

***AD HOC* PLANNING MEETING FOR THE JCOMM
PILOT PROJECT FOR THE WMO INTEGRATED
GLOBAL OBSERVING SYSTEMS (WIGOS)**

(OSTEND, BELGIUM, 29 MARCH 2008)

FINAL REPORT

JCOMM MEETING REPORT No. 57

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NOTE

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EXECUTIVE SUMMARY

The ad hoc planning meeting for the JCOMM Pilot Project for the WMO Integrated Global Observing Systems (WIGOS) was held in Ostend, Belgium on 29 March 2008 at the kind invitation of the IOC Project Office for the International Oceanographic Data and Information Exchange (IODE). The aim of the Pilot Project is to promote and develop integration of marine and other appropriate observations into the global observing system through three core deliverables: (i) integration of instrument best practices, (ii) development of interoperability arrangements between the ocean data systems and the WMO Information System (WIS), and (iii) the integration of quality management systems. The meeting agreed that the cooperation with the ocean community was essential to the success of the Pilot Project, especially regarding interoperability issues with the IODE Ocean Data Portal (ODP) being developed by the ocean community. The synergies between the ODP and WIS are potentially important regarding historical and recent data. In the process, the ownership of IOC for some of the components of the Global Ocean Observing System (GOOS), and the WMO and IOC respective data policies will be respected, as well as specific data policies for specific data sets.

Development of standards and their wide acceptance within the meteorological and oceanographic communities is also an important activity that will be addressed by the Pilot Project. It will link naturally with the development of a Standards process recently started by JCOMM and IODE (see <http://www.oceandatastandards.org>).

The meeting addressed the instrument best practices issues, recognized the need for traceability to agreed standards, and recommended to establish cooperation with the WMO Commission on Instruments and Methods of Observation (CIMO) and to build on its experience with regard to instrument intercomparisons, instrument centres, etc. The various related publications available via WMO and IOC will be reviewed and updated as required. JCOMM has also recently proposed to compile a catalogue of best practices to be eventually published as a JCOMM Technical Document. Related activity will be included in the Pilot Project plan. The meeting proposed to explore establishment of one or more marine and oceanographic instrument centre(s) and reviewed the methodology proposed by CIMO for conducting instrument intercomparisons to ensure homogeneity, and compatibility of the observations. The meeting agreed to explore how JCOMM and ocean instrument comparisons can profit from the CIMO experience.

The meeting reviewed its project plan and proposed some changes. It particularly identified partners willing to pursue participation in the Pilot Project by providing data sets to the ODP and WIS (e.g. World Ocean Atlas, World Ocean Database, Surface currents from HF radars, sea level data and marine climatology summaries). Other potential partners to provide additional data-sets (e.g. Argo, GHRSSST, ocean model fields and SeaDataNet), metadata (e.g. META-T), technology (e.g. End-To-End), or training facilities or materials for Capacity Building purposes (e.g. ODINs) were listed and the Pilot Project will approach them to seek their participation.

Because of the strong potential synergies between the ODP and the JCOMM Pilot Project for WIGOS, the meeting proposed to establish a joint Steering Group with balanced representation from the IOC and WMO communities. Terms of Reference and Membership for the Steering Group will be finalized soon. The first meeting of the Steering Group is planned to be held in September 2008. The meeting will work at defining a more detailed implementation plan based on the project plan.

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. ORGANIZATION OF THE SESSION

1.1 The Chairperson of the JCOMM Data Management Coordination Group, Mr Robert Keeley opened the meeting at 9:00 a.m. on 29 March 2008 at the Project Office of the IOC International Oceanographic Data and Information Exchange (IODE) in Ostend, Belgium.

1.2 On behalf of the Secretary-General of WMO, Mr Michel Jarraud, the Secretariat representative welcomed the participants to the meeting, and in doing so expressed the sincere thanks to the IOC Project Office for the International Data and Information Exchange (IODE) and to Mr Peter Pissierssens and his staff for the excellent support for the meeting. He recalled that the WMO Fifteenth Congress agreed on establishing a comprehensive, coordinated, and sustainable system of observing systems with ensured access to its component observing systems' data and products through interoperable arrangements (Res. 30 – Cg XV). WIGOS/WIS will address all WMO Programmes and Co-sponsored programmes requirements, ensure availability of required information, meet data quality standards, and facilitate access in real/quasi-real time as well as to archived information. Cg-XV recommended to initiate five Pilot Projects, one of which being the integration of marine and other appropriate oceanographic observations into the Global Observing System (GOS). The Fifty-ninth WMO Executive Council, Geneva, Switzerland, 28-30 May 2007, established a Working Group on WIGOS and WIS (EC WG WIGOS-WIS) to follow the development of an over-arching WIGOS Development and Implementation Plan and also to review the progress in the implementation of WIGOS/WIS "Pilot Projects". JCOMM responded quite proactively to the challenge proposed by the Congress and Executive Council and drafted an ambitious JCOMM Pilot Project for WIGOS as an important contribution to the development of WIGOS/WIS respecting the ownership of partner organizations regarding their components of the observing system. The Pilot Project is expected to demonstrate the strong and growing level of collaboration and coordination between the WMO and IOC stakeholders both striving to enhance and sustain global ocean observing networks and provide free and unrestricted data access in line with their respective data policies. The Secretariat representative concluded his remarks by assuring the continued commitment of WMO to support and strengthen the work of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) and to the Pilot Project in particular, and wished for a successful meeting.

1.3 On behalf of the Executive Secretary IOC, Dr Patricio Bernal, the co-Chairperson of the IODE, Mr Greg Reed welcomed the participants. He expressed the oceanographic community's appreciation to WMO for taking the initiative to develop WIGOS. As a co-sponsor of one of the Global Observing Systems, GOOS, the IOC agrees fully with the need for a comprehensive, coordinated and sustainable global observing system. Through WIGOS, WMO and its partner agencies such as IOC, will put the fundamental technical and operational building blocks in place to achieve availability of, and access to data and information across the many disciplines in the global observing systems GCOS and GOOS. IOC welcomes the lead that WMO is taking in this ambitious effort. He also expressed the strong interest in participating in this effort, e.g. through JCOMM. JCOMM will be a crucial partner in the cooperation between WMO and IOC on WIGOS and IODE, therefore, looks forward to the successful implementation of the JCOMM Pilot Project for WIGOS. This will also further strengthen the already ongoing cooperation between the IODE Ocean Data Portal and WIS, which in itself was an outcome of the JCOMM activity on E2EDM.

1.4 After the opening remarks, the participants reviewed the agenda for the Session and adopted it (Annex I). They received information on local arrangements. The list of participants is provided in Annex II.

1.5 The participants at the meeting, recognizing his pro-active role with the development of the JCOMM Pilot Project for WIGOS in recent months, elected Mr Robert Keeley to Chair the meeting. The Chair then outlined the goal of the meeting which was to develop guidelines and principles for the JCOMM Pilot Project for WIGOS, refine the project plan, outline a business case

for assisting Members at implementing WIGOS requirements at the national level, and propose a Steering Group for the Project.

2. PRESENTATION OF THE PILOT PROJECT

2.1 The session noted the information provided by Mr Rainer Dombrowsky, Vice-resident of the WMO Commission for Instruments and Methods of Observation (CIMO), regarding the results of the first meeting of the WMO Executive Council Working Group on the WMO Integrated Global Observing Systems (WIGOS) and the WMO Information System (WIS). The session received an overview of the outcomes from the first meeting of the Executive Council Working Group on WIGOS-WIS (EC WG WIGOS-WIS), Geneva, Switzerland, 4-7 December 2007, where the five Pilot Projects, including the one from JCOMM were presented and discussed. In addition to the outcomes of the EC-WG WIGOS-WIS, they also received the latest information on pilot project *ad hoc* working groups, which had previously met (i.e. CIMO, GAW, JCOMM).

2.2 The WMO EC WG WIGOS-WIS has also established a Sub-Group Chaired by Dr John Nash, President of CIMO. . The meeting noted that the chairpersons of the Steering Teams of the Pilot Projects are automatically participants in the Sub-Group. The JCOMM Pilot Project is invited to provide feedback to the Sub Group of the WMO EC WG WIGOS-WIS (November 2008), to the WMO EC WG on WIGOS-WIS (December 2008) and then to WMO Executive Council (EC-LXI, 2009). The Project Plan needs to be updated accordingly (**action, Chair, *ad hoc* Steering Group, Sept 2008**). Mr Dombrowsky informed the participants that he will be acting as a coordinator between the five Pilot Projects under WIGOS.

2.3 The session also received background information of the proposed eight regional demonstration projects implemented at the WMO Regional Association (RA) level. The meeting noted the recent proposal by Morocco (RA-I) to develop a regional instrument centre (see Terms of Reference in Annex VI). The meeting agreed that some of the demonstration projects should be involved with the development of the JCOMM Pilot Project for WIGOS and become partners e.g.:

- RA IV (USA) regarding state of the lower atmosphere and air sea interactions useful for hurricane forecasts on one hand, and Automated Shipboard Aerological Programme soundings to be offered as additional upper air data sets on the other hand;
- RA VI (Russian Federation) with End to End technology and interoperability;
- RA I (Morocco) with instrument centres;
- RA V (Australia) regarding interoperability.

2.4 Other potential partners had to be approached for participating in the Pilot Project by offering connectivity with the WIS or ODP or instrument centre facilities.

2.5 Additional information was provided by Mr Dombrowsky on behalf of Dr James Purdom, Chair of the CBS OPAG-IOS. The report, "Integrated Observing Systems activities within the WIGOS framework", provided information on OPAG-IOS activities related to WIGOS. The presentation was provided for the meeting to take into account and comment on the CBS Expert Team on the Evolution of the Global Observing System (ET EGOS) proposals for the initial WIGOS pilot activities. In Dr Purdom's paper, there were steps mentioned which all projects should consider as they develop guidance for their pilot or demonstration project:

- Develop ways of measuring the effectiveness of the WIGOS pilot or demonstration project;
- Conduct further assessment of the WIGOS concepts;
- Provide further specificity of the proposal; and
- Start the preparation for the WIGOS Implementation Plan.

2.6 The meeting agreed with these recommendations and noted that the report from Dr Purdom required updating with regard to the most recent changes of the JCOMM project plan. It

requested the Secretariat to provide Dr Purdom with appropriate feedback (**action, WMO Secretariat, April 2008**).

2.7 Mr Dombrowsky explained the WIGOS Concept of Operations (CONOPS), which is regarded as a living document. As WIGOS moves forward in the implementation process, the CONOPS will be revised with input from the Pilot Projects.

2.8 Dialogue should take place with developing countries to inform them of the minimal requirements for the observing systems they implement or plan to implement.

2.9 The meeting discussed spatial and temporal requirements of the observing system and noted that these affected the costs of the networks while building on existing systems. The meeting agreed that a gap analysis has to be conducted and noted that the participation of JCOMM in the CBS Rolling Review of Requirements (RRR) was consistent with this approach.

2.10 The meeting agreed that it had to discuss and agree on the level of resources required to develop the project plan (meetings), related documentation (consultancy), and for making the case for the Pilot Project with potential partners (missions of experts to visit agencies requiring assistance for implanting the project plan).

2.11 The meeting noted that many of the JCOMM observing systems relied on research funding while some of them were progressing towards more operational systems. Many of the ocean centres hold chemistry and biology data (ocean colour, ph, pCO₂, chlorophyll). This broader suite of data can be contributed to the WIGOS. Research data are not always available and WIGOS will help in making the delayed mode data available, for example for data reanalysis purposes. The meeting agreed that the Pilot Project should be promoting the transition of observing systems from research to operational. Data made available and shared from a system declared operational have then to be used by NMHSs and then become automatically available through the WIS.

