Information Systems Department.

3.6.1.4 SG-WIGOS recommended that a representative of WIS should be also invited to attend the meeting.

### 3.6.2 ***Pilot Project on space-based observation***

3.6.2.1 The Director, WMO Observing and Information Systems Department provided an overview of recent discussions at the CGMS-36 meeting (Coordination Group on Meteorological Satellites) (November 2008). He noted that guidance from CGMS was sought for the development of the space-based aspect of WIGOS and in particular with respect to the potential space related activities that should contribute to WDIP. For example, the Pilot Project on Marine Meteorology may offer a particular scope for a significant contribution from space-based monitoring platforms. GSICS might also be considered as a model case for global integration of space-based observations at data quality level.

3.6.2.2 CGMS was invited to:

- Comment on the possible role of space agencies in the development of the space-based aspect of WIGOS, and identify potential space related activities that should contribute to WDIP;
- Consider, in particular, possible support from satellite operators to the Pilot Project on Marine Meteorology for fostering integration of space-based ocean surface wind data with surface-based wind observation;
- Consider GSICS as a potential new Pilot Project demonstrating the benefit of integration at the data quality level.

3.6.2.3 The CGMS further noted that the CBS ICT-IOS at its fifth session (September 2008) reviewed CONOPS and raised a number of questions including that the WIGOS concept should foster more effective integration of satellite and *in-situ* observations; however, little involvement of satellite expert groups is seen so far. It proposed that satellite components be incorporated into relevant Pilot Projects. The CGMS Members were invited to consider and discuss the above information, noting in particular the comments from ICT-IOS that there should be greater involvement of satellite components in the relevant Pilot Projects. CGMS was invited to comment on the role to be played by space agencies for the development of WIGOS.

3.6.2.4 The CGMS supported a recommendation to develop a WIGOS Pilot Project on GSICS.

3.6.2.5 SG-WIGOS was very supportive of an enhanced involvement of the Space Programme and the existing WIGOS Pilot Projects and accepted the concept of a potential new project on GSICS. They requested the Director to provide a Project proposal in accordance with the CGMS deliberations. It was further noted that reference should be made to work done in the past by a ICT-IOG on linkages between surface and space-based observing systems.

3.6.2.6 IOC is supportive of the idea of an integrated surface vector wind observation activity connecting remote sensing and *in-situ* measurements as proposed by CGMS. Like WMO, IOC is a member of CGMS. IOC notes that surface vector winds are a GCOS essential climate variable and have been suggested as a potential CEOS constellation. IOC looks forward to working in partnership with WMO as this activity develops.

### 3.6.3 **Pilot Project on integration of terrestrial carbon observing networks and other terrestrial observations into WIGOS**

3.6.3.1 The Programme Director of GTOS introduced the idea of a preliminary pilot project aimed at the Integration of carbon fluxes and biomass monitoring into WIGOS; this pilot project is currently in its initial stage of collaboration and planning.

3.6.3.2 The overview of the project was provided as follows. The climate-carbon feedback has been recognized as one of the areas of concern for future climate studies. Understanding and managing greenhouse gases (carbon in particular) stock and fluxes is a fundamental step for avoiding dangerous climate change, especially in consideration of the ongoing negotiation cycle to define emission reductions after the Kyoto Protocol.

3.6.3.3 Vegetative Biomass and terrestrial carbon fluxes are both two key components of the global carbon cycle, linked one to the other and related to climate. Vegetation has a direct influence on local, regional and also global climate (particularly on air temperature and humidity) depending on the amount of biomass. Moreover biomass stores atmospheric CO<sub>2</sub> through photosynthesis, acting as a carbon sink, and emits in turn CO<sub>2</sub> to the atmosphere in a long time term (through the decomposition process) and in a very short time term (through fires). The increasing importance of the biomass role in the climate system is also due to the growing use of biomass for energy production (so the increasing percentage of global GHGs emitted from biomass consumption) and the increasing concern on the possibility to significantly reduce global GHGs emissions by avoiding biomass losses from deforestation and forest degradation.

3.6.3.4 Terrestrial carbon fluxes are direct information of the sink or source role of an ecosystem. Terrestrial carbon fluxes can also be used for validation and parameterization of biogeochemical models in coupled Earth and Climate System Models. These models play an important role in estimating our mitigation potential in future world.

3.6.3.5 This pilot project aims at growing and ultimately aimed to create a global network of *in situ* carbon related monitoring sites by coupling biomass and terrestrial carbon fluxes measurements in order to: i) improve and standardize biomass inventories, ii) better correlate biomass changes and ecosystem fluxes; iii) cross check the atmospheric CO<sub>2</sub> measurements with this bottom up approach; iv) create a global dataset of *in situ* carbon related variables tailored for climate studies and meteorological observations. The process is to be introduced stepwise through a demonstration proof of concept.

3.6.3.6 The partners would include GTOS-through its TCO panel, University of Tuscia, WMO, and GEO.

3.6.3.7 The funding for the project is not secure and as such it remains as a proposed pilot project.

### **3.7 Coordination of Pilot Projects**

3.7.1. SG-WIGOS discussed the scope, time frame and role of WIGOS Pilot Projects, taking into account guidance from Cg-XV that Pilot Projects should be designed to test concepts, identify problem areas and to help in elaborating WDIP by inputs from respective technical commission.

3.7.2. SG-WIGOS agreed that the Pilot Projects required active coordination and support from the WIGOS Project Office and so a suitable project management function needed to be established. This will also allow for better interaction between the Project Team responsible for each Pilot Project and the Subgroup on WIGOS and the respective technical commission.

3.7.3. It was emphasized that each Pilot Project should have a realistic implementation plan with clearly defined time frame, activities and achievable deliverables for each individual phase, taking into account WDIP guidance which foresees that activities of Pilot and Demonstration Projects begun in Phase I and II should be completed and evaluated by the beginning of Phase III for viability of the WIGOS concept as well as having resources available.

3.7.4. In this regard, each Project Team should elaborate its Work Programme with specified tasks, activities, deliverables and deadlines; it will enable to monitor the progress reached in the implementation of the Project.

3.7.5. For each Project, a detailed Implementation Plan and Project Team Work Programme should be available to the WIGOS Project Office for planning required support, resources and monitoring activities planned.

3.7.6. It was recommended that details of the activities planned under each Project together with the action schedule should be specified and available at WIGOS web site ([http://www.wmo.int/pages/prog/www/wigos/index\\_en.html](http://www.wmo.int/pages/prog/www/wigos/index_en.html)).

3.7.7. Concern was expressed that lack of funds would not allow for completion of some Pilot Projects as planned. In this regard, SG-WIGOS discussed the legacy from the Pilot Project, lessons learned, benefits of the Pilot Project (apart from testing the WIGOS concept and identification of problem areas), and potential end users of data and deliverables of each Pilot Project. Clear answers to these questions would be beneficial to potential users and motivate them to support the Pilot Project.

3.7.8. SG-WIGOS also agreed with the proposal by Prof. Hoffmann that CBS should appoint its representative in each Pilot Project to advise on issues concerning the WIS contribution to integration within the Pilot Project and to ensure that WIS elements and components required for the implementation of the project are developed and coordinated to meet respective project aims and requirements. This would greatly facilitate a leading role of the CBS in the implementation of the WIGOS concept.

#### **4. STATUS OF WIGOS DEMONSTRATION PROJECTS**

4.1 SG-WIGOS was briefed on the decision of EC WG on WIGOS and WIS to include Demonstration Projects on the Development and Implementation of WIGOS at NMHSs into WDIP as well as the guidance and recommendation made by EC-LX to support the involvement of NMHSs and regional associations in the implementation of the WIGOS concept as crucial to ensure important benefits for all Members.

4.2 One of the problems found in planning WIGOS activities was the assumption that there was a clear understanding by Members of what WIGOS compliance means or should mean. However, the Subgroup on WIGOS has been still working to clarify this issue and some initial standards need to be identified.

4.3 Apart from this, the scope of some of the proposed Pilot and Demonstration Projects seems to be too large to be achieved in the time frame of the Test of Concept Phase of WIGOS. Thus, SG-

WIGOS felt that large scale investments in WIGOS Demonstration Projects were not justified at this time, and Members requesting support should make sure that the parts of the projects being implemented should make useful information about WIGOS issues available quickly.

4.4 SG-WIGOS took into account that EC-LX accepted the willingness of Kenya, Morocco and Namibia (RA I), the Republic of Korea (RA II), Brazil (RA III), the United States (RA IV), Australia (RA V) and the Russian Federation (RA VI) to carry out Demonstration Projects in their countries and requested the Secretary-General to provide the necessary support for the efficient implementation of their activities and keeping other Members informed. These NMHSs should demonstrate how to initiate and keep WIGOS together with WIS components running at the required levels of performance. Feedback and lessons learned from these NMHSs will be beneficial in understanding expectations of WIGOS/WIS concept implementation. In addition to WWW/GOS, the Demonstration Projects would involve functions of other national observing networks that provide data and information important for basic operations of NMHS.

4.5 SG-WIGOS considered the status of Demonstration Projects provided by respective Countries and presentations made by representatives of Members concerned at the session. The status of them can be summarized as follows:

#### 4.6 ***Demonstration Project Kenya***

4.6.1 The aim of the Project is to integrate all national observing systems including upper-air and marine observations in Kenya through three areas (levels) of WIGOS integration. For this project, Kenya Meteorological Department (KMD) established a steering committee to oversee its development and implementation.

4.6.2 KMD, with an assistance of WMO, has been building up its calibration laboratory as the Regional Instruments Calibration Center (RIC) for RA I. These capabilities will enable to improve the traceability of measurements in the Region.

4.6.3 KMD is in the process of standardizing the data transmission from national observation network through the migration from traditional alphanumeric codes to the Table Driven Codes Forms. Corresponding software has been developed and now is in a testing phase. Relevant training workshop will be organized.

4.6.4 KMD plans to build up an Integrated Meteorological Information System (IMIS) that will comprise of the Meteorological and Climatological Data Bank (MCDB) for integrating all data, metadata and products from different sources and implementing quality control procedures.

4.6.5 The project indicates that extra funds from WMO VCP and WIGOS Trust funds as well as training of the managerial and technical staff will be needed for a successful implementation.

4.6.6 Demonstration Project summary is reproduced in the Appendix VIII.

#### 4.7 ***Demonstration Project Morocco***

4.7.1 The Project is focused on standardization and traceability of measurements in the RA I that will be accomplished by strengthening capabilities of the Regional Instrument Centre in Casablanca, Morocco in accordance with the Recommendation 11 (CIMO-XIV) – Regional Instrument Centre with full capabilities and functions.

4.7.2 Apart from this, the project aims to develop metadata catalogues of all stations constituting the Moroccan Meteorological Surface Observing Network and building up a climatological database; in the later stage there will be an upgrade of NMS observing system with integration of data from other observing systems in Morocco, hydrological network included. For the successful implementation, extra funds from WMO VCP and WIGOS Trust funds as well as training of the managerial and technical staff will be needed.



4.7.3 Demonstration Project summary is reproduced in the Appendix IX.

#### 4.8 ***Demonstration Project Republic of Korea***

4.8.1 The aim of the project is to integrate meteorological observations from various domestic institutions. This will be achieved by standardization of observing equipment and data acquisition processes, by establishment of a quality management system and by common information infrastructure for observational data.

4.8.2 For this purpose, the Korea Meteorological Administration plans to enforce a law on the standardization of meteorological observational data, provide technological support to other national observing institutes, optimize its observing network, ensure traceability of measurement and undertake other relevant activities.

4.8.3 The need for advice regarding the scope and type of integration was mentioned.

4.8.4 Demonstration Project summary is reproduced in the Appendix X.

#### 4.9 ***Demonstration Project Brazil***

4.9.1 A new automatic surface observing system is being implemented in Brazil. More comprehensive approach (instead of just implementing automatic weather stations) includes planning for all components of the observing system, from the observational platforms (AWS) to satellite communication in real time, to round the clock monitoring of the system performance, maintenance, building up a database for real-time delivery of data and products to all potential users.

4.9.2 By this project the National Meteorological Institute INMET plans to build up its Integrated Meteorological Information, Data Management and Monitoring System that should be fully operational by 2011.

4.9.3 The whole system should comprise and implement: integrated network management and warning system for real-time and near-real-time data; integrated data processing, management and monitoring system; quality assurance for all stages of the data acquisition process; quality controlled database of observational data; integrated metadata system.

4.9.4 The need for advice from CIMO (on the subject of traceability of measurements) as well as from CBS (e.g. regarding quality control procedures for AWS data) was indicated.

4.9.5 Demonstration Project summary is reproduced in the Appendix XI.

#### 4.10 ***Demonstration Project the USA***

4.10.1 This project endeavours to build up an Integrated Atmosphere Observing System (IAOS) with enhanced interoperability features through the integration of various component systems representing surface-based upper-air observations from RA IV Member countries, and space-based observations derived from satellite soundings.

4.10.2 Important aspects of the Demonstration Project include development of metadata catalogues across RA IV, ensuring a common information infrastructure consistent with WIS plans for data and products generated by the IAOS, and quality assurance.

4.10.3 NOAA, National Weather Service (NWS) will take the lead and work with RA IV Members to further develop the IAOS concept recognizing specific needs of the Region, but also considering the broader Regional interests.

4.10.4 The proposed project will assess issues appropriate to the development of a regional

capacity to integrate observations from various atmosphere observing platforms such as rawinsonde, AMDAR, wind profilers, Doppler radar, satellite and other emerging sensing systems. The Project will consider national and regional requirements in the design of enhanced interoperability features through the integration of the various component observing systems and the establishment of appropriate information management architecture consistent with WIS goals.

4.10.5 Demonstration Project summary is reproduced in the Appendix XII.

#### 4.11 ***Demonstration Project Australia***

4.11.1 The project is centred on designing and implementing an operational Composite Observing System through optimising the mix of surface and space-based observing system components and network characteristics to cost-effectively meet constraints set by budget and user requirements.

4.11.2 The project documents the processes followed in assessing comprehensively the current and future requirements for weather and climate observations, the adequacy of existing systems in meeting the requirements and developing a future strategy for meeting the requirements cost-effectively through optimising the mix of surface-based and space-based systems, automation, remote sensing, manual methods and access to external data.

4.11.3 The project will explore integration at all relevant areas. The first stage, documentation of the assessment, development and planning processes, is underway and will be significantly advanced by CBS-TECO in March 2009. The second stage involves reviewing and documenting the implementation of the Composite Observing System strategy, including the transition from plan to reality and the extent to which the strategy provides a sound basis for tackling budget realities, critical system/process/output/methodology decision points and the effectiveness and sustainability of the outcomes. The third stage will involve a comparative assessment of experiences with those of other Member countries.

4.11.4 Demonstration Project summary is reproduced in the Appendix XIII.

#### 4.12 ***Proposal of Demonstration Project UK***

4.12.1 Dr Nash informed the SG-WIGOS that he has authorisation to elaborate the Demonstration Project of the UK. The Demonstration Project proposal will be submitted to the WMO Secretariat by the end of January 2009.

#### 4.13 ***Coordination of Demonstration Projects***

4.13.1 SG-WIGOS underlined that the complete set of Demonstration Projects should address all areas (levels) of integration; although SG-WIGOS cautioned against overly ambitious scope at this stage of WIGOS concept development. The initiated Demonstration Projects should focus on some specific aspects of WIGOS concepts and be used to highlight areas of success or concern. They should not be expensive or ambitious new projects. The SG-WIGOS recommended that requests for additional funding to support DPs should be reviewed by EC-WG in that context.

