WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

JOINT WMO / IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY (JCOMM)

SOT-V/Doc. I-2.2
(13.05.2009)

SHIP OBSERVATIONS TEAM

ITEM I-2.2

FIFTH SESSION

GENEVA, SWITZERLAND, 18-22 MAY 2009

Original: ENGLISH

REPORT BY THE JCOMM OBSERVATIONS PROGRAMME AREA (OPA) COORDINATOR

(Submitted by Candyce Clark, OPA Coordinator)

Summary and purpose of the document

This document contains a report from the JCOMM Observations Programme Area (OPA) Coordinator, outlining goals and progress made towards: achieving global coverage by the *in situ* networks, system-wide monitoring and performance reporting, and funding to meet implementation targets.

ACTION PROPOSED

The Team will review the information contained in this report, and comment and make decisions or recommendations as appropriate. See part A for the details of recommended actions.

Appendices:
- A. Draft JCOMM Observing System Implementations Goals (March 2009)
- B. OCG-III draft summary of Decisions, Recommendations, Messages Actions
- C. Draft JCOMM Catalogue of Standards and Best Practices
- D. Draft Oceanographer's and Marine Meteorologist's Cookbook for submitting Data in Real Time and in Delayed Mode

- A - DRAFT TEXT FOR INCLUSION IN THE FINAL REPORT

1. Candyce Clark, Observations Programme Area (OPA) Coordinator, noted that the Implementation Goals for the Observations Programme Area is based on the GCOS *Implementation Plan for Climate in Support of the UNFCCC* (GCOS-92). The OPA Implementation Goals are designed for climate but also serve global and coastal ocean prediction, marine transportation, marine hazards warning, marine environmental monitoring, naval applications, and many other non-climate users. It was reported that the global system is presently about 61% complete as measured against the implementation targets identified in GCOS-92 and the JCOMM Implementation Goals; new resources will be necessary to advance system-wide implementation. System-wide progress in the deployment of data buoys, profiling floats, tide gauge stations, and ship-based systems was summarized. JCOMM's monitoring of system performance against sampling requirements was also reviewed.

2. The SOT contribution to this global observing system comes from VOS including the VOSClim programme and from the SOOP network of XBT lines. These SOT contributions are central to the global ocean system operations, not only because of the met-ocean data sets delivered from voluntary observing ships, but also because the voluntary fleet provides the platforms of opportunity necessary for deployment of the drifting arrays, and the platforms of opportunity that support underway carbon dioxide air-sea flux measurements. Clark noted that the VOS did not have a clear target or metric under GCOS-92. 41 SOOP XBT/XCTD trans-oceanic sections were called for in GCOS-92. The OOPC, through the OPA, raised a number of issues for the VOS and SOOP Panels *(see SOT-V/Doc. 1-3.1.1*).

3. The OPA Coordinator reported on the third session of the Observations Coordination Group (OCG-III, 9-11 March 2009, Paris). The Group reaffirmed that its priority remains on building and sustaining the current systems (including those coordinated under the SOT) to agreed standards with near-real-time data reporting, and broadening the base of national participation. The Group recommended that the SOT maintain contact with the SCOR group on voluntary ship ocean observations to avoid overlap and duplication, and to align messages to both ship operators and the scientific communities. It asked the SOT to discuss the management of Publication 47 in order to make a recommendation to JCOMM-III. The OCG asked the SOOP to consider implementation of a stricter real-time QC for profile data. The OCG reviewed the OPA implementation goals, and proposed a strategy for updating the document, taking into account the latest developments with regard to the GCOS implementation plan and foreseen recommendations, as well as non-climate requirements arising from the CBS Rolling Review of Requirements and resulting Statements of Guidance and gap analysis. It emphasized the importance of a dialogue between those who implement the networks and potential users asking for new capabilities based on their requirements, in order to find ways forward that balance technological capability, network optimization, and funding interest. The OCG discussed the draft *JCOMM Catalogue of Standards and Best Practices*, to be presented at JCOMM-III; and discussed the JCOMM OPA metrics, and noted in particular that non-GTS data, including XBT data in the Coriolis database, should be included in metrics.

4. Clark presented the draft "An Oceanographer's and Marine Meteorologist's Cookbook for Submitting Data in Real Time and in Delayed Mode". The intention of this document is to provide a practical resource to those who collect oceanographic and marine meteorological data to facilitate contribution of the data to the international community. The focus is on in-situ, directly observed measurements, rather than on remote sensing data.

5. The Team took note of the issues raised by OPA Coordinator Clark. The future requirements and specific recommendations and actions for VOS and SOOP were addressed during the agenda items focused on each panel. **Specific actions were decided as follows**:

(i) Review the appropriate sections of the *Progress Report on the Implementation of the*

Global Observing System for Climate in Support of the UNFCCC 2004-2008 (available at gcos.wmo.int) for technical errors related to their panels (***action; panel chairs; 20 June 2009***);

(ii) Review and provide comments on draft *JCOMM Catalogue of Standards and Best Practices* (***action; panel chairs; 1 July 2009***); and

(iii) Review and provide comments to OPA Coordinator on draft *An Oceanographer's and Marine Meteorologist's Cookbook for Submitting Data in Real Time and in Delayed Mode* (***action; panel chairs; 1 July 2009***).

- B - BACKGROUND INFORMATION

From the Progress Report on the Implementation Plan of the Global Observing System for Climate in Support of the UNFCCC 2004-2008 (actual status May 2009 is 61%):