2.12 The meeting agreed that it was important to develop standards that are broadly agreed and used. It recognized the recent efforts of JCOMM to engage jointly with the IODE in a standards process.

2.13 Mr Robert Keeley then presented the Pilot Project as proposed by JCOMM for the integration of marine and other appropriate oceanographic observation into the WMO Global Observing System (GOS), also designated as JCOMM Pilot Project for WIGOS. Mr Keeley explained how the proposal was developed, how it was received by the WMO EC WG WIGOS-WIS, and also explained the expected outcomes of this meeting.

2.14 The meeting recognized that not all of the data (e.g. ocean research data) were flowing through the GTS and that effort is spent to compile and provide higher quality delayed mode data. Parallel real-time data systems such as Argo, TAO, OceanSITES, GTSPP, and GOSUD provide higher quality and higher resolution data than the GTS. Also, the End-To-End (E2E) technology developed by JCOMM and IODE (e.g. Russian Federation NODC, Obninsk prototype acting as a WIS DCPC) has been employed to initiate the development of the Ocean Data Portal (ODP). ODP will provide access to many ocean data archives and will naturally be part of the WIGOS Pilot Project. Other initiatives such as SeaDataNet, and DMAC have started to work on data access and interoperability on a regional scale and should be invited to participate in the Pilot Project.

2.15 Mr Keeley recalled that there are three components proposed in the JCOMM Pilot Project, namely: (i) best practices for consistent, and coherent data provided with appropriate metadata and meeting agreed upon standards, (ii) interoperability of ocean data systems with the WIS through an interdisciplinary approach to make data sets available to meet the requirements of WMO and IOC programmes, and (iii) quality management and documentation of processes for more timely data of known and high quality minimizing duplicates. WIGOS now provides for an opportunity to make substantial progress on those issues that have already been addressed by

JCOMM with limited resources. He recalled in particular the development of the JCOMM/IODE End-To-End Technology, the IODE Ocean Data Portal (ODP), the JCOMM/IODE standards process, and the Water Temperature Metadata Pilot Project (META-T).

2.16 The meeting agreed that the JCOMM Observations Programme Area (OPA) had also to be involved in the development of the Pilot Project especially in terms of best practices and data management (e.g. table driven codes, metadata). It requested the Secretariat to relay the recommendation to the OPA and sub panels (**action, Secretariat, ongoing**).

2.17 The meeting agreed that the cooperation with the ocean community was essential to the success of the Pilot Project in order not only to secure the results from more than two decades of fruitful cooperation between WMO and IOC with regard to the development and implementation of ocean observing systems but also to succeed in establishing interoperability arrangements with the ocean data systems (e.g. via ODP for historical and recent data) while respecting both WMO and IOC data policies as well as specific data policies for specific data sets.

2.18 The meeting noted a number of benefits that can be expected from the development of the Pilot Project:

- Improving the visibility of oceanographic institutes with the National Meteorological and Hydrological Services (NMHSs) while keeping their independence regarding parallel data systems they have put in place;
- WIS will provide for multi-disciplinary access to data. Oceanographic institutes will be gaining better access to meteorological (input for ocean modelling and research applications regarding ocean-atmosphere interactions), and climate (input for ocean modelling), and hydrological (river discharges into the oceans) data through direct WIS access. It will be more difficult to access some of these data outside of the scope of the Pilot Project;
- NMHSs gaining better access to oceanographic data to feed into operational and research applications;
- Solidifying the links between meteorological and oceanographic data centres (by providing time critical and delayed mode ocean data to the WIS and accessing multi-disciplinary data from the WIS);
- Accessing more, and better data of known quality obtained through consistent, coherent, and traceable instrumentation that meet standards agreed upon between both the meteorological and oceanographic communities. This will permit a better use of the data for the production of consistent products as well as facilitating observational data intercomparisons, and data quality monitoring;
- Enhancing the development of operational oceanography nationally or worldwide for delivering products and services that serve the end users better (e.g. ocean mesoscale forecasting).
- Enhancing NMHSs cooperation with the oceanographic centres nationally or worldwide for delivering products and services that serve the end-users better (weather forecasts, marine services, marine climatology, climate monitoring and prediction).

2.19 The meeting noted with appreciation the substantial support provided by the WMO and IOC in the development of the WIGOS and ODP development and implementation plans, respectively. However, the participants recognized that implementation costs will have to be met by Members/Member States.

3. INSTRUMENT BEST PRACTICES (AND RELATION WITH CIMO)

3.1 The session was provided with a presentation by Mr Dombrowsky on instrument best practices, the establishment of standards, the importance of traceability to these standards and the process used to conduct instrument intercomparisons. The information provided was relevant to the JCOMM pilot project, but also to future CIMO-JCOMM coordination and collaboration.

3.2 The discussions which followed Mr Dombrowsky's presentation provided the background for assisting the ad hoc working group in identifying how CIMO could best assist JCOMM in fulfilling the goals of its pilot project under the WIGOS/WIS Framework. The discussion also led to additional discussions on how JCOMM might provide assistance to other pilot and demonstration projects through the WIGOS/WIS process.

3.3 It was recalled that one of the deliverable of the Pilot Project will be documenting and integrating best practices and standards being used amongst the marine meteorological and oceanographic communities. As standards and best practices have in some cases been developed separately between the meteorological (via CIMO) and oceanographic (via IOC and its IODE) communities, enhanced coordination between the two communities will be required. The meeting recognized CIMO's strong experience in this regard. At the same time, the meeting noted that CIMO had focused mainly on land and air *in situ* observations and needed to expand its capabilities especially with regard the marine and oceanographic observations. This is a good opportunity for JCOMM and CIMO to cooperate. The meeting agreed that it also had to work at developing minimum standards in order to permit the integration of additional data sets of perhaps lower quality but still useful for a number of applications provided the quality is known.

3.4 Mr Keeley informed the meeting on recent recommendations from the sixth JCOMM Management Committee meeting, Paris, France, 3-6 December 2007, in terms of Best Practices and standards, as well as on the outcome of the first IODE/JCOMM Forum on Oceanographic Data Management and Exchange Standards, Ostend, Belgium, 21-25 January 2008, and the resulting development of a JCOMM/IODE standards process (<http://www.oceandatastandards.org>). A number of JCOMM documents as well as IOC Manuals and Guides are already in the process of being reviewed and updated. JCOMM was also working on the development of an oceanographer's and marine meteorologist's "Cookbook" for submitting data in real-time and in delayed mode.

3.5 The meeting noted that maintenance and calibration issues were critical for ensuring stability and sustainability of systems. Work is needed to understand the systems and components, to document observing platform siting and history, record and update the metadata, and eventually to eliminate inhomogeneities in data records. For example, one of the challenges proposed by the climate community was to conduct instrument intercomparisons over a long enough period, usually on the order of 10 years.

3.6 The meeting noted with appreciation that the WMO Guide to Instruments and Methods of Observation (WMO Publication No. 8) was now available on the CIMO web site. Considering some of the outdated information, the meeting agreed that JCOMM had to propose more frequent updates to the marine chapter of the WMO Publication No. 8 in close cooperation with CIMO. If there are unique differences with regard to specific observing systems (e.g. ship-based AWS) these need to be considered and included in the Guide. The meeting also noted that CIMO maintained a number of instrument related publications and agreed that JCOMM could contribute to those. It requested the Secretariat to relay these recommendation to the JCOMM Observations Programme Area and its observing panels (**action, Secretariat, as soon as possible**). The meeting asked the Observations Coordination Group (OCG) to nominate a marine instrument focal point for liaising with the CIMO rapporteur for the WMO Publication No. 8 (**action, Chair, OCG, May 2008**).

3.7 The meeting reviewed and updated the outline for the Pilot Project. The revised version is included in Annex IV. The meeting asked the Secretariat to post it on the WIGOS web pages once these are formally in place (**action, Secretariat, as soon as possible**).

3.8 The meeting requested the Secretariat to circulate the “best practices” approach of the Pilot Project to the JCOMM Observations Programme Area and Sub-Panels (***action, Secretariat, as soon as possible***).

4. INTEROPERABILITY WITH THE WIS

4.1 The WIS Project Manager, Mr David Thomas, provided an overview regarding the recent developments of the WIS, its implementation plan, and the requirements for ocean data systems to develop interoperable arrangement with the WIS. The meeting explored how convergence between the different ISO 19115 compatible metadata profiles developed under the WIS (WMO Core metadata profile), the Ocean Data Portal (Ocean Community Profile), and the SeaDataNet (Common Data Index) could be promoted and realized.

4.2 The meeting noted with appreciation that Greg Reed who was tasked by the JCOMM/IODE standards forum to conduct a comparison of the WMO Core metadata profile, the Marine Community Profile (MCP, used in ODP), and the SeaDataNet Common Data Index (CDI), had almost completed his work and was about to make recommendations regarding the solutions to have the different profiles converge or become compatible for interoperability purposes between the WIS and the ODP taking into account the interactions with SeaDataNet (***action, Greg Reed, 30 April 2008***).

4.3 In terms of ocean data systems interoperability with the WIS, the meeting agreed on the following:

- (i) The WIS Compliance Specifications provide the information necessary to insure a centre will be compliant for WIS. The extent of the requirements will depend on the extent of the functionality the centre wants to utilise;
- (ii) For DCPC holdings to be discoverable in WIS, the centre is required by WIS to make ISO 19115 WMO compliant metadata files available to a GISC;
- (iii) Utilising WIS for information exchange will require an appropriate interface, i.e. ftp, authentication, GTS internet guidelines, etc. For a DCPC to send information across WIS, it must utilise unique filenames and have an associated metadata in WIS. This metadata may be sent as an XML file but need only be sent once or when the metadata changes. The lead time for the file will be program and content specific (e.g. see GTS manual for notification lead times of station detail changes);
- (iv) For a DCPC to make its own catalogues searchable from within WIS, it will need to have an ISO 23950 interface or gateway;
- (v) WIS is a Service Orientated Architecture (SOA). To participate in a service technically only requires compliance at the interface. These are described in detail in the WIS Compliance Specifications;
- (vi) WIS is working with the European INSPIRE Directive to ensure compliance with WIS is consistent with INSPIRE and GEOSS;
- (vii) Because of the SOA nature of WIS and the focus on interfaces, providing a centre has an appropriate infrastructure in place to support information management and exchange, there is potential to gain considerable connectivity to the WIS community. This can be done through only a relatively inexpensive additional interface without changing the infrastructure.

4.4 The meeting noted the following:

- The E2E prototype at the Russian Federation NODC in Obninsk is ready to connect to WIS as a DCPC but needs access to more data providers.
- As demonstrated in the E2E prototype, the ODP could be an interface between the ocean centres and WIS, both for making ocean metadata available to WIS and acting as a data service for the WIS community.
- The first WIS DAR metadata catalogue is likely to be with the implementation of the European VGISC planned to be operational in early 2009 and can be used for developing interoperability of some of the ocean data systems with the WIS (e.g. GCCs, and SeaDataNet).
- SeaDataNet is building a core infrastructure ideal for collaborating with the WIS, including the use of ISO 19115 compliant metadata (SeaDataNet - CDI). The CDI metadata could be made available directly to a GISC via SeaDataNet's own interface, via participants interfaces or via the E2E interface already established with the SIMDAT project. In addition, an ISO23950 type system search interface will allow WIS searches to search in SeaDataNet.
- Once the metadata is discovered, SeaDataNet data and products could be accessed via the SeaDataNet portal, the E2E portal or participants own portals.
- ODP providing an interface between SeaDataNet and WIS could be a pilot for connecting other regional initiatives or infrastructure to WIS.
- Interfacing SeaDataNet to WIS should be a small amount of work enabling connectivity between SeaDataNet and the wider WMO community as well as Europe.