4.13.2 It was emphasized that each Demonstration Project should have its realistic implementation plan with clearly defined time frame, activities and achievable key deliverables for each individual phase, taking into account WDIP guidance which foresees that activities of Pilot and Demonstration Projects begun in Phase I and II should be completed and evaluated for viability of the WIGOS concept as well as resources available.

4.13.3 In this regard, each Project Team should elaborate its Work Programme with specified tasks, activities, deliverables and deadlines; it will enable to monitor the progress reached in the implementation of the Project.

4.13.4 For each Project, a detailed Implementation Plan and Project Team Work Programme should

be available to the WIGOS Project Office for planning required support and resources and monitoring activities planned.

4.13.5 Prof. Hoffmann expressed the opinion that Data Collection or Production Centres (DCPC) should be developed in the case of all Demonstration Projects and the relevant guidance from CBS and WIS as well as training on programming would be needed. For such training activities, it will be necessary to identify funds.

4.13.6 Requirements of the individual WMO Regions should be taken into account when considering Demonstration Projects and guidance given to the respective Members initiating them.

4.13.7 It was noted that in some cases (Kenya and Morocco) extra funds, e.g. WMO VCP and WIGOS Trust Fund are needed for the successful implementation of the Demonstration Project in a full range.

4.13.8 SG-WIGOS agreed that like Pilot Projects, Demonstration Projects also required active coordination and support from the WIGOS Project Office. In a similar way, this will allow for better interaction between the Demonstration Project Team and the Subgroup on WIGOS or relevant regional association working bodies.

4.13.9 SG-WIGOS considered the reporting mechanism for Demonstration Projects. It was agreed that the WIGOS Project Office (PO WIGOS) and WIGOS web pages should serve for this purpose as a web portal of updated information on the status of development and implementation of Demonstration Projects as well as for establishing interlinks between Demonstration Projects contact points and relevant working bodies of the respective regional association or corresponding technical commission and its expert team(s) whenever guidance or advice are needed, problem appears. Details of the activities planned under each Project together with the action schedule should be specified and available at WIGOS web site ([http://www.wmo.int/pages/prog/www/wigos/index\\_en.html](http://www.wmo.int/pages/prog/www/wigos/index_en.html)). This will enable Members and RAs/TCs to keep up-to-date with progress and will improve the visibility of the WIGOS initiative.

4.13.10 It was also agreed that annual reports should be submitted for the consideration by the annual session of SG-WIGOS.

## **5. WIGOS INTEGRATION LEVELS**

5.1 The SG-WIGOS agreed that integration in WIGOS, within a system of systems context, will be underpinned by standardisation in three key areas: measurements and observations; data exchange, discovery, access and retrieval; and end-product quality management.

### **5.2 *Standardization of instruments and methods of observation***

5.2.1 Mr R. Dombrowsky presented an overview of some considerations associated with the standardization, integration and interoperability of instruments and methods of observation. He noted that for WIGOS to function effectively, managers of national observing networks will have to grasp the expectations and benefit of the integrated system so as to ensure effective operation and maintenance of these national networks.

5.2.2 Standards can vary from legally binding to voluntary. Within WIGOS it is preferred that critical standards be documented and published as official WMO standards. In some areas where observing systems are developing rapidly, best practices may have to be documented and then, as the system matures, more rigorous standards may be introduced.

5.2.3 If WIGOS is to be cost effective, some observations of a given meteorological variable may be of lower quality, and this information will have to be conveyed in the metadata associated with the observation. Metadata is in many ways almost as valuable as the observations themselves.

5.2.4 Within WIGOS much of the added value is to be gained by integrating observations from different observing networks/systems (NMHS and other owners) and this will require generation of metadata to describe the instrumentation, performance characteristics, procedures implemented, maintenance, network/system monitoring, quality of the observations from each network, etc. This is a role of metadata to which highest attention should be paid. For this purpose, an appropriate SW tool which allows for generating metadata files and their incorporation into WIS is required.

5.2.5 However, in some cases new observing products may be produced by integrating basic observations (e.g. space-based and surface-based remote sensing) and then metadata will need to describe these end-user products.

5.2.6 Where different observing systems measure the same variable, differences between the techniques will need to be documented so that users can understand how best to combine the information from the different types of systems.

5.2.7 Generation of the metadata needed for individual observing sites as well as for different types of observing system is an enormous task and estimation of the task size has yet to be made. Thus, it is essential that some of the WIGOS Pilot and Demonstration Projects make a start on a limited subset of the whole task, so that the efforts required can be clarified. In particular, the Pilot Project IV (CIMO) needs to provide some examples. The guidance available in the WMO Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8) as well as in the Guide to the Global Observing System (WMO-No. 488), Part III could be used for this purpose.

5.2.8 Dr B. Goodison, representing observing components of WCRP, noted that, in the context of the discussion on these areas (level) of integration, the climate aspect was not specifically mentioned. Current WMO strategic trusts refer to “weather, climate, water and related environmental information”. WIGOS objectives include addressing the needs of the atmospheric, hydrologic, oceanographic, cryospheric and terrestrial domains within the operational scope of a comprehensive integrated system. The current document on standardization, integration and interoperability did not mention climate observations. He also noted that the needs for climate and environmental information did not seem to be captured in the WIGOS process. He felt that WIGOS should ensure these needs were also being considered even in the initial phase.

5.2.9 SG-WIGOS noted that all purposes of observations (weather, climate, water and related environmental information) as all types of observations and data/products are within the focus of WIGOS. The capacity to address requirements for different applications of observations will be accomplished through specifying the appropriate standards for measurement, data exchange, and quality management.

### **5.3 Common information infrastructure**

5.3.1 Prof G.-R. Hoffmann, Chair ICG-WIS briefed SG-WIGOS on Compliance Specification of Global Information System Centres (GISC), Data Collection or Production Centres (DCPC) and National Centres (NC) in the WMO Information System.

5.3.2 Any centre participating in WIS must comply with the WIS compliance specifications. These are based on Service Oriented Architecture principles and describe only what has to be the same for contributing systems to interface with other systems.

5.3.3 The WIS area of integration is actually an interoperable level rather than integration, but it is an essential component of the overall integration within WIGOS. From a WIGOS perspective, data representation is defined just as requirement for data exchange.

5.3.4 Each WIGOS Pilot and Demonstration Project has its own specific requirements and involves WIS in several key areas as a communication system for collecting and exchange of observation, also for Discovery, Access and Retrieval (DAR) services, as well as a model for data management

(harmonised metadata so all can read each others metadata). For compliance, some of these areas must be addressed in the same way, while for others it is preferable but not mandatory.

5.3.5 WMO Member States may apply for designation as one of the functional centres forming the core infrastructure of WIS: GISC, DCPC and National Centre NC. Designation as a WIS centre requires a statement of compliance with the required WIS functions. The approved WIS Compliance Specifications is the authoritative source for "interoperable interfaces" required of GISCs, DCPCs, and NCs. They identify fifteen technical specifications for interoperability of WIS interfaces as well as specifications for data representation and codes.

5.3.6 WIS with its two components (first - communication and DAR services, second - data management) constitutes the second WIGOS integration area and is all about interoperability. The key aspects for Compliance are laid out in the WIS Compliance Specifications, available at <http://www.wmo.int/pages/prog/www/WIS-Web/RefDocuments.html>.

5.3.7 It was reiterated that 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, what the content of them is and how to link them to the Volume A (WMO-No. 9), Observing Stations and WMO Catalogue of Radiosondes.

#### **5.4 End-product quality assurance**

5.4.1 Dr G. Love presented considerations on the end-product quality management framework.

5.4.2 The procedures and practices described in the technical Regulations (WMO-No. 49) provide the basic material for use as the reference material in national quality management systems (QMS) to define specific procedures, processes and resources to meet specified standards. The publication also contains some quality requirements and quality assurance practices and procedures.

5.4.3 The complete quality assurance process relies to some extent on the ability and willingness to standardise and sustain the quality of the basic observations, but the quality management framework also needs to document the procedures necessary to evaluate the quality of user products and to identify when anomalies in the measurements are causing unacceptable errors in the user products.

5.4.4 Thus, development of the WMO Quality Management Framework is essential for the future of WIGOS operations. The appropriate quality management system shall operate continuously at all points of the whole system, from planning and installation, operations, maintenance and inspection, test and calibration, quality and performance monitoring, training, to data pre-processing, dissemination, processing and archiving; feedback and follow-up actions are inseparable parts of this chain. The owner of the observing system must accept the responsibility for implementing cost-effective QMS.

5.4.5 This process is tied up with the quality of end-user products; therefore the issue should not be addressed and worked on just under the WIGOS umbrella. Some strategic recommendations are sought from the EC Working Group on WIGOS and WIS as to how the quality management framework should be developed and implemented in operational practice. The EC Inter-Commission Task Team on Quality Management Framework must cooperate on it as well.

5.4.6 One of the core goals of each Pilot Project/Demonstration Project is to coordinate the development of and implement a cost-effective Quality management System (QMS). At different steps of the data production line it is expected that improved quality management will provide benefits such as follows: more data meet the requirements of different applications; data quality and the conditions under which measurements are made will be known and documented; data quality and consistency will improve; quality of products and services using such data will improve.

## **6. REVIEW OF INTEGRATION NEEDS AND POTENTIAL PROBLEMS OF WMO GLOBAL**

## **OBSERVING SYSTEM AND RELEVANT CO-SPONSORED OBSERVING SYSTEMS**

### **6.1 GOS (Surface- and Space-based components)**

6.1.1 Dr Sue Barrell, Co-Chair OPAG-IOS discussed issues related to the Global Observing System (GOS) in the context of WIGOS. The GOS is the largest global observing network within the WMO observing systems and features a long history of efficient coupling and complementing of surface-based and space-based components. It should serve as a backbone and proven prototype for the integration and take a lead role in the challenging WIGOS process.

6.1.2 The fifth session of the ICT-IOS (Geneva, Switzerland, September 2008) highlighted concerns related to lack of clarity on reporting mechanisms, responsibilities and potential duplication of work, as well as the inadequate resources allocated to support the development and implementation of WIGOS, especially in relation to staffing of the WIGOS Project Office.

6.1.3 At the same time, the risk of resources, both financial and expertise, being drawn from existing commitments essential to the work program of CBS was raised. The ICT-IOS-5 queried the scope of the Pilot Projects, the value of building appropriate linkages with Project Teams and the need to ensure adequate involvement of space-based elements of the GOS in the projects.

6.1.4 Dr Barrell discussed various aspects of GOS integration according to the three key aspects of standardization as per the revised CONOPS and advised that GOS would adhere to all aspects. WIGOS will require agreement on common and/or compatible standards to facilitate homogeneity, interoperability and compatibility of observations for all WIGOS constituent observing systems. With the GOS as the backbone, the Manual on the GOS (WMO-No. 544) provides the essential framework within which the common set of standards to support interoperability and coordinated operation can be agreed and promulgated. The Manual on the GOS already provides linkages to integrate most of the constituent WIGOS systems.

6.1.5 She also drew attention to additional integration issues such as the optimum composition and design of composite networks that reflect emerging technical solutions, new observing practices and realities of budgetary issues facing most national observing programs. This is highlighted by the integration of surface and space-based systems as fundamental constituents of a composite observing system, and the future evolution of the Global Observing System as documented and continuously updated by CBS ET-EGOS with the assistance of the other OPAG-IOS Expert Teams.

6.1.6 Integration between surface-based and space-based systems is not simply a matter of harmonising instrument specifications across surface and space. Such integration has not been well addressed to date, but is under consideration through three initiatives: collaboration with surface-based sites for VIS-IR imager calibration (an ongoing initiative); dialogue between the Global Space-based Inter-calibration System (GSICS) and the GRUAN initiative; and Satellite – AWS calibration (through collaboration amongst CBS OPAG-IOS expert teams). The latter two initiatives are relevant to the algorithm and quality control of derived geophysical products (Level 2 and 3 data) rather than to instrument calibration as such and accordingly goes beyond the 'observation' process.

6.1.7 It should be noted that many NWP centres already routinely integrate surface and space-based observations through data assimilation systems, and many users might benefit from the NWP products rather than from the individual system observations. However, the expected approach should not be expected to be the same for all meteorological variables.

6.1.8 The GSICS initiative, which represents a quality assurance aspect of WIGOS, was discussed as a potential additional Pilot Project, and it was agreed that the WMO Space Programme would develop this idea further and present a proposal in due course.

6.1.9 The suggestion made by ICT-IOS-5 that the GCOS Reference Upper Air Network might make a useful additional Pilot Project was discussed and the GCOS Secretariat indicated that consideration would be given to this at the first GRUAN Implementation and Coordination meeting in March 2009.

6.1.10 In addition, a number of issues related to a revised Vision for the GOS 2025 and integration of space and *in-situ* systems were raised and attention drawn to aspects of work currently underway to address some of them through the work of OPAG-IO expert teams. Some of these aspects will be considered at the CBS Management Group, the ninth session, November 2008.

6.1.11 Additional dimensions that will benefit from consideration within WIGOS include integration of research-based observing activities and their potential transition to operation. The work underway on transition of R&D satellites to operations was also mentioned.

## **6.2 GCOS atmospheric observing systems**

6.2.1 Dr T. Fuchs, representing GCOS, briefly introduced the GCOS concept, networks and systems, and then raised some issues from the perspective of GCOS *in-situ* atmospheric observing systems.

6.2.2 GCOS consists of the climate-relevant components of existing WMO and non-WMO atmospheric, oceanic and terrestrial observing systems and their enhancement to meet all user needs for climate observations. GCOS uses all relevant and available operational and research observation networks as basis for monitoring and analysis of Essential Climate Variables (ECV) in support of the work of e.g. Global Earth Observation System of Systems (GEOSS), Intergovernmental Panel on Climate Change (IPCC) and United Nations Framework Convention on Climate Change (UNFCCC).

6.2.3 Improvement and better integration of observing systems under WIGOS, for example through better coordination, continuous operations, systematic quality control, managed change and enhanced infrastructure, can only be beneficial to GCOS and deserves full support.

6.2.4 The GCOS Climate Monitoring Principles (GCMPs), endorsed by WMO Congress, Committee on Earth Observation Satellites (CEOS), and the UNFCCC provide overall guidance regarding the planning, operation and management of GCOS observing networks and systems, including satellites, to ensure that high-quality climate data are available and contribute to effective climate information.

6.2.5 Focusing on the GCOS atmospheric *in-situ* networks, the following needs have been identified in the context of WIGOS:

- a) Needs concerning the first area (level) of integration (Observation standardization):
  - Improved standardization of observations, in particular related to precipitation measurements (instrumentation, practices, methods, procedures);
  - Regular observation intercomparison activities in different climate regions;
  - Instrumentation calibration and maintenance (specific attention to developing countries);
  - Stronger focus on consistent and complete metadata information on the instrumentation of global *in-situ* observing stations (e.g. concerning precipitation gauge type, installation, siting);
- b) Needs concerning the second area (level) of integration (Common information infrastructure):
  - Improvement of insufficient telecommunication (e.g. due to failure in technology, outdated routing tables);
  - Higher awareness of WMO data standards in NMHSs, e.g. through improved communication and access to documentation;
  - Capacity building on coding and transmitting data (e.g. training, software exchange);
  - Improved data exchange with GCOS Data Centres (enhanced high-level support to better enforce WMO data policies);
- c) Needs concerning the third area (level) of integration (End-product quality assurance):
  - Improved monitoring and quality control of network performance, including active feedback loops between data users and providers;
  - Standardized description of datasets and products;
  - Standardized quality control procedures for end-user products both on the part of providers and users; both automatic and manual procedures are recommended;

- Fostering the development of integrated products using *in-situ* data, models and space-based information, by taking into account advances in research and technology.