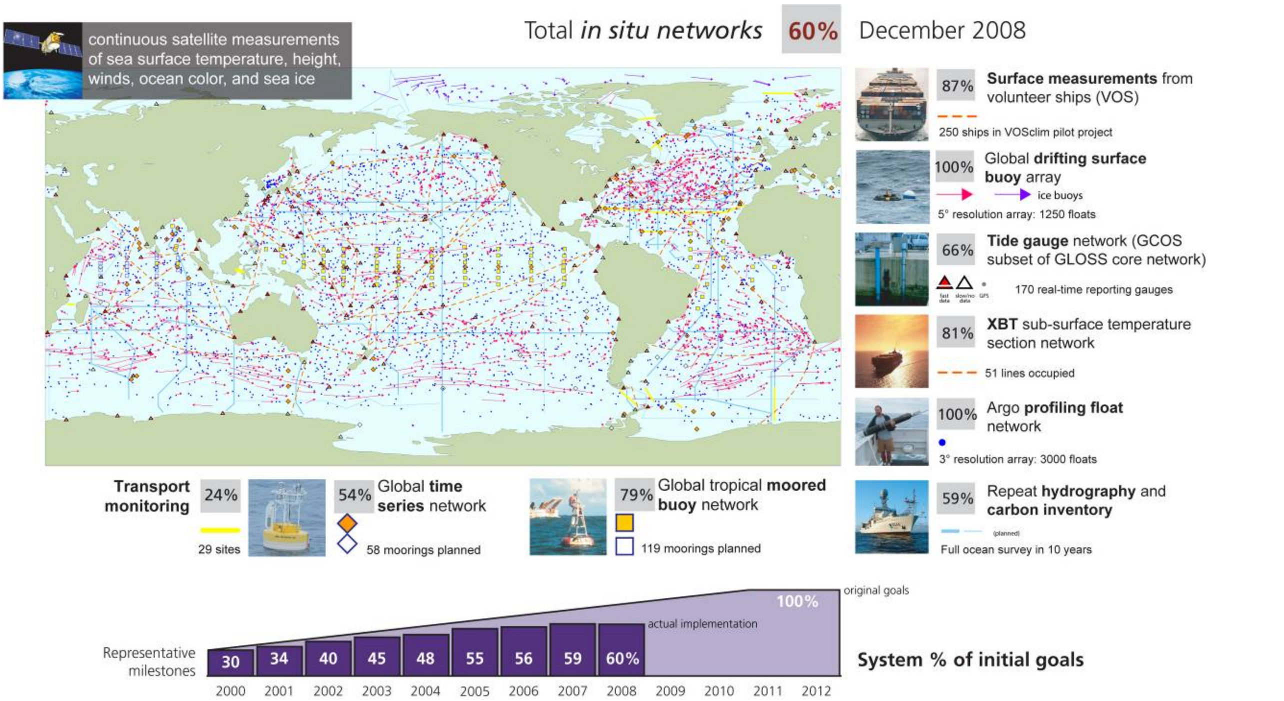

Figure 1: Status of the in-situ global ocean observing system. By December 2008, total implementation reached 60% of its initial goals. Note that gaps between individual systems are significant despite the overall impression of dense in-situ coverage of the oceans. Implementation has progressed steadily but slowly, falling short of the original goals.

Appendices: 4

APPENDIX A

DRAFT JCOMM
OBSERVING SYSTEM IMPLEMENTATION GOALS
for Building a Sustained Global Ocean Observing System
in Support of the Global Earth Observation System of Systems
(March 2008)

1.0 Scope

There is presently significant international momentum for implementation of a global ocean observing system. The GCOS *Implementation Plan for the Global Observing System for Climate in support of the UNFCCC* (GCOS-92) has now been endorsed by the United Nations Framework Convention on Climate Change (UNFCCC) and by the Global Earth Observation System of Systems (GEOSS) 10-Year Implementation Plan Reference Document. The ocean chapter of GCOS-92 provides specific implementation targets for building and sustaining an initial global ocean observing system.

This initial ocean observing system represents the climate component of the Global Ocean Observing System (GOOS), and the ocean component of the Global Climate Observing System (GCOS). The Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) is the intergovernmental body that has primary responsibility for implementation of the *in situ* elements. The work plan that follows provides details on how the JCOMM Observations Programme Area plans, can do its part to help implement the initial ocean observing system in support of GOOS and GCOS, and consequently contribute to the Global Earth Observation System of Systems.

Suggested additions, drawn from the CBS Rolling Review, are noted in yellow, and OCG-III is asked to comment, as appropriate.

2.0 System Design

The ocean observing system documented in GCOS-92 is a composite system of systems, made up of sustained high-quality satellite measurements of the atmosphere and ocean surface, *in situ* measurements of the ocean surface and the sub-surface ocean, and *in situ* measurements of the atmosphere over the ocean. Each component subsystem brings its unique strengths and limitations; together they build the composite system of systems. Figure 1 illustrates this initial global ocean observation system of systems. In addition to the platforms illustrated in Figure 1, two more components are essential: data and assimilation subsystems, and product delivery.

Although this baseline system is designed to meet climate requirements, marine services in general will be improved by implementation of the systematic global observations called for by the GCOS-92 plan. The system will support global weather prediction, global and coastal ocean prediction, marine hazard warning, marine environmental monitoring, naval applications, and many other non-climate uses.

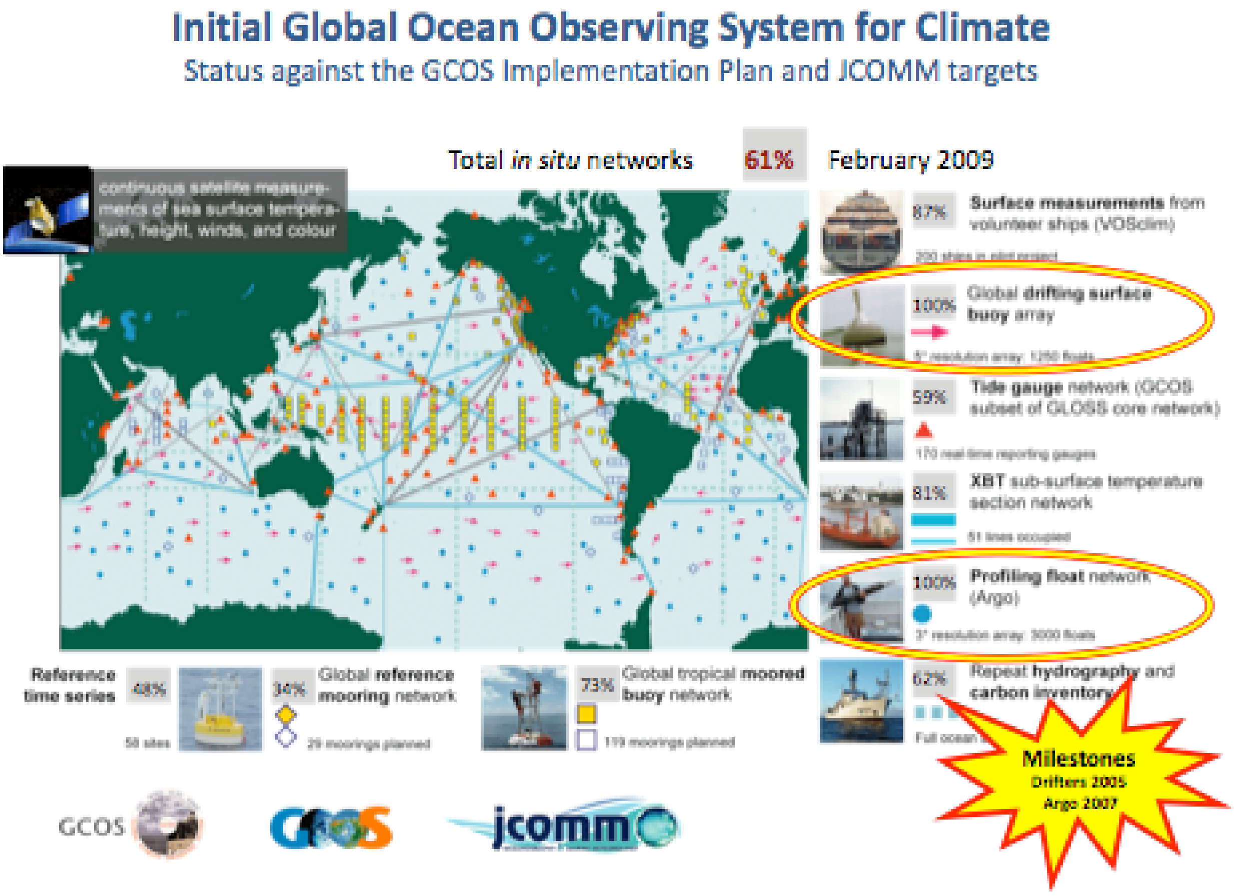

Figure 1: A schematic of the initial composite ocean observing system design, including the current status against the goals of the GCOS Implementation Plan (GCOS-92).