4.5 The meeting requested David Thomas to keep the *ad hoc* Steering Group informed of progress regarding the implementation of the WIS and to provide a list of likely WIS components to become available on line (**action, David Thomas, ongoing**).

4.6 The meeting asked Nick Mikhailov to provide additional information on the technical specifications for WIS-ODP interoperability (**action, Nick Mikhailov, 31 May 2008**).

5. QUALITY MANAGEMENT

5.1 Mr Etienne Charpentier provided an overview of quality management aspects currently considered under the Pilot Project at the platform/instrument, data collection/distribution/archiving, and product levels. He presented the efforts by JCOMM to rationalize quality management within its three Programme Areas in a way consistent with the WMO Quality Management Framework (QMF).

5.2 One of the core goals of the Pilot Project will be to coordinate the development of cost-effective Quality Management Systems by Members and to propose practical solutions or examples. As stated in the WIGOS Concept of Operations (CONOPS), many of the WIGOS aims relate to Quality Management, and in particular the following ones:

- *Access*: 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.
- *Standards*: Ensure required data quality standards are met and sustained for all programme requirements.
- *Quality Management Systems*: Facilitate improved data management including archival

and data retrieval capabilities.

- *Documentation*: Develop appropriate regulatory documentation including organization and recommended practices and procedures.

5.3 The meeting agreed that “access” will be achieved through (i) better interoperability arrangements between the ocean and meteorological communities, (ii) establishing procedures to manage duplicates and for avoiding them, and (iii) collection and distribution of instrument/platform metadata.

5.4 Regarding “standards”, the meeting reviewed and agreed with the recommendations from the first IODE/JCOMM Forum on Oceanographic Data Management and Exchange Standards in terms of quality management and agreed that these should now be considered as part of the JCOMM Pilot Project for WIGOS. In particular, the initiation of the IODE/JCOMM standards process will facilitate the development of widely accepted standards within the meteorological and oceanographic communities. The standards will cover issues such as instrument best practice, real-time and delayed mode quality control procedures (automatic and/or manual), data collection and exchange formats, and products using the observational data.

5.5 Regarding “Quality Management Systems”, the meeting agreed that the development and implementation of QMSs that comply with WMO and IOC quality policies should be promoted in the context of the Pilot Project with recommendation to compile at the national level regulatory documentation produced in a way consistent with the eight Quality Management Principles developed by ISO. This may lead in some instances to the certification of such QMS related to the products using the observational data. The meeting agreed that ISO 9001 certification will be not be mandatory as some of the meteorological and/or oceanographic services participating in the Pilot Project might wish to comply with other standards than ISO.

5.6 As far as “documentation”, the meeting recognized that QMSs were proposing methodologies for documenting processes and quality control procedures. Implementing such systems would facilitate the work required for a better integration of quality related documentation in the WIGOS framework. Also, work is taking place through the routine activities of the WMO and IOC as many technical publications are being produced and maintained, thanks mainly to the work of the Technical Commissions and Expert Teams. WMO has engaged in the Quality Management Framework (QMF) where one of the goals is to produce a catalogue of technical publications related to quality management and their review to ensure that they adhere to quality management principles. Finally, at its Sixth Session, Paris, December 2007, the JCOMM Management Committee recommended producing a catalogue on JCOMM best practices and standards to be published as a JCOMM Technical Document. The meeting agreed that the Pilot Project should assist in the production of the catalogue (**action, ad hoc Steering Group, Sept 2008**). The meeting agreed that both the IODE OceanTeacher training facility and the new WIGOS web site should be used by the Pilot Project to share appropriate documentation (**action, Secretariat, ongoing**).

5.7 The meeting recalled that the CONOPS recommended that all WIGOS observational data and metadata and processed observational products should adhere to WIGOS standards for instruments and methods of observation as well as standard observing network practices and procedures and will be exchanged via WIS using agreed upon data and metadata representation forms and formats. To achieve this, the meeting agreed that a key element to add in the Project Plan was the promotion of instrument centres dedicated to marine and other appropriate oceanographic instruments (**action, ad hoc Steering Group, ongoing**). Such centres would be essential for monitoring instrument performance, calibration procedures, providing assistance with regard to intercomparisons, as well as providing for appropriate training facilities that would complement what the manufacturers are already providing. Invited ocean experts would be in a position to provide required training. The meeting recalled CIMO's experience with regard to regional instrument centres and radiation centres, and recommended CIMO to provide assistance regarding the establishment of such centres (**action, CIMO, as soon as possible**). The meeting

noted that the WMO web site provided a current list of regional instrument centres (<http://www.wmo.int/pages/prog/www/IMOP/IMOP-home.html>). Their Terms of Reference are reproduced in Annex VI. The meeting also noted that links should be established with the climate community as climate instrument centres have also been developed (**action, Secretariat, as soon as possible**).

5.8 The meeting noted the cooperation established by CIMO with the Association of Hydro-Meteorological Equipment Industry (HMEI) in terms of evaluating instrument performances for documenting them. The meeting asked the Secretariat to approach HMEI to seek their participation in the Pilot Project (**action, Secretariat, as soon as possible**).

5.9 The meeting agreed with the strategy described above and recognized the following benefits to be expected from the Pilot Project: (i) more data will meet the requirements of one or more of the identified applications (e.g. NWP, climate forecast, ocean mesoscale forecast, marine climatology, satellite validation and bias correction); (ii) the data quality and the conditions under which the measurements are made will be known; (iii) data quality will improve as well as their consistency (thanks to wider acceptance of documented standards); (iv) data will be more timely in reaching their targeted applications and data assimilation systems; (v) duplication will be avoided and the origin of the data identified; (vi) users will have increased trust in the data; and finally (vii) the products and services using such data will improve.

6. STRATEGY FOR DEVELOPING THE BUSINESS CASE FOR THE PILOT PROJECT

6.1 The meeting reviewed and discussed the potential benefits that the Meteorological and Oceanographic agencies could gain from developing the Pilot Project. It agreed that it would be useful for the Pilot Project to develop a business case to be used by the Directors of these agencies to make the case at the national level for becoming a partner in the JCOMM Pilot Project for WIGOS, and therefore engaging in the necessary developments, funded nationally, to meet the requirements eventually proposed under the Pilot Project. While remaining relatively simple through a qualitative approach, the document should include the information necessary for funding to be obtained. The Group agreed that the name "business case" was not appropriate and suggested calling it a "business plan", and that there was insufficient time during this one day meeting to review the draft template that was presented.

6.2 The meeting asked for a small task group comprised of Candyce Clark (leader), Bob Keeley, and Terry Tielking, with the addition of Jack Harlan (to be asked if he is willing to participate) to finalize the template by the first meeting of the Pilot Project *ad hoc* Steering Group (**action, task group, Sept 2008**). The participants at the meeting were invited to provide the task group with input or examples (**action, meeting participants, Sept 2008**).

6.3 The meeting noted that three basic documents will have to be developed to answer the following questions:

Question	Document
Why the Pilot Project?	Business plan
What is the Pilot Project?	Project plan
How to develop the Pilot Project?	Implementation plan (e.g. requirements for partners to develop interoperability)

7. CAPACITY BUILDING

7.1 The meeting addressed Capacity Building issues in order to engage developing countries to become part of the Project. The meeting noted that two issues had to be considered, namely: (i) contribution of information to the WIS and ODP, thanks to participation in the JCOMM OPA, CB training courses, instrument donation, etc., and (ii) accessing information from the WIS and ODP.

7.2 The meeting agreed that the organization of training courses would be an effective mechanism and noted that appropriate facilities were available at the IOC Project Office for IODE in Ostend. The meeting agreed that the IODE Ocean Data and Information Networks (ODINs) could substantially help developing countries to benefit from the Pilot Project by engaging in it as partners. For example, the ODIN for the Black Sea (ODINBlackSea) was working on an action plan for integrating real time and delayed mode data sets in the ODP based on E2E technology. The ODIN for the Caribbean and South America (ODINCARSA) has also expressed interest in using the E2E technology. The meeting requested Greg Reed to ask the ODINAFRICA planning committee to consider the inclusion of ODP and WIGOS activities in the ODINAFRICA-IV proposal that will be prepared in May 2008 (**action, Greg Reed, as soon as possible**).

7.3 The meeting noted that the WMO Education and Training Programme (ETRP) would be an effective mechanism for promoting WIGOS and the JCOMM Pilot Project in developing countries by providing training materials and training courses to them. It requested the Secretariat to investigate how ETRP could be involved in the development of the project plan (**action, Secretariat, ongoing**).

7.4 The meeting also agreed that one or more of the WIGOS Demonstration Projects should be associated to the JCOMM Pilot Project. The meeting at least identified Morocco (RA I), USA (RA IV), Australia (RA V), and the Russian Federation (RA VI) as potential candidates. It asked the WMO Secretariat to check the current status of the demonstration projects, to approach them and investigate whether interest was expressed by some of them to be associated (**action, Secretariat, May 2008**).

7.5 The meeting noted that a Training Course on the End-To-End Technology was successfully organized at the IODE Project Office for IODE in 2007. The meeting recommended that the IODE PO Secretariat contact all the participants at the Training Course, invite them to participate in the Pilot Project, and ask them to list any additional requirements they might have in terms of training (**action, IODE PO, April 2008**).

7.6 The meeting agreed that training materials had to be developed. At the same time, it noted that the JCOMM DMCG had an action item to review and update 11 documents relevant to the End-To-End (E2E) technology and appropriate for the Pilot Project.

7.7 The meeting recommended that the JCOMM Observations Programme Area and its Sub-Panels review the marine chapter of the WMO Publication No. 8 with the view to provide feedback and proposed updates to CIMO (**action, OPA, ongoing**).

7.8 The meeting agreed that visits of experts to national meteorological and oceanographic agencies will be required to promote the implementation of WIGOS at the national level, and to assist with development of interoperability arrangements with the WIS. While noting that funding requirements in this regard would remain low during the first year, it was likely to increase in the following years. It recommended the *ad hoc* Steering Group to precisely evaluate required resources in this regard for inclusion on the project plan (**action, ad hoc Steering Group, Sept 2008**).

7.9 The meeting noted that CIMO was cooperating with the HMEI in terms of Capacity Building and requested the WMO Secretariat to contact HMEI to investigate how HMEI could assist the Pilot Project in a similar way (**action, Secretariat, April 2008**).

8. PROJECT PLAN

8.1 Bob Keeley presented the project plan as developed so far in liaison with the JCOMM Co-Presidents and the WMO Secretariat. The plan had been presented to the sixth JCOMM Management committee and the first meeting of the WMO EC WG on WIGOS-WIS. It was then refined with input from Greg Reed and Nick Mikhailov prior to the meeting.

8.2 The meeting reviewed the project plan and checked its compatibility with the WIGOS Concept of Operations (CONOPS). It proposed some changes (Annex V) but agreed that it should still be refined by the first Session of the *ad hoc* Steering Group late this year (**action, ad hoc Steering Group, Sept 2008**). The modified version of the project plan is provided in Annex V. Participants at the meeting were invited to provide feedback to the *ad hoc* Steering Group for updating the project plan (**action, participants, Aug 2008**). As discussed under agenda item 6, the meeting also agreed to develop an implementation plan to complement the project plan. It requested Robert Keeley and the Secretariat to produce a first draft version by September 2008 (**action, Robert Keeley, Sept 2008**). The implementation plan will provide for detailed information on actions proposed to implement the plan. The meeting asked the Secretariat to add an agenda item in the provisional agenda that will be proposed for the first meeting of the *ad hoc* Steering Group for completing the implementation plan and listing actual partners (**action, Secretariat, mid-2008**).

8.3 The participants invited Greg Reed, and Robert Keeley to prepare an Ocean Data Portal project plan that ought then to be reflected in the JCOMM Pilot Project plan so that the two initiatives are consistent, synergies addressed, and do not duplicate efforts (**action, Greg Reed, Sept 2008**). The ODP Project plan will address the role of the IODE in ODP.