### **6.3 IOC/UNESCO Ocean observing systems**

6.3.1 Dr. Keith Alverson, representing the Intergovernmental Oceanographic Commission of UNESCO (IOC) gave a presentation on the Global Ocean Observing System (GOOS). GOOS is co-sponsored by IOC, WMO, United Nations Environment Programme (UNEP) and International Council for Science (ICSU) and has been in existence for over a decade.

6.3.2 During this first decade, GOOS was primarily engaged in planning observational strategies and developing the international governance structures required to facilitate multi-national ownership and development of the system.

6.3.3 This work is done and the most important challenge now facing GOOS is to complete and sustain an integrated global system with clear user benefits. GOOS hopes that by participating in WIGOS this goal can be more readily achieved than would otherwise be the case.

6.3.4 GOOS has already achieved substantial success. Sixty percent of the *in-situ* open ocean observing system for climate is in the water, including buoys, moorings, floats, tide gauges and repeat hydrographic lines. Operational warnings for coastal hazards based on this GOOS observational backbone are widely available and provide clear societal benefits.

6.3.5 At the same time, substantial challenges remain. GOOS must increase research community contribution to and benefit from the system and improve and enhance accounting of governmental commitments to the system.

6.3.6 A second challenge is to fill geographic and thematic gaps e.g. in developing regional systems in the Arctic and Southern Oceans and by transitioning biological pilot projects into fully operational components. GOOS hopes that WIGOS will help tackle some of these key challenges.

### **6.4 GTOS (Terrestrial observing systems)**

6.4.1 Mr J. Lathan, representing GCOS terrestrial observing systems for climate (GTOS) briefed SG-WIGOS on the importance and status of the observations of the terrestrial variables that affect climate and its effects on food security, the environment and sustainable development.

6.4.2 He briefed on the significant contribution and change in position of GTOS within the international framework agreements for climate change and informed on the contribution that the GTOS Secretariat is now making to the international agenda and negotiations for new framework approach for the standardization of Essential Climate Variables (ECVs) in the terrestrial domain.

6.4.3 Globally consistent sets of observational data are needed to be able to attribute the causes of climate change, analyse the potential impacts, evaluate the adaptation options and enable characterization of extreme events such as floods, droughts and heat waves. Without such baseline data it is not possible to develop products needed by policy-makers and other relevant stakeholders. Moreover, faced with the reality of the need for adaptation strategies to be evolved at national levels, WIGOS recognizes the need for improved observations in terms of spatial distribution, frequency and quality built around standards and reporting guidelines which underpin the long-term meteorological and hydrological records.

6.4.4 Primary issues which remain of key concern to GTOS and which are adopted by WIGOS include: Are data from satellite and *in-situ* systems adequate? Are data accessible? Are they standardized? Are the variables measured frequently enough? Are observations adequate for national reporting? Are systems and data centres functional and viable, sustainable entities?

### **6.5 Baseline Surface Radiation Network (BSRN)**

6.5.1 On behalf of Dr E. G. Dutton, Dr. B. Goodison made a short presentation of BSRN.

6.5.2 BSRN was initiated as a project of the World Climate Research Programme (WCRP) and the

Global Energy and Water Experiment (GEWEX), whose goal is to acquire climatically-diverse, surface based, radiation budget measurements of the highest possible quality for climate, weather and remote sensing applications.

6.5.3 BSRN was established to monitor the background shortwave and longwave radiative components (least influenced by immediate human activities which are regionally concentrated) and their changes with the best methods currently available; provide data for the calibration of satellite-based estimates of the surface radiative fluxes; produce high quality observational data to be used for validating the theoretical computations of radiative fluxes by models.

6.5.4 At 2004, BSRN was designated as the global baseline network for surface radiation for the Global Climate Observing System.

6.5.5 BSRN has mandate to examine and improve radiation measurement methods. BSRN follows modified GCOS Observing principles.

6.5.6 The most pressing issues in the operations of BSRN currently are as follows:

- Premium quality sites are in serious jeopardy (Saudi Arabia, South Africa, Nigeria);
- Reduction in WCRP financial support;
- Support for maintenance of international measurement reference standards for radiation (currently pursued in Davos, Switzerland with CIMO endorsement);
- Transition from research mode to operational mode at some US-funded sites in the Pacific.

6.5.7 Mostly internal issues/needs are as follows:

- Needs for more oceanic, central Asia, and African sites (considering all offers);
- Slow data submissions (should improve with AWI as a new archive);
- Data summary products for users (new job for archive);
- Completion of data uncertainty assessment (a GRP project);
- Aerosol optical depth – observations are being made but no central processing and archival (greatest BSRN disappointment to date, efforts continue).

6.5.8 The challenge of transitioning a research network to operations was discussed, BSRN being an example of the challenge. Participants noted that this challenge exists for many projects and that WIGOS needs to consider this aspect in actually creating an integrated observing system.

## **6.6 WCRP observing components**

6.6.1 Dr. B. Goodison, representing observing components of WCRP, presented and discussed the needs and issues of the World Climate Research Programme in the context of WIGOS. This included an overview of the proposed WMO initiative, Global Cryosphere Watch.

6.6.2 He noted that the current structure of WCRP may evolve to address its new strategy aimed to facilitate analysis and prediction of Earth system variability and change for use in an increasing range of practical applications of direct relevance, benefit and value to society.

6.6.3 One of the primary WCRP pathways to application and end-user benefits will continue to be the integration of observations and models to generate new understanding, leading to enhanced benefits from climate predictions. To be successful, there needs to be greater synergy between *in-situ* and space-based observations; greater dialogue on requirements between the climate prediction and observing components of WCRP; a routine climate system state estimation activity inclusive of observational error estimates; sustained data/information delivery; a plan for access and archival of research observations, and infrastructure to ensure climate quality, continuity, and reprocessing capabilities. These needs are similar to other organizations.

6.6.4 He noted that WCRP, like GCOS, is not itself an operator of observing networks but has initiated both *in-situ* and satellite initiatives to meet its scientific needs, from which many observing networks and products have evolved to be considered “operational” for the research community. This

raised the discussion of the ultimate transfer of observations and products from research to operations in the context of WMO and WIGOS.

6.6.5 The WCRP Observation and Assimilation Panel (WOAP) deals with crosscutting issues related to global observations, their analysis and assimilation, and the resulting products, from a research perspective on behalf of WCRP and GCOS. The major concerns and issues also include satellite matters and interactions with space agencies.

6.6.6 Future needs for observation and analyses identified by WOAP that relate to WIGOS include: observations from *in-situ* and from space that satisfy the climate observing principles; a performance tracking system; development and improvement of climate data records; the ingest, archival, stewardship of data, data management; access to data; the analysis and re-analysis of the observations and derivation of products, and data assimilation and model initialization. Many of these needs could be met through WIGOS and WIS. WOAP can help in improving communication and coordination in this area on behalf of WCRP and its Projects.

6.6.7 Advances made by GEWEX/CEOP in the data management of *in-situ*, satellite and model data were also noted. It should be noted that these CEOP data are already open to outside groups and can be accessed from the data centres. This is an example of efficient data archiving and data access within the research community.

6.6.8 The legacy of IPY Observing was noted, including the desire for continuing networks such as SAON/iAOOS, PantOS/SOOS, Polar Satellite Constellation and the new Global Cryosphere Watch (GCW). On overview of the proposed WMO initiative, Global Cryosphere Watch was presented with an emphasis on challenges and issues of relevance to WIGOS.

6.6.9 Dr. Goodison noted that the cryosphere occurs in over 100 countries, so is of wide interest among Members. The cryosphere is not measured solely by NMHSs and GCW success will require collaboration with other agencies and operators. This is important in the WIGOS concept – WIGOS must be able to address outside users.

6.6.10 The background of GCW, its mission, initial concept, relation to WMO departments and commissions, and consultations to date were discussed. The observational component of GCW would be part of WIGOS, but given that GCW is not yet operating, and given the schedule of current WIGOS pilot projects, it is recognized that it is unrealistic for GCW to be considered explicitly as a pilot project. Its development however should be WIGOS and WIS compliant.

6.6.11 GCW will serve as an example of partnering with outside agencies, exchange of data and the production of products. GCW will provide authoritative information on the current state and projected fate of the cryosphere for use by the media, public, decision and policy makers.

## **7. PROPOSALS FOR UPDATE OF CONOPS AND WDIP**

7.1 SG-WIGOS considered in detail the WIGOS Concept of Operations and the WIGOS Development and Implementation Plan and elaborated updated versions of these documents to be submitted to the second session of the EC WG on WIGOS and WIS for the consideration.

7.2 When doing so, SG-WIGOS kept in mind the guidance of Cg-XV, EC-LIX and EC-LX regarding the WIGOS concept and initiative towards enhanced integration of WMO observing systems.

7.3 In this regard, SG-WIGOS expressed its concern regarding the time frame for testing the concept and very limited resources provided through secondments of experts and contribution to the WIGOS Trust Fund and/or redirection of existing WMO Secretariat resources in a contrast to the request of EC-LX emphasizing the need of an increased level of resources required in 2008-2011.

7.4 SG-WIGOS reached a common consensus and understanding that integration is a complex

and evolving process. Thus there is a clear need to have detailed conceptual descriptions of WIGOS operations and expected benefits of the integration to make them clear and transparent for all WMO Members as well as for partner organizations and policy makers.

7.5 SG-WIGOS recast the “levels of integration” into “areas of standardisation” that are key features of an integrated system of systems, so as to clarify that the “integrated” is more about systems than data, and be more explicit about a systems of systems approach, underpinned by more coherent coordination, adherence to standards in measurement, metadata, data formats, quality control, documentation, etc.

7.6 SG-WIGOS underlined that for this purpose, a standardized description of all observational networks contributing to WIGOS, including information on the owners of the WIGOS components and generated data, as requested by EC-LX, is urgently needed.

7.7 The updated versions of CONOPS and WDIP are reproduced in Appendices XIV and XV respectively.

## **8. FUTURE WORK PROGRAMME**

8.1 Based on the Terms of the Reference approved by EC-LX as well as the discussion and outcomes of the session, the meeting considered the draft Future Work Programme of the Subgroup on WIGOS.

8.2 When considering the draft during the session, WDIP, mainly its Implementation Phases until Cg-XVI in 2011 were also taken into account to ensure that the activities of the Subgroup as well as deliverables will be in line with them. The draft is reproduced in the Appendix XVI and will be submitted to Chair of the EC WG on WIGOS and WIS for consideration and approval.

## **9. ANY OTHER BUSINESS**

9.1 No item of business requiring the attention of the SG-WIGOS, not covered above, was submitted for consideration.

## **10. CLOSURE OF SESSION**

The session closed at 12.50 hours on Thursday, 13 November 2008.

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**Terms of reference of Subgroup on WIGOS**

- 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 areas of integration of WIGOS including standard practices to be applied to the different areas of WIGOS integration; integration areas being as follows and further described in the WIGOS Concept of Operations:
    - Standardization of instruments and methods observations (instruments and methods of observation levels);
    - Common information infrastructure, (WIS data levels);
    - End-product quality assurance (QM/QA/QC product levels).
  - 3) To work with each WIGOS component, propose new components and coordinate agreed interactions 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 overarching 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.
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**Improvement of Dissemination of Ozone (total column, profiles and surface) and Aerosol observations through WIS**

<b>Project Name</b>	Improvement of <b>Dissemination of Ozone</b> (total column, profiles and surface) and <b>Aerosol</b> observations through the WIS
<b>Acronym</b>	GAW-IDOA
<b>Project Type</b>	WIS-WIGOS Pilot
<b>Project Status</b>	Planning
<b>Project Overview</b>	<p>This pilot will improve availability of ozone and Aerosol Optical Depth (AOD) and surface Particulate Matter (PM) observations to the user community and prepare documentation to help other communities make their observing practices compatible.</p> <p>This pilot project combines activities already proposed by four advisory groups: SAG Ozone, SAG Aerosol, ET-NRT, ET-EGOS. The original proposals as provided to the March 2008 meeting are in annexes to this pilot project document.</p>
<b>Project Aims</b>	<p><i>Improve dissemination of ozone (total column, profiles and surface) and aerosol observations through the WIS (noting that WIS includes the GTS) for:</i></p> <p>Ingestion into atmospheric models using data assimilation</p> <p>Support improved forecasts of weather, surface UV and air quality</p> <p>Verification of models</p> <p><i>by:</i></p> <p>Dissemination on timescales appropriate to the applications</p> <p>Instituting a Rolling Review of Requirements (RRR) Process, as prescribed by the Manual on GOS (WMO-No. 544)</p> <p>Supporting training and capacity building as necessary</p> <p><i>Assist other observing communities to make their observations more widely available by documenting:</i></p> <p>Benefits, challenges and solutions encountered</p> <p>Procedures developed for the ozone and AOD communities</p>
<b>Partners/ Participants</b>	<p><i>Key participants</i></p> <p>MACC partnership (Monitoring Atmospheric Composition and Climate, led by ECMWF) with collaborating environmental agencies, WDCA (World Data Centre for Aerosols), WOUDC (World Ozone and Ultraviolet Radiation Data Centre), CBS, CAS, CIMO, PMOD/WRC, JMA (WDCGG, World Data Centre for Greenhouse Gases), WMO Secretariat</p> <p><i>Also contributing</i></p> <p>Atmospheric composition community, WMO Members, HMEI (HydroMeteorological Equipment Industry Association), Universities</p>
<b>Project cost</b>	<p>Estimates to be confirmed</p> <p>Support for meetings of 3 expert groups: CHF50k</p> <p>One meeting of Ad Hoc group: CHF10k</p> <p>Consultants: 6 months: CHF60k</p>

<b>Funding Source(s)</b>	WIGOS Trust Fund, Government grants
<b>Project Timescale</b>	Report to EC WG on WIGOS/WIS at the end of 2009 on the status of the objectives.
<b>Expected Key Deliverables</b>	<p>Description of deliverables will be provided by the three CAS groups referenced in the project overview in coordination with CBS, using the three areas of interoperability of WIGOS: measurement, distribution (WIS), quality.</p> <p><b>Measurement</b></p> <p>Increase the number of stations delivering observations for use in NWP, air composition forecasting and possibly hazard warning.</p> <p><b>Distribution</b></p> <p>Increase in ozone and AOD observations received by Numerical Weather Prediction (NWP) and other centres (compared with 2008 baseline) on a time scale determined by the RRR</p> <p>“quick look” AOD data available (with initial quality control but without finalized quality assurance) to centres executing experimental sand and dust storm models (Task 6.5 of GAW strategy) on timescales determined by the RRR</p> <p>Document the further enhancements needed for WIS</p> <p><b>Quality</b></p> <p>Standard procedures for quality control in accordance with GAW strategic plan</p>
<b>Project Links</b>	<a href="http://need">http://need</a> a project web site
<b>Project Summary</b>	<p>Ozone and aerosol observations from the GAW network are needed for ingestion into atmospheric models, via data assimilation techniques, in support of improved forecasts of weather, surface UV and air quality. To be useful, the data must be disseminated in near real time, which will benefit in addition such products as the Ozone Bulletins. This project will contribute to the design of activities that enhance the transfer of GAW data in near real time through WIS.</p> <p>A detailed implementation plan is being developed by the three component leads in cooperation with CBS.</p> <p>The project will be implemented on the basis of current programmes and activities, carried out by Expert Teams of CAS, CBS and CIMO. Other relevant Programmes would be involved.</p> <p>The Secretariat and component leads will facilitate the implementation of the project. The WIGOS GOS-GAW Pilot Project Ad-hoc Group Chairman will monitor the results and report to the EC SG on WIGOS/WIS.</p> <p><i>Management outcomes</i></p> <p>Identify the benefits and challenges associated with moving to use of the WIS for data dissemination and integration of GAW data into the work of other Programmes, including hazard warnings</p> <p>Document a procedure that could be used to guide interoperability of other atmospheric chemistry components with WIS/WIGOS and propose changes to the Manual on the GOS and other Technical Regulations where appropriate</p> <p><i>Common to ozone and AOD</i></p> <p>Expand the number of stations submitting ozone and AOD observations to operational users in near real time via WIS</p> <p>Increase the availability and use of ozone and AOD observations to NMHS</p>