An urgent and fundamental need identified by GCOS-92 – endorsed by the UNFCCC and the GOESS 10-Year Implementation Plan Reference Document – is the need for achieving global coverage by the *in situ* networks. The *in situ* networks include moored and drifting buoys, tide gauge stations, profiling floats, and ship-based systems. Coordination of national contributions to implementation of these networks is the job of JCOMM, in cooperation with other global programmes. Within the ocean chapter of GCOS-92, JCOMM is identified as the implementing agent, or a contributing implementing agent, for 21 of the specific actions. These specific actions for implementation of the *in situ* elements have been adopted by JCOMM as an implementation roadmap. The initial work plan described below outlines the ongoing work and the challenges ahead for JCOMM in building the global ocean component a Global Earth Observation System of Systems.

3.0 Milestones

In order to achieve global coverage as soon as possible, the following schedule has been established. It is an ambitious schedule based on the initial system design and projections of adequate funding. Global coverage cannot be achieved with existing resources. Accomplishment of this plan will require substantial additional investment by the Members/Member States. The milestones will be updated annually to reflect evolution of the design as knowledge and technology advance, and to reflect the realities of funding availability.

	2002	2003	2004	2005	2006	2007	2008	2009	2010
System Percent Complete Targets	40	44	48	53	60	66	77	88	99
Actual Achieved	40	45	48	55	56	59	59		

The following sections indicate individual network improvements that work toward building the observing system as a whole. The ocean observing system is a composite of complementary networks; most serve multiple purposes. One of the primary goals of JCOMM is to look for efficiencies to be gained by utilizing common platforms/sites/data infrastructure for several objectives in parallel. Although individual network priorities are described below, they must all go forward together as a system. For example, the global Argo array of profiling floats is a primary tool for documenting ocean heat content; yet deployment of the floats in the far corners of the ocean cannot be achieved without the ships-of-opportunity and dedicated ship elements; and the Argo array cannot do its work without global over-flight by continued precision altimeter space missions; while the measurements taken by all networks will be rendered effective only through the data and assimilation subsystems, and effective product delivery.

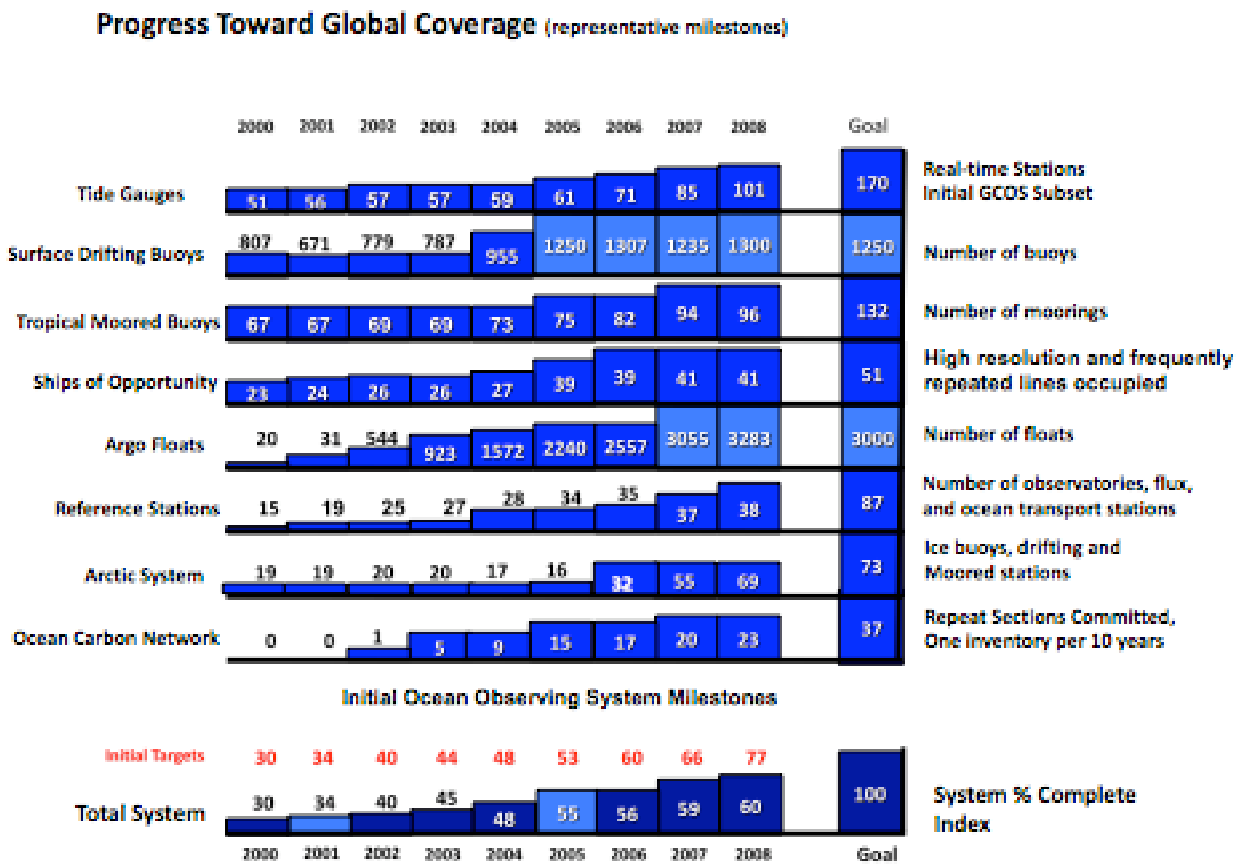

Figure 2: Phased Multi-year Implementation Plan: The history and future plan showing representative milestones for the implementation of the *in situ* elements of the ocean observing system. The plan envisions completion of the initial ocean climate observing system by 2010, which will require substantial additional investment by the Members/Member States.

3.1 Tide Gauge Network: Tide gauges are necessary for accurately measuring long-term trends in sea level change and for calibration and validation of the measurements from satellite altimeters, which are assimilated into global climate models for predicting climate variability. Many tide stations need to be upgraded with modern technology. Permanent GPS/DORIS receivers will be installed at a selected subset of stations, leading to a geocentrically located subset expansion from the present 69 GPS/DORIS sites to 170 sites globally. These 170 GCOS Climate Reference Stations will also be upgraded for real-time reporting, not only for climate monitoring, but also to support marine hazard warning (e.g., tsunami warning). Cooperating Member/Member States will maintain a global network of 290 tide gauge stations, including the GCOS subset noted above, for measuring tides and storm surges, tsunami warning, validation of satellite retrievals, validation of climate model results, documentation of seasonal to centennial variability in the El Nino Southern Oscillation, Indian Ocean and Asian-Australian monsoons, tropical Atlantic variability, North Atlantic Oscillation, North Pacific variability, high latitude circulation, western boundary currents, and circulation through narrow straits and chokepoints.

	2004	2005	2006	2007	2008	2009	International Goal
Operational GLOSS stations	204	204	206	219	219		290
GPS/DORIS installation	53	68	69	80	80		170
Real-time reporting	59	61	71	85	101		170

Tide gauges: For ocean applications, *In situ* observations are used for assimilation in ocean circulation models, and for calibration / validation of the satellite altimeter and models, and the sea level observing network needs to be enhanced so that any tide gauge make measurements with the following minimal requirements: 1cm accuracy, 6 to 15 min high frequency data with accurate timing (1 min.). Measurements must be made relative to a fixed and permanent local tide gauge benchmark (TGBM).