9. IDENTIFY POTENTIAL AND INITIAL VOLUNTEERING PARTNERS AS WELL AS DATA SETS TO INCLUDE

9.1 Participants at the meeting provided information regarding their foreseen level of participation in the Pilot Project. The meeting then investigated what additional agency or centre could be invited to participate in the Pilot Project and explored what specific data sets should be given priority for inclusion in the Pilot Project. From the discussion, the following: (i) potential data sets, products, and partners; and (ii) tentatively committed ones were identified:

Potential partners:

- In situ data sets from the JCOMM Observations Programme Area such as:
 - Profiling floats (Argo),
 - Deep ocean time-series reference stations (OceanSITES),
 - Tropical moorings (TAO),
 - Drifters (DBCP),
 - Ship based observations on the SOT (ASAP, VOS, XBTs),
 - Tide gauges (GLOSS),
 - Water temperature and salinity profiles (GTSP),
 - Surface underway data (GOSUD),
 - Ocean carbon (IOCCP), etc.
- Satellite products and analysis, and merged in situ/satellite products (e.g. GHRST)
- Model output fields (e.g. GODAE)
- Metadata about the platforms/instruments (e.g. META-T)
- Integrated data systems (e.g. SeaDataNet, DMAC)
- ODINs (Demonstration projects, because some of them had E2E training course already they could provide data sets and get access to the WIS)
- Fast delivery sea level data (University of Hawaii Sea Level Center)
- Instrument centres
- Ocean current data from VOS

Tentatively committed partners:

- US NODC (Terry Tielking)
 - World Ocean Atlas
 - World Ocean Database
 - US NODC GTSP (Charles Sun)

- Surface currents from HF radar (Jack Harlan)
- Russian Federation NODC (Nick Mikhailov):
 - EndTo-End prototype technology, Russian Federation
- GTS operational database, marine surface climatology (air T, SST, sub-sal, oxygen)
- Canada, ISDM (Bob Keeley):
 - Upper ocean T&S gridded in situ fields
 - Ocean currents derived from surface drifters
- Permanent Service for Mean Sea Level (PSMSL) (Lesley Rickards)
- Marine Climatological Summaries and Global Collecting Centres (GCCs) (UK Met Office or DWD via Virtual GISC) (Nicola Scott)
- Blended quality climatology products (e.g. ICOADS) (Scott Woodruff)

9.2 The meeting agreed that a more detailed list of identified partners, including focal points, should be made available at the first meeting of the *ad hoc* Steering Group. It requested the *ad hoc* Steering Group and the Secretariat to liaise with the potential partners and to seek information from them regarding their interest in the Pilot Project and their possible future participation (**action, *ad hoc* Steering Group, Aug 2008**).

9.3 The meeting noted that the requirements for participating in the Pilot Project had to be clearly defined in order to bring new partners into the project and to assist identified ones in understanding all implications of their participation. Particularly, E2E technology requirements, requirements for offering data sets to the WIS and ODP, as well as requirements for being able to access WIS data will have to be documented.

9.4 The meeting suggested that the *ad hoc* Steering Group work at the requirements and liaise with Nick Mikhailov to understand the efforts required to develop the interoperability component. The meeting noted the action resulting from the Third Session of the JCOMM DMCG regarding the review of the E2E technology documentation (11 documents). It asked the DMCG group reviewing the documents to address the priority given to the Pilot Project requirements. It requested the DMCG group to review the documents relevant to implementation and “check list” first, and to distribute them to the tentatively committed partners listed above as well as to Bob Keeley to ask them to provide feedback with regard to their specific implementation of the E2E (**action, DMCG E2E doc review group, Sept 2008**). Results from this exercise will constitute input for the Pilot Project implementation plan.

9.5 The meeting noted that the real-time GTS data were de facto and by definition already part of WIS and therefore included in the Pilot Project. It also noted that many of the potential partners listed above were already providing the data through the GTS (e.g. Argo, DBCP, VOS, XBTs, ASAP). However, value added data from these projects were also available and efforts will have to be made to integrate them in the WIGOS framework.

9.6 The meeting agreed that its plan should be made consistent with the WIS implementation plan. In particular, it will be important to identify through what GISC and when WIS access will be possible for every data set.

10. STEERING TEAM TERMS OF REFERENCE & MEMBERS, AND PARTNERS IN THE PILOT PROJECT

10.1 The meeting discussed requirements for establishing a Steering Group for the Pilot Project, including its Terms of Reference and membership. The meeting recalled the recommendation from the Third Session of the JCOMM Data Management Coordination Group (DMCG), Ostend, Belgium, 26-28 March 2008, to combine efforts of the JCOMM Pilot Project for WIGOS with the Ocean Data Portal initiative of the IODE as important synergies were foreseen between the two projects. It was proposed to establish a joint Steering Group instead of two distinct steering teams. The meeting agreed with this proposal. The Steering Group would be called the “Joint Steering Group for the IODE Ocean Data Portal and the JCOMM Pilot Project for WIGOS”.

10.2 The meeting proposed that the Steering Group should have two co-chairpersons, one with an IODE ODP perspective, and one with a WIGOS perspective. Until formal nomination by appropriate bodies, the meeting proposed Greg Reed to Co-chair the *ad hoc* Steering Group on the IODE side. Rainer Dombrowsky was asked to nominate a CIMO representative to Co-chair from a WIGOS perspective (**action, Rainer Dombrowsky, April 2008**).

10.3 The meeting reviewed the draft Terms of Reference for the Steering Group. These are provided in Annex III. The meeting requested Greg Reed to coordinate the finalization of the proposed Terms of Reference in liaison with Rainer Dombrowsky before 30 April (**action, Greg Reed, 30 April 2008**). Once agreed, the draft Terms of Reference ought to be sent to Dr Nash, Chairman of the WMO EC WG WIGOS-WIS Sub Group (**action, Secretariat, May 2008**). The proposed TOR will then be submitted to the *ad hoc* Steering Group for adoption at its first meeting in September 2008. The Terms of Reference and Membership will eventually be presented for approval to the second meeting of the WMO EC WG for WIGOS-WIS (as well as its Sub-Group), and to the Twentieth Session of the IODE.

10.4 The meeting agreed with the following membership for the *ad hoc* Steering Group (those indicated with a “*” have offered to fund their participation in the group and related meetings from national sources):

- **IODE Co-Chair - Greg Reed, or his representative**
- **CIMO Representative (Co-Chair) – Rainer Dombrowsky to designate a person**
- JCOMM DMPA Coordinator - *Bob Keeley*
- JCOMM OPA Representative – *Candyce Clark**
- JCOMM ET-DMP Chair - *Nick Mikhailov*
- WIS Representative – *Eliot Christian*
- US-IOOS representative, Jack Harlan*
- US NODC representative, Terry Tielking to suggest person*
- MCSS and GCC representative – *Nicola Scott*
- Atmospheric climate (AOPC) WMO Secretariat to raise issue at next AOPC meeting

10.5 Remaining nominations will have to be made by the end of April 2008 (**action, ad hoc Steering Group, 30 April 2008**). A couple of additional technical people will be nominated.

10.6 The participants agreed to plan for the first meeting of the *ad hoc* Steering Group, tentatively in Geneva, Switzerland, from 16 to 17 September 2008. This will offer an opportunity to interact with the CBS Inter Coordination Team on the Integrated Observing System (ICT-IOS) which will also meet in Geneva during this period.

10.7 While the Steering Group will be relatively small and focus on the project plan, the meeting agreed that a more comprehensive list of individuals should be proposed in parallel as “participants”. The participants will include the following persons:

- Members of the IODE/JCOMM ETDMP Task Team for Ocean Data Portal and the JCOMM Pilot Project for WIGOS (nine people, including representatives of SeaDataNet, Australian BOM, OBIS, GEOSS, WIS/WIGOS; needs to meet regularly; financial implications are estimated at a level of about \$15k per year).
- Members of the IODE/JCOMM ETDMP Task Team for Standards Process (functions mainly by email; financial implications are low).
- Committed partners listed in paragraph nine above and not belonging to the *ad hoc* Steering Group (i.e. Terry Tielking, Leslie Rickards, and Scott Woodruff).
- JCOMM DBCP Chairperson - David Meldrum.
- JCOMM SOT Chairperson - Graeme Ball.
- Other participant as required.

10.8 The meeting requested the *ad hoc* Steering Group to consider proposing a funding mechanism for hiring a consultant to produce the JCOMM Catalogue of standards (***action, ad hoc Steering Group, Sept 2008***).

11. REPORT TO THE WMO EXECUTIVE COUNCIL

11.1 The meeting discussed the requirements for the reporting to the WMO Executive Council working Group on WIGOS-WIS and its Sub-Group. It noted that the Sub-Group was planned to meet probably in Geneva in November 2008, and the EC WG WIGOS-WIS also in Geneva in December 2008.

11.2 The meeting noted that resources required to develop the Pilot Project had to be thoroughly addressed. While the requirements for this year were relatively well identified (this meeting, the meeting planned in September 2008 and the visit of experts to specialized meeting), the requirements for the following years were likely to differ. The participants agreed that future meetings would make recommendations on the costs and resources required for the following years.

11.3 The meeting agreed that it had to plan for the first meeting of the *ad hoc* Steering Group in September 2008 to discuss these issues in particular and to finalize a report to the sub-group of the WMO EC WG WIGOS-WIS. It requested the Secretariat in liaison with Greg Reed and Bob Keeley to prepare the draft document to be discussed at the first meeting of the *ad hoc* Steering Group and eventually presented to the Sub-Group of the ET WG on WIGOS-WIS (***action, Secretariat, Greg Reed and Bob Keeley, Sept 2008***). The participants agreed that the following items should eventually be included in the agenda for the first meeting of the *ad hoc* Steering Group:

- Consideration on how to finance JCOMM catalogue on best practices and standards;
- Implementation of some of the data sets based on E2E requirements;
- Certify/verify the documents (business plan, project plan);
- Produce an implementation plan;
- Address costs related to the implementation plan and to be included in the business plan;
- How to actually have the work done (consultant requirements etc.);
- Budget and projected costs;
- Name and acronym for the Pilot Project; and
- What information to be published on the web.

12. CLOSURE OF THE SESSION

12.1 The Chairperson of the meeting, Mr Bob Keeley, expressed his sincere thanks to the IOC Project Office for IODE, and particularly to Mr Peter Pissierssens, for hosting the meeting and providing such excellent hospitality and support. He also thanked the participants and the Secretariat for their very positive contributions during the meeting.

12.2 Action items arising from the meeting are summarized in Annex VII.

12.3 The meeting of the *ad hoc* planning meeting for the JCOMM Pilot Project for WIGOS closed at 5:30 pm on 29 March 2008.