	<p>and other user communities</p> <p>Develop and deliver training and provide capacity building to support increased provision and use of the data and products created from the data</p> <p>Update the WMO database of observation requirements to take account of the Rolling Review of Requirements</p> <p>Promote the measurement of ozone and AOD to a common set of standards</p> <p>Identify a set of relevant standards as a candidate for an WMO/ISO standard</p> <p>Standardise on BUFR/CREX format for data distribution</p> <p>Ensure that WIS can distribute the data (including ensuring that telecommunications headers are defined)</p> <p><i>Total Ozone and Ozone Profiles</i></p> <p>Invite NMHSs to make use of the ability of the computer program DOBSON to produce total ozone data in CREX for transmission via WIS on timescales identified by the RRR</p> <p>Encourage NMHSs using Brewer spectrophotometers to implement the subroutine CX.RTN to prepare total ozone data in CREX for transmission via WIS on timescales identified by the RRR</p> <p>Initiate distribution of ozone sounding data from NILU using the WIS</p> <p>Invite producers of sounding systems to upgrade their software to allow production of ozone sounding data in BUFR or CREX</p> <p>Encourage development and implementation of BUFR/CREX encoding programs for other types of instrumentation that measure total ozone or ozone profile observations (eg DOAS, lidars, FTIR)</p> <p><i>Surface Ozone</i></p> <p>Demonstrate routine exchange of hourly data in at least one region</p> <p>Aerosols</p> <p>Develop communications headers for AOD information</p>
<b>Date of Last Update</b>	27 March 2008
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### Hydrological Applications Runoff Network

<b>Project Name</b>	<b>HYDROLOGICAL APPLICATIONS RUNOFF NETWORK</b>
<b>Acronym</b>	<b>HARON</b>
<b>Project Type</b>	WIGOS Pilot
<b>Project Status</b>	Planning
<b>Project Overview</b>	<p>The Implementation Plan for the Global Observing System for Climate (GCOS) in support of the UNFCCC included a call for the development of a baseline observing network, the Global Terrestrial Network – Runoff (GTN-R) as a component to the Global Terrestrial Network-Hydrology (GTN-H), which aims to improve access to near real-time river discharge data for nearly 380 selected gauging stations around the world (<a href="http://grdc.bafg.de/servlet/is/2492/">http://grdc.bafg.de/servlet/is/2492/</a>). In response, the <b>H</b>ydrological <b>A</b>pplications and <b>R</b>un-<b>O</b>ff <b>N</b>etwork (HARON) has been developed aiming towards an integrated approach to the global understanding and continuous monitoring of the availability and variability of the world's freshwater resources.</p> <p>The HARON project has been developed by the Hydrology and Water Resources Branch (WMO-HWRD), jointly with GEO and in particular the Integrated Global Water Cycle Observations (IGWCO) theme of GEO, and participating Organizations.</p> <p>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.</p> <p>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.</p>
<b>Project Aims</b>	<p>The goal of HARON is to observe and analyze surface runoff and lake storage variations to a much higher degree of accuracy and timeliness than has ever been achieved before with the objective to considerably enhance in-situ hydrological measurements supplemented with remote sensing observations to produce integrated, comprehensive datasets that are essential for hydrological research and effective water resources management.</p> <p>Features of this enhanced network include:</p> <ul style="list-style-type: none"> <li>➤ Observations of the run-off of major rivers derived from a rehabilitated network of 380 GTN-R baseline stations operated by the NHSs;</li> <li>➤ Monitoring of water levels of major lakes and reservoirs;</li> <li>➤ Incorporation of new operational technologies, instruments, and methodologies, such as space-borne radar altimetry to determine water levels in rivers, lakes, and reservoirs, with in-situ hydro-meteorological observations from the GTN-R network and SOLS/HYDROLARE;</li> <li>➤ Development of user-oriented information products that make full use of the wealth of observations made accessible by HARON.</li> </ul> <p>Complementary to the WHYCOS programme, HARON is designed specifically to facilitate a global understanding of the time and spatial variability of the principal components of the hydrological cycle.</p>
<b>Partners /</b>	National Hydrological Services engaged in in-situ runoff observations in the

<b>Participants</b>	participating countries would be the major partners in the project. Input would be provided by scientific partners for space research and data in developing interpretation algorithms to convert surface water radar echoes into water levels. Core-partners for the project will include European Space Agency (ESA), the Committee on Earth Observation Satellites (CEOS), WCRP/GEWEX, the Integrated Global Water Cycle Observing (IGWCO), GEO and its members and the Global Data Runoff Centre (GRDC), together with WMO-CHy and Hydrology and Water Resources Programme (HWRP), and the Global Climate Observation System (GCOS).
<b>Project cost</b>	Up to 9 million EURO if all three project phases will be implemented. Detailed cost estimate has been submitted to the EU 7 <sup>th</sup> Framework Programme. Programme Phase I in the order of 3 million EURO.
<b>Funding Source(s)</b>	WIGOS Trust Fund, external funding organizations; Project has been submitted to EU 7 <sup>th</sup> Framework programme for funding. Project will be resubmitted for funding January 2010 to an EU specialized call specifically focusing on HARON objectives
<b>Project Timescale</b>	Report to CHy-XIII in November 2008, project phases total 60 months from start of implementation
<b>Expected Key Deliverables</b>	<p>The <b>short- and medium-term benefits</b> of HARON will be an improved overview of the freshwater resources of the world, thereby supporting water resources management and contributing in a cross-cutting fashion to all Societal Benefit Areas of GEO. It will include development of an implementation plan for a global water cycle data integration system combining water cycle <i>in-situ</i>, satellite data, and model prediction outputs. The <b>long-term benefit</b> will be to support the closure of the global water budget in line with requirements of the Global Climate Observing System (GCOS) and the Global Water Cycle Experiment (GEWEX). It will help disseminate knowledge and support global and regional approaches to scientific research within a modeling and forecasting framework.</p> <p>Capacity Building in order to facilitate the understanding of the observation principles and techniques and to promote interoperability standards would form an essential component of the project. It will assist the national water managers in the use of observation provided through HARON for the improvement of national water management practices.</p> <p>The project will be implemented in three phases, starting from the integration of the GTN-R. In Phase 3, HARON will consolidate integration of hydrological observation networks and facilitate their interoperation with atmospheric networks, including synoptic weather observations and products generated by the Global Climate Prediction Centres that are supported by WMO. One of the priorities of this Phase is the linkage to other Programmes and organizations to encourage increased participation in this global hydrological initiative, leading to the integration of several hydrological systems. In particular, sea-level observations and the integration of environmental networks are seen as a priority for this Phase. This would enable the development of a global framework of observations, reaching from continental observations to the coastal zones into the open oceans. This framework would be particularly enhanced when supported by atmospheric (synoptic) observations, leading to a better understanding of the global water cycle system with a view to pragmatic applications in many sectors of direct human and environmental relevance.</p>
<b>Project Links</b>	Project web site to be established
<b>Project Summary</b>	The project will provide integrated global observations on water –related variables with a focus on continental freshwater fluxes to the oceans from a multitude of <i>in-situ</i> and satellite observation platforms to serve the hydrological research and applications- as well as the climate and ocean communities. The implementation of the project will be in three distinct phases with an overall duration of 60 months

<b>Date of Last Update</b>	27 October 2008
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**Integration of AMDAR into WIGOS**



<b>Project Name:</b>	Integration of AMDAR into WIGOS
<b>Acronym:</b>	WIGOS-PP-AMDAR
<b>Project Type:</b>	Pilot
<b>Project Status:</b>	The WIGOS Pilot Project for AMDAR is currently in the initial stages of collaboration and planning.
<b>Project Overview:</b>	This Project will focus on the practices impacting AMDAR data collection, processing, archiving and dissemination. The standard practices used in observing the atmosphere need to be well documented to ensure sufficient detail accompany the observations so that users can interpret measurements correctly. In addition new methods and procedures will be required in preparation for the deployment of new operational instruments, such WVSSII water vapour sensor.
<b>Project Aims:</b>	Short-term: (1) Development of a standardised BUFR Template for AMDAR; (2) Application of WMO Metadata relevant to AMDAR; (3) Development of a standardised Quality Management Framework for AMDAR data; and (4) Validation and preparation for intercomparison of available Water Vapour sensor performance. Long-term: (5) Update of the AMDAR Reference Manual WMO-No.958; and (6) Development of the framework for generic software specification for AMDAR. <i>Note: In case of lack of resources provided towards the WIGOS-PP-AMDAR, Project Aims will be prioritized accordingly.</i>
<b>Partners / Participants:</b>	AMDAR Panel E-AMDAR and USA AMDAR Programmes WMO Technical Commissions
<b>Project Cost:</b>	Estimated costs for meetings, consultants and publication CHF 125K
<b>Funding Source(s):</b>	This project will make optimum use of the expertise available from the AMDAR Panel and its WIGOS partners. Financial support shall be required through the WMO AMDAR Panel Trust Fund and WIGOS-WIS Trust Fund.
<b>Project Timescale:</b>	Will all be done in parallel and completed by December 2009
<b>Deliverables:</b>	(1) Agreed BUFR Template for AMDAR; (2) Published best metadata practice for AMDAR; (3) Published best practice for Quality Management procedures for AMDAR; (4) Published results from the validation of the available Water Vapour sensors; (5) Updated AMDAR Reference Manual WMO-No. 958; and (6) Agreed framework for generic software specification for AMDAR. <i>Note: In case of lack of resources provided towards the WIGOS-PP-AMDAR, Deliverables will be prioritized accordingly.</i>
<b>Project Links:</b>	<a href="http://www.wmo.int/amdar/">http://www.wmo.int/amdar/</a>
<b>Project Summary:</b>	With the completion of the project aims, AMDAR will be better integrated into WIGOS by adhering to WMO standards for instrumentation, data exchange and for end products.
<b>Date of Last Update:</b>	3/07/2008
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## Integration of AMDAR into WIGOS – Sub Projects

Sub Project	Objective	Who	Action	Deadline	Cost (CHF)
1.	Development of a BUFR Template for AMDAR	<b>Dean Lockett</b> (Jitze v. d. Meulen, Stewart Taylor, Magali Stoll and Dave Helms) in collaboration with the ET-DR&C Validation Centres (to be nominated)	<ol style="list-style-type: none"> <li>1. Investigate the various versions of BUFR templates for AMDAR and their elements currently in use by national and regional AMDAR Programs. Provide specification to ET DR&amp;C;</li> <li>2. Develop a standardised BUFR Template for AMDAR that includes all the new extensions supporting parameters for AMDAR;</li> <li>3. Validation of the AMDAR BUFR Template; and</li> <li>4. Approval of the AMDAR BUFR Template.</li> </ol>	<ol style="list-style-type: none"> <li>1 &amp; 2. Q3 2008</li> <li>3. Q4 2008</li> <li>4. Q1 2009</li> </ol>	20K (2008)
2.	Application of WMO Metadata relevant to AMDAR	<b>(Frank Grooters)</b> Contractor TBD under the guidance of the AMDAR Panel Chairperson, ad-hoc support from WIS Project Office, IPET-MI	<ol style="list-style-type: none"> <li>1. Classify components of metadata associated with AMDAR. In particular, identify metadata needed for describing data and products, metadata needed for usage of data and metadata needed for the operation of the AMDAR observing system;</li> <li>2. Identify metadata for quality control and administration. Also identify relevant policies for the sharing and usage of the metadata, data and products;</li> <li>3. Describe the metadata utilising WMO profile of ISO 19115 to ensure appropriate compatibility with WIS and WIGOS; and</li> <li>4. Create examples and best practice guides for inclusion in the AMDAR Reference Manual and relevant CIMO documents.</li> </ol>	<ol style="list-style-type: none"> <li>1. &amp; 2. Q4 2008</li> <li>3. Q1 2009</li> <li>4. Q4 2009</li> </ol>	20K (2009)
3.	Development standardised procedure for Quality Management of AMDAR data	<b>Jitze v. d. Meulen</b> E-AMDAR QEv in coordination with the AMDAR Science Sub Group, other AMDAR Data Monitoring Centres	<ol style="list-style-type: none"> <li>1. Examine the requirements for Quality Monitoring and Quality Assurance of AMDAR Data;</li> <li>2. Develop a Quality Framework and procedure in support of high quality AMDAR Data to users; and</li> <li>3. Identify potential AMDAR archive centres (DCPCs for WIS).</li> </ol>	<ol style="list-style-type: none"> <li>1. Q4 2008</li> <li>2. Q3 2009</li> <li>3. Q4 2009</li> </ol>	10K (2009)
4.	Validation and preparation for intercomparison of available Water Vapour sensor performance	<b>Dave Helms</b> E-AMDAR Programme in coordination with CIMO ET-UASI	<ol style="list-style-type: none"> <li>1. Perform calibration and flight test and report; and,</li> <li>2. Organize preparatory meeting to define the rules and procedures for the intercomparison of AMDAR and other upper-air data.</li> <li>3. Take part in the WMO Radiosonde Intercomparison, China, 2010</li> </ol>	<ol style="list-style-type: none"> <li>1. Q2 2009</li> <li>2. Q3 2009</li> <li>3. Q2 2010</li> </ol>	<p>40K (2009)</p> <p>40K (2010)</p>

5.	Update of the AMDAR Reference Manual, WMO-No.958	<b>(Frank Grooters)</b> Contractor TBD under the guidance of the AMDAR Science Sub Group, CIMO Rapporteur	<ol style="list-style-type: none"> <li>1. Review those sections of the AMDAR Reference Manual as identified (ensure the full suite of water vapour sensors and their measurements are included, turbulence and icing and future requirements for AMDAR;</li> <li>2. Update to both technical and scientific components of the AMDAR Reference Manual and propose changes to the <i>CIMO Guide</i>; and</li> <li>3. Incorporate input from other sub projects.</li> <li>4. Draft new version of AMDAR Reference Manual</li> </ol>	<ol style="list-style-type: none"> <li>1. Q4 2008</li> <li>2 &amp; 3. Q3 2009</li> <li>4. Q4 1010</li> </ol>	<p>25K (2009) 25K (2010)</p>
6.	Development of the framework for generic software specification for AMDAR	<b>(Frank Grooters)</b> Contractor TBD under the supervision of Stewart Taylor in coordination with AMDAR Panel Technical Sub-Group, Aviation Industry Groups.	<ol style="list-style-type: none"> <li>1. Review all versions of current software specifications currently in use by operational AMDAR Programs; and</li> <li>2. Provide framework for the development of the generic software solution for AMDAR.</li> </ol>	<ol style="list-style-type: none"> <li>1. Q1 2009</li> <li>2. Q4 2009</li> </ol>	<p>10K (2009) 20K (2010)</p>

**Elaboration of the underpinning/crosscutting role and responsibilities of the Instruments and Methods of Observation Programme and CIMO in the context of WIGOS**

