JCOMM OBSERVATIONS COORDINATION GROUP
FOURTH SESSION

Hobart, Australia
18-20 April 2011

FINAL REPORT

JCOMM Meeting Report No. 85

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WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

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NOTES

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Chair, Publications Board
World Meteorological Organization (WMO)
7 bis, avenue de la Paix
P.O. Box No. 2300
CH-1211 Geneva 2, Switzerland

Tel.: +(41 22) 730 84 03
Fax: +(41 22) 730 80 40
E-mail: Publications@wmo.int

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C O N T E N T S

EXECUTIVE SUMMARY

The Fourth Session of the JCOMM Observations Coordination Group (OCG) was held in Hobart, Australia, from 18 to 20 April 2011, at the kind invitation of the Government of Australia. The Session was sponsored by the Australian Bureau of Meteorology (BOM). The meeting focused on issues and actions that would help improve the 'systems' aspects of JCOMM, and on collaboration that would appeal and help each individual component. The Group reviewed requirements, refined the implementation goals for the observing networks, and addressed common technical coordination through JCOMMOPS. It noted the need to raise for JCOMM and intergovernmental attention a number of issues relating to the requirements for satellite observations, the fragility of sustained funding for research-supported observing networks critical for weather/seasonal forecasting, the need for the support of navies for deployment in the northwest Indian Ocean, the need to improve high-frequency historical and real-time tide gauge data, and improving support for JCOMMOPS.

GENERAL SUMMARY OF THE WORK OF THE SESSION

1 Opening

The reader is referred to the meeting web page[1] which hosts working documents from each network on issues and challenges, background documents, and all of the presentations given at the meeting. The presentations given at the meeting are linked to from within this document by hyperlink with the full URL in footnotes.

1.1 Welcome and logistical arrangements

The Coordinator of the JCOMM Observations Programme Area, Candyce Clark (USA), opened the meeting at 9:00 on Monday 18 April 2011, thanking the Australian Bureau of Meteorology and JCOMM co-president Peter Dexter (Australia) for acting as host.

1.2 Meeting goals

Clark gave a presentation[2] outlining the meeting goals. JCOMM coordinates an integrated system of ocean observing, where the system is greater than the sum of its parts. She asked meeting attendees to focus on issues and actions that would lead to this systems perspective, while understanding that collaboration needed to appeal and help to each individual component. The meeting would focus on identifying the intersection between networks and management of common issues, as well as focusing on paths for additional funding. She thanked all the representatives of observing networks in the room for their hard work in making the observing system function.

1.3 The role of the OCG in a post-OO'09 Framework for Ocean Observations

Albert Fischer (IOC) gave a presentation[3] on a Framework for Ocean Observations that had been developed by a group sponsored by the international sponsors of the OceanObs'09 conference (21-25 September 2009, Venice, Italy, www.oceanobs09.net). Consultative versions of the Framework for Ocean Observing document[4] are available on the OceanObs'09 web site. The Framework takes lessons learned from the successes of existing ocean observing efforts, and serves as a guide to the ocean observing community to establish the requirements for an integrated (from physics through biogeochemistry to ocean biology and ecosystems) and sustained global observing system, including the variables to be measured, the approach to measuring these, and the way in which data and products will be managed and made widely available.

Framework processes are organized around “essential ocean variables (EOVs),” rather than by observing system, platform, program, or region. Implementing new EOVs will be carried out according to their readiness levels, allowing timely implementation of components that are already mature, while encouraging innovation and formal efforts to improve readiness and build capacity. A common language and consistent handling of requirements, observing technologies, and information flow among different, largely autonomous, observing elements is introduced. The Framework takes advantage of existing structures, promotes a collaborative system with voluntary participation, and seeks to support self-funding and self-managing elements that together will provide more than the sum of their individual efforts.

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[1] http://www.jcomm.info/ocg4

[2] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7117

[3] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7118

[4] http://www.oceanobs09.net/wg/outputs.php

The Observations Coordination Group **recognized** its role in coordinating observing networks within the Framework for Ocean Observations. It stressed the role of the observing networks in engaging in a dialogue with the requirements-setting process, providing information on feasibility.

The Group **recommended** that the Framework in setting requirements and observing needs explicitly take into account models and the production of ocean information.

2 Requirements for the Observations Programme Area

2.1 Review of scientific requirements for climate

Fischer gave a presentation[5] on the work of the GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), and on scientific requirements for sustained ocean observations for climate monitoring, research, and forecasting. While the OOPC's main objective was to define these scientific requirements, it recognized that the sustained ocean observing system for climate was the backbone for ocean forecasting and other marine meteorological services.

OOPC has been working on promotion and real-time display of simple ocean climate indices, which are visible on its web site[6]. To improve the utility for a more casual user, and to promote messages on how remote ocean conditions can impact human well-being on land through changes in precipitation and extremes, we have developed an inverted view of the ocean climate indices as a web wiki, which focuses on particular land-based regions. For these regions, the prototype wiki page explains how remote ocean conditions affect local climate and display a real-time update of ocean climate indices.

Fischer reviewed the updated 2010 GCOS Implementation Plan[7], and in particular its requests of the observing networks represented in the OCG. These actions are summarized here, with the relevant team in square brackets:

- O3: Improve number and quality of climate-relevant marine surface observations from the VOS. Improve metadata acquisition and management for as many VOS as possible through VOSClim, together with improved measurement systems.
- O5: Complete and maintain a globally-distributed network of 30-40 surface moorings as part of the OceanSITES Reference Mooring Network.
- O6: Develop and deploy a ship-based reference network of robust autonomous in situ instrumentation for biogeochemical and ecosystem variables. [SOOP, IOCCP, IOCCG, IGBP]
- O8: Sustain global coverage of the drifting buoy array (total array of 1250 drifting buoys equipped with ocean temperature sensors), obtain global coverage of atmospheric pressure sensors on the drifting buoys, and obtain improved ocean temperature from an enhanced VOS effort.
- O9: Implement the GLOSS Core Network of about 300 tide gauges, with geocentrically-located high-accuracy gauges; ensure continuous acquisition, real-time exchange and archiving of high- frequency data; put all regional and local tide gauge measurements within the same global geodetic reference system; ensure historical sea-level records are recovered and exchanged; include sea- level objectives in the capacity-building programmes of GOOS, JCOMM, WMO, other related bodies, and the GCOS system improvement programme.
- O11: Implement a programme to observe sea-surface salinity to include Argo profiling floats, surface drifting buoys, SOOP ships, tropical moorings, reference moorings, and research ships.