ANNEX I

AGENDA

1. ORGANIZATION OF THE SESSION

- 1.1 Opening of the meeting
- 1.2 Adoption of the agenda
- 1.3 Working arrangements

2. PRESENTATION OF THE PILOT PROJECT

3. INSTRUMENT BEST PRACTICES (AND RELATION WITH CIMO)

4. INTEROPERABILITY WITH THE WIS

5. QUALITY MANAGEMENT

6. STRATEGY FOR DEVELOPING THE BUSINESS CASE FOR THE PILOT PROJECT

7. CAPACITY BUILDING

8. PROJECT PLAN

9. IDENTIFY POTENTIAL AND INITIAL VOLUNTEERING PARTNERS AS WELL AS DATA SETS TO INCLUDE

10. STEERING TEAM TERMS OF REFERENCE & MEMBERS, AND PARTNERS IN THE PILOT PROJECT

11. REPORT TO THE WMO EXECUTIVE COUNCIL

12. CLOSURE OF THE SESSION

ANNEX II

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ANNEX III

DRAFT* TERMS OF REFERENCE FOR THE JOINT STEERING GROUP FOR THE IODE OCEAN DATA PORTAL AND THE JCOMM PILOT PROJECT FOR WIGOS

The development of the JCOMM Pilot Project for WIGOS on one hand, and the IOC Ocean Data Portal on the other hand will be coordinated by a joint Steering Group, providing liaison with appropriate WMO and IOC Programmes and subsidiary bodies. The Steering group will be responsible for:

- a) Producing the respective Pilot Project Plans in a coherent and consistent way;
- b) Liaising with the WMO EC WG WIGOS-WIS sub-group on WIGOS (SG-WIGOS) regarding the development of the Pilot Project and refinement of the WIGOS Concept of Operations (CONOPS);
- c) Liaising with the IODE Officers regarding the development of the Ocean Data Portal (ODP);
- d) Promoting the continued development and implementation of a system that provides data and information from a sustained and coordinated global ocean observing system;
- e) Coordinating and promoting the development, documentation, and integration of best practices for the different components of the marine observing and data systems;
- f) Coordinating and promoting the development of interoperability arrangements between different components of the marine data system, and the provision of the real-time and delayed mode observational data through the WIS and ODP;
- g) Coordinating and promoting the development, documentation, and integration of Quality Management Systems (QMS) at the required levels of the data production line from marine observations to the delivery of data and products;
- h) Coordinate its activities with the other WIGOS Pilot Projects as well as the WIGOS Demonstration Projects;
- i) Seeking resources to be committed to the Pilot Project;
- j) Guiding the implementation of the plan and working with the WMO and IOC Secretariats to facilitate its implementation;

The Steering Group will report to the WMO Executive Council Working Group on WIGOS-WIS via its sub-group on one hand, and to the IOC International Oceanographic Data and Information Exchange (IODE) on the other hand. Reporting will also be provided to the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM).

* To be finalized by Greg Reed by 30 April 2008 in coordination with the participants at the ad hoc planning meeting for the JCOMM Pilot Project for WIGOS, Ostend, 29 March 2008.

ANNEX IV

THE JCOMM PILOT PROJECT FOR WIGOS (OUTLINE)

(29 March 2008)

“Integration of marine meteorological and other appropriate oceanographic observations into the WMO Integrated Global Observing Systems”

Project Name	JCOMM Pilot Project for WIGOS
Acronym	N/A
Project Type	Pilot
Project Status	The pilot is currently in its initial stage of collaboration and planning. A Joint Steering Group for the IODE Ocean Data Portal and the JCOMM Pilot Project for WIGOS was proposed at the Third Session of the JCOMM DMCG (Ostend, Belgium, 27-28 March 2008), and the <i>ad hoc</i> planning meeting for the JCOMM Pilot Project for WIGOS (Ostend, Belgium, 29 March 2008).
Project Overview	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) promoting and documenting best practices, (ii) promoting interoperable arrangements between ocean data systems and the WIS, and (ii) quality management. The Project will recognize and respect the ownership of all partner organizations as well as the WMO and IOC data policies.
Project Aims	<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>Partners/Participants</p>	<ul style="list-style-type: none"> • International organizations co-sponsoring GOOS: WMO, IOC, UNEP and ICSU • WMO and IOC Technical Commissions and Programmes (e.g. CIMO, CBS, GOOS and IODE) • WMO Information Systems and its Expert Teams, ICT-WIS • Ocean Data Portal and ETDMP Task Team on ODP/JCOMM Pilot Project WIGOS • ETDMP Task Team on standards process • IODE Ocean Data and Information Networks (ODINs) • JCOMM E2E prototype (Russian Federation NODC, Obninsk) • Instrument centres • Observing Panels • Association of Hydro-Meteorological Equipment Industry (HMEI) • Partners hosting relevant data sets <ul style="list-style-type: none"> ○ In situ and space based ocean observations data sets ○ Surface based remote sensing (e.g. HR Radar) ○ Model output fields (e.g. GODAE) ○ Metadata about the platforms/instruments (e.g. META-T) ○ Climatologies (Marine Climatological Summaries and World Ocean Atlas) ○ Blended quality climatology products (e.g. ICOADS) ○ Integrated data sets (e.g. World Ocean Atlas and SeaDataNet, DMAC) ○ Upper ocean T&S gridded in situ fields ○ Permanent Service for Mean Sea Level (PSMSL) • Additional participants and partners to be discussed and defined
<p>Funding Source(s)</p>	<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>
<p>Project Timescale</p>	<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;</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>

<p><i>Expected Key Deliverables</i></p>	<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"> (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; (ii) Project Plan; (iii) Implementation Plan; (iii) Documenting and integrating best practices and standards among the marine meteorological and oceanographic communities; (iv) Developing interoperable arrangements between the marine and oceanographic data systems and the WMO Information System (WIS) in close cooperation with the IOC ocean community; (v) Establishing compliance with the WMO Quality Management Framework (QMF); (vi) Participation in the WMO ET-EGOS Rolling Review of Requirements (RRR) process and provide input to the WMO Database (instrument performances and requirements).
<p><i>Project Links</i></p>	<p>http://www.wmo.int/pages/prog/www/wigos/index_en.html http://www.oceandataportal.net http://www.oceandatastandards.org</p>

<p>Project Summary</p>	<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>-1- Documenting and integrating best practices and standards. 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>-2- Making marine data systems and WIS interoperable. 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>-3- Quality Management. 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 Quality Management Principles 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>
<p>Date of Last Update</p>	<p>29/03/2008</p>
<p>JCOMM Contact Person Name Organization Address Telephone Fax E-Mail</p>	<p>Mr Robert Keeley Integrated Science Data Management Department of Fisheries and Oceans Canada 12W082 - 200 Kent Street Ottawa K1A 0E6 Ontario Canada Tel: +1 613 990-0246 Fax: +1 613 993-4658 E-mail: Robert.Keeley@dfo-mpo.gc.ca</p>

ANNEX V

JCOMM PILOT PROJECT FOR WIGOS, PROJECT PLAN (as of 29 March 2008)

INTEGRATION OF MARINE METEOROLOGICAL AND OTHER APPROPRIATE OCEANIC OBSERVATIONS INTO THE WMO GLOBAL OBSERVING SYSTEMS

1. BACKGROUND

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

2. SCOPE AND DELIVERABLES

2.1 Scope

2.1.1 The JCOMM Management Committee, following guidance from the WMO Executive Council Working Group on the WMO Integrated Global Observing System and the Information System (WIS) (EC-WG/WIGOS-WIS), has drafted this version of the Pilot Project plan and has proposed an *ad hoc* Steering Group for coordinating and facilitating the development and implementation of the JCOMM Pilot Project for WIGOS (including relevant WIS items) as well as the IODE Ocean Data Portal (ODP).

2.1.2 This will, of course, require coordination with appropriate WMO Technical Commissions and Expert Teams:

- The WMO Commission for Basic Systems (CBS) is responsible in particular for the cooperation with Members, other technical commissions and relevant bodies in the development and operation of integrated systems for observing, data-processing, telecommunications, and data management in response to requirements of all WMO Programmes and opportunities provided by technological developments. The development of the WMO Information Systems (WIS) is undertaken in the framework of the CBS. WIS will be at the heart of the JCOMM Pilot Project for WIGOS as developing interoperability of ocean data management systems with the WIS will be one of the key Pilot Project deliverables. The development of the WIS is coordinated through the Inter Commission Coordination Group on WIS (ICT-WIS). Three Expert Teams have also been established by the CBS to undertake specific aspects of the WIS development: (i) the Inter - Programme Expert Team on Metadata Implementation (IPET-MI), (ii) the Expert Team on Global Information System Centres (GISC) and Data Collection and Production Centres (DCPC) (ET-WISC), and (iii) the Expert Team on WIS GTS, Communication Techniques and Structures (ET-CTS). Liaison with these Expert Teams will be developed further. See details under 3.4 (roles) below.
- The WMO Commission for Instruments and Methods of Observation (CIMO) is responsible for matters relating to international standardization and compatibility of instruments and methods of observation of meteorological, related geophysical, and environmental variables. The work of CIMO relates directly to one of the deliverables of the Pilot Project, i.e. documenting and integrating best practices and standards being

used amongst the marine meteorological and oceanographic communities. As standards and best practices have in some cases been developed separately between the meteorological (via CIMO) and oceanographic (via IOC and its IODE) communities enhanced coordination between the two will be required. See details under 3.4 (roles) below.

2.1.3 In addition, this will require coordination with:

- The JCOMM Management Committee (MAN) with regard to the overall development of the Pilot Project, and JCOMM cross cutting issues;
- The JCOMM Observations Programme Area (OPA) and its Observations Panels to assist in the development of best practices and standards, and ensure that the flow of real-time and delayed mode observations will eventually be provided through the WIS and partner ocean data systems;
- The JCOMM Data Management Programme Area (DMPA) to assist in the development of standards through a proposed standards development and accreditation process, as well as to coordinate the development of interoperable arrangements between the ocean data systems and the WIS;
- The IOC of UNESCO through the International Oceanographic Data and Information Exchange (IODE) committee to assist in the development of standards through a proposed standards development and accreditation process, to coordinate the development of interoperable arrangements between the ocean data systems and the WIS, to ensure a sufficient level of compatibility between the Marine Community Metadata profile (MCP) and the WMO Core Profile, as well as to connect National Oceanographic Data Centres (NODC) and the Ocean Data Portal (ODP) with the WIS.

2.1.4 Coordination with the IOC-WMO-ICSU-UNEP Global Ocean Observing System and its GOOS Scientific Steering Committee (GSSC) will also be required to make sure that the standards and best practices developed meet their expressed requirements. Through linkages between NODCs and World Data Centres of ICSU, the project will endeavour to engage at least one WDC Oceanography.

2.1.5 Progress will be reported to the JCOMM Management Committee and to the WMO EC Working Group on WIGOS-WIS by the JCOMM Pilot Project representative at their regular Sessions.

2.2 Deliverables

2.2.1 The Pilot Project will promote the following: (i) documentation and integration of best practices and standards among the marine meteorological and oceanographic communities; (ii) interoperability of marine data systems with the WMO Information System (WIS) in close cooperation with the IOC ocean community; and (iii) establish compliance with the WMO Quality Management Framework (QMF). This will be realized according to the following guidelines:

2.2.2 *Documenting and integrating best practices and standards*

2.2.2.1 The goal is to define and agree on common standards 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. Data records must be traceable to standards. Maintenance and calibration issues are critical for ensuring stability and sustainability of systems. Work is needed to understand the systems and components, to document observing platform siting and history, record and update the metadata, and eventually to eliminate inhomogeneities in data records. For example, one of the challenges proposed by the climate community was to conduct instrument intercomparisons over a long enough period, usually

on the order of 10 years. Best practices and standards have sometimes been developed separately between the oceanographic (e.g. sea level) and the marine meteorological (e.g. voluntary observing ships) communities when there was no clear connection. However, there are instances where these have been developed in common between the WMO and IOC (e.g. ships of opportunity and data buoys). Still, much work remains to be undertaken.

2.2.2.2 Some documentation of practices already exists. Based on these, the Pilot Project will identify standards and best practices that are relevant to it, identify those publications that need updating, and make recommendations for updating them. Updating existing standards or developing new ones will be made in a way consistent with the process that is now being developed jointly by JCOMM and IODE under the new ETDMP Pilot Project.