<b>Project Name</b>	Elaboration of the underpinning/crosscutting role and responsibilities of the Instruments and Methods of Observation Programme and CIMO in the context of WIGOS
<b>Acronym</b>	N/A
<b>Project Type</b>	Pilot
<b>Project Status</b>	The pilot is currently in its initial stage of collaboration and planning.
<b>Project Overview</b>	This pilot is directed at defining the CIMO's role and responsibilities within the WIGOS-WIS framework. Once these proposed role and responsibilities (Terms of Reference (TOR)) are endorsed by the EC-WG-WIGOS/WIS and Sub-group on WIGOS, the proposal will be tested and demonstrated across the remaining WIGOS Pilot and Demonstration Projects to prove the effectiveness of the proposed TOR in addressing the WIGOS needs.
<b>Project Aims</b>	Phase 1 of this project is to elaborate the underpinning / crosscutting role of CIMO in WIGOS (TOR for CIMO in the context of WIGOS). Phase 2 of this project is to develop and implement a plan which demonstrates the process by which CIMO fulfils its newly EC-agreed role and responsibilities within the WIGOS framework.
<b>Partners/Participants</b>	Phase 1: All WMO Technical Commissions and Co-sponsored Programmes and related International Organizations. Phase 2: Selected WIGOS Pilot & Demonstration Projects relevant to the CIMO-PP.
<b>Funding Source(s)</b>	The two phases of this project will, to the maximum extent possible, make use of the expertise to be provided through the working structure of CIMO and its WIGOS partners. Additional support will be required through the WMO budget and/or WIGOS-WIS Trust Fund.
<b>Project Timescale</b>	Phase 1: pilot project proposal for the role of CIMO within WIGOS and draft implementation plan development; fourth quarter 2008. Phase 2: Implementation: 2009-2011.
<b>Expected Key Deliverables</b>	Phase 1: Proposed CIMO TOR within WIGOS and draft proposal for implementation. Phase 2: Project implementation, periodic evaluation and management, a report with recommendations.
<b>Project Links</b>	<a href="http://www.XXXXXXXXXXX">http://www.XXXXXXXXXXX</a>
<b>Project Summary</b>	The CIMO Pilot Project is in the first stages of development
<b>Date of Last Update</b>	01/02/2008
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**Role and Responsibilities of the Commission for Instruments and Methods of Observation (CIMO) within the framework of the WMO Integrated Global Observing System (WIGOS)**

Within the framework of the WMO Integrated Global Observing System (WIGOS)

The Commission shall be responsible for matters relating to international standardization, compatibility and sustainability of instruments and methods of observation of meteorological, climatological, hydrological, oceanographic, and related geophysical and environmental variables.

This responsibility underpins all observations within WIGOS, and will be carried out in close consultation with relevant WMO partner organizations that co-sponsor, own and/or operate some of the observing systems.

This shall include in particular (priority to be defined at later stage):

- (a) Addressing the requirements across all elements of WIGOS for standardized and compatible observations, including data content, quality and metadata;
  - (b) Providing advice, studies and recommendations concerning effective and sustainable use of instruments and methods of observation, including methods for testing, calibration and quality management consistent with the WMO Quality Management Framework ;
  - (c) Conducting and/or coordinating global and regional field intercomparisons and functional testing of instruments and methods of observation;
  - (d) Promoting the development of measurement traceability to recognized international standards, including reference instruments and effective hierarchy of world, regional, national and lead centres for instrument calibration, development and testing;
  - (e) Promoting compatibility, inter-calibration, integration and inter-operability with respect to both, and between, space-based and surface-based (*in situ* and remote sensing) observations, including conducting testbed observing experiments;
  - (f) Encouraging research and development of new approaches in the field of instruments and methods of observation of meteorological, climatological, hydrological, oceanographic, and related geophysical and environmental variables;
  - (g) Promoting the appropriate and economical production and use of instruments and methods of observation with particular attention to the needs of developing countries;
  - (h) Supporting training and capacity building activities in the area of instruments and methods of observation.
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**Integration of marine meteorological and other appropriate oceanographic observations  
into the WMO Integrated Global Observing System**

<b>Project Name</b>	<b>JCOMM Pilot Project for WIGOS</b>
<b>Acronym</b>	N/A
<b>Project Type</b>	Pilot
<b>Project Status</b>	The pilot has defined a detailed implementation plan at the meeting of the joint Steering group for the IODE Ocean Data Portal (ODP) and the WIGOS Pilot Project for JCOMM (Geneva, 18-19 September 2008). The Project plan was defined at the <i>ad hoc</i> planning meeting for the JCOMM Pilot Project for WIGOS (Ostend, Belgium, 29 March 2008). Mechanisms have been defined for providing input to the CIMO Guide (WMO No. 8) and other appropriate JCOMM documentation. A standards process for developing ocean data standards is being established in cooperation with IOC. The development of a JCOMM Catalogue of Best Practices and Standards is planned. Thirteen key potential partners have been identified (see below) for providing data through WIS. The Pilot Project is considering establishing regional marine instrument centres. It is engaging in a stronger cooperation with HMEI.
<b>Project Overview</b>	Development of the Pilot Project is coordinated by a Steering Group, providing liaison with appropriate WMO Programmes and Technical Commissions, the WMO EC-WG on WIGOS-WIS (and its sub group), and the International Oceanographic Data and Information Exchange (IODE) of IOC. The Steering Group is responsible for producing the Pilot Project Plan and promoting the continued development and implementation of a system of interoperable systems that provides consistent, documented data and information of known quality from a sustained and coordinated global ocean observing system. Three components are proposed in the development of the Pilot Project: (i) promote and document instrument best practices and related standards, (ii) build marine data systems that are interoperable with WIS, and (ii) promote quality management and standards. The Project will recognize and respect the ownership of all partner organizations as well as the WMO and IOC data policies.
<b>Project Aims</b>	<p>Enable the integration of marine and other appropriate oceanographic observations (in situ, surface marine and satellite), real time and delayed mode data and products (e.g. models) within the oceanographic marine community. The Pilot Project will also consider assembled in situ fields, biochemistry, model outputs, surface and underwater marine climatologies and measurements.</p> <p>The Pilot Project will aim at making the appropriate identified data sets interoperable with the wider WMO and IOC communities. It will develop and agree on consistent standards to be used across the community. It will increase accessibility of data; ensure standards and best practices; as well as set guidelines regarding Capacity Building and training programme.</p>

<p><b>Partners/Participants</b></p>	<ul style="list-style-type: none"> <li>• International organizations co-sponsoring GOOS: WMO, IOC, UNEP and ICSU</li> <li>• WMO and IOC Technical Commissions and Programmes (e.g. CIMO, CBS, GOOS and IODE)</li> <li>• WMO Information Systems and its Expert Teams, ICT-WIS</li> <li>• Ocean Data Portal and ETDMP Task Team on ODP/JCOMM Pilot Project WIGOS</li> <li>• ETDMP Task Team on standards process</li> <li>• IODE Ocean Data and Information Networks (ODINs)</li> <li>• JCOMM E2E prototype (Russian Federation NODC, Obninsk)</li> <li>• Instrument centres</li> <li>• Observing Panels</li> <li>• Association of Hydro-Meteorological Equipment Industry (HMEI)</li> <li>• Partners hosting relevant data sets (<i>in situ</i>, space based ocean observations data sets, as well as products)             <ul style="list-style-type: none"> <li>○ Integrated data sets                 <ul style="list-style-type: none"> <li>▪ The World Ocean Database (WOD);</li> <li>▪ SeaDataNet;</li> <li>▪ The Global Temperature and Salinity Profile Programme (GTSP);</li> </ul> </li> <li>○ Data from specific networks                 <ul style="list-style-type: none"> <li>▪ Argo profiling float data;</li> <li>▪ RNODC/DB (drifter data);</li> <li>▪ XBT data;</li> <li>▪ Instrument / platform metadata (META-T, ODASMS);</li> </ul> </li> <li>○ Remote sensing                 <ul style="list-style-type: none"> <li>▪ The Virtual constellation for Ocean Surface Vector winds;</li> <li>▪ The GODAE High-Resolution SST (GHRSSST) Pilot Project;</li> <li>▪ Surface based remote sensing (e.g. HR Radar);</li> </ul> </li> <li>○ Climatologies                 <ul style="list-style-type: none"> <li>▪ World Ocean Atlas (WOA)</li> <li>▪ Marine Climatological Summaries, e.g. Delayed-mode VOS data collected by the Global Collecting Centres (GCCs)</li> <li>▪ Blended quality climatology products such as the International Comprehensive Ocean-Atmosphere Data Set (ICOADS)</li> </ul> </li> <li>○ Metadata about the platforms/instruments (e.g. META-T)</li> </ul> </li> <li>• Additional participants and partners to be discussed and defined</li> </ul>
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<b>Funding Source(s)</b>	<p>The project will, to the maximum extent possible, make use of the expertise to be provided through the working structure of JCOMM, IOC IODE, and its WIGOS partners. Additional support will be required through the WMO budget and/or WIGOS-WIS Trust Fund.</p> <p>Implementation costs will be met by the Members.</p>
<b>Project Timescale</b>	<p>2007 – Mid-2008: Establishment of the Pilot Project and proposal for its Steering Group Terms of Reference and Membership;</p> <p>Sept 2008: First meeting of the Pilot Project Steering Group; Adoption of the project implementation plan</p> <p>Nov/Dec 2008: Reporting to the WMO EC WG WIGOS-WIS;</p> <p>End 2008 – 2009: discussions with partner observing programmes (DBCP, SOT, GLOSS, Argo, etc.) and organizations (IOC and IODE);</p> <p>November 2009: Third Session of JCOMM;</p> <p>2010-2011: Implement the projects;</p> <p>End 2010: Report to Congress XVI finalized;</p> <p>Implementation schedule will depend upon how well WIS is progressing.</p>
<b>Expected Key Deliverables</b>	<p>The Pilot Project will address Result Based Management of WMO and IOC (i.e. it will link its deliverables to the Expected Results).</p> <p>The Pilot Project will have the following deliverables:</p> <ul style="list-style-type: none"> <li>(i) Business plan to be used by the directors of NMHS and Oceanographic institutes to make the case at the national level for engaging in the necessary developments, funded nationally, to meet the requirements for the Pilot Project;</li> <li>(ii) Project Plan;</li> <li>(iii) Implementation Plan;</li> <li>(iii) Documenting and integrating instrument best practices and related standards among the marine meteorological and oceanographic communities;</li> <li>(iv) Build marine and oceanographic data systems that are interoperable with the WMO Information System (WIS) in close cooperation with the IOC ocean community;</li> <li>(v) Promote quality management and standards and establishing compliance with the WMO Quality Management Framework (QMF);</li> <li>(vi) Participation in the CBS Rolling Review of Requirements (RRR) process and provide input to the WMO Database (instrument performances and requirements).</li> </ul>
<b>Project Links</b>	<p><a href="http://www.wmo.int/pages/prog/www/wigos/index_en.html">http://www.wmo.int/pages/prog/www/wigos/index_en.html</a></p> <p><a href="http://www.oceandataportal.net">http://www.oceandataportal.net</a></p> <p><a href="http://www.oceandatastandards.org">http://www.oceandatastandards.org</a></p>



<b>Project Summary</b>	<p>The Pilot Project is an interdisciplinary exercise seeking the integration of <i>in situ</i> and space based observing systems. These will be implemented and sustained by the WMO and IOC Members through JCOMM in order to make appropriate data sets available in real-time and delayed mode to WMO and IOC applications through interoperability arrangements with the WIS and ODP. The data sets will be produced according to agreed upon standards and the quality control procedures documented according to QMS principles. This integration will enhance the coherence and consistency of the data sets and the availability of relevant instrument/platform metadata. More timely and better quality data will be expected while duplicates will be minimized.</p> <p><b>-1- Documenting and integrating best practices and standards.</b> The goal is to define and agree on common standards between the meteorological (WMO) and oceanographic (IOC) communities for instruments and methods of observation as well as subsequent organization and handling of the data and information to serve consistent and better quality data to both the broad user and modelling communities.</p> <p><b>-2- Making marine data systems and WIS interoperable.</b> The goal is to provide access to marine meteorological and oceanographic data and information to serve a number of applications, including climate. This shall be done in an integrated way via the WIS and thereby facilitating access to well documented and standardized data. Much work remains to develop interoperability between the WMO and IOC communities at both the data discovery (metadata) and data level (compatible formats). The Pilot Project will address these two aspects.</p> <p><b>-3- Quality Management.</b> The goal is to coordinate the development of cost-effective Quality Management Systems by Members and to propose practical solutions or examples. At different steps of the data production line, it is expected that improved quality management will result in better, timelier data, minimized duplication, and an operational data delivery system. This will be achieved through the compilation of regulatory documentation in a way consistent with the eight <a href="#">Quality Management Principles</a> developed under ISO/TC176/SC2/WG15 (User/customers focus, Leadership, Involvement of people, Process approach, System approach to management, Continual improvements, Factual approach for decision making and, Mutually beneficial supplier relationships).</p>
<b>Date of Last Update</b>	19/09/2008
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**WIGOS Demonstration Project - Kenya**

<b>Project Name</b>	WIGOS Demonstration Project in Kenya
<b>Acronym</b>	WDP
<b>Project Type</b>	Demonstration Project
<b>Project Status</b>	In Progress
<b>Project Overview</b>	<ul style="list-style-type: none"> <li>• Kenya is in support of the EC Working Group on the WMO Integrated Global Observing System and the WMO Information System (EC WG WIGOS-WIS) for the WIGOS-WIS implementation. Through the Kenya Meteorological Department (KMD), Kenya has accepted to implement the WIGOS Demonstration Project (WDP).</li> <li>• Three Focal points have been nominated for coordination of the WDP.</li> <li>• A committee has been formed for the project implementation with the following terms of reference.</li> <li>• Take inventory of all the observational systems in KMD. These will include land , sea, and upper air observations</li> <li>• Consider stake holders who have environmental observational systems.</li> <li>• Integrate data and products from all the observational systems in KMD into one Information system taking into account the WMO recommended data formats where applicable.</li> <li>• Consider Data from other stakeholders and integrate it into the Information system.</li> <li>• Develop a KMD Meteorological Information Processing System (MIPS)</li> <li>• Develop a KMD Meteorological Climatological Data Bank (MCDB) with a well defined Meta data for push and pull of data into GTS.</li> <li>• Consider the status of the existing GTS and make recommendations on its improvements.</li> <li>• Give a progress report every three months to the Director for forward transmission to WMO.</li> <li>• In support of this project KMD is in the process of procuring an Integrated Meteorological Information System (IMIS) which is in the national Budget for the 2008-2009 financial year.</li> </ul>
<b>Project Aim</b>	The aim of this Project is to integrate all national observation systems including land, sea, and upper air observations from the NMHS network and other national observing networks that provide the delivery of time critical data and products. Feedback and lessons learnt from these projects will be beneficial in understanding expectations of WIGOS/WIS concept implementation.
<b>Partners/ Participants</b>	<ul style="list-style-type: none"> <li>• The university of Nairobi</li> <li>• Kenya Agricultural Research Institute (KARI)</li> <li>• Kenya Sugar Authority (KSA)</li> <li>• Kenya Maritime Authority (KMA)</li> <li>• Lake Victoria Environmental Programme (LVEP)</li> </ul> <p>List will be updated once all partners are established</p>
<b>Funding Sources</b>	The implementation of the Project will be from the National Budget and support through WMO VCP and WGOS&WIS Trust Fund.
<b>Overall Project Costs</b>	Estimated at being around US\$ 4,000,000
<b>Project Timescale</b>	2008 – 2011
<b>Expected Key Deliverables</b>	<ol style="list-style-type: none"> <li>1. Homogeneity, interoperability and compatibility of observations from related observation networks;</li> <li>2. Conformity of data and information generated by observation networks with a comprehensive, standardized set of WIS data and information</li> <li>3. A well defined meta data catalogue at WIS level</li> </ol>