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[5] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7119

[6] http://ioc-goos-oopc.org

[7] *Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (2010 Update),* GCOS-138, GOOS-184, available at http://ioc-goos.org/goos-184

- O13: Develop and implement an internationally-agreed strategy for measuring surface pCO_2. [IOCCP]
- O14: Develop instrumentation for the autonomous measurement of either DIC, Alk, or pH with high accuracy and precision. [IOCCP and research community]
- O16: Implement a wave measurement component as part of the Surface Reference Mooring Network. [OceanSITES]
- O18: Plan, establish and sustain systematic in situ observations from sea-ice buoys, visual surveys (SOOP and Aircraft), and ULS in the Arctic and Antarctic. [DBCP, SOT]
- O21: Establish plan for, and implement, global Continuous Plankton Recorder surveys.
- O23: Establish a global network of long-term observation sites covering all major ocean habitats and encourage collocation of physical, biological and ecological measurements. [OceanSITES]
- O24: Development of a plan for systematic global full-depth water column sampling for ocean physical and carbon variables in the coming decade; implementation of that plan. [GO-SHIP]
- O25: Sustain the Ship-of-Opportunity XBT/XCTD transoceanic network of about 40 sections. [SOOP]
- O26: Sustain the network of about 3000 Argo global profiling floats, reseeding the network with replacement floats to fill gaps, and maintain density (about 800 per year).
- O27: Complete implementation of the current Tropical Moored Buoy, a total network of about 120 moorings. [TIP]
- O30: Deploy a global pilot project of oxygen sensors on profiling floats. [research community and Argo]
- O31: Monitoring the implementation of the IOC Data Policy.
- O32, 33, 34, 35, 36: ocean data management procedures, metadata standards, ocean data transport system based on emerging work in WIS, OPeNDAP, implement system of regional specialized and global data and analysis centers for each ECV, data rescue projects
- O37: cost-effective telecommunication capabilities

2.2 Review of non-climate requirements and feasibility

2.2.1 Operational ocean forecast systems observing requirements

Gary Brassington (Australia), chair of the JCOMM Expert Team on Operational Ocean Forecast Systems (ET-OOFS) gave a presentation[8] on the activities of the Team and on the impact of ocean observing systems on ocean forecasting.

He stressed the importance of altimetry to operational ocean forecast systems, and warned the OCG that a data gap in altimetry might arise in the coming years. A particular challenge of operational systems was dealing with changes in real-time data streams, as there was a latency for operational systems to adapt to such changes.

The OCG **recommended** that all observing networks consult with ET-OOFS (through its chair) regarding planned changes in real-time data stream formats (on DACs, not on the GTS) (**Action for observing network data teams and technical coordinators, continuous**).

Brassington noted that glider data had good potential to contribute to ocean forecasts, but that there was a lack of standardization. The team discussed this item and formulated an action in Section 4.2.

Adaptive sampling also had potential to help operational ocean forecast systems to respond with appropriate information and higher skill in emergency situations, such as marine accident and emergency or search and rescue.

[8] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7120

The team discussed a multi-part and long-term **action** on exploration of adaptive sampling, including impact studies, leading to eventual proof-of-concept experiments. The steps would be to:

- identify impacts on forecast (for ET-OOFS),
- ET-OOFS to seek cost and feasibility information from the observing network side (from Argo, DBCP, SOOP), and
- ensure continued dialogue (for OCG chair, secretariat) to identify willing forecast centers and network PIs to design a pilot (likely a few years away).

Brassington concluded by noting that OOFS systems were making jumps in performance, that there was objective evidence of positive impact of the forecast systems to applications, and developing evidence of the impact of observing systems on forecast skill.

2.2.2 Variable focus: GHRSST

Ian Barton (Australia), member of the Group for High-Resolution Sea Surface Temperature (GHRSST) Science Team, gave a presentation[9] on requirements from the *in situ* observing networks for SST products. The GHRSST team would like a greater number of radiometric skin SST measurements from VOS ships, and emphasized the importance of accurate SST data with metadata. A test of Argo floats measuring near-surface temperatures was underway and was also likely to help. Barton encouraged group members to also use the GHRSST dataset to help in assessing the accuracy of their in situ SST measurement instruments.

The OCG **recommended** that *satellite-ship SST biases* be explored in greater detail where metadata is available, for feedback to SOT (by GHRSST, for the next SOT meeting); and **requested** GHRSST to provide advice on best practice for ship-based SST measurement to SOT.

The OCG **encouraged** use of BUFR for transmission of SST.

The OCG **requested** GHRSST to provide needed specifications for siting of radiometers on commercial vessels (see also item 5.2.6 in JCOMM MR-84, SOT-VI).

The OCG noted that a productive dialogue had been established between GHRSST and the DBCP, stemming from the wide use of drifter SST for satellite validation. This had led to the establishment of a joint pilot project for the reporting of HRSST from drifters in BUFR code, the results of which were yet to be evaluated. The OCG **encouraged** GHRSST and the DBCP to continue with this exercise, and to report back at its next session.

Action: for relevant teams to continue providing feedback to GHRSST on feasibility and cost of improved SST measurements from their platforms, by next GHRSST meeting, in particular:

- SOT: radiometers on ships, underway SST
- Argo, DBCP, OceanSITES: temperature profiles in upper 2 m

2.2.3 Services and Forecast Systems Programme Area

Ming Ji (USA), coordinator for the Services and Forecast Systems Programme Area gave a presentation[10] on other teams within the SFSPA (ET-OOFS was presented in item 2.2.1). He emphasized the importance of satellite altimetry and scatterometry for operational wave, storm surge, and sea ice science and services. He also highlighted a general lack of adaptive sampling capability in the ocean observing system, which could be used to respond to emergency situations.

The OCG **took note** of the requirements for satellite observations (and in particular concerns about continuous and adequate altimetry, surface vector winds, microwave SST) expressed by the SFSPA for their services and **recommended** raising this need through JCOMM and other channels including the WMO Rolling Review of Requirements (see item 2.2.4 below), the WMO space programme, CGMS, and CEOS (**action** for MAN).

[9] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7163
[10] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7173

The OCG **acknowledged** that it needed to take some action to improve *linked understanding of satellite and in situ observing needs*, coordination needs, for operational services and more generally.

Action for OCG vice-chair (David) to inform ET-WS chair (Val Swail) of wave spectral data available from ship navigation radars, already implemented on a number of ships, and ask ET-WS to evaluate if this will meet their requirements.