2.2.2.3 To achieve integration of instrument best practices, the Project Plan will be promoting the establishment of instrument centres dedicated to marine and other appropriate oceanographic instruments. Such centres will be essential for monitoring instrument performance, calibration procedures, providing assistance with regard to intercomparisons, as well as providing for appropriate training facilities that would complement what the manufacturers are already providing. Invited ocean experts will be in a position to provide required training. CIMO has build experience in this regard and will be assisting the Pilot Project regarding the establishment of such centres (<http://www.wmo.int/pages/prog/www/IMOP/IMOP-home.html>). Links will be established with the climate community as climate instrument centres have also been developed. The Pilot Project will also cooperate with the Association of Hydro-Meteorological Equipment Industry (HMEI) for evaluating instrument performances and documenting them.

2.2.3 *Making marine data systems and WIS interoperable*

2.2.3.1 The goal is to provide access to marine meteorological and oceanographic data and information to serve a number of applications, including climate, in an integrated way via the WIS and thereby facilitating access to well documented and standardized data. Despite the WMO Resolution 40 that designates marine data as essential, it is presently difficult for the oceanographic community to access the Global Telecommunication System (GTS) in order to obtain marine observations in real-time or delayed mode and to provide data to circulate on the GTS.

2.2.3.2 The WMO Information System was designed as an overarching, integrated system that meets the requirements for data exchange of all WMO Programmes, affiliated international organizations and programmes, as well as relevant national non-NMHS users such as disaster prevention and mitigation agencies and research facilities. The main functional components of WIS are: National Centres (NC), Data Collection or Product Centres (DCPC), Global Information System Centres (GISC) and data communication networks connecting the components. WIS provides for (i) routine collection and automated dissemination of operation-critical data, (ii) timely delivery of high-volume data and processed products ("push"), (iii) discovery, access, retrieval services for data from WMO Programmes and Co-sponsored programmes ("pull"), and (iv) common procedures for real- and non-real time data exchange and standardized data formats and metadata.

2.2.3.3 At the same time, the ocean community has real-time and delayed mode data systems that will have to become interoperable. Work has already started with the development of (i) the JCOMM/IODE End-To-End Data Management technology, and the DCPC prototype developed at the Russian Federation NODC in Obninsk, and (ii) the Ocean Data Portal (ODP) at the data discovery level. Much work remains to develop interoperability between the two communities at both the data discovery (metadata) and data level (compatible formats). The Pilot Project will address these two aspects.

2.2.4 *Quality Management*

2.2.4.1 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 [Quality Management Principles](#) 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, Mutually beneficial supplier relationships).

3. PILOT PROJECT APPROACH, ROLES AND RESPONSIBILITIES

3.1 Cooperation with the ocean community

3.1.1 Operational models of the interior of the oceans have been significantly improved with the success of the Argo Pilot Project deploying an increasing number of instruments and having lately attained the 3000 float target. A number of countries are now engaged in combining multi-level atmospheric and oceanographic models and installing real-time modelling functions. With this ability, the oceanographic community is seeing important advantages to becoming involved in making, reporting and using ocean observations in real-time. The ocean observing components of JCOMM that are not currently reporting onto the GTS will be encouraged to submit their data in real-time through the WIS (this should be easier to realize than with the current GTS because of the greater variety of available formats and the possibility of the WIS to consider specific data exchange policies).

3.1.2 We can expect the importance of historical data to modelling will increase. Historical data are valuable as tests of the ability of models to reproduce past conditions and so provide confidence that they can also make reliable predictions. As well as the high resolution, high quality delayed mode data that reach data centres in the ocean community will be important for hindcasting conditions in areas that were poorly sampled in the past or improving the forecasts of operational models that use real-time data only.

3.1.3 The following aspects will be considered for the Pilot Project:

1. Providing access through the WIS to historical and recent data holdings in ocean data centres. This work will exploit the prototype JCOMM End-To-End Data Management (E2EDM) effort that has already started. However, substantial effort remains to integrate the various sources of *in situ* and satellite data (e.g. Argo, OceanSITES, GHRSSST, XBT, Ocean carbon, sea level stations, satellite altimetry data, etc.). The Pilot Project will consider prioritization for the integration of these different components. Managers of the data systems involved in these programmes will be approached to encourage them to install the necessary software infrastructure to support access. Those systems for which access is relatively simply met will be included earlier than others.
2. At the same time that marine data managers are being approached to provide access, to the data they will also be encouraged to join the efforts to develop documentation in the form of discovery metadata, and standards and best practices for such data. This will result in more consistency in processing, and available documentation for users that explains where the data can be found and the processes through which the data have gone.
3. The Ocean Community is developing the Ocean Data Portal (ODP) under the auspices of the International Oceanographic Data and Information Exchange (IODE). The Ocean Data Portal is based on a standards-based infrastructure that provides the integration of marine data and information from a network of distributed IODE National Oceanographic Data Centres (NODCs). The key principle of the Ocean Data Portal is the interoperability with existing systems and resources. ODP will require

IODE data centres to generate discovery metadata about their datasets for distributed data search and retrieving. OPD will periodically harvest these metadata, monitor the accessibility of a remote data source and update the portal metadata catalogue. Hence, users will be able to search for single or multiple data types from a distributed set of sources. The ocean community will contribute to the Pilot Project through interoperability arrangements of the ODP with the WIS.

4. To recognize ownership of both WMO and IOC marine and oceanographic observing systems, the development of marine and oceanographic instrument centres will have to be made in the framework of the joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM). Such instrument centres could then be hosted by either an NMHS or an oceanographic institute.

3.2 Benefits

3.2.1 There are clear advantages for the ocean community to participate in the Pilot Project and provide interoperability with the WIS. These include:

- Improving their visibility with the National Meteorological and Hydrological Services (NMHS) while keeping their independence regarding parallel data systems they have put in place;
- Gaining better access to meteorological (input for ocean modelling and research applications regarding ocean-atmosphere interactions), and climate (input for ocean modelling), and hydrological (river discharges into the oceans) data through direct WIS access. It will be more difficult to access some of these data outside of the scope of the Pilot Project;
- Solidifying the links between meteorological and oceanographic data centres (by providing time critical and delayed mode ocean data to the WIS and accessing multi-disciplinary data from the WIS);
- Accessing more, and better data of known quality obtained through consistent, coherent, and traceable instrumentation that meet standards agreed upon between both the meteorological and oceanographic communities. This will permit a better use of the data for the production of consistent products as well as facilitating observational data intercomparisons, and data quality monitoring;
- Enhancing the development of operational oceanography nationally or worldwide for delivering products and services that serve the end-users better (e.g. ocean mesoscale forecast).

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

- Gaining better access to oceanographic data to feed into operational and research applications;
- WIS will provide for multi-disciplinary access to data;
- Enhancing NMHS cooperation with the oceanographic centres nationally or worldwide for delivering products and services that serve the end users better (weather forecasts, marine services, marine climatology, climate monitoring and prediction).

3.3 Joint Steering Group for the IODE Ocean Data Portal and the JCOMM Pilot Project for WIGOS

3.3.1 The development of the JCOMM Pilot Project for WIGOS on one hand, and the IOC Ocean Data Portal on the other hand will be coordinated by a joint Steering Group, providing liaison with appropriate WMO and IOC Programmes and subsidiary bodies. The Steering Group will be responsible for:

- a) Producing the respective Pilot Project Plans in a coherent and consistent way;
- b) Liaising with the WMO EC WG WIGOS-WIS Sub-Group on WIGOS (SG-WIGOS) regarding the development of the Pilot Project and refinement of the WIGOS Concept of Operations (CONOPS);
- c) Liaising with the IODE Officers regarding the development of the Ocean Data Portal (ODP);
- d) Promoting the continued development and implementation of a system that provides data and information from a sustained and coordinated global ocean observing system;
- e) Coordinating and promoting the development, documentation, and integration of best practices for the different components of the marine observing and data systems;
- f) Coordinating and promoting the development of interoperability arrangements between different components of the marine data system, and the provision of the real-time and delayed mode observational data through the WIS and ODP;
- g) Coordinating and promoting the development, documentation, and integration of Quality Management Systems (QMS) at the required levels of the data production line from marine observations to the delivery of data and products;
- h) Coordinate its activities with the other WIGOS Pilot Projects as well as the WIGOS Demonstration Projects;
- i) Seeking resources to be committed to the Pilot Project;
- j) Guiding the implementation of the plan and working with the WMO and IOC Secretariats to facilitate its implementation.

3.3.2 The Steering Group will report to the WMO Executive Council Working Group on WIGOS-WIS via its sub-group on one hand, and to the IOC International Oceanographic Data and Information Exchange (IODE) on the other hand. Reporting will also be provided to the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM).

3.3.3 Initial Members of the *ad hoc* Steering Group.

The following nominations were proposed at the *ad hoc* planning meeting for the JCOMM Pilot Project for WIGOS, Ostend, Belgium, 29 March 2008. Remaining nominations are to be made by the end of April 2008 and a couple of additional technical experts will be proposed:

- **IODE Co-Chair - *Greg Reed, or his representative***
- **CIMO Representative (Co-Chair) – *Rainer Dombrowsky to designate a person***
- JCOMM DMPA Coordinator - *Bob Keeley*
- JCOMM OPA Representative – *Candyce Clark**
- JCOMM ET-DMP Chair - *Nick Mikhailov*
- WIS Representative – *Eliot Christian*
- US-IOOS representative, Jack Harlan*
- US NODC representative, Terry Tielking to suggest a person*
- MCSS and GCC representative – *Nicola Scott*

* Offered to fund their participation in the group and related meetings from national sources.

- Atmospheric climate (AOPC) WMO Secretariat to raise issue at next AOPC meeting

3.3.3 The proposed Terms of Reference will be submitted to the *ad hoc* Steering Group for adoption at its first meeting in September 2008. The Terms of Reference and Membership will eventually be presented for approval to the second meeting of the WMO EC WG for WIGOS-WIS (as well as its sub-group), and to the Twentieth Session of the IODE.

3.4 Participants in the Pilot Project

3.4.1 The *ad hoc* planning meeting for the JCOMM Pilot Project for WIGOS (Ostend, 29 March 2008) identified the following partners tentatively committed for participating in the Pilot Project and the following potential partners to be approached.

Potential partners

- In situ data sets from the JCOMM Observations Programme Area such as
 - Profiling floats (Argo),
 - Deep ocean time-series reference stations (OceanSITES),
 - Tropical moorings (TAO),
 - Drifters (DBCP),
 - Ship based observations on the SOT (ASAP, VOS, XBTs),
 - Tide gauges (GLOSS),
 - Water temperature and salinity profiles (GTSP),
 - Surface underway data (GOSUD),
 - Ocean carbon (IOCCP), etc.
- Satellite products and analysis, and merged in situ/satellite products (e.g. GHRST)
- Model output fields (e.g. GODAE)
- Metadata about the platforms/instruments (e.g. META-T)
- Integrated data systems (e.g. SeaDataNet, DMAC)
- ODINs (Demonstration projects, because some of them had E2E training course already they could provide data sets and get access to the WIS)
- Fast delivery sea level data (University of Hawaii Sea Level Center)
- Instrument centres
- Ocean current data from VOS

Tentatively committed partners

- US NODC (Terry Tielking)
 - World Ocean Atlas
 - World Ocean Database
 - US NODC GTSP (Charles Sun)
- Surface currents from HF radar (Jack Harlan)
- Russian Federation NODC (Nick Mikhailov):
 - End to End prototype technology, Russian Federation
- GTS operational database, marine surface climatology (air T, SST, sub-sal, oxygen)
- Canada, ISDM (Bob Keeley):
 - Upper ocean T&S gridded in situ fields
 - Ocean currents derived from surface drifters
- Permanent Service for Mean Sea Level (PSMSL) (Lesley Rickards)
- Marine Climatological Summaries and Global Collecting Centres (GCCs) (UK Met Office or DWD via Virtual GISC) (Nicola Scott)
- Blended quality climatology products (e.g. ICOADS) (Scott Woodruff)

3.4.2 The potential partners will be contacted for investigating whether or how they could participate in the Pilot Project.