<b>Project Links</b>	To be provided later
<b>Project Summary</b>	To be given periodically
<b>Date updated</b>	9/11/2008
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**WIGOS Demonstration Project in Morocco**

<b>Project Name</b>	WIGOS Demonstration Project in Morocco
<b>Acronym</b>	WDP Morocco
<b>Project Type</b>	Demonstration Project
<b>Project Status</b>	In Progress
<b>Project Overview</b>	<p>The WDP aims to improve the climatic and meteorological data quality of the Surface observing Network of the National Meteorological Service of Morocco. This could be accomplished through the achievement of the two following standardization and traceability actions:</p> <ul style="list-style-type: none"> <li>• Strengthening material capacities and human knowledge of the Moroccan Regional Instrumentation Center (RIC) for AR-I and improving its technical procedures to allow it to accomplish its task of calibration in link to recognized Metrological International chain ,</li> <li>• Establishment of Metadata catalogues of the whole synoptic, marine, aeronautic and automatic weather stations constituting the Moroccan Meteorological Surface observing Network.</li> </ul> <p>The reinforcement of Moroccan RIC capacities should be procured in four big domains:</p> <ol style="list-style-type: none"> <li>a) Setting up of laboratories and purchase of standardization devices;</li> <li>b) Quality Insurance and control;</li> <li>c) Training;</li> <li>d) Assessment of the RIC.</li> </ol> <p>In order to reinforce RIC material capacities, the following actions are planned:</p> <ul style="list-style-type: none"> <li>▪ Renewing and calibrating existing standards of RICs,</li> <li>▪ Acquisition of new high accuracy standards and calibrating equipments,</li> <li>▪ Support in developing appropriate calibration/maintenance procedures, etc...</li> <li>▪ Achieving or purchase of appropriate calibrating software, historical databases and traceability system.</li> </ul> <p>Training and sensitization activities are also expected and could concern:</p> <ul style="list-style-type: none"> <li>▪ Organizing theoretical and practical courses on metrology for RIC Staff,</li> <li>▪ Organizing special workshops and sensitisation actions for some surface network observers on the importance of calibration and Metadata and the interest of the respect of WMO standards in matter of instrumentation and meteorological methods of observation,</li> <li>▪ Conducting visits to RIC of advanced countries.</li> </ul> <p>The demonstration project integrates also the aspect of Quality insurance and control. For this purpose, the following actions are planned:</p> <ul style="list-style-type: none"> <li>▪ Organizing quality circles for the RIC staff on 17025 requirements,</li> <li>▪ Establishing Quality Manuals,</li> <li>▪ Preparing the certification of the RIC.</li> </ul> <p>A real involvement and technical support of WMO experts and responsible of RIC of advanced countries will be very useful for the achievement of the goals of the project.</p> <p>As a demonstration project, Sub Group on WIGOS should define the manner to assess the real progress of the achievement of the actions</p>

	mentioned above based on regular reports and deliverables.
<b>Project Aim</b>	<p><u>In the short term:</u></p> <ol style="list-style-type: none"> <li>1. homogeneity and reliability of observations,</li> <li>2. conformity of data and information generated by Surface observation Network with international standards and requirements,</li> <li>3. sensitization to the importance of standardization, calibration and traceability in the improvement of quality of climatic and meteorological data,</li> <li>4. strengthening coordination and partnership between RIC and other RICs.</li> </ol> <p><u>In the mean term:</u></p> <ol style="list-style-type: none"> <li>1. Standardizing and achieving calibrating operations for the surface observing network of Moroccan NMS Partners (surface network of: ministry of agriculture and water resource management)</li> <li>2. Experience share and knowledge transfer with other RICs and NMHS of the AR-I</li> </ol>
<b>Partners/Participants</b>	Moroccan National Meteorological Service, Water resources management department, Hydrologic Agencies, Ministry of agriculture, Private sector.
<b>Funding Sources</b>	The demonstration project will need consequent financial resources. NMS of Morocco could take into charge some actions but additional financial resources are expected through WMO VCP, GCOS and WIGOS/WIS Trust Fund.
<b>Overall Project Costs</b>	Estimated at being around US\$ <b>750.000</b>
<b>Project Timescale</b>	2008 – 2010
<b>Expected Key Deliverables</b>	<p>Regular reports including:</p> <ul style="list-style-type: none"> <li>▪ Report of each event organized (Training, workshop and visits);</li> <li>▪ Document including technical characteristics of standards, calibrating equipments and appropriate software acquired;</li> <li>▪ Technical report of calibrating operations achieved in laboratory;</li> <li>▪ Technical report of calibrating operations and controls achieved on site;</li> <li>▪ Report describing collecting metadata progress.</li> </ul> <p>The first report is expected in January 2009.</p>
<b>Project Links</b>	Not established at this time
<b>Project Summary</b>	The project summary and progress status reports are to be provided on yearly basis, or in case of need.
<b>Date Last Updated</b>	10/11/2008
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**WIGOS Demonstration Project of the Republic of Korea**

<b>Project Name</b>	<b>Establishment of a Common Information Infrastructure for Meteorological Observation Data</b>
<b>Acronym</b>	KMA-WIGOS
<b>Project Type</b>	Demonstration Project
<b>Project Status</b>	Active
<b>Project Overview</b>	<p>Goal:</p> <p>Integration and co-use of meteorological observation data produced by diverse domestic agencies</p> <p>Strategy:</p> <p>To achieve the goal through implementing the following three tasks in phases:</p> <ul style="list-style-type: none"> <li>• Standardization of observation environment: to implement the standards for data acquisition process;</li> <li>• Quality control of observation data: to implement QA/QC procedures recommended by WMO Technical Regulations; and</li> <li>• Co-use of observation data: to use commonly the data via internet site.</li> </ul> <p>Contents of Implementation</p> <p><u>Standardization of Observation Environment</u></p> <p>To enforce the Meteorological Observation Standardization Law</p> <p>Role of the Korea Meteorological Administration (KMA):</p> <ul style="list-style-type: none"> <li>• technological support to other observation institutes</li> <li>• enforcement of standardization policies</li> <li>• optimization of meteorological observation network</li> <li>• establishment of common use of data via WIS</li> </ul> <p>Role of observation institutions:</p> <ul style="list-style-type: none"> <li>• standardization of observation equipment</li> <li>• production of observation data and transmitting them to KMA</li> <li>• purchase, installation and maintenance of meteorological observation equipment</li> <li>• training of observation workforce</li> <li>• regular maintenance and calibration of observation equipment</li> </ul> <p><u>Quality Control of Observation Data</u></p> <p>To establish quality assurance system implementing Quality Management System for Meteorological Observational Data (QMSMOD)</p> <p>Target data from: AWSs; radiosondes and wind profilers; marine data buoys and light beacons; and PM10 for Asian sand and dust storms</p> <p><u>Co-use of Observation Data</u></p> <p>Establishment of a Common Information Infrastructure for Meteorological Observation Data</p> <p>To establish a common data service system</p> <p>Types of infrastructure for data service: Web portal, Web to web, FTP</p> <p>Function: collection, data management and distribution of meteorological data and metadata</p> <p>Purpose: to support national disaster prevention such as prevention,</p>

	<p>protection, response, and rehabilitation of disaster by providing meteorological data and products including forecasts and early warnings</p> <p>web portal - <a href="http://metsky.kma.go.kr">http://metsky.kma.go.kr</a></p> <p>web-to-web : selective data service using XML</p> <p>data transmission via FTP</p> <p>Expected results</p> <p>To perform a Role Model for WIGOS via demonstrating to countries in Region II the integration and joint usage system of meteorological observation data produced by various domestic institutions</p>
<b>Project Aim(s)</b>	To maximize common usage of meteorological observation data and support integrated meteorological information
<b>Partners/Participants</b>	KMA, local governments, public sector, etc.
<b>Funding Source(s)</b>	Current budget of KMA and the participating institutions.
<b>Overall Project Costs</b>	Estimated around US\$3,800,000
<b>Project Timescale</b>	2008-2011 (ongoing project)
<b>Expected Key deliverables</b>	Efficient and cost-effective national observing network. National early warning and natural disaster prevention system.
<b>Project Links</b>	<a href="http://www.kma.go.kr/WIGOS/index.html">http://www.kma.go.kr/WIGOS/index.html</a> (tentative)
<b>Project Summary</b>	KMA is to provide and update the procedure of this Project implementation on yearly basis
<b>Date Last Updated</b>	07/05/2008
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**WIGOS Demonstration Project of Brazil**

<b>Project Name</b>	<b>System for Meteorological Information and Quality Control</b> Centro de Controle da Informação Meteorológica
<b>Acronym</b>	CCIM – II
<b>Project Type</b>	Demonstration Project in RA-III, Brazil
<b>Project Status</b>	Phase I of the system implemented and functioning. Review the specification for the second phase to meet WIGOS requirements
<b>Project Overview</b>	The project started as a tool to control the status of INMET's observing network, including communication links, installation and maintenance teams. The idea is to include in phase II of the system additional specifications to meet WMO developments and guidance, such as standard catalog of products, availability of metadata to server DAR requirements. New types of data will be included on the data bank.
<b>Project Aim(s)</b>	Review the specifications with the view of the WMO future developments of WIGOS and WIS.
<b>Partners/Participants</b>	National Meteorological Institute (INMET) and a partner private company
<b>Funding Source(s)</b>	Government budget allocated to INMET
<b>Overall Project</b>	Estimated at US\$ 1.5 million
<b>Project Timescale</b>	2009 – 2011
<b>Expected key Deliverables</b>	Operationally available by 2011 (1) Control the status of the observational network (2) control the status of the communication links (3) data bank synchronization (4) standard metadata (5) automatic meteorological product generation (6) monitoring tools (7) development under free software solution
<b>Project Links</b>	Not available at the moment
<b>Project Summary</b>	To be translated from Portuguese
<b>Date Last Updated</b>	May 2008
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## **WIGOS Demonstration Project of the United States of America (USA)**

### **PROJECT NAME**

United States of America/RA IV-WIGOS Demonstration Project for an Integrated Atmosphere Observing System

### **ACRONYM**

WDP-IAOS

### **PROJECT TYPE**

Demonstration Project, Regional

### **PROJECT STATUS**

Development/Active

### **PROJECT OVERVIEW**

The WMO Integrated Global Observing System (WIGOS) is a comprehensive, coordinated and sustainable system of observing systems. WIGOS is based on all WMO Program's observational requirements and ensures availability of required information and facilitates access by the WMO Information System (WIS). WIGOS includes four broad objectives: i) improve management and governance of component systems; ii) increase interoperability between the various systems; iii) address atmospheric, oceanic and terrestrial/hydrological domains; and, iv) ensure that broader governance frameworks and relationships with other international initiatives are sustained and strengthened.

The proposed US/RA IV WIGOS Demonstration Project (WDP) endeavors to build an Integrated Atmosphere Observing System (IAOS) with enhanced interoperability features through the integration of various component systems representing surface-based upper-air observations such as rawinsondes, airborne observations including AMDAR from RA IV Member countries, and space-based observations derived from satellite soundings. Interoperability will be facilitated through metadata catalogues and archival sites consistent with evolving WIS architecture. The Project will be developed in an incremental manner. The goal of the WDP-IAOS is to provide the means to access and integrate, in a relatively transparent manner, data from a variety of atmosphere observing platforms to provide a volumetrically consistent set of basic kinematic and thermodynamic variables of the atmosphere over both terrestrial and marine environments with ensuing improvements to Numerical Weather Prediction. The Project can also be considered a step towards implementing GEOS.

Important aspects of the WDP-IAOS include development of metadata catalogues across RA IV, ensuring a common information infrastructure consistent with WIS plans for data (and products) generated by the IAOS, and quality assurance. To steer and monitor integration activities, a Rolling Review of Requirements mechanism, as stipulated in the Manual on the GOS (WMO-No. 544) will be applied. Further, the WDP will be a constituent component of the WIGOS Development and Implementation Plan. NOAA's National Weather Service (NWS) will take the lead and work with RA IV Members to further develop the WDP-IAOS concept recognizing specific needs of the Region, but also considering the broader Regional interests.

### **PROJECT AIMS**

The proposed WDP-IAOS will assess issues appropriate to the development of a regional capacity to integrate observations from various atmosphere observing platforms such as rawinsonde, AMDAR, wind profilers, Doppler radar, satellite (vertical profile and occultation), RF attenuation (GPS-Met) and other emerging sensing systems. The Project will consider national and regional requirements in the design of enhanced interoperability features through the integration of the various component observing systems and the establishment of appropriate information management architecture consistent with WIS goals. The proposed WDP-IAOS will consider the results of the assessments and feasibility studies to commence a phased implementation of the demonstration

project within the scope of current and planned WIGOS and WIS-related programs and available national budgets.

### **PARTNERS/PARTICIPANTS**

The NOAA National Weather Service is the lead partner for the proposed WDP-IAOS. We will work with Member NMHSs of WMO's Regional Association IV (North America, Central America and the Caribbean) to accomplish this Regional WDP. We will engage various national and regional institutions and the private sector as appropriate.

### **FUNDING SOURCES**

The Regional WDP will rely on current and planned budget allocations at the national level to implement the WIGOS framework and WIS infrastructure. The Project will build on existing national and regional observing systems and information management infrastructure. Extraordinary budget resources will be considered and sought when and where necessary to advance the implementation of specified aspects of the WDP, particularly at the regional level.

### **OVERALL PROJECT COSTS**

To Be Determined

### **PROJECT TIMESCALE**

We envision an approach involving assessments and feasibility studies followed by a phased implementation. The availability of the basic elements of the WDP-IAOS will be determined as the project's implementation plan is developed.

### **EXPECTED KEY DELIVERABLES**

Key deliverables and timelines will be defined upon completion of the phased implementation plan. The intent of the Demonstration Project is improved use of atmospheric sensing resources throughout the Region (WIGOS component) and to improved access to atmospheric data for both operational and research purposes (WIS component). The defining characteristics include:

- (1) homogeneity, interoperability and compatibility of observations from related atmosphere observation platforms;
- (2) conformity of data and information generated by the atmosphere observing systems with comprehensive, standardized set of WIS data presentation and exchange requirements;
- (3) conformity of various end-products generated on the basis of the atmosphere observations/measurements with Quality Management Framework requirements to ensure best possible products available to users.