3.2 Drifting Buoy Array: Sea surface temperature is used to drive all forecast models. Data sparse regions of the global ocean are a major source of uncertainty in the seasonal forecasts and are a major uncertainty in the detection of long-term trends in global sea surface temperature, which in turn is an indicator of global change. Surface drifting buoys to reduce these sources of error to acceptable limits must fill data gaps. JCOMM will extend the global SST/velocity drifting buoy array to data sparse regions, maintaining 1250 buoys while adding wind, pressure, and salinity measurement capabilities to serve short term forecasting as well as climate research, seasonal forecasting, and assessment of long-term trends. JCOMM achieved the design target of 1250 buoys in sustained service in 2005. The global drifting buoy array thus became the first component of GOOS to be completed.

	2004	2005	2006	2007	2008	2009	International Goal
Operational buoys	955	1250	1307	1235	1300		1250
Barometer upgrades	312	333	400	502	600		1250
Ice buoys	17	16	32	55	69		
Salinity sensors		9	12	5	0		300

Drifters: The Pilot Project for the development of wave observations from drifters must be promoted. Once/if feasibility is demonstrated, the programme should target the operations of an initial network of 300 units. Surface pressure observations are important to anchor the global NWP model surface pressure. Even very isolated stations may play an important role in synoptic forecasting, especially when they point out differences with NWP model output. All drifters should be equipped with barometers and provide for hourly observations in support of global NWP, and synoptic meteorology.

Ice buoys: Ice buoys should report snow observations in support of global NWP, where feasible.

3.3 Tropical Moored Buoy Network: Most of the heat from the sun enters the ocean in the tropical/sub-tropical belt. The advanced understanding of the role of the tropics in forcing mid-latitude weather and climate was learned primarily through the observations of the tropical moored buoy array (TAO/TRITON) in the Pacific. A similar array in the Atlantic basin (PIRATA) now offers the potential of even better understanding, improved forecasts, and improved ability to discern the causes of longer-term changes in the Oceans. In addition to monitoring the air-sea exchange of heat, the moored buoys provide platforms for supporting instrumentation to measure carbon dioxide and rainfall in the tropics. The global tropical moored buoy network will be expanded to 132 stations and will ultimately span all three oceans - Pacific, Atlantic, and Indian Ocean.

	2004	2005	2006	2007	2008	2009	International Goal
Operational buoys	73	75	82	94	96		132
TAO/TRITON	63	60	60	68	68		68
PIRATA	7	12	16	18	17		18
RAMA	3	3	6	8	11		46
Add salinity sensors	23	23	46	68	68		132
Add flux capability	0	0	7	9	10		15

3.4 Voluntary Observing Ships and Ships of Opportunity: The global atmospheric and oceanic data from Ships of Opportunity (SOOP) have been the foundation for understanding long-term changes in marine climate and, together with the marine meteorology observations from Voluntary Observing Ships (VOS), are essential input to climate and weather forecast models. Improved instrument accuracy, automated reporting, and improved information about how the observations were taken (the VOSClim project) will greatly enhance the quality of these data, reducing both systematic and random errors. JCOMM will improve meteorological measurement capabilities on the global volunteer fleet for improved marine weather and climate forecasting in general, and will concentrate on a specific subset of high accuracy SOOP lines to be frequently repeated and sampled at high resolution for systematic Upper Ocean and atmospheric measurement. This climate-specific subset will build from 34 lines presently occupied to a designed global network of 51 lines and will provide measurements of the upper ocean thermal structure, sea surface temperature and chemistry, and surface meteorology of high accuracy. Additionally, the volunteer fleet is the primary vehicle for deployment of the drifting arrays.

	2004	2005	2006	2007	2008	2009	International Goal
VOS reporting	7329	7329	4639	4340	3066		
High resolution XBT lines	16	22	22	24	24		26
Frequently repeated lines	11	17	17	17	17		25
Auto-met systems	80	140	140	204	204		500

VOSClim ships	108	113	113	217	217		250

VOS: All the Voluntary Observing Ships should be encouraged to report horizontal visibility in a more systematic way to meet the requirements for Ocean Applications (for maritime safety essentially), and precipitation for global and regional NWP, as well as synoptic meteorology.

ASAP: The OPA Observing System Implementation Goals should promote the deployment of ASAP units in support of global NWP and synoptic meteorology. ASAP are providing aerological profiles that complement AMDAR reports over remote ocean areas where only horizontal AMDAR reports (or no such report) are available. More information is needed in order to derive a realistic target for the programme (e.g., E-ASAP is deploying about 5000 radiosondes per year in the North Atlantic Ocean).

3.5 Argo array of profiling floats: Just as knowledge of the structure of the atmosphere is essential for weather and climate forecasting and the resultant societal benefits, so is knowledge of the upper ocean essential to a wide range of applications. Only in the past decade has the technology been available to make these ocean measurements in a sustained manner.

Argo is the program that collects, and distributes quality assured data in real time within (24 hours, including via the GTS) and delayed mode. Argo provides essential broad-scale, basin-wide monitoring of temperature, salinity and velocity in the upper 2000m and is complemented by sea surface topography data from satellite altimeters. The 3000 float full array (approximately a 3^0 X 3^0 spacing) was first achieved in 2007 and must be maintained by annual deployments of around 800 floats. The floats are potential platforms for other sensors. The capability to measure dissolved oxygen has already been demonstrated and plans for global implementation are being discussed. Argo is essentially restricted to the major ice-free ocean basins deeper than 2000m. Limited float deployments have been made in ice-covered areas. Glider technology is expected to supplement Argo in boundary regions.

	2004	2005	2006	2007	2008	2009	International Goal
Argo floats in operation	1572	2240	2557	3055	3283		3000

3.6 Ocean Reference Stations:

3.6.1 Subtask 1: JCOMM, together with international OceanSITES, will implement a global network of ocean reference station moorings to monitor air-sea fluxes of heat, water, and carbon, and full depth ocean temperature and salinity. The stations will also be augmented with biological measurements as technology develops. OceanSITES will provide the major piece of the infrastructure needed for this network, establishing high-capability moored buoys in remote ocean locations. JCOMM will maintain long-term weather and climate instrumentation aboard the OceanSITES platforms.

Moorings (OceanSITES, tropical moorings): making wave measurements from as many OceanSITES as possible would permit to address the requirements for ocean applications (model and satellite product validation). All OceanSITES and Tropical Moorings should be reporting precipitation observations for global and regional NWP, and synoptic meteorology.

3.6.2 Subtask 2: Monitoring the transport within the ocean is a central element of documenting the overturning circulation of fresh water and heat and carbon uptake and release; heat and carbon generally are released to the atmosphere in regions of the ocean far distant from where they enter. Long-term monitoring of key choke points, such as the Indonesian through-flow, and of boundary currents along the continents, such as the Gulf Stream, must be established to measure the primary routes of ocean heat, carbon, and fresh water transport. Monitoring thermohaline circulation is a central element of documenting the ocean's overturning circulation and a critical need for helping scientists understand the role of the ocean in abrupt climate change. It is essential that the ocean observing system maintain watch at a few control points at critical locations. Key monitoring sites have been identified by the OceanSITES team of scientists for deployment of long-term subsurface moored arrays and repeated temperature, salinity, and chemical tracer surveys from research vessels.