2.2.4 WMO Rolling Review of Requirements and the ET-EGOS Implementation plan

Etienne Charpentier (WMO) presented[11] the WMO Rolling Review of Requirements process, and emphasized some gaps in ocean variables needed for non-climate related WMO Application Areas where ocean observations substantially address their requirements (i.e. Seasonal to Inter-annual Forecasts, Ocean Applications, Global Numerical Weather Prediction, High Resolution Numerical Weather Prediction, and Nowcasting and Very Short Range Forecasting), bearing in mind that the Climate Monitoring Application Area (GCOS) is already well-covered by JCOMM through its Implementation Goals.

Action for OCG chair, WMO secretariat to ensure that observing networks currently funded on limited-lifetime research funding but important for medium-range weather and seasonal climate forecasting be highlighted to WMO Members as *potential gaps* in the ET-EGOS Implementation Plan (by next ET-EGOS meeting in June 2011). These are in particular the:

- *Tropical moored arrays*,
- Argo,
- a fraction of barometer upgrades on surface drifters (for weather forecasting), and
- altimeter, scatterometer, microwave SST, sea ice measurements from Ocean research satellite missions.

The meeting agreed that the draft EGOS Implementation Plan had to be further reviewed by JCOMM to better consider the long term aspects of the Vision of the GOS in 2025 (**action**; JCOMM Co-President; ASAP).

3 Are we meeting the requirements for observing ocean variables?

3.1 General discussion and feedback for requirements process

The OCG had a discussion on how to respond to the different requirements processes, picking up from discussion at the previous (OCG-III) meeting.

The OCG **recognized** a clear role for itself in advancing the feedback loop on requirements by feeding back information on cost and feasibility, and in engaging in pilot projects exploring feasibility/cost and impact where sponsorship can be identified.

The OCG **agreed** that it should endorse promising pilot projects as a way to give authority and help find funding.

3.2 JCOMM Implementation Goals and Metrics

Fischer gave a presentation[12] on JCOMM system metrics, noting that they were important in presenting a systems view to an external audience on the ocean observing system, but that in a collaborative voluntary system such as JCOMM, they needed to serve the purposes of the individual observing networks and needed to be simple to calculate. The current JCOMM metrics for completion of the initial in situ ocean observing system needed repair and updating, and the

[11] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7167
[12] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7171

responsibility for calculation network by network clearly defined. He encouraged each group member to think of appropriate and simple metrics of the intensity of effort being put into sustaining the observing system, and suggested the group define some metrics for collaborative objectives, across observing networks.

Action: OCG chair and secretariat to work with each observing network to clarify their *overall system goal metric(s)* and any metrics of network efficiency, intensity of yearly effort, data timeliness and quality that should be reported for high-level systems view. An initial departure would come from this first draft:

- SOT/VOS: 25% of ships VOSClim-class (500), [at least 20 reports per month per % per month of 5x5 squares with coverage], N/S bias. [from JCOMMOPS]
- SOT/SOOP: XBTs dropped / 37000 (needed to complete OO'09 lines), % completion of lines. [responsibility?: JCOMMOPS working on linking ships, drops, lines]
- DBCP/drifting buoys: # of buoys / 1250, Equivalent buoy density: adequacy of coverage: % per month of 5x5 squares with adequate number of observations [average of 1 platform per month, 60N to 60S], N/S bias. Intensity: 1250 floats/years. [from GTS as most robust source]
- TIP: # moorings active/125 for all 3 tropical basins, [data return rate.] [from JCOMMOPS]. Intensity: ship days [from who? McPhaden] or # of buoys refreshed [automated way of getting this? for TAO yes from THREADS server]
- GLOSS: 300 stations in GLOSS Core network, real-time data transmission, GPS/DORIS co-location [Mark needs to make information available to OSMC]. Intensity: [estimate $30k/year]?
- Argo: replace #floats active/3000 by # of floats contributing to core mission [3200, not graylisted], % / month of 3x3° box with adequate coverage [3 profiles per month, 60N to 60 S], N/S bias. Intensity: 800 floats/year (rolling year).
- GO-SHIP: rolling index of research funding (ship days?) secured to maintain lines; also see data flow index below. [nothing that can be calculated automatically]
- IOCCP underway carbon measurements: these will need to be defined in collaboration with IOCCP.
- OceanSITES: number of platforms in the NDBC or Coriolis GDAC as OceanSITES. Intensity: number of buoys refreshed (can be parsed from the OceanSITES data file format)

The OCG discussed a challenge that many networks faced related to *spreading investment over more countries* - **action** to maintain information about national participation in each network as a top-level metric.

Action: OCG chair, secretariat, JCOMMOPS, and national in-kind efforts calculating metrics need to clarify *responsibilities for routine production and assembly of these metrics* [through meeting summer 2011].

Action: *metrics for collaboration within OCG* for Argo and DBCP to implement generation of routine information of how many floats/drifters are deployed on research ships, commercial vessels (by JCOMM-IV, then continuous).

The OCG **identified** as a dual collaboration and data system metric: the % of completed GO-SHIP profiles in the Argo reference database: CCHDO.

Action: to identify for all observing networks the metrics of flow of real-time and delayed-mode data, in collaboration with data teams.

4 Issues and challenges faced by the observing networks

4.1 Review of each observing network

4.1.1 SOT/VOS

Graeme Ball (Australia), chair of the Ship Observations Team presented written input[13] provided on behalf of the entire team and of the Voluntary Observing Ship marine meteorological measurement program in particular. The SOT-VI meeting[14] took place in the week before the OCG-IV meeting, also in Hobart. The SOT encouraged all operators to upgrade to VOSClim class reporting of metadata, and agreed on performance measures. Actions were being taken to shift to the required BUFR format for the GTS. Port Meteorological Officers (PMOs) were important for the VOS but also in helping to find deployment opportunities for other networks.

4.1.2 SOT/SOOP

Gustavo Goni (USA), chair of the SOT's Ship of Opportunity Programme Implementation Panel gave a presentation[15] on the status of the SOOP XBT observing network, including extensive maps and statistics maintained by NOAA/AOML on behalf of the programme. Full implementation of the lines agreed in the OceanObs'09 Community White Paper would require about 37000 XBT drops per year. The major gaps in the network were largely due to a lack of full funding to implement the lines, and only in minor cases on logistics (lack of a ship).

Action for SOOP chair to inform CLIVAR/GOOS Indian Ocean Panel of threat to XBT line S. Africa-Australia - as this would be first to be dropped by Scripps if budgets reduced (asap).