### **PROJECT LINKS**

Not established at this time

### **PROJECT SUMMARY**

Not available

### **CONTACTS**

US, Members of RA IV, Secretariat

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**Demonstration Project: Implementing a Composite Observing System**

<b>Project Name</b>	WIGOS Demonstration Project – Australia / RA V – Implementing a Composite Observing System
<b>Acronym</b>	WDP ImpCOS
<b>Project Type</b>	Demonstration Project (within Regional Association V)
<b>Project Status</b>	In progress
<b>Project Overview</b>	<p>The implementation of a Composite Observing System model is currently underway in the Australian Bureau of Meteorology. In earlier approaches, new technologies and new sources of observations tended to be adopted as supplementary and additional to existing core observing methods. The new model requires a genuinely integrated and balanced mix of surface based and space based observations with an emphasis on automation, new technology and access to observations from external sources. This integration must be tackled at each of the three WIGOS integration levels to ensure standardisation of instruments and methods of observation, common information infrastructure, and end-product quality assurance. Similarly, it is important to achieve an integrated approach at what may be considered a fourth level and that is the assessment of requirements leading to national network planning and design.</p> <p>This project will document the processes followed in pursuit of an integrated Composite Observing System and the experiences gained to date and over the coming three years as implementation progresses. It may be possible, through collaboration with other NMHS, to provide a comparative assessment of experiences with those of other Member countries.</p>
<b>Project Aim(s)</b>	<p>The aims of the project are to:</p> <ol style="list-style-type: none"> <li>1. document the process and experiences of the Australian Bureau of Meteorology in developing and planning for the implementation of a Composite Observing System. This includes working with users to assess requirements, a review of the existing national Observing System, assessment of its adequacy in meeting current and future requirements, identifying future opportunities, prioritizing, then deciding a strategy matched to available resources;</li> <li>2. review and document the implementation of a Composite Observing System strategy, including the translation from plan to reality, the extent to which the strategy provides a robust basis for tackling budget compromises and system/output/methodology/user decision points, and the effectiveness and sustainability of the outcomes;</li> <li>3. resulting from the above, to demonstrate to Member countries of WMO the feasibility of sustaining a highly integrated Composite Observing System including an integrated view of user requirements, an integration of observations from many sources inside and outside the NMHS, and an integration of observations from different technologies with a range of characteristics.</li> </ol>
<b>Partners/Participants</b>	Australian Bureau of Meteorology; collaborating NMHS (TBA)
<b>Funding Source(s)</b>	This project will rely on existing budget allocations at the national level. Additional funding may need to be sought to facilitate some elements such as collaboration with other NMHS.
<b>Overall Project Costs</b>	To be determined
<b>Project Timescale</b>	2008 – 2011

<b>Expected Key Deliverables</b>	<p>ImpCOS will produce an initial report on process and experiences in early 2009, followed by a number of progressive status reports up until late 2011. Further details to be developed in an implementation plan for ImpCOS.</p> <p>The deliverables resulting from the implementation of the Bureau's Composite Observing System (BCOS) include:</p> <p>(1) homogeneity, interoperability and compatibility of observations from related components;</p> <p>(2) conformity of data and information generated by BCOS with a comprehensive, standardized set of WIS data presentation and exchange requirements;</p> <p>(3) conformity of various end-products generated on the basis of BCOS observations/measurements with Quality Management Framework requirements to ensure best possible products to be delivered to end users.</p>
<b>Project Links</b>	To be advised
<b>Project Summary</b>	To be advised
<b>Date Last Updated</b>	05/Nov/2008
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**CONCEPT OF OPERATIONS (CONOPS)***(Version 1.1.1 November 2008)**(CONOPS updated by SG-WIGOS-1 reflecting the status of development and implementation of initiated Pilot and Demonstration Projects)***Foreword**

There is a broadly recognized need for a comprehensive, coordinated and sustainable global observing system which integrates diverse space- and surface-based observing systems in a holistic approach. Many international agencies have to administer systematically these diverse systems and have developed data policies to meet their needs. The WMO Integrated Global Observing System (WIGOS) is the organizational response of WMO to this need for integration. Strong cooperation is therefore needed among all partners to accomplish the broad integration objectives.

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

WIGOS will be a comprehensive, coordinated and sustainable system of observing systems based on the observational requirements of all WMO Programmes. It will be a framework facilitating standardisation and interoperability and will ensure availability of, and real-, near-real-time and non-real-time access to required good-quality data and products and associated metadata through the WMO Information System (WIS) in accordance with identified temporal and spatial requirements; required data quality standards will be documented, met and sustained. In doing so, it will respect partnership, ownership and data-sharing policies of all observing components and partner organizations.

The components of WIGOS (surface and space-based) will be as follows: weather observing networks, atmospheric composition observing networks; radiation observing networks; marine meteorological and relevant oceanographic networks; hydrological observing networks; relevant components of atmospheric, hydrologic, oceanographic and terrestrial observing systems contributing to GCOS, and others yet to be specified. Improved monitoring through the integration of surface- and space-based observations is essential for understanding global climate change, optimizing knowledge of current environmental conditions and exploitation of this information for predictive weather, climate and water products and services.

WIGOS development and implementation will proceed in parallel with the planning and implementation of 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.

The concept of WIGOS is based on the premise that agreed-upon standards and recommended practices and procedures will apply to all WMO and sponsored observing systems and Programmes.

## **1. INTRODUCTION**

### **1.1 Vision**

WIGOS will benefit society through enhanced availability and integration of global weather, climate and water observations contributed by constituent systems.

### **1.2 Purpose**

The purpose of WIGOS is to create an organizational, programmatic, and 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.

### **1.3 Integration**

Integration in the context of WIGOS should be defined as establishment of a comprehensive, coordinated and sustainable system of observing systems, ensuring interoperability between its component systems. It will be an organizational framework facilitating standardisation and interoperability and ensuring availability of, and access to, good-quality data and products, and associated metadata.

### **1.4 Objectives**

The integration process should encompass four broad objectives:

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

## **2. OVERVIEW**

### **2.1 Aim**

WIGOS is aiming to:

- (a) Address in the most cost-effective approach 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.) including 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:

- WIGOS will:
  - Develop strategies to satisfy observational requirements of WMO Programmes and international partners through the WMO Rolling Requirements Review Process;
  - Develop strategies to guarantee system interoperability, including meeting documented standards for data quality of observing systems and instruments;
  - Develop a strategy for the production, editing and management of metadata;
  - Evaluate existing and emerging capabilities before developing, acquiring, and or deploying new observing systems or sensors, and in the design of cost-effective composite observing systems;
  - Exploit existing platforms and employ multi-sensor platform concept to the maximum possible extent;
  - Coordinate the response to requirements, plans and activities with all appropriate technical commissions, regional associations and Programmes;
  - Be built initially upon existing observing systems and provide an interoperable framework for new systems.
- All WIGOS observational data, metadata and processed observational products 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 centres.

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 and oceanographic observing systems) cooperatively with consortia of countries operating a system jointly. Integration therefore will have a direct relationship to national programmes and activities as well as on coordination through the international organization.

## **3. ASSUMPTIONS**



### 3.1 General

WIGOS will provide a sustainable 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 Key areas of standardisation

A key requirement for integration within a system of systems construct will be standardisation in three key areas as shown schematically in Figure 1:

- Standardization of instruments and methods of observation;
- WIS information infrastructure;
- End-product quality assurance.

#### 3.2.1 Standardization of instruments and methods of observation

WIGOS should encompass homogeneity, interoperability and compatibility and traceability 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 observation by IMOP within WIGOS constituent networks including tests, calibration and intercomparisons.

#### 3.2.2 WIS Information infrastructure

3.2.2.1 The planning and implementation of WIGOS shall 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);
- Input from regional associations and technical commissions;
- Coordination role of the Secretariat, including the WIGOS Project Office.

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 representation in compliance with WIS information exchange requirements for all WMO Programmes.

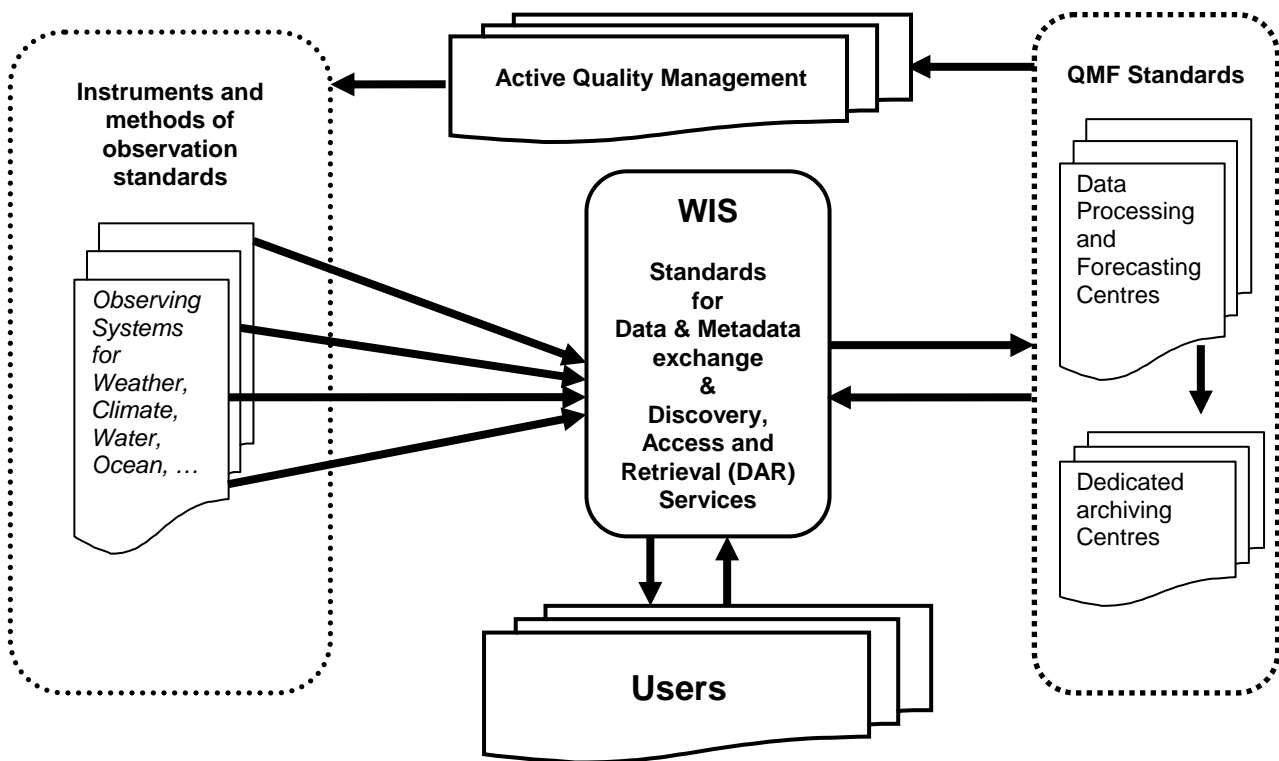
3.2.2.3 A role of WMO Information System (WIS) will be as follows:

- It will be used in the collection and sharing of information for all WMO and related international programmes;
- It 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;
- It will utilize international agreed-upon standards for protocols, hardware and software.

#### 3.2.3 End-product quality assurance

The third key area of standardization for WIGOS should embrace a quality management framework (QMF) to ensure the best possible products to be delivered to end users. This should be based on agreed-upon quality assurance and quality control standards, 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 quality management system that delivers reliable and timely data streams with adequate quality control and relevant metadata.



**Figure 1: Key areas of WIGOS standardisation**

The three areas of standardisation of the WMO-sponsored and co-sponsored observing systems contributing to WIGOS: standardization of instruments and methods of observation, WIS information infrastructure; and end product quality assurance.

**The first area of standardisation:** a sustained, optimized, end-to-end WMO Integrated Global Observing System should encompass homogeneity, interoperability, compatibility, and traceability of observations from all WIGOS constituent observing systems. This should be achieved through meeting the requirements for instruments and methods of observation established by CIMO including tests, calibration and intercomparisons.

**The second area of standardisation:** Data and information generated by all WIGOS constituent networks should meet a comprehensive, standardized set of WIS data representation and exchange requirements for all WMO Programmes.

**The third area of standardisation:** 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:

- Sponsors and co-sponsors of WIGOS constituent systems, both current and future;
- EC WG on WIGOS and WIS;
- SG WIGOS;
- Inter-Commission Coordination Group on WIS (ICG WIS);
- Regional associations and technical commissions;
- WMO Secretariat.

## **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 use WIS as the data discovery, access and retrieval mechanism.

### **5.2 WIGOS components**

The WIGOS constituents are (noting the following are not mutually exclusive):

- (a) The surface-based component of the Global Observing System of the World Weather Watch Programme;
- (b) Space-based component of the GOS including the geostationary meteorological satellite constellation, the core polar-orbiting meteorological constellation and R&D earth observation satellites;
- (c) Aircraft Meteorological Data Relay (AMDAR) systems including expansions of aircraft measurement capabilities for atmospheric composition constituents;
- (d) Marine meteorological and relevant oceanographic observing networks;
- (e) The relevant components of atmospheric, oceanographic and terrestrial observing systems contributing to GCOS;
- (f) Related terrestrial network;
- (g) Regional, river basin and global hydrological networks;
- (h) The Global Atmosphere Watch networks and systems for observations of atmospheric chemical composition and related environmental parameters;
- (i) The various radiation networks both observing solar and net radiation (e.g. the BSRN);
- (j) The observing component of the proposed Global Cryosphere Watch approved by the fifteenth WMO Congress;
- (k) Other possible components yet to be defined.

### **5.3 Integration, Standardisation and Interoperability**

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

- 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 efficiency 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 Congresses (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 include the following:

- Improved observation and product services including those in support of disaster risk reduction and adaptation to climate change;
- Improved efficiency and timeliness of access to observations across all domains;
- Optimisation of observing network design;
- Improvements in the quality and consistency of observations across all domains; and
- Flexibility to incorporate new observing systems.

## **8. CHALLENGES**

Challenges associated with embarking upon integration of WMO and co-sponsored observing systems include:

- The cross cutting nature of WIGOS will require close cooperation and coordination by all concerned;
- Timely application of standardisation concepts by individual Members;
- Time and resources will be critical risk factors. The development of a detailed, comprehensive Implementation Plan and the elaboration of targeted Pilot and Demonstration Projects need to be addressed early in the period; and
- Differences in levels of development of national and regional systems and services.

## **9. RESOURCES**

Implementation of WIGOS will require substantial resources on the national, regional and global levels as well as within the WMO Secretariat.

### **LIST OF ACRONYMS**

AMDAR	Aircraft Meteorological Data Delay
BSRN	Baseline Surface Radiation Network
CONOPS	Concept of Operations
EC WG	Executive Council Working Group
GAW	Global Atmospheric Watch
GCOS	Global Climate Observing System
GOOS	Global Ocean Observing System
GOS	Global Observing System
GTOS	Global Terrestrial Observing System
ICG WIS	Inter-Commission Coordination Group on WIS
QA	Quality Assurance
QC	Quality Control
QMF	Quality Management Framework
QMS	Quality Management System
R&D	Research and Development
WDIP	WIGOS Development and Implementation Plan
WHYCOS	World Hydrological Cycle Observing System
WIGOS	World Integrated Global Observing System
WIS	WMO Information System
WWW	World Weather Watch

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**WIGOS TEST OF CONCEPT DEVELOPMENT AND IMPLEMENTATION PLAN (WDIP)***(Version 1.1.1 November 2008)**(WDIP updated by SG-WIGOS-1 reflecting the status of development and implementation of initiated Pilot and Demonstration Projects)***I. Introduction**

The following document is an update of the WIGOS Development and Implementation Plan as mandated by the Fifteenth WMO Congress (Cg-XV).

**II. Strategic Roadmap for Testing the WIGOS concept**

2.1 Cg-XV agreed that planning and implementation of the WIGOS test of concept 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 would be considered at Cg-XVI (2011), and the WIGOS Implementation Plan for the next intersessional period would be determined.

2.2 EC-LIX, by its Resolution 3 (EC-LIX), established the EC Working Group on the WMO Integrated Global Observing System and the WMO Information System (EC WG WIGOS&WIS) with terms of reference as follows:

- (1) Provide advice and guidance in the preparation of an overarching 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 the development and implementation of WIGOS/WIS “Pilot Projects”, as suggested by the Fifteenth Congress, to test concepts, identify problem areas, and to help in elaborating the Development and Implementation Plan.

2.3 As authorized by EC-LIX, EC WG WIGOS&WIS established its Subgroup on WIGOS with following 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 areas of integration of WIGOS including standard practices to be applied to the different areas of WIGOS integration; integration areas being as follows and further described in the WIGOS Concept of Operations:
  - Standardization of instruments and methods observations (instruments and methods of observation levels);
  - Common information infrastructure (WIS data levels);
  - End-product quality assurance (QM/QA/QC product levels).
- 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.