	2004	2005	2006	2007	2008	2009	International Goal
Flux moorings	2	6	7	9	10		29
Transport stations	26	28	28	28	28		58

3.7 Coastal Moored buoys: Improved off shore measurements from moored buoys are critical to coastal forecasting as well as to linking the deep ocean to regional impacts of climate variability. The boundary currents along continental coastlines are major movers of the ocean's heat and fresh water (e.g., the Gulf Stream). Furthermore, the coastal regions are critical to the study of the role of the ocean in the intensification of storms, which are the key to the global atmospheric transport of heat, momentum and water, and are a significant impact of climate on society. Coastal arrays are maintained by many nations making this a "global" network of "coastal" stations. A climate subset of this network will be improved by augmenting and upgrading the instrument suite to provide measurements of the upper ocean as well as the sea surface and surface meteorology. Of these moorings, many will serve as platforms-of-opportunity for the addition of carbon sampling instrumentation and other biochemical measurements.

	2004	2005	2006	2007	2008	2009	International Goal
Weather Buoys	473	489	482	506	472		

3.8 Ocean Carbon: Understanding the global carbon cycle, and the accurate measurements of the regional sources and sinks of carbon are of critical importance to international policy decision-making as well as to forecasting long-term trends in climate. Projections of long-term global climate change are closely linked to assumptions about feedback effects between the atmosphere, the land, and the ocean. To understand how carbon is cycled through the global climate system, ocean measurements are critical. JCOMM will coordinate with the IOCCP and OceanSITES for the addition of autonomous carbon dioxide sampling to the moored arrays and the VOS fleet to analyse the seasonal variability in carbon exchange between the ocean and atmosphere, and in cooperation will help implement a program of systematic global ocean surveys that will provide a complete carbon inventory once every ten years.

	2004	2005	2006	2007	2008	2009	Goal

Inventory lines per decade	9	15	17	20	23		37
Time series moorings	4	8	10	15	22		
Flux on ships of opportunity	12	28	29	29	29		

3.9 Arctic and Antarctic Observing Systems: Given the sensitivity of the Arctic and Antarctic environment to climate variability and change, it is in these regions that early indications of the future progression of climate change are likely to be first detected. A program of observations of this area was developed for the International Polar Year through dedicated and shared ship-based cruises and oceanographic moorings, ice buoys, and supplemented by acquisition and analysis of historical data sets. The long-term goal is to detect climate-driven physical and ecological change, especially due to changes in sea ice extent and duration, and in ocean density and circulation that together may lead to changes in ocean heat transport, productivity, and food web structure. Ice-tethered buoys and bottom-mounted moorings are deployed to monitor the drift of sea ice and to determine its thickness. The long-term goal is to provide an accurate record of changes in sea ice thickness that, together with satellite observations of sea ice extent, can provide an estimate of changes in sea ice volume.

	2004	2005	2006	2007	2008	2009
Ice buoys and Ice Stations	17	16	32	55	69	
Subsurface moorings	4	4	4	8	8	
Ship transects maintained	1	1	1	2	2	

3.10 Dedicated Ships: Ship support within the international research fleets for deployment of the moored and drifting arrays, and for deep ocean surveys is an essential component of the global ocean observing system. The deep ocean cannot be reached by SOOP and Argo; yet quantification of the carbon and heat content of the entire ocean column is needed to solve the climate equations. In addition to providing the survey and deployment platforms for the autonomous arrays, the research fleet will maintain sensor suites on a small core of vessels in coordination with the VOSClim project as the highest quality calibration points for validation of the other system measurements.

3.11 Satellites:

The initial ocean observing system for climate depends on space based global measurements of 1) sea surface temperature, 2) sea surface height, 3) surface vector winds, 4) ocean colour, and 5) sea ice. These satellite contributions are detailed in other international plans, but continued close coordination with the *in situ* systems is essential for comprehensive ocean observation.

3.11.1 Sea surface temperature: Satellite measurements provide high-resolution sea surface temperature data. Both infrared and microwave satellite data are important. Microwave sea surface temperature data have a significant coverage advantage over infrared sea surface temperature data, because microwave data can be retrieved in cloud-covered regions while infrared cannot. However, microwave sea surface temperatures are at a much lower spatial resolution than infrared. In addition, microwave sea surface temperatures cannot be obtained within roughly 50 km of land. A combination of both infrared and microwave data are needed because they have different coverage and error properties. Drifting buoy and other *in situ* data are critically important in providing calibration and validation in satellite data as well as providing bias correction of these data. Satellite biases can occur from orbit changes, satellite instrument changes and changes in physical assumptions on the physics of the atmosphere (e.g., through the addition of volcanic aerosols). Thus, drifting buoy and other *in situ* data are needed to correct for any of these changes.

3.11.2 Sea surface height: The value of spaced-based altimeter measurements of sea surface height has now been clearly demonstrated by the TOPEX/Poseidon and Jason missions. Changes in sea level during major El Nino events can now be discerned at high resolution and provide realistic model initializations for seasonal climate forecasting. The same data, when calibrated with island tide gauge observations, are also able to monitor the rate of global sea level change with an accuracy of 1 mm per year. The planned NPOESS altimeter will be adequate for shorter term forecasting, but the NPOESS altimeter will not fly in the same orbit as TOPEX/Poseidon and Jason; and for monitoring long-term sea level change, continuation of precision altimeter missions in the TOPEX/Poseidon/Jason orbit is necessary. Jason follow-on altimeter missions (Ocean Surface Topography Mission, OSTM) are necessary to continue the long-term sea level record.

3.11.3 Surface vector winds, ocean colour, and sea ice: The best methods of sustaining satellite measurement of surface vector winds, ocean colour, and sea ice are still research and development questions. Over the next five years, the satellite agencies will weigh the alternatives and determine the long-term strategy for maintenance of these elements.

Satellite observations: Wave observations must be added as a key variable to be derived from satellite observations using polar altimeters for significant wave height, and SAR.

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APPENDIX B

THIRD SESSION OF THE JCOMM OBSERVATIONS COORDINATION GROUP
DRAFT SUMMARY OF DECISIONS, RECOMMENDATIONS, MESSAGES, ACTIONS
(Paris, France, 9-11 March 2009)
v. 1, 11 March 2009

1. Opening

2. Requirements for the Observations Programme Area (OPA)

2.1 Quick review of scientific requirements for climate, GCOS progress and update

- OCG priority remains on building and sustaining the current systems

2.2 Critical review of non-climate requirements and feasibility

- OCG emphasizes the importance of a dialogue between implementers and potential users asking for new capabilities based on their requirements, in order to find ways forward that balance technological capability and funding interest

- (see also 4.2)

2.3 Coordination and integration issues from the point of view of the JCOMM Data Management Programme Area (DMPA)

- Action: SOOPIP to finalize BUFR templates for profile and underway data and forward to Keeley

- Action: Panel Chairs to work with Keeley to ensure input into the process of harmonizing and finalizing BUFR templates