Action for SOOP chair and IOCCP, to improve collaboration on development of pCO_2 lines by linking carbon PIs with SOOP implementers (continuous)

4.1.3 DBCP

Al Wallace (Canada), chair of the Data Buoy Cooperation Panel (DBCP) gave a presentation[16] on the status, issues, and challenges the team faced. The DBCP sponsored a number of pilot projects on satellite telecommunications, on wave measurements from drifters and from moored buoys. The team faced a continuous challenge in filling gaps in the global drifter array, and was working to increase the number of barometer buoys.

Action: for DBCP and Argo: to coordinate in contact with navies and coast guards for deployment in NW Indian Ocean.

OCG **recommended** that the IOC Assembly be given this message as well, that navies could offer deployment opportunities (**action** for JCOMM co-president and OCG coordinator, secretariat).

4.1.4 DBCP-TIP

Ken Ando (Japan), co-chair of the Tropical Moored Array Implementation Panel (TIP), gave a presentation[17] on the status of this network. All 78 planned moorings in the tropical Pacific (the TAO/TRITON array) were in place, implemented by the USA (NOAA) and Japan (JAMSTEC). Korea (KORDI), China (IOCAS), and Indonesia (BPPT) have all shown interest in participating in the Pacific array. All 18 planned moorings in the tropical Atlantic (PIRATA array) were in place, implemented by the USA (NOAA), France (IRD, Météo-France), and Brazil (INPE, DHN). In the Indian Ocean it is planned that 30-32 of the total of the 46 desired moorings (RAMA array) will be

[13] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7013
[14] http://www.jcomm.info/sot6
[15] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7172
[16] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7180
[17] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7161

in place soon, implemented by a cooperation between the USA, Japan, India, France, Indonesia, China, Australia, and the GEF ASCLME project.

Development of new mooring and sensor technology to combat vandalism and to develop new measurements were underway. In the Indian Ocean, particularly in the Northwest Indian Ocean, piracy was a major impediment to implementation (see action under 4.1.3 above).

Ando raised two particular common issues: the interaction between global and regional activities and issues (also discussed in Section 5.2), and that key portions of the tropical moored arrays were sustained with research funding, which was in many cases becoming increasingly difficult to justify (see also the Action under Item 2.2.4).

4.1.5 GLOSS

Mark Merrifield (USA), chair of the GLOSS Group of Experts, gave a presentation[18] by teleconference on the status and challenges of the global tide gauge network. The GLOSS core network was now about 80% operational, and new initiatives will increase this to 85-90%. The main challenges included cost, the remoteness of some sites, and national engagement. About half (48%) of this network had GPS and/or DORIS geolocation, where cost, maintenance, and national participation were the major barriers to improvement. More than half of tide gauges delivered their data in near-real-time or fast delivery, where the primary impediment was national commitments. GLOSS continued to work on metrics, and expected progress by its next meeting in fall 2011.

The OCG **noted** the importance of historical release of high-frequency tide gauge data for studies improving predictability of extreme water levels - connected to data sharing issues that require diplomatic solutions. It **recommended** that this be raised at IOC level.

4.1.6 Argo

Susan Wijffels (Australia), co-chair of the Argo Steering Team, gave a presentation[19] on the Argo profiling float array. The core mission is nearly complete, with contributions from 29 countries and the EU (of active floats in the water). The array degraded for the first time in 2010 compared to 2009, in large part due to a deployment halt in 2009 to deal with a pressure sensor problem. Float lifetimes are improving, and some floats now being deployed could last 10 years. The use of Iridium telecommunications is growing. The Argo Data System has made great strides, but faced challenges in dealing with new missions and sensors.

Challenges in the near-term included maintaining national contributions, dealing with a delay in deployments and pressure biases, and dealing with velocity data and the diurnal cycle. In the longer term, the community was working to tackle new challenges, including near-surface temperature data, Bio-Argo, the inclusion of glider data, deep profiling floats, Argo under ice, and the need for higher data density in some areas.

Cross-challenges with other networks included filling gaps in the network, diversifying support for the international infrastructure including JCOMMOPS, and intercalibration of data streams.

Action for DBCP and Argo chairs to explore collaboration in chartering vessels for deployments in data-sparse regions (to bring up at next DBCP meeting).

The OCG recommended that OOPC, SOOS, and the Arctic community tackle requirements and observing needs for under-ice zone. (Argo technology is ready)

4.1.7 OceanSITES

Uwe Send (USA), co-chair of the OceanSITES reference station network, gave a presentation[20] on the issues and challenges faced by the network. The OceanSITES team has been debating the definition of an OceanSITES time series site, and in particular how multidisciplinary these sites

[18] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7175
[19] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7181
[20] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7651

should be. There is an ambition to enlarge the number of sites. The moored sites are ideal platforms to test new sensors for new variables, although one challenge that the team is working on is the diversity of technologies available and used. Progress has been made by the data system team, with 30-40 platforms on the data system currently, and 60-70 expected in the near future. One challenge has been a lack of project office support for the network.

The OCG **encouraged** OceanSITES to define some clear metrics of success to help focus their efforts and help identify the needed collaboration with other parts of the observing system. Further discussion related to OceanSITES took place under item 4.2 below.

4.1.8 IOCCP

Maciej Telszewski (IOC), deputy director of the International Ocean Carbon Coordination Project (IOCCP), gave a presentation[21] on the goals of the project, and in particular its coordination activities for underway pCO_2 observations and carbon time series stations, associated data management systems and synthesis activities. He expressed the willingness of the IOCCP community to cooperate with JCOMM where relevant to both sides.

Action: Collaborations to be investigated between SOOP and IOCCP for providing hardware (and airtime) to permit transmission of the SST & SSS data in real-time

Action for Telszewski and Goni: SOOP to collaborate for Quality Control of salinity data from pCO_2 lines (see also action under item 4.1.2)

4.1.9 GO-SHIP

Bernadette Sloyan (Australia), co-chair of the Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP), gave a presentation[22] on the goals and status of the program. Based on development by CLIVAR and the IOCCP, GO-SHIP's objectives were to provide coordination to achieve a sustained integrated/interdisciplinary repeat hydrography network, facilitating planning, agreement on standards and methods, data management and synthesis activities. The Program had agreed on a list of core and ancillary variables to be observed and agreed on data release requirements.

Development plans included the desire to establish a program office, initiating network evaluation from the CLIVAR decadal survey and launching joint planning exercises, and the establishment of a data management committee to promote collaborative action.

The Argo data system had an ongoing need for near-real-time CTD profiles to help in quality control.