2.4 The WIGOS Test of Concept Development and Implementation Plan (WDIP), should take into account the WIS Development and Implementation Plan, and will be updated annually during the four-year period 2008-2011. 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 benefit from experience gained from the various Pilot Projects, Demonstration Projects and inputs from the Technical Commissions, Regional Associations and the advisory/steering bodies of WMO co-sponsored programmes. 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 of 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, Demonstration Projects and their results, details of actions required to address revisions of the terms of reference (TOR) of the technical commissions, the WMO Programme structure, and WMO Secretariat budgetary, personnel and organizational implications. Many observing 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 WDIP needs to address this from the aspect of improving data access across these boundaries. Data dissemination practices must be capable of respecting the data-sharing policies as designated by the owners of the observing systems including authorization of users.

2.5 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 of the Preparatory Phase that occurred prior to Cg-XV is reproduced as well. The preparation of Version 1.0 of WDIP (WDIP V.1.0) that was endorsed by the EC in June 2008 was a crucial first step. WDIP V.1.1, and its subsequent revisions, will be important for informing the Technical Commissions, Regional Associations and the steering committees of GCOS, GOOS, GTOS and WCRP on WIGOS and WIS planning activities and to encourage their input into the process. Scheduling of as many regular sessions of Technical Commissions and Regional Associations as possible 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. Essential to taking this process forward will be the staffing of a WIGOS planning office in the WMO secretariat as was proposed in III.(3).



**STATUS of the testing the WIGOS concept**

**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; (Status: Completed)
- (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); (Status: Completed)
- (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. (Status: Not completed. Recommended Action: This situation should be reviewed by the EC WG WIGOS&WIS and EC-LXI)

**IV. Test of Concept, Phase I. Cg-XV (May 2007) – EC-LX (June 2008)**

- (1) Establish and update as appropriate the WIGOS Concept of Operations (CONOPS); (Status: Completed)
- (2) Cg-XV through the EC-LIX establishes the EC WG WIGOS&WIS to oversee the development of WIGOS and WIS; (Status: Completed)
- (3) Full time WIGOS Planning Unit organized in the WMO Secretariat (June 2007); (Status: Partially done)
- (4) Coordinate with IOC regarding the WIGOS-WIS initiatives; (Status: Completed)
- (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; (Status: Completed)
- (6) Initiate first Pilot Projects:
  - (a) Joint GOS-GAW Pilot Project to accelerate implementation of WIGOS/WIS; (Status: Initiated);
  - (b) Initiation of Global Hydrological Network addressing a GCOS Requirement; (Status: Still in planning process)
  - (c) Integration of AMDAR into WIGOS; (Status: Initiated)
  - (d) Elaborating the underpinning/crosscutting role and responsibilities of the Instruments and Methods of Observation Programme; (Status: Initiated)
  - (e) Integration of marine meteorological and other appropriate oceanic observations into the WMO Global Observing System. (Status: Initiated)
- (7) Adjust draft WDIP and CONOPS v.1.0 as guided by EC WG WIGOS&WIS and present draft WDIP and draft CONOP v.1.1 to EC-LX; (Status: Completed (v1.1))
- (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; (Status: done)
- (9) At meeting of Presidents of Technical Commissions a major agenda item should be the WDIP to which the EC WG WIGOS&WIS would provide input. (Status: Partly completed)
- (10) Initiate planning for the eight Demonstration Projects (see paragraph IX.); (Status: Done in the case of six)

## **PLANNING of the testing the WIGOS concept**

### **V. Test of Concept, Phase II. EC-LX (June 2008) - EC-LXI (June 2009)**

- (1) EC-LX provides guidance for this phase; (Status: Ongoing)
- (2) Review and update as appropriate the WIGOS CONOPS and WDIP; (Status: Ongoing)
- (3) Initiate planning for the Pilot Projects concerning the integration of marine meteorological and oceanographic observations with WIGOS-WIS; (Status: done)
- (4) The Pilot Projects (PP) begun in Phase I evaluated by corresponding Project Teams and SG-WIGOS; adjustments to the WDIP may arise from the evaluations; (Status: done; PP-I: Pending, Implementation Plan is missing; PP-II: Pending; PP-III: Ongoing; PP-IV: Ongoing; PP-V: Ongoing)
- (5) Coordinate with GTOS regarding terrestrial initiatives of relevance to WIGOS;
- (6) Additional Pilot Projects may be identified. Discussion has begun with GTOS regarding possible inclusion of Carbon monitoring; GCOS regarding GRUAN; WMO Space Programme regarding GSICS;
- (7) Demonstration Projects begun in Phase I evaluated by SG-WIGOS; adjustments to the WDIP may arise from the evaluations; (Status: Ongoing; Namibia and Russian Federation - Demonstration Projects are missing)
- (8) 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); not feasible
- (9) Initiate work on the proposed revisions to the WMO Technical Regulations; (Status: Noted that some action is required on Technical Regulations concerning metadata to be accomplished upon completion of Pilot and Demonstration Projects)
- (10) Revise the WDIP and CONOPS as appropriate with guidance from EC WG WIGOS&WIS – issue WDIP and CONOPS v. 1.2, and submit to EC –LXI for review and guidance; (Status: Ongoing)
- (11) 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; (Status: Ongoing)
- (12) Coordinate a way that RA working bodies can be involved into WIGOS activities in the Region (Status: Ongoing);
- (13) Develop a reporting mechanism for Pilot and Demonstration projects; (Status: Ongoing)
- (14) Elaborate basic definitions of WIGOS operations; (Status: Ongoing);
- (15) Elaborate three areas of integration; (Status: Ongoing);
- (16) Elaborate guidance on Demonstration Projects; (Status: Ongoing)
- (17) Organize a DCPC workshop for the Pilot and Demonstration Projects. (Status: Pending)

### **VI. Test of Concept, Phase III. EC-LXI (June 2009) - EC-LXII (June 2010)**

- (1) EC-LXI provides guidance for this phase (note this is the last period for active planning before specific proposals are prepared for submission to Cg-XVI);
- (2) Review and update as appropriate WIGOS CONOPS and WDIP;
- (3) Agreed activities of Pilot and Demonstration Projects begun in Phase I and II should be completed and evaluated for viability of the WIGOS concept. Experiences from Pilot and Demonstration Projects to be reflected in the draft Implementation Plan for WIGOS.

- (4) SG-WIGOS meets in 2009 to consider status of Demonstration and Pilot Projects, updates of CONOPS and WDIP and formulate recommendations for EC WG WIGOS&WIS;
- (5) EC WG WIGOS&WIS meets in 2010 to elaborate draft recommendations for EC-LXII;
- (6) The agendas of Technical Commissions and Regional Associations should include an item relating to the WIGOS and should seek their “consensus inputs” to the WDIP;
- (7) Finalize elaboration of areas of standardisation;
- (8) Elaborate standardized description of all observing networks contributing to WIGOS;
- (9) Develop WIS component (e.g. DCPC) for each Demonstration and Pilot Project when needed;
- (10) Develop Guidance for NMHSs why and how to optimize their observing network by integration of their observing systems;
- (11) Coordinate with GCW regarding cryospheric initiatives of relevance to WIGOS.

#### **VII. Test of Concept Phase IV. EC-LXII (June 2010) - Cg-XVI (May 2011)**

- (1) EC-LXII to agree on the content of the submission to Cg-XVI regarding the implementation of WIGOS. This will include the proposed changes to the Technical Regulations, the revised roles and Terms of References of the various Technical Commissions, the adjustments to the WMO Programme structure, and the impact on the Secretariat budgets and personnel, proposed actions of Cg-XVI how to implement WIGOS.
- (2) Subgroup WIGOS meets in 2010 to formulate advice and recommendations to EC-WG WIGOS&WIS;
- (3) EC WG WIGOS&WIS considers matters relating to the revision of the Technical Regulations, the TORs of Technical Commissions, and proposals regarding WMO Programme structure and content, and the WMO Secretariat structure will be addressed in this Phase;
- (4) Coordinate a way that RA working bodies can be involved into WIGOS activities in the Region (Status: Ongoing);
- (5) Pilot and Demonstration Projects will be evaluated for sustained legacy within WIGOS if appropriate. Experiences from Pilot and Demonstration Projects should be reflected in the draft Implementation Plan for WIGOS.
- (6) Test of concept WDIP and CONOPS are completed and draft WIGOS Implementation Plan is prepared;
- (7) EC WG WIGOS&WIS submits its final report and recommendations to Cg-XVI.

#### **VIII. Pilot Projects**

Undertaking at the earliest possible stage several WIGOS Pilot Projects would be useful to address major issues on the integration process and would help in elaborating the WDIP. Pilot Projects will emphasize the role and contributions to be made by the Technical Commissions. In accordance with recommendations by Cg-XV, the following Pilot Projects were identified:

- *Pilot Project I:* Improvement of **D**issemination of **O**zone (total column, profiles and surface) and **A**erosol observations through the WIS;
- *Pilot Project II:* **H**ydrological **A**pplications **R**unoff **N**etwork;
- *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 Oceanographic Observations into the WMO Integrated Global Observing System.

Additional projects can be initiated after approval of EC WG WIGOS&WIS.

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

9.1 Helping Members to more fully understand WIGOS and keeping them up-to-date 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 Demonstration projects will be linked to demonstrating aspects of the WIGOS concept and, at this early stage of WIGOS development, the Demonstration Projects should aim to be focussed on specific aspects of WIGOS and not be overly ambitious. Feedback and lessons learnt from these NMHSs will be extremely beneficial in understanding expectations of WIGOS concept at a national or regional level. These projects will also have a high profile impact since they may 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.

9.2 The following countries expressed their willingness and intention to launch Demonstration Project: Kenya, Namibia and Morocco (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). Proposals for new Demonstration projects will be considered when submitted.

## **X. WIGOS web page**

It is 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, relevant focal points for WIGOS in regional associations and technical commissions, will establish and update of a WIGOS web pages on the WMO Web site by publishing information about WIGOS, including information on the current status of implementation of Pilot and Demonstration Projects, providing condensed information to various WIGOS user communities. ((Status: Completed; See: [http://www.wmo.int/pages/prog/www/wigos/index\\_en.html](http://www.wmo.int/pages/prog/www/wigos/index_en.html)).

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

To accomplish the goals above regarding the development of a WMO Integrated Global Observing System, adjustments must be made in the WMO Technical Regulations, the WMO Programme structure, the working structure and functions of the Technical Commissions, and of the WMO Secretariat. The motivations for WIGOS are focused to the objective of instituting an integrated end-to-end system of systems - comprised principally of 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 structures to support it, will all be important and essential components of the systems 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, 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* supplement the regulatory material contained in the TR and their *Annexes*.

12.2 The present structure of the Technical Regulations Volume I describes 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 System, 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.

12.4 The revised structure of the TR must document the structure of WIGOS. The revised TR will need to be comprehensive and reflect all of the component systems. It will allow addressing the wide ranging multi-discipline issues and requirements for observational resources from all domains (atmosphere, ocean, and terrestrial). It should also build on and amplify the integration across surface-based and space-based observations.

12.5 In undertaking such a revision, a clearer vision for the purpose, scope, content and structure 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 It may be considered that one single WMO Programme should be assigned the responsibility to lead the planning of WIGOS and WIS and with its ultimate implementation and operation, noting that EC-LX emphasised that CBS should take a lead role for WIGOS. Participation during the integration by the other Programmes which currently have responsibility for components of the WMO Global Observing System will be crucial in this transition. The feasibility of this idea, in particular for the operation of WIGOS, should be investigated during the test of concept phase and incorporated into the draft WIGOS Implementation Plan for consideration by Cg-XVI.

13.2 As recognized in Resolution 30 (Cg-XV), the process leading to WIGOS would have a wide 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.

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

In progressing towards enhanced integration between WMO observing systems, it will be important that this be carried out in close coordination and cooperation 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);
- those terrestrial/hydrological observing systems which serve as part of the FAO-UNEP-

WMO-ICSU Global Terrestrial Observing System (GTOS);

- WCRP (WMO, IOC, ICSU) observing components.

## LIST OF ACRONYMS

AMDAR	Aircraft Meteorological Data Delay
CBS	Commission for Basic Systems
CIMO	Commission for Instruments and methods of Observation
CONOPS	Concept of Operations
DCPC	Data Collection or Production Centres
EC WG	Executive Council Working Group
FAO	Food and Agriculture Organization
GAW	Global Atmospheric Watch
GCW	Global Cryosphere Watch
GCOS	Global Climate Observing System
GDPFS	Global Data-Processing and Forecasting System
GOOS	Global Ocean Observing System
GOS	Global Observing System
GRUAN	Global Reference Upper-Air Network
GSICS	Global Space-based Inter-Calibration System
GTOS	Global Terrestrial Observing System
GTS	Global Telecommunication System
ICSU	International Council for Science
IOC	Intergovernmental Oceanographic Commission
QA	Quality Assurance
QC	Quality Control
QM	Quality Management
QMF	Quality Management Framework
QMS	Quality Management System
UNEP	United Nations Environment Programme
WCRP	World Climate Research Programme
WDIP	WIGOS Development and Implementation Plan
WIGOS	World Integrated Global Observing System
WIS	WMO Information System
WWW	World Weather Watch

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## SG-WIGOS Work Plan 2008-2011

Task	Action	Responsible	Deadline	Deliverable (KPI)
1.	To provide overall technical guidance, assistance and support for the implementation of the WIGOS concept	All Members (responsible for related TC/observing system)	As required, but at a minimum annually at the Subgroup meeting	Technical guidance for implementation of the WIGOS concept
2.	To elaborate in detail the three areas (levels) of integration of WIGOS including standard practices to be applied at the different areas (levels) of WIGOS integration	Minimum of two designated Members per integration Area (level)	Cg-XVI	Proposal for the update of CONOPS, WDIP
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.)	All Members (responsible for related TC/observing system)	Cg-XVI	Proposal for the update of CONOPS, WDIP
4.	To refine the concept of WIGOS operations, including its basic definitions	Chairperson + Pilot Project Representatives + Observing system Representatives	Annually	Proposal for the update of CONOPS
5.	To address major issues identified by the EC Working Group on WIGOS and WIS	Work plan tailored to requirements by Chairperson	Continuous	Proposals for the update of CONOPS, WDIP
6.	To develop a mechanism for the inclusion of the regional aspects of WIGOS through involvement of the presidents of regional associations	Chairperson + Regional representatives on EC Working Group on WIGOS and WIS	Cg-XVI	Draft procedures for inclusion of regional aspect of WIGOS (Resolutions of RA sessions)
7.	To coordinate the WIGOS planning phases (including the Pilot Projects) according to the WIGOS Development and Implementation Plan	Pilot Project Representatives + Observing system Representatives	At a minimum of 3 month intervals, reporting to chairman	Proposal for the update of WDIP
8.	To coordinate WIGOS implementation with the planning and implementation of the WMO Information System (WIS)	Chairperson of ICG-WIS	Actions required after EC Working Group Meeting	Proposal for the update of CONOPS, WDIP Feedback to Members on work necessary for the exploitation of WIS.
9.	To advise the EC Working Group on WIGOS and WIS on aspects related to management, governance and interoperability	Chairperson + Observing system representatives	Annually	Guidance on management, governance, interoperability
10.	To report to the EC Working Group on WIGOS and WIS	Chairperson	Annually	Chair's Progress Report
11.	To specify process/way how to assess the concept of WIGOS	Chairperson	Cg-XVI	Assessment of the WIGOS concept