- Action: Panel Chairs and/or Technical Coordinators to ensure JCOMM catalogue of standards and best/common practices document is populated with the formal and informal documents used by the panel *(and that these are submitted to the Ocean Data Standards portal)*

- (unresolved question on ODAS and Meta-T for metadata; and more generally how to move forward on metadata)

- (see also 4.4)

2.4 Coordination and integration issues from the point of view of the JCOMM Services Programme Area (SPA)

2.4.1 Overview

2.4.2 Requirements for Ocean Forecasting

- Recommendation: SOOPIP to consider implementation of stricter real-time QC for profile data

- (see also 4.2)

3. Review of status and challenges for each observing system component

- for all teams, see also 4.2

3.1 JCOMM Ship Observations Team (SOT)

3.1.1 Overview of SOT, VOS, ASAP

- Action: for SOT and IOCCP to put together short information note/pamphlet for the carbon community on the PMO network, the SOT programmes and information on recruiting VOS lines

- Recommendation: SOT maintain contact with SCOR group on volunteer ship ocean observatories to avoid overlap/duplication and to align messages to both ship operators and the scientific community

- Action: National Pub47 submissions to be forwarded by WMO Secretariat to JCOMMOPS

- Recommendation: SOT to discuss management of Pub47 in view of making recommendation to JCOMM-III

- Recommendation: JCOMM to make the case of climate VOS observations with shipping/maritime companies at Maritime events, drawing on research users to make the case

3.1.2 SOOP

- (see 2.4.2)

3.2 JCOMM Data Buoy Cooperation Program (DBCP)

- Action: DBCP Chair to contact Stan Wilson (NOAA NESDIS) regarding data availability delays due to the blind orbit issue

- Recommendation: Observing Panels should have a system approach to achieve coverage in data sparse areas (e.g. getting SST from cheap moorings in Gulf of Guinea instead of from drifters; or use longer drogues to limit drift out of area) – *outstanding question on how to implement this approach*

- (see also 7.4)

3.3 JCOMM Global Sea Level Observing System (GLOSS)

- Recommendation: GLOSS should consider expanding core mission from global sea level rise to include higher time resolution and space resolution information about relative sea level change for other users (as they are already doing in part)

3.4 Argo

- Action: OCG implementation goals and JCOMMOPS to separate number of all active profiling floats from number of floats contributing to core Argo mission (providing good data 60°N to 60°S in open ocean)

3.5 OceanSITES

- Action: OceanSITES/TC to provide status of surface flux reference stations for GCOS Progress Report by next week

- Action: OceanSITES/TC to provide OCG with updated inventory and community plans for implementation (see also 4.2)

3.6 International Ocean Carbon Coordination Program (IOCCP)

- Action: IOCCP director to work with hydrography community to share cruise plans with JCOMMOPS on a regular basis so that deployment opportunities can be taken advantage of (goal to have info 6 months before cruise opportunity)

3.7 Satellites

- Action: OCG to produce 1-pager / annotated ppt slide (variable by variable) about in situ data available for validation of satellite missions with prominent JCOMM logos, distribute to satellite community.

- *(outstanding question about whether JCOMM or other intergovernmental action required/useful for data access solution, rather than bilateral negotiations)*

- Recommendation: SOT to take note of ships using radiometers for calibration of satellite SST IR and ocean colour missions (funded directly by satellite agencies)

- Recommendation: to organize a small workshop on sea surface salinity validation requirements with in situ and satellite representatives

4. Issues and synergies for cross-component integration and coordination

4.1 JCOMM OPA Metrics

- Recommendation: to look at using different grid boxes sizes for addressing horizontal resolution coverage (e.g. Argo uses 9 deg x9 deg boxes – a smoothed metric based on same requirement) (Action for Roemmich/Belbeoch and Keeley)

- Recommendation: separate animal profiles, CTDs, and Argo data (all reporting in TESAC)

- Recommendation: non-GTS data must be included (e.g. Coriolis XBT data)

- Recommendation: To include a paragraph or two of interpretation of the graphs (see also 3.7)

- Recommendation: start a discussion with the Aquarius team on the salinity metric – what is their sampling requirement? (see also 3.7)

- Other groups/panels are invited to comment on the metrics

4.2 Are requirements being met?

- GLOSS: OCG implementation goals should be aligned with GLOSS Manual Appendix 1 – goal: research quality stations 290, GPS/DORIS-equipped stations 170, real-time reporting (1-minute sampling) 290. These satisfy the RRR requirements as well as GCOS-92.

- DBCP goals should be: all surface drifting buoys 1250, including SLP 1250, salinity sensors should be deleted as a target for OCG.
  DBCP believes it is ready to provide additional capacity in measuring ice thickness and pCO2, should resources be identified to support this.

- TIP / tropical moored buoys – *outstanding discussion on implementation goal number for OCG (including RAMA calls for 132) vs. GCOS-92 (which called for ~120)*

- SOT has provided updated implementation numbers.

- Argo implementation goals should identify core mission (see 3.4)

  As more floats move to Iridium communications, the timeliness (requirement for ocean forecasting) will be improved.

  Action: Roemmich to bring this request from ET-OOFS (improved timeliness) to the upcoming AST meeting

  Argo has left shallow/marginal seas strategies to regional groups.
  Expectation that an international target for the high-latitude oceans may be part of the Argo CWP for OceanObs'09.

  Recommendation: that minimum depth on Argo profiles is brought to 3 m from 5 m.

  Action for Roemmich and Lindstrom: to bring sea surface salinity calibration need to the AST again.

- OceanSITES:
  surface flux implementation goal should appear once under OceanSITES and not again under the tropical moorings

  Action: Best practice for the surface flux reference sites should be documented by OceanSITES

  OceanSITES will revise implementation goals for:
  1. surface flux reference sites
  2. water column reference sites (physical, biogeochemical, etc.)
  3. transport sites (including trans-oceanic sections, straights/passages, boundary currents)

  Action: OceanSITES to contact IOCCG regarding the role it can play in providing in situ optical properties, chlorophyll and productivity data

IOCCP plans in development for OceanObs'09 (GO-SHIP, others)

<u>Non-climate requirements brought by WMO/CBS RRR</u>

- *High time resolution SST*:
  DBCP has been in contact with GHRSST – GHRSST members invited to write proposal to their funding agencies for increased time resolution of SST in specific area as a research

experiment, based on cost information provided by DBCP

- *Wave measurements*:

  Understanding is that wave models need very high quality spectral wave data in order to be validated (ETWS to correct if not true).

  ETWS is asked to encourage the submission of proposals in dialogue with OceanSITES implementers for the addition of wave rider buoys to OceanSITES reference sites.

  DBCP has a pilot project for wave measurement technology development.

- *Surface pressure*:
  OCG suggests a working group should consider how to, best provide SLP information. Goal should be to develop an implementation strategy based on tradeoffs between different systems (SLP on buoys vs. integration of SVW remote sensing products). Group should include representation from ET-EGOS/CBS, AOPC, OOPC, DBCP, satellite community

- *Precipitation*:
  OceanSITES will bring this request to its members and believes it can make progress (surface reference flux sites already measure precipitation).
  SOT has only 8 ships with rain gauges (7 of which are research) and feels it would be impossible to ask this of the VOS fleet without additional resources for optical rain gauges.
  Argo has some pilot acoustic precipitation sensors deployed

  Recommendation – small working group to consider tradeoffs between systems

- *Horizontal visibility:*
  SOT requests further dialogue with potential user of this information – SOLAS ships are all already required to carry equipment for this.