Action for Argo and GO-SHIP to maximize use of research ships for deployment as CTD cast makes these the ideal platform for data quality comparison (for Argo TC, GO-SHIP officer or chairs, continuous).

Action for Goni, Wijffels to finalize and publicize the manual for fall rate equation experiments including multiple deployments at the same time.
Followup **Action** for SOOPIP and and GO-SHIP chairs, to maximize possibilities for this work on GO-SHIP cruises.
Tim Boyer (USA) is the focal point for receiving this data.

Action GO-SHIP to engage with repeat hydrography community about getting CTD profiles our in near-real-time, agree on format, agree on real-time assembly/GTS injection center (some possibilities include: Coriolis, AOML, or CCHDO). This might be on the GTS or a more restricted real-time distribution.

Once GO-SHIP has agreement on format and arrangements, **Action** for GO-SHIP chair to approach SeaBird about generating correct message out of CTD automatically.

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[21] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7179
[22] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7178

4.2 Discussion of issues raised by observing networks

The OCG discussed a number of more general issues during the presentations above and in a separate discussion period, and decided on a number of actions:

Action for JCOMM (OCG chair and secretariat) to sponsor a workshop on the potential for *gliders* to contribute to sustained ocean observing:

- potential partners: CLIVAR, POGO, GOOS (OOPC)
- objective: to identify the potential of different modes of operation, necessary technical development, and the need for strategic and technical coordination, data management; to identify some champions

OCG chair and secretariat to explore an **action** with/by SCOR and the biologging community to host workshop on coordination needs in the marine mammal (and other animal tagging) observing community. This community had already organized itself through a series of symposia, the latest of which took place in March 2011 (Biologging 4, http://www.cmar.csiro.au/biologging4/). Concrete **action**: invitation to next OCG meeting.

Action for OCG chair, secretariat, through contact with each observing network chair: to maintain information on major constraints to full implementation (lack of funding, logistics, need for technical coordination, data management issues), so these can be easily raised in high-level fora and documents. (regularly updated)

OCG **noted** importance of *generation and publicity of ocean information products* (indices, local ocean information) for a larger public in developing advocacy for ocean observing networks OOPC can play a role in publicizing these indices through its indices website and in cooperation with other initiatives. In addition, products such as throughflow, western boundary current characteristics, heat transports, time history of steric height can be used for validation/ intercomparison with models, the PCMDI / CMIP5 project has a lot of interest in these. The OCG **encouraged** all teams to think about generating some of these products or indices to help in advocacy for their network (**Action** for all team chairs). These products should be promoted with ET-OOFS, GODAE OceanView, CLIVAR WG-OMD, and the GSOP/reanalysis community.

5 Identifying and working on common challenges and building positive synergies

5.1 Technical coordination: JCOMMOPS

Mathieu Belbéoch (JCOMMOPS) gave a presentation[23] on the status of the JCOMM Observing Programme Support Centre, its support to the DBCP, Argo, SOT, and OceanSITES. and the common infrastructure that had been built. He reported on a new initiative for deployment of Argo profiling floats, using a chartered sailing vessel, the "Lady Amber".

He proposed future development of JCOMMOPS with a Cruise Information Centre / Coordinator, noting that a majority of the funds needed to pilot this position for one year (in 2012) were already assembled. He also encouraged other networks (GO-SHIP, IOCCP, gliders, marine mammals) to think of investing in technical coordination building on the synergies of JCOMMOPS. To increase the capabilities of the centre required an increase in investment. The IOC was preparing to renew the MoU between UNESCO and France to formalize JCOMMOPS as an IOC Programme Office according to IOC guidelines.

He warned that JCOMMOPS was at a crossroads - that the two technical coordinators presently in their posts were not sufficient to deliver full services to four programmes, and that common

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resources were limited. He believed there was a way forward, but this would require investment by the host country and by the observing networks to achieve the full vision of JCOMMOPS as a technical coordination service for a system of observing networks.

Regarding the ship coordinator proposal: the OCG was generally supportive of the idea as a pilot, but **encouraged** further refinement in the terms of reference with the panels,to increase the possibility for success.

The OCG endorsed the new and creative initiative by the Argo TC for deployment of Argo profiling floats using the charter sailing vessel Lady Amber, and encouraged other in situ platforms to consider using this deployment opportunity to address the increasingly growing problem of decreasing ship time.

Action for Mathieu and Albert: follow up with a letter from IOC on an offer from Europe (P-Y Le Traon) for 10k€ contribution in support of OceanSITES.

Noting that the panels supporting JCOMMOPS were fully satisfied of the technical coordination support provided by JCOMMOPS, OCG members **emphasized** that the coordinator has first priority to serve the individual networks, before working on cross-platform actions, but that they believed integration would bring benefits. OCG encouraged all panels to consider working through JCOMMOPS for technical coordination.

OCG **noted** that *new funding will be attached to deliverables* and that there will be a clear advantage for a cross-network synergy of JCOMMOPS technical coordinators working together. JCOMMOPS **needs both *strategic and operational management*** so that the networks can find accountability for their deliverables based on their investment in the center. The TCs cannot play this management role; rather a stable and appropriate management structure needs to be approved and properly resourced. This structure needs to consider both a funding model based on specific deliverables that also includes funding for a common infrastructure; and an operating model that allows flexibility in how these deliverables are generated, and builds on positive synergy, integration and a common infrastructure.

The OCG **recognized** a need to clarity the person or structure for this management between the panel chairs, OCG, secretariats and JCOMMOPS. In consultation with the panels contributing to JCOMMOPS, OCG requested a strategic and operational plan for JCOMMOPS including clear deliverables, performance targets, and budget including staff costs so that new programs have a clear understanding of the costs. **Action:** JCOMMOPS (Y. Desaubies and M. Belbeoch), OCG and panel chairs, IOC, WMO to draft strategic and operational plan and budget (including both salary and operating costs) for JCOMMOPS, before JCOMM-IV.

The OCG **stressed the importance** of IOC being proactive in providing the budgeting information and invoicing countries on time, to build trust that money is properly managed for the benefit of the networks and countries. This information should include national contributions to be used for peer pressure. **Action** for IOC secretariat, continuous.

In growing JCOMMOPS, the conversation needs to be between networks not getting service currently from JCOMMOPS and this point person for management, and budget proposals should be developed.

OCG also **took note** of the initiative to find support from JTA and telecommunication service providers for JCOMMOPS.