3.4.3 While the Steering Group will be relatively small and focus on the project plan, a more comprehensive list of individuals is proposed in parallel as “participants”. The participants include the following persons:

- Members of the IODE/JCOMM ETDMP Task Team for Ocean Data Portal and the JCOMM Pilot Project for WIGOS (nine people, including representatives of SeaDataNET, Australian BOM, OBIS, GEOSS, WIS/WIGOS; needs to meet regularly; financial implications are estimated at a level of about \$15k per year)
- Members of the IODE/JCOMM ETDMP Task Team for Standards Process (functions mainly by email; financial implications are low)
- Committed partners listed in paragraph nine above and not belonging to the *ad hoc* Steering Group (i.e. Terry Tielking, Leslie Rickards, and Scott Woodruff).
- JCOMM DBCP Chairperson - David Meldrum
- JCOMM SOT Chairperson - Graeme Ball
- Other participant as required

3.5 Roles

The role of bodies and expert teams as well as those of the Members and the Secretariat are defined in the table below some of these will have direct roles in working with the ST and others will have liaison roles:

Body	Role(s)
EC-WG/WIGOS-WIS	The WMO Executive Council working Group on WIGOS and WIS (EC-WG/WIGOS-WIS) provides for the overall vision and guidance.
SG-WIGOS	The Sub-Group on the WIGOS (SG-WIGOS-WIS) of the EC-WG/WIGOS-WIS provides overall technical guidance, assistance and support for the implementation of the WIGOS concept. The sub-group works with each WIGOS component, proposes new components and coordinates agreed inter-actions with other partners (e.g. co-sponsored systems, international initiatives' systems, etc.). It refines the concept of WIGOS operations, including its basic definitions. It coordinates the WIGOS planning phases and implementation (including the Pilot Projects) according to the over-arching WIGOS and WIS Development and Implementation Plans.
JCOMM OPA	The JCOMM Observations Coordination Group (OCG) coordinates and promotes the development, documentation, and integration of best practices and QMS. It ensures the flow of the data to the WIS.
JCOMM DMPA	The JCOMM Data Management Coordination Group (DMCG) coordinates and promotes the development of interoperability arrangements. It coordinates and promotes the development, the documentation, and the integration of data management best practices and QMS.
JCOMM ETDMP	The JCOMM/IODE Expert Team on Data Management Practices (ETDMP) proposes practical steps regarding the development of interoperability arrangements and implementation of QMS. It also administers the process by which standards and best practices are agreed to between JCOMM and IODE (Task Team of the Pilot Project on the IODE/JCOMM Standards Process). ETDMP provides guidance to the Steering Group of the IODE Ocean Data Portal and the JCOMM Pilot Project for WIGOS.
JCOMM ETMC	The JCOMM Expert Team on Marine Climatology (ETMC) coordinates and promotes the development, the documentation, and the integration of QMS regarding delayed mode marine data and Marine Climatological Summaries.
CIMO	The WMO Commission for Instruments and Methods of Observation (CIMO) will consider JCOMM requirements in terms of standards and best practices. It will assist with the inclusion of appropriate best practices or references to best practices in the WMO Publication No. 8, Guide on Instruments and Methods of

	Observation.
IOC IODE	International Oceanographic Data and Information Exchange (IODE). Assist in the development of interoperability arrangements. Assist in the integration of best practices. Assist in the development and integration of QMS.
Members	Provide expertise. Commit resources to the Pilot Project. Continue to develop, implement, and sustain the observing systems in a coordinated way and following recommended best practices. Implement QMS at required levels of the data production line. Provide the observational data through the WIS.

4. SCHEDULE

Proposed Schedule and Actions (depending on resources allocation):

- i. Sixth Session of the JCOMM Management Committee, 3-6 December 2007. Draft proposal presented for discussion.
- ii. IODE/JCOMM Forum on Oceanographic Data Management and Exchange Standards, Ostend, Belgium, 21-25 January 2008. Draft proposal presented for discussion.
- iii. Third session of the JCOMM Data Management Coordination Group, Ostend, 26-28 March 2008. Draft proposal presented for discussion.
- iv. *Ad hoc* planning meeting for the Pilot Project, Ostend, 29 March, 2008. Finalizing project plan, business plan, identifying potential participants and data sources, propose *ad hoc* Steering Group Terms of Reference and membership.
- v. Representation of the Pilot Project at the annual plenary meeting of the Pan-European infrastructure for Ocean & Marine data Management (SeaDataNET), Athens, 3-4 April 2008.
- vi. April 2008. Consultations with the *ad hoc* Steering Group, the JCOMM Management Committee, and the IODE Officers, and reports on progress and proposed strategy by the pilot project. Consolidated report by the Secretariat for review by the Sub-Group of the EC WG WIGOS/WIS.
- vii. Representation of the Pilot Project at the 9th meeting of the GHRSSST Pilot Project Science Team, Perros-Guirrec, Brittany, France, 9-13 June 2008.
- viii. Sept 2008: Pilot Project *ad hoc* Steering Group meeting to monitor progress, make adjustments and refine targets for the next year, and propose a formal Steering Group.
- ix. Oct/Nov 2008: Discussion with the Data Buoy Cooperation Panel at its Twenty-fourth Session (South Africa). Expected outcome: progress regarding integration of best practices and standards regarding buoy observations.
- x. April 2009: Discussion with the JCOMM Ship Observations Team at its Fifth Session. Expected outcome: Progress regarding integration of best practices and standards regarding ship observations.
- xi. June 2009: Reporting to the Sixty First Session of the WMO EC.
- xii. Twentieth Session of IODE, March/April 2009. Expected outcome: Formal endorsement from IODE and Resolution.
- xiii. Third Session of JCOMM, November 2009. Expected outcome: Formal endorsement from JCOMM and Resolution.
- xiv. Implement the projects by November 2010 reporting to the JCOMM Management Committee and EC WG and finally Cg-XVI (May 2011).

5. ESTIMATED COSTS

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

Item	Yearly	Total 3 years
Meetings of the Steering Group (10 people meeting once a year)	CHF 20 000	CHF 60 000
Experts attending specific meetings or visiting data centres on behalf of the Pilot Project (5 missions per year)	CHF 10 000	CHF 30 000
Consultant (one person x month per year)	CHF 10 000	CHF 40 000
Total	CHF 40 000	CHF 120 000

5.2 It is important to note that the estimates outlined above do not cover software, hardware or personnel costs that will be required by individual contributors. In the end, it is the identification and use of such funds that will allow the linking of data collections across organizations to accomplish the goals of the Pilot. Costs to individual organizations to take part in this Pilot Project will vary depending on their present computing capabilities. It is expected that more than a one cost solution will be proposed to organizations in order to reduce the impact of funding.

ANNEX VI

TERMS OF REFERENCE OF WMO REGIONAL INSTRUMENT CENTRES

Recommendation 11 (CIMO-XIV)

REGIONAL INSTRUMENT CENTRE WITH FULL CAPABILITIES AND FUNCTIONS

THE COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

Noting Recommendation 19 (CIMO-IX) – Establishment of Regional Instrument Centres (RICs),

Considering:

- (1) The results of the evaluation of the RICs and the need for the sustainability of their services to Members,
- (2) The need for regular calibration and maintenance of meteorological and related environmental instruments to meet increasing needs for high quality meteorological and hydrological data,
- (3) The need for building the hierarchy of traceability of measurements to International System of Units (SI) standards,
- (4) The requirements of Members in the Region for standardization of meteorological and related environmental measurements,
- (5) The need for international instrument comparisons and evaluations in support of worldwide data compatibility and homogeneity,
- (6) The role RICs may play in the Global Earth Observing System of Systems, Natural Disaster Prevention and Mitigation, QMF and other WMO crosscutting programmes,

Recommends that:

- (1) Regional Instrument Centres with full capability should have the following capabilities to carry out their corresponding functions:

Capabilities:

- (a) A RIC must have, or have access to, the necessary facilities and laboratory equipment to perform the functions necessary for the calibration of meteorological and related environmental instruments;
- (b) A RIC must maintain a set of meteorological standard instruments and establish traceability of its own measurement standards and measuring instruments to the SI;
- (c) A RIC must have qualified managerial and technical staff with necessary experience in fulfilling its functions;
- (d) A RIC must develop its individual technical procedures for calibration of meteorological and related environmental instruments using calibration equipment employed by the RIC;
- (e) A RIC must develop its individual quality assurance procedures;

- (f) A RIC must participate in, or organize inter-laboratory comparisons of standard calibration instruments and methods;
- (g) A RIC must, as appropriate, utilize the resources and capabilities of the Region to the best interest of the Region;
- (h) A RIC must, as far as possible, apply international standards applicable for calibration laboratories, such as ISO 17025;
- (i) A recognized authority must assess a RIC, at least every five years, to verify its capabilities and performance;

Corresponding Functions:

- (j) A RIC must assist Members of the Region in calibrating their national meteorological standards and related environmental monitoring instruments;
- (k) A RIC must participate in or organize, WMO and/or regional instrument intercomparisons, following relevant CIMO recommendations;
- (l) According to relevant recommendations on the WMO Quality Management Framework a RIC must contribute positively to Members regarding quality of measurements;
- (m) A RIC must advise Members on inquiries regarding instrument performance, maintenance and the availability of relevant guidance materials;
- (n) A RIC must actively participate in, or assist in the organization of regional workshops on meteorological and related environmental instruments;
- (o) The RIC must cooperate with other RICs in standardization of meteorological and related environmental measurements;
- (p) A RIC must regularly inform Members and report¹, on an annual basis, to the president of the Regional Association and to the WMO Secretariat on services offered to Members and activities done;

(2) The WMO *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8) Annex 1.A should be updated accordingly.

¹ Web based approach is recommended.

Recommendation 12 (CIMO-XIV)

REGIONAL INSTRUMENT CENTRE WITH BASIC CAPABILITIES AND FUNCTIONS

THE COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

Noting Recommendation 19 (CIMO-IX) – Establishment of Regional Instrument Centres (RICs),

Considering:

- (1) The results of the evaluation of the RICs and the need for the sustainability of their services to Members,
- (2) The need for regular calibration and maintenance of meteorological and related environmental instruments to meet increasing needs for high quality meteorological and hydrological data,
- (3) The need for building the hierarchy of the traceability of measurements to International System of Units (SI) standards,
- (4) The requirements of Members in the Region for standardization of meteorological and related environmental measurements,
- (5) The need for international instrument comparisons and evaluations in support of worldwide data compatibility and homogeneity,
- (6) The role RICs play in the Global Earth Observing System of Systems, Natural Disaster Prevention and Mitigation, QMF and other WMO crosscutting programmes,

Recommends that:

- (1) Regional Instrument Centres with basic capabilities and functions should have the following capabilities to carry out their corresponding functions:

Capabilities:

- (a) A RIC must have, or have access to, the necessary facilities and laboratory equipment to perform the functions necessary for the calibration of meteorological and related environmental instruments,
- (b) A RIC must maintain a set of meteorological standard instruments¹ and establish traceability of its own measurement standards and measuring instruments to the SI,
- (c) A RIC must have qualified managerial and technical staff with necessary experience in fulfilling its functions,
- (d) A RIC must develop their individual technical procedures for calibration of meteorological and related environmental instruments using calibration equipment employed by the RIC,
- (e) A RIC must develop their individual quality assurance procedures,

¹ For calibrating one or more of the following variables: temperature, humidity, pressure and others specified by the Region.