- *Snow from ice buoys*:
  DBCP believes more research is needed into sensors to accurately provide this variable. Open to dialogue on technology development.

- *ASAP*:
  will be addressed at SOT in May

4.3 Instrument best practices and standards (contribution to WIGOS pilot project, JCOMM Catalogue))

- OCG notes that in some observing networks with rapidly evolving technology ‘common practice’ is easier to identify than ‘best practice’

- Recommendation: catalogue database should include a ‘last updated by Panel’ date, in addition to publication date

- (see also 2.3)

4.4 Common capacity-building requirements and how to effectively, implement the PANGEA concept

- Recommendation: suggest to Members/Member States that a percentage of the platforms being purchased can be reserved for donation purposes; joint initiatives to be promoted with DBCP, Argo, etc.

- Recommendation: PMOs can be a useful entry point for Pangaea-concept endeavours (identifying reliable partners)

- Action: Panel Chairs or their nominated person to look at the cookbook sections that are relevant to their Panel and provide input to Bob Keeley

- Recommendation: cookbook to include basic information or links to Quality Control procedures

- Action: Section on JCOMMOPS to be added in the cookbook, provided by TCs

4.5 Common strategy to move forward including cross-coordination and synergies

- OCG directs Technical Coordinators (*with approval of Panel Chairs*) to make deployment opportunities a higher priority in their actions

- OCG to highlight difficulties with deployment opportunities and dedicated ship time for under sampled regions with governing bodies so awareness is raised at governmental level

- (see also 2.4)

5. Technical coordination

5.1 Status of JCOMMOPS

- Action: JCOMMOPS to work with wider JCOMM community (incl. ISDM and AOML for metrics), GCOS, GOOS, OSMC in getting feedback for their website.

- Recommendation: JCOMMOPS to work with wider community in distributed approach to providing some information (i.e. metrics) as links from their website

5.2 JCOMM OPA Network Status Reporting, including JCOMMOPS and the Observing System Monitoring Center (OSMC)

5.3 Report from the secretariat on process for Observing Program Support Centre (OPSC) expansion

- General message: OCG disappointed in outcome of the process, in particular in the lack of new resources identified to supporting the centre.

- OCG re-emphasized importance of scientific director(s) as part of the concept of the center, and that the link to a scientific institution was important

- Recommendation: Evaluation committee to negotiate leading offer, including asking for staff to help for the project office function and clarifying role of all partners (2 week delay for starting negotiations)

- Recommendation: Other agencies to be approached in the country of the host as potential supporters of the center

- Decision: final TOR and management arrangements of OPSC will depend on outcome of the negotiations

- Action: secretariat to organize a teleconference of the evaluation committee after the results of the negotiation

5.4 Guidance from the Observing Networks

- Recommendation: OCG chair, in consultation with Panel Chairs that contribute to JCOMMOPS, the IOC and WMO, to regularly review the priorities in the JCOMMOPS workplan from overall system perspective

6. OceanObs'09

6.1 Status of planning for OceanObs'09

6.2 Review of the Community White Papers from the OPA

6.3 Identification of the common issues to be raised in Plenary Papers

7. JCOMM-III and parent body (WMO + IOC) reporting and recommendations

7.1 What needs to be raised at the cross-programme area technical level?

- to SPA: welcome studies of the impact of observations on the products and services provided by the SPA teams as this helps argue for sustained support for the observing system

- (see also 2.4 and 4.4 for DMPA)

7.2 What needs to be raised at the intergovernmental level?

- Action: OPA coordinator to consult with the OCG to finalize the list of decisions to be brought to the WMO and IOC governing bodies (immediate)

7.3 OPA drafting operating plan

- Action: OPA coordinator in consultation with OCG by e-mail to finalize draft workplan for the next 4 years for consideration by JCOMM-III (by mid-April)

7.4 New business

- OCG welcomes inclusion of tsunameter group as action group of DBCP if tsunami community accepts, sees scope for coordination

- OCG welcomes animal oceanographer group(s) for coordination in terms of common standards/intercomparison, QC, data distribution and exchange, data management.

- OCG welcomes continued dialogue with SAON on interoperability of the observing system

8. Closing

APPENDIX C

DRAFT JCOMM CATALOGUE OF STANDARDS AND BEST PRACTICES

TITLE	CREATOR	SUBJECT	DESCRIPTION	PUBLISHER	DATE	STANDARD TYPE	FORMAT	ID	SOURCE	LANGUAGE	RELATION	COVERAGE
Reference Guide to the GTS Sub-system of the Argos Processing System	DBCP	GTS Argos	A Reference Guide to the Argos GTS Processing Sub-system was prepared and issued at that time (DBCP Technical Document No. 2) to assist Principal Investigators (PIs) running Argos programmes and wishing their data to be distributed on the GTS; PIs and manufacturers intending to design Argos platforms and messages for GTS distribution; and GTS users who receive data from the Argos centres. This guide has recently been updated to reflect various changes that have been made in the last few years and to clarify certain issues. The guide should be read in conjunction with the Guide to Data Collection and Services Using Service Argos (DBCP Technical Document No. 3), which provides details of the structure of the sub-system, and provides background on the system's various applications.	WMO and IOC	2005	GTS distribution. GTS codes, quality control	http://www.jcommops.org/doc/satcom/argos/Argos-GTS-sub-system-ref-guide.pdf	2	Data Buoy Cooperation Panel	EN	rev 1.6	world wide

Guide to Data Collection and Location Services using Service Argos	DBCP	Argos	The Argos system locates fixed and mobile platforms and collects environmental data from them. The system was developed under a co-operative programme between the French Space Agency (CNES, France), the National Aeronautics and Space Administration (NASA, USA) and the National Oceanic and Atmospheric Administration (NOAA, USA). The purpose is to provide an operational service for the entire duration of the Polar-orbiting Operational Environmental Satellites (POES) NOAA programme (TIROS-N series), that is, beyond year 2000. As many WMO and IOC Member countries developed data buoy and other observational programmes using the Argos system, information had to be widely available. The 1995 guide recognizes that a number of technical and procedural changes which have taken place since 1988.	WMO and IOC	1995	Argos: data collection, data processing, quality control	http://www.jcommops.org/dbcp/Argos-guide.pdf	3	Data Buoy Cooperation Panel	EN	Revised edition of MMROA Report No. 10 - Guide to Data Collection and Locations Services Using Service Argos	world wide
Guide to Moored Buoys and Other Ocean Data Acquisition Systems	DBCP				1997		AWAITING COPY FROM WMO	8				

DBCP Quality Control Guidelines	DBCP	GTS Buoy data	Quality control procedures, jointly developed and implemented by the DBCP, GTS Data Processing centres and the operators buoys, currently ensure that surface observations are validated in real-time before insertion on to the GTS (see DBCP Technical Document No. 2). Sub-surface (e.g., from the TAO array) data are further controlled by NOAA / NDBC. Several other bodies (ECMWF, national weather and oceanographic agencies, GDC, ISDM, etc.) contribute to an active off-line assessment of data quality. A well-defined (see Annex A) feedback mechanism ensures that any interventions arising from this off-line quality control (e.g., modifications to individual sensor transfer functions) are implemented into the real-time data processing chain in a coordinated and auditable fashion. Some history of the mechanism is given below.	TC DBCP	2004	GTS Buoys: quality control	http://www.jcommops.org/dbcp/2qgd.html	Data Buoy Cooperation Panel	EN		world wide