The OCG **thanked** Mathieu Belbéoch for his report and pro-active actions to further develop JCOMMOPS and promote positive synergies between the different components of the global ocean observing system in terms of programme monitoring, and day to day technical support to programme managers for the networks implementation and operations. The OCG **encouraged** him to continue doing so in close collaboration with the OCG chair, Panels and associated programmes' chairs, and the Secretariat.

5.2 The interface between national, regional, and global initiatives

Tim Moltmann (Australia), director of the Australian Integrated Marine Observing System (IMOS) gave a presentation[24] presenting his perspective on the interface between national and regional initiatives and the global system. There was an area of overlap between JCOMM and IMOS in bluewater physical-chemical observations, notably Argo, SOOP, OceanSITES, and IOCCP, and 1/3 of IMOS investment in facilities supported JCOMM global objectives. He asked the OCG to reflect on how this cooperation could be improved, providing some specific examples including in data discoverability and integration.

Steve Rintoul (Australia), co-chair of the SCAR/SCOR Oceanography Expert Group that developed a plan for the Southern Ocean Observing System (SOOS), gave a presentation[25] on the role of the Southern Ocean in the earth system, the need for sustained observations, and an overview of SOOS. Many elements of the SOOS existed already and were parts of the global system. SOOS was establishing a project office at the University of Tasmania, as well as a Scientific Steering Committee. For implementation to progress, quantitative targets would need to be established, early wins identified, and a more rigorous experimental design established with a refined sampling plan for biology and ecology in particular. SOOS was establishing a data portal. Rintoul emphasized that SOOS and the global ocean observing system implemented by JCOMM should be fully coordinated, and that SOOS would help to organize a regional activity that was part of the global system.

5.3 Legacy recommendations from the JCOMM pilot project for WIGOS; standards and best practice

Etienne Charpentier (WMO) gave a presentation[26] on legacy recommendations from the JCOMM pilot project for WIGOS, a related presentation[27] on standards and best practices, and a brief presentation[28] on the establishment of Regional Marine Instrumentation Centres (RMIC).

OCG **endorsed** the legacy recommendations of the JCOMM Pilot Project for WIGOS and invites OPA Panels and Associated Programme to address them as appropriate.

Action: OCG vice-chair (David) to be focal point for

- maintaining JCOMM catalogue of standards and best practices.
- undertake a review of WMO & IOC Publications (WIGOS)
- Review “ongoing actions” from the OPA Panels session reports and translating some of them into recommendations/practices to be included in manuals & guides

The OPA Panels and associated programmes were **invited** to compile and document their instrument practices and make recommendations whether they should be promoted through specific guides, JCOMM TRs, or WMO & IOC Publications.

The OPA will follow the development of the new WIGOS Manuals and contribute as appropriate (input from Etienne).

Action: OCG members to review 'cookbook' for data management when ready.

OCG **accepts** of the decision by MAN, based on the recommendations by the pilot project which was acting on behalf of the OCG, on the procedures for accreditation of RMICs and the approval of the first two centers in the USA and China.

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[24] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7176
[25] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7177
[26] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7169
[27] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7170
[28] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7168

5.4 Technology infusion and pilot projects

David Meldrum (UK), vice-coordinator of the OCG, gave a presentation with suggestions for pilot projects across the Observations Coordination Group that would be of benefit to multiple networks, based on the discussion held at the meeting.

Action to maintain communication on DBCP tender process for telecommunications with the rest of the interested teams in OCG (for DBCP chair and OCG coordinator).

Action: inform OCG members on development of seabed cable observation talks with ITU and providers (for Meldrum).

The OCG **recommended continued effort** on sensor development for Argo, surface drifters, moorings (with a particular focus on ocean carbon system)

5.5 Data management

Sissy Iona (Greece), Coordinator of the JCOMM Data Management Programme Area, gave a presentation[29] outlining activities of the DMPA with particular relevance to the OCG, and focusing on what DMPA could contribute to the teams in the OCG, and what was needed from those teams in order to advance.

Action: OCG panels to submit documentation on their data and metadata standards for implementation of the WIGOS pilot project.

OCG **recommends** a better link between the individual network data teams and the JCOMM Data Managment Programme Area and IODE efforts.

OPA members are **invited** to contribute to the training course in encoding/ decoding BUFR for real-time data transmission (need to insert details).

Ocean Data Portal - DMPA **invited** to contact the individual network DACs to provide the needed information to make network data discoverable through the ODP (working through Mathieu for the panels he coordinates).

The OCG **recommended** engaging data management community in IODE/JCOMM in a review of the historical thermal dataset.

6 Work plan, milestones, and recommendations

The OCG reviewed a draft list of the decisions, recommendations, and actions decided by the coordination group which form the basis of this report.

7 Issues to raise at the JCOMM-wide and intergovernmental (WMO, IOC) level

The OCG briefly reviewed a number of actions in which JCOMM or high-level (WMO, IOC) intergovernmental attention would be needed. These actions can be found in sections: 2.2.3 (requirements for satellite observations), 2.2.4 (fragility of sustained funding for research-supported observing networks critical for weather/seasonal forecasting), 4.1.3 (support of navies for deployment in the northwest Indian Ocean), 4.1.5 (exchange of high-frequency historical and real-time tide gauge data), and 5.1 (JCOMMOPS).

[29] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=7375

8 Closing

Clark thanked all the participants for blocking out the time and participating actively in the meeting, the local host and Peter Dexter, and the members of the IOC, WMO, and local secretariat. She closed the meeting at

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ANNEX I

AGENDA

1 Opening

Monday AM 9:00-9:15. The fourth session of the JCOMM Observations Programme Area Coordination Group (OCG) will open Monday 18 April 2011 at 9 am, at Old Woolstore Hotel, Hobart, Tasmania, Australia. Candyce Clark, OPA Coordinator, will chair the session.

1.1 Welcome and logistical arrangements

9:15-9:30. Peter Dexter, JCOMM Co-President, and the local host will welcome participants. Albert Fischer, IOC secretariat, will review the provisional agenda, documents, and timetable, and the meeting will adopt or modify them.

1.2 Meeting goals

9:30-9:45. Clark will provide a quick overview of the meeting goals: a sharing of experience and status amongst the observing networks, identifying best ways to take advantage of new technologies (sensors, communications), improving observing programme support, and identifying other areas of common work.

1.3 The role of the OCG in a post-OceanObs'09 Framework for Ocean Observations

9:45-10:15 (20 min presentation + 10 min discussion). presented by Fischer. Draft consultative Framework recommendations document available.