- (f) A RIC must participate in, or organize inter-laboratory comparisons of standard calibration instruments and methods,
- (g) A RIC must, when appropriate, utilize the resources and capabilities of the Region to the best interest of the Region,
- (h) A RIC must, as far as possible, apply international standards applicable for calibration laboratories, such as ISO 17025,
- (i) A recognized authority must assess a RIC, at least every five years, to verify their capabilities and performance,

Corresponding functions:

- (j) A RIC must assist Members of the Region in calibrating their national meteorological standards and related environmental monitoring instruments according to Capabilities (b),
 - (k) According to relevant recommendations on WMO Quality Management Framework a RIC must contribute positively to Members regarding quality of measurements,
 - (l) A RIC must advise Members on inquiries regarding instrument performance, maintenance and the availability of relevant guidance materials,
 - (m) The RIC must cooperate with other RICs in standardization of meteorological and related environmental measurements,
 - (n) A RIC must regularly inform Members and report¹, on an annual basis, to the president of the Regional Association and to the WMO Secretariat on services offered to Members and activities done,
- (2) The WMO *Guide to Meteorological Instruments and Methods of Observation* (WMO No. 8) Annex 1.A should be updated accordingly.
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¹ Web based approach is recommended.

ANNEX VII

ACTION ITEMS ARISING FROM THE MEETING

No	Agenda item	Action Item	Action by	Deadline
1	2	To provide feedback to the Sub Group of the WMO EC WG WIGOS-WIS (November 2008), to the WMO EC WG on WIGOS-WIS (December 2008) and then to WMO Executive Council (EC-LXI, 2009). The Project Plan needs to be updated accordingly.	Chair, <i>ad hoc</i> Steering Group	Sept 2008
2	2	To provide Jim Purdom with appropriate feedback regarding the document "Integrated Observing Systems activities within the WIGOS framework".	WMO Secretariat	April 2008
3	2	To relay the recommendation to the OPA and sub panels regarding their role in the development of the Pilot Project especially in terms of best practices and data management (e.g. table driven codes, metadata).	Secretariat	Ongoing
4	3	To relay best practice recommendations from the Pilot Project (e.g. updating CIMO guide) to the JCOMM Observations Programme Area and its observing panels.	Secretariat	ASAP
5	3	To nominate a marine instrument focal point for liaising with the CIMO rapporteur for the WMO Publication No. 8.	Chairperson, OCG	May 2008
6	3	To post the Pilot Project outline on the WIGOS web pages once these are formally in place.	Secretariat	ASAP
7	3	To circulate the "best practices" approach of the Pilot Project to the JCOMM Observations Programme Area and sub-Panels.	Secretariat	ASAP
8	4.	To make recommendation regarding solutions to have the different profiles (WMO Core, MCP, CDI) converge or become compatible for interoperability purposes between the WIS and the ODP taking into account the interactions with SeaDataNet.	Greg Reed	30 April 2008
9	4	To keep the <i>ad hoc</i> Steering Group informed of progress regarding the implementation of the WIS and to provide a list of likely WIS components to become available on line.	David Thomas	Ongoing
10	4	To provide additional information on the technical specifications for WIS-ODP interoperability.	Nick Mikhailov	31 May 2008
11	5	To assist in the production of the JCOMM best practices catalogue.	<i>ad hoc</i> Steering Group	Sept 2008
12	5	To use the IODE OceanTeacher training facility and the new WIGOS web site to share appropriate documentation about the Pilot Project.	Secretariat	Ongoing
13	5	To add in the Pilot Project the promotion of instrument centres dedicated to marine and other appropriate oceanographic instruments.	<i>ad hoc</i> Steering Group	Ongoing
14	5	To provide assistance regarding the establishment of instrument centres.	CIMO	ASAP
15	5	To establish links with the climate community as climate instrument centres have also been developed.	Secretariat	ASAP
16	5	To approach HMEI so seek their participation in the Pilot Project.	Secretariat	ASAP
17	6	To finalize the Business Plan by the first meeting of the Pilot Project <i>ad hoc</i> Steering Group (task group comprised of Candyce Clark (leader), Bob Keeley, and Terry Tielking, with the addition of Jack Harlan (to be asked if willing to participate)).	Task group	Sept 2008
18	6	To provide the Business Plan task group with input or	meeting	Sept 2008

		examples	participants	
19	7	To request the ODINAFRICA planning committee considers the inclusion of ODP and WIGOS activities in the ODINAFRICA-IV proposal that will be prepared in May 2008.	Greg Reed	ASAP
20	7	To investigate how ETRP could be involved in the development of the project plan.	Secretariat	Ongoing
21	7	To check the current status of the demonstration projects, to approach them and investigate whether there is interest for some of them to be associated.	Secretariat	May 2008
22	7	To invite all the participants at the E2E Training Course to participate in the Pilot Project, and ask them to list any additional requirements they might have in terms of training.	IODE PO	April 2008
23	7	To review the marine chapter of the WMO Publication No. 8 with the view to provide feedback and proposed updates to CIMO.	OPA	Ongoing
24	7	To precisely evaluate required resources regarding visits of experts to national meteorological and oceanographic agencies (to promote the implementation of WIGOS at the national level, and to assist with regard to the development of interoperable arrangements with the WIS) for inclusion in the project plan.	<i>ad hoc</i> Steering Group	Sept 2008
25	7	To contact HMEI to investigate how HMEI could assist the Pilot Project in a similar way as with CIMO.	Secretariat	April 2008
26	8	To refine the Project Plan by the first Session of the <i>ad hoc</i> Steering Group later this year.	<i>ad hoc</i> Steering Group	Sept 2008
27	8	To provide feedback to the <i>ad hoc</i> Steering Group for updating the project plan.	participants	Aug 2008
28	8	To produce a first draft version of the Pilot Project implementation plan.	Robert Keeley and Secretariat	Sept 2008
29	8	To add an agenda item in the provisional agenda that will be proposed for the first meeting of the <i>ad hoc</i> Steering Group for completing the implementation plan and list actual partners in it.	Secretariat	mid-2008
30	8	To prepare an Ocean Data Portal project plan that ought then to be reflected in the JCOMM Pilot Project plan so that the two initiatives are consistent, synergies addressed, and do not duplicate efforts.	Greg Reed	Sept 2008
31	9	To liaise with potential partners and to seek information from them regarding their interest in the Pilot Project and their possible future participation.	<i>ad hoc</i> Steering Group	Aug 2008
32	9	To review the documents relevant to implementation and "check list" first, and to distribute them to the tentatively committed partners listed above as well as to Bob Keeley to ask them to provide feedback with regard to their specific implementation of the E2E.	DMCG E2E doc review group	Sept 2008
33	10	To nominate a CIMO representative to Co-chair from a WIGOS perspective.	Rainer Dombrowsky	April 2008
34	10	To coordinate the finalization of the proposed Terms of Reference in liaison with Rainer Dombrowsky.	Greg Reed	30 April 2008
35	10	To send the draft Terms of Reference for the Steering Group to the chairman of the WMO EC WG WIGOS-WIS Sub Group, Dr Nash.	Secretariat	May 2008
36	10	To nominate additional members of the <i>ad hoc</i> Steering Group.	<i>ad hoc</i> Steering Group	30 April 2008
37	10	To consider proposing a funding mechanism for hiring a consultant to produce the JCOMM Catalogue of standards.	<i>ad hoc</i> Steering Group	Sept 2008
38	11	To prepare the draft document to be discussed at the first meeting of the <i>ad hoc</i> Steering Group and	Secretariat and Bob Keeley	Sept 2008

		eventually presented to the Sub-Group of the ET WG on WIGOS-WIS		
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ANNEX VIII

ACRONYM LIST

AOPC	Atmospheric Observation Panel for Climate
ASAP	Automated Shipboard Aerological Programme
BOM	Bureau of Meteorology (Australia)
CB	Capacity Building
CBS	WMO Commission for Basic Systems
CDI	SeaDataNET Common Data Index
CIMO	WMO Commission on Instruments and Methods of Observation
CONOPS	WIGOS Concept of Operations
DBCP	Data Buoy Cooperation Panel
DCPC	Data Collection and Production Centre (of WIS)
DMAC	IOOS Data Management and Communications (USA)
DMCG	JCOMM Data Management Coordination Group
DMPA	JCOMM Data Management Programme Area
DWD	Deutscher WetterDienst
E2E	End to End Data Management
E2EDM	End to end Data Management Pilot Project
EC	Executive Council
EC WG WIGOS-WIS	Executive Council working Group on WIGOS and WIS
ET-EGOS	CBS Expert Team on the Evolution of the Global Observing System
ETRP	WMO Education and Training Programme
ET-WISC	CBS Expert Team on WIS GISCS and DCPCs
ET-DMP	JCOMM Expert Team on Data Management Practices
GAW	Global Atmosphere Watch
GCC	Global Collecting Centre
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GHRSSST	GODAE High Resolution SST Pilot Project
GISC	Global Information System Centres (of WIS)
GLOSS	JCOMM Global Sea-level Observing System
GODAE	Global Ocean Data Assimilation Experiment
GOOS	IOC-WMO-UNEP-ICSU Global Ocean Observing System
GOS	WMO Global Observing System
GOSUD	Global Ocean Surface Underway Data Pilot Project
GTS	Global Telecommunication System
GTSP	Global Temperature and Salinity Profile Programme
HMEI	Association of Hydrometeorological Equipment Industry
ICOADS	International Comprehensive Ocean-Atmosphere Data Set
ICG-WIS	Inter-commission Coordination Group on the WMO Information System
ICSU	International Council for Science
ICT IOS	Implementation-Coordination Team on IOS
ICTT-QMF	Inter Commission Task Team on Quality Management Framework
IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data and Information Exchange
IOOS	Integrated Ocean Observing System (USA)
IOS	Integrated Observing Systems
IMOP	WMO Programme for Instruments and Methods of Observation
INSPIRE	Infrastructure for Spatial Information in Europe
IOCCP	IOC International Ocean Carbon Coordination Project
IODE	IOC International Oceanographic Data and Information Exchange
IPET-MI	CBS Inter Programme Expert Team on Metadata Implementation
ISDM	Integrated Science Data Management (Canada)
ISO	International Organization for Standardization

JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
MAN	JCOMM Management Committee
MCP	Marine Community Profile
MCSS	Marine Climatological Summaries Scheme
MCS	Marine Climatological Summary
META-T	Water Temperature metadata Pilot Project
MQCS	Minimum Quality Control Standards
NetCDF	Network Common Data Form
NMHS	National Meteorological and Hydrographic Service
NOAA	National Oceanic and Atmospheric Administration (USA)
NODC	IODE National Oceanographic Data Centre
NWP	Numerical Weather Prediction
OBIS	Ocean Biogeographical Information System
OceanSITES	OCEAN Sustained Interdisciplinary Timeseries Environment observation System
OCG	JCOMM Observations Coordination Group
ODAS	Ocean Data Acquisition System
ODIN	IOC Ocean Data and Information Network
ODINAFRICA	ODIN for Africa
ODINBlackSea	ODIN for the Black Sea
ODINCARSA	ODIN for the Caribbean and South America
ODP	IODE Ocean Data Portal
OPA	JCOMM Observations Programme Area
OPAG	Open Programme Area Group
OT	OceanTeacher
PA	Programme Area (of JCOMM)
PO	Project Office
PSMSL	Permanent Service for Mean Sea Level
QA	Quality Assurance
QC	Quality Control
QMF	WMO Quality Management Framework
QMS	Quality Management System
RA	WMO Regional Association
RRR	Rolling Review of Requirements
SeaDataNet	Pan-European infrastructure for Ocean & Marine Data Management
SOT	JCOMM Ship Observations Team
SST	Sea Surface Temperature
TAO	Tropical Atmosphere Ocean network of tropical moorings
VGISC	Virtual GISC (Europe)
VOS	Voluntary Observing Ship
WDC	ICSU World Data Centre
WIGOS	WMO Integrated Global Observing Systems
WIS	WMO Information System
WMO	World Meteorological Organization
XBT	Expendable Bathythermograph
XML	Extensible Markup Language