2 Requirements for the Observations Programme Area (OPA)

2.1 Review of scientific requirements for climate

10:45-11:05 (15+5 min). Fischer will review changes in the GCOS Implementation Plan 2010 version, the draft update to the GCOS Satellite Supplement, and outcomes from the OOPC Deep Ocean Workshop (30 March - 1 April 2011).

2.2 Review of non-climate requirements and feasibility

2.2.1 Operational ocean forecast systems observing requirements

11:05-11:25 (15+5 min, might be delayed to after 2.2.4). Gary Brassington, chair of the JCOMM ET-OOFS, and Andreas Schiller, co-chair of GODAE OceanView, will discuss requirements for ocean observations to support ocean forecast systems. Short Doc 2.2.1 available.

2.2.2 Variable focus: GHRSST

11:25-11:45 (15+5 min). Ian Barton, member of the GHRSST science team, will address requirements from in situ observing networks for SST products. Short Doc 2.2.2 available.

2.2.3 SFSPA further observing requirements: waves, storm surges, ocean-related hazards, sea ice

11:45-12:05 (15+5 min). Ming Ji, JCOMM Services and Forecast Systems Programme Area (SFSPA) coordinator, will present further observing requirements for teams in the SFSPA. Short Doc. 2.2.3 available.

2.2.4 WMO Rolling Review of Requirements, ET-EGOS Implementation Plan

12:05-12:25 (15+5 min). Etienne Charpentier (WMO) will present specific requirements for marine and ocean observations from the WMO Rolling Review of Requirements process. Short Doc. 2.2.4 available.

3 Are we meeting the requirements for observing ocean variables?

3.1 Discussion: feedback for the requirements-setting processes

Monday PM 13:45-14:30. Clark will lead a discussion on feedback from the observing networks for the requirements-setting processes, and the process of matching requirements with funding for new observational capability.

3.2 Review of the current JCOMM OPA Implementation Goals (network-based goals)

14:30-14:45. Clark will present the current status of OPA Implementation Goals and the meeting will identify needed updates. Doc 3.2 (OPA Implementation Goals: to be revised) available.

3.3 JCOMM metrics

14:45-15:05. Fischer will review the current state of JCOMM metrics (network-based and variable-based), and the meeting will identify steps to improve them, including needed technical support.

4 Issues and challenges faced by the observing networks

4.1 Quick review from each observing network of issues and challenges faced

Reports focused on key issues and challenges with a particular emphasis on areas of cooperation across networks, while a written document for each network will summarize status as well as issues and challenges.

4.1.1 SOT - Volunteer Observing Ships (VOS)
15:30-16:00 (15 min presentation+15 min discussion). presented by Graeme Ball, chair JCOMM SOT. Doc 4.1.1 available.

4.1.2 SOT - Ship of Opportunity Programme (SOOP)
16:00-16:30. presented by Gustavo Goni, chair SOOPIP. Doc 4.1.2 available.

4.1.3 Data Buoy Cooperation Panel (DBCP)
16:30-17:00. presented by Al Wallace, chair DBDP. Doc 4.1.3 available.

4.1.4 Tropical Moored Buoy Implementation Panel (DBCP-TIP)
17:00-17:30. presented by Ken Ando, JAMSTEC. Doc 4.1.4 available.

4.1.5 Global Sea Level Observing System (GLOSS)
Tuesday AM 9:00-9:30. presented on behalf of Mark Merrifield, chair GLOSS/GE. Doc 4.1.5 available.

4.1.6 Argo
9:30-10:00. presented by Susan Wijffels, co-chair Argo Steering Team. Doc 4.1.6 expected.

4.1.7 OceanSITES
10:00-10:30. presented by Uwe Send, co-chair OceanSITES Executive Committee. Doc 4.1.7 expected.

4.1.8 International Ocean Carbon Coordination Programme (IOCCP)
11:00-11:30. presented by Maciej Telszewski, deputy director IOCCP. Doc 4.1.8 available.

4.1.9 Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP)
11:30-12:00. presented by Bernadette Sloyan, co-chair. Doc 4.1.9 available.

4.2 Discussion
12:00-12:30. Discussion of the particular issues and challenges raised, and the general challenge of adjusting network goals to new requirements, and sustaining and identifying new funding sources

5 Identifying and working on common challenges and building positive synergies

5.1 Technical coordination

5.1.1 JCOMMOPS goals and priorities
Tuesday PM 14:00-14:30. presented by Mathieu Belbeoch, JCOMMOPS, Argo Technical Coordinator. Doc 5.1.1 available.

5.1.2 Followup on proposal process to expand and sustain technical coordination
14:30-15:10. presented by Clark. Background documents: requirements for an expanded OPSC sent out during bid process.

5.2 The interface between national and regional initiatives and the global system
15:30-16:00. Tim Moultmann, director of the Australian Integrated Marine Observing System (IMOS), will provide an introduction to this discussion from the perspective of Australia

5.3 Legacy recommendations from the JCOMM pilot project for WIGOS
16:00-16:30. presented by Charpentier

5.4 Technology infusion and pilot projects
16:30-17:00. Discussion led by David Meldrum. Based on inputs from each network, the goal of the discussion will be to identify interfaces between groups to be nurtured, and potential joint pilot projects to undertake.

5.5 Instrument and data standards and best practices
17:00-17:30. Clark will introduce work on a JCOMM catalogue of best practices and standards, and lead a discussion on needed actions at the network and JCOMM levels.

5.6 Data management
Wednesday AM 9:00-9:45. Sissy Iona, coordinator of the JCOMM Data Management Programme Area (DMPA) will introduce this item. Short Doc 5.6 expected.

5.7 Common challenges
9:45-10:15. Discussion of approaches for common challenges, such as: deployment opportunities for autonomous platforms, communications, working with commercial ships / industry, ship time requirements, integration and funding stovepipes; and how to move forward identifying positive synergies

6 Work plan / milestones / recommendations
10:45-11:45. Review of the decisions, recommendations, and actions decided by the coordination group.

7 Issues to raise at the JCOMM-wide and intergovernmental (WMO, IOC) level

11:45-12:15.

8 Closing

12:15-12:30. The session is expected to close by lunchtime on Wednesday 20 April 2011.

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ANNEX II

LIST OF PARTICIPANTS

Kentaro ANDO
Research Scientist
Japan Agency for Marine-Earth Science and Technology, Yokosuka
Research Institute for Global Change Japan Marine Science and Technology Centre 2-15 Natsushima-cho
Yokosuka
237-0061
Japan
Tel: +81-46-867-9462
Fax: +81-46-867-9835
Email: andouk@jamstec.go.jp

Graeme BALL
Manager, Marine Operations Group
Bureau of Meteorology
GPO Box 1289
Melbourne
VIC 3001
Australia
Tel: +61-3 9669 4203
Fax: +61-3 9669 4168
Email: g.ball@bom.gov.au

Dr Ian BARTON
Reaearch scientist
State Ministry of Research and Technology
Australia
Tel: +61 3 62325481
Fax: +61 3 62325123
Email: ian.barton@marine.csiro.au

Mathieu BELBEOCH
Argo Technical Coordinator
JCOMMOPS
8-10 rue Hermès
Parc Technologique du Canal
31520 Ramonville St Agne
France
Tel: +33 5 61 39 47 30
Fax: +33 5 61 75 10 14
Email: belbeoch@jcommops.org

Gary BRASSINGTON
Bureau of Meteorology, Melbourne
Centre for Australian Weather and Climate Research
A partnership between the Australian Bureau of Meteorology and CSIRO
PO Box 1289
700 Collins Street
Melbourne 3001
Australia
Tel: +61 3 9669 4170
Fax: +61 3 9669 4660
Email: g.brassington@bom.gov.au

Etienne CHARPENTIER
Scientific Officer
World Meteorological Organization
Observing and Information Systems Department
Observing Systems Division
World Meteorological Organization
7bis, av. de la Paix
Case Postale 2300
1211 Genève 2
Switzerland
Tel: +41 22 730 82 23
Fax: +41 22 730 81 28
Email: ECharpentier@wmo.int

Candyce CLARK
National Oceanic & Atmospheric Administration, Silver Spring
NOAA/Climate Program Office (CPO)
Climate Observation Division
1100 Wayne Avenue, suite 1202
Silver Spring MD 20910
United States
Tel: +1 301 427 2463
Fax: +1 301 427 0033
Email: candyce.clark@noaa.gov

Peter DEXTER
Co-president of JCOMM
Bureau of Meteorology, Melbourne
International Oceans Policy Advisor
Bureau of Meteorology
GPO Box 1289
Melbourne VIC 3001
Australia
Tel: +61 (0) 3 9669 4870
Fax: +61 (0) 3 9669 4725
Email: p.dexter@bom.gov.au

Albert FISCHER
Programme Specialist, Technical Secretary of OOPC
Intergovernmental Oceanographic Commission of UNESCO
1 rue Miollis
75732 Paris cedex 15
France
Tel: +33 1 45 68 40 40
Fax: +33 1 45 68 58 13
Email: a.fischer@unesco.org

Gustavo J. GONI
National Oceanic and Atmospheric Administration, Atlantic Oceanographic and Meteorological Laboratories
Physical Oceanography Division
USDC/NOAA/AOML/PHOD 4301 Rickenbacker Causeway
Miami FL 33149
United States
Tel: +1 305-361-4339
Fax: +1 305-361-4412
Email: gustavo.goni@noaa.gov

D. E. HARRISON
NOAA Pacific Marine Environmental Laboratory
NOAA Pacific Marine Environmental Laboratory
7600 Sand Point Way NE
Seattle WA 98115
United States
Tel: +1 206 526 6225
Fax: +1 206 526 6744
Email: d.e.harrison@noaa.gov

Sissy IONA
Head HNODC
Hellenic Centre for Marine Research, Anavyssos Institute of Oceanography
46.7 Km, Athens-Sounio Ave.
PO BOX 712 Anavyssos
190 13 Attica
Greece
Tel: +30-22910-76367
Fax: +30-22910-76347
Email: sissy@hnodc.hcmr.gr

Ming JI
Director
Ocean Prediction Center, NOAA
NOAA/NCEP
Ocean Prediction Center
5200 Auth Road, Room 410
Camp Spring MD 20746-4304
United States
Tel: +1 301 763 8000 x 7400
Fax: +1 301 763 8085
Email: Ming.Ji@noaa.gov

David MELDRUM
Research Fellow, Technology Development
Scottish Association for Marine Science
Scottish Marine Institute
Oban, Scotland
PA37 1QA
United Kingdom
Tel: +44 1631 559 273
Fax: +44 1631 559 001
Email: dtm@sams.ac.uk

Tim MOLTANN
Director
Integrated Marine Observing System
University of Tasmania
Private Bag 110
Hobart Tasmania 7001
Australia
Tel: + 03 6226 276
Fax: + 0407 558 004
Email: Tim.Moltmann@imos.org.au

Steve RINTOUL
CSIRO Marine and Atmospheric Research, Tasmania
Marine Laboratories
Castray Esplanade
GPO BOx 1538
Hobart Tasmania 7001
Australia
Email: Steve.Rintoul@csiro.au

Andreas SCHILLER
Theme Leader: The Dynamic Ocean
State Ministry of Research and Technology
CSIRO Marine and Atmospheric Research Hobart
GPO Box 1538
Hobart TAS 7001
Australia
Tel: +61 3 6232 5300
Fax: +61 3 6232 5000
Email: Andreas.Schiller@csiro.au

Uwe SEND
Professor
University of San Diego, Scripps Institution of Oceanography
Scripps Institution of Oceanography, Mail Code 0230
University of California, San Diego
La Jolla CA 92093-0230
United States
Tel: +1 858 822-6710
Fax: +1 858 534-9820
Email: usend@ucsd.edu

Bernadette SLOYAN
CSIRO Marine and Atmospheric Research, Tasmania
Marine Laboratories
Castray Esplanade
GPO BOx 1538
Hobart Tasmania 7001
Australia
Email: Bernadette.Sloyan@csiro.au

Maciej TELSZEWSKI
IOCCP Deputy Project Director
Intergovernmental Oceanographic Commission of UNESCO
1 rue Miollis
75732 Paris cedex 15
France
Tel: +33 (0)1 45 68 39 39
Email: m.telszewski@unesco.org

Hester VIOLA
Program Coordinator: Public, Agricultural and Marine Weather Services
Australian Bureau of Meteorology
GPO Box 1289
Melbourne VIC 3001
Australia
Email: h.viola@bom.gov.au

Al WALLACE
DBCP Chairperson
Environment Canada, Meteorological Service of Canada, Pacific and Yukon Region
201-401 Burrard Street
VANCOUVER V6C 3S5
BC
Canada
Tel: +1 604 664 9090
Fax: +1 604 664 9004
Email: al.wallace@ec.gc.ca

Susan WIJFFELS
CSIRO Marine and Atmospheric Research, Tasmania
Marine Laboratories
Castray Esplanade
GPO BOx 1538
Hobart Tasmania 7001
Australia
Email: Susan.Wijffels@csiro.au