Guide to IGOSS (now JCOMM) Data Archives and Exchange (BATHY and TESAC)	IOC	Data manageme nt	This Guide is intended to document the procedures to be followed in archiving and exchanging BATHY/TESAC/TRACKOB/D RIFTER data' within the IGOSS & IODE systems. It describes the arrangements developed between IODE & IGOSS to share data so as to better serve the need of users. It is also intended to provide information on IGOSS data collection, data flow and data archival for scientists and engineers who wish to use the data and who are not familiar with the system. The Guide deals primarily with oceanographic data collected under IGOSS and reported in codes for oceanographic data [the WMO code forms are: FM 63-IX BATHY (report of bathythermal observation); FM 64-TX TESAC (temperature, salinity & current report from a sea station); FM 62-VI11 Ext. TRACKOB (report of marine surface observation [temperature, salinity and/or current] along a ship's track); FM 18-IX Ext. DRIFTER (report of a drifting buoy observation)]. As other types of IGOSS data may flow on the GTS (e.g., various kinds of observations coded alon	JCOMM & IODE via DMCG	1993	oceanographi c research; oceanographi c data; data exchange; guides	http://unesdoc. unesco.org/ima ges/0009/0009 55/095547eo.p df	1	Internatio nal Oceanogr aphic Data and Informatio n Exchange , Data Managem ent Coordinati on Group	EN	SECOND REVISED EDITION	world wide
Internation al Catalogue of Ocean Data	IOC	Chemical marine monitoring	This is an early catalogue of Ocean Data Stations listing geographic area, lat/lon, name of station, frequency and Institution responsible for it.	GOOS	1976	ocean stations; oceanographi c data; guides	http://unesdoc. unesco.org/ima ges/0013/0013 88/138875eb.p df	2	Global Ocean Observing System	EN	Amendeme nt, no. 1	world wide

Station												
Guide to operational Procedures for the Collection and Exchange of IGOSS (now JCOMM) Data, Third Revised Edition	IOC	Data management	This document is intended as a general guide to the operational procedures for the collection, encoding, quality control and exchange of oceanic surface and sub-surface temperature, salinity and current (BATHY, TESAC and TRACKOB) data. It is anticipated that individual nations will issue specific guidelines within the framework of this document. In all cases, it should be recalled that the overall objectives of JCOMM include the timely collection and exchange of oceanographic data and products.	JCOMM via DMCG	1999	oceanographic data; data collection; data exchange; guides	http://www.jcommops.org/soopip/mg3.html	3	Data Management Coordination Group	EN	Third Revised Edition	world wide
Guide to Oceanographic and Marine Meteorological Instruments and Observing Practices	IOC	Observation instrument practices	This guide is intended to provide information on commonly used oceanographic instruments and accepted observing practices. Since many of the observations in this category require supporting meteorological data, relevant portions of the World Meteorological Organization (WMO) guide to instruments and observing practices have been included.	JCOMM	1975	oceanographic research; meteorology; oceanographic measurement; oceanographic equipment; guides	http://unesdoc.unesco.org/images/0005/000599/059947eo.pdf	4		EN		world wide

Wave Reporting Procedures for Tide Observers in the Tsunami Warning System	IOC	Waves Tsunami observation warning	The purpose of this publication is to provide general information and specific instructions to aid tide observers in reporting tsunamis. The Tsunami Warning System in the Pacific is an international system which makes use of more than 67 seismic stations, 67 tide stations and 51 dissemination points scattered throughout the Pacific basin. These facilities are under the varying control of the many Member States of IOC, with general guidance provided by the IOC through its International Co-ordination Group for the Tsunami Warning System in the Pacific (ICG-ITSU) and the International Tsunami Information Centre. Information from the network of stations is transmitted to the Pacific Tsunami Warning Centre where it is analysed and relayed as tsunami watches and warnings to civil defence organizations, meteorological and other local governmental offices that have been designated to receive the information by the participating countries, territories, and administrative areas throughout the Pacific. Effectiveness of	1988	ocean waves; tsunami; Oceania	http://unesdoc.unesco.org/images/0005/000599/059966eo.pdf	6		EN	rev	Pacific

Manual on International Oceanographic Data Exchange. (Fifth Edition), including Guide for Responsible National Oceanographic Data Centres as Annex II	IOC	Data management	The purpose of this manual is to assemble in a convenient form. the procedures, responsibilities and facilities for the international exchange of oceanographic data under the International Oceanographic Data and Information Exchange (IODE) system and under the ICSU WDC System. ICSU oceanographic programmes may be non-governmental, but many, especially for the World Climate Research Programme, are organized and conducted in collaboration with such bodies as IOC and WMO. which then involve governmental oceanographic institutions in Member countries.	JCOMM via DMCG	1991	oceanographic data; data exchange; data centres; data processing; guides	http://unesdoc.unesco.org/images/0008/000895/089591eb.pdf	9	Data Management Coordination Group	EN	rev	world wide
Chemical Methods for Use in Marine Environment Monitoring	IOC	Chemical marine monitoring	The Manual contains descriptions of chemical methods for analysis of parameters of general interest in programmes for chemical oceanography, as well as for marine environmental monitoring. It is intended for use by marine science institutes that are or will become involved in such activities, particularly within the Regional Seas Programme of UNEP.	GOOS	1983	chemical oceanography; marine environment; oceanographic research; guides	http://unesdoc.unesco.org/images/0005/000559/055950eo.pdf	12	Global Ocean Observing System	EN		world wide
Manual for Monitoring Oil and Dissolved/ Dispersed Petroleum Hydrocarbons in Marine Waters and on Beaches.	IOC	Oil marine monitoring coastal	This document describes the procedures for field sampling and observations, laboratory analyses, data reduction and reporting for the petroleum component of the IOC Marine Pollution Monitoring System (MARPOLMOM-P).	JCOMM	1984	marine pollution; water sampling; water pollution; hydrocarbons; beaches; sea water; guides	http://unesdoc.unesco.org/images/0006/000606/060618eb.pdf	13		EN		world wide

Manual on Sea Level Measurement and Interpretation, Volumes I – IV	IOC	Sea-level tide gauge observation Tsunami	The Intergovernmental Oceanographic Commission has sponsored a series of courses at the Bidston Laboratory of the United Kingdom Institute of Oceanographic Sciences under the auspices of the Permanent Service for Mean Sea Level. This manual summarises the information presented at these courses. The emphasis is on techniques and on the practical aspects of site selection, maintenance, and critical data reduction.	JCOMM via GLOSS	2006	sea level, tide gauges, tsunami	http://unesdoc.unesco.org/images/0014/001477/147773e.pdf	14	Global Sea Level Observing System	EN	JCOMM TD No. 31, WMO TD. No. 1399	
Procedures for Sampling the Sea-Surface Microlayer	IOC	Sea-surface observation micro-algae	The IOC Manuals and Guides No 15 contributes to the Marine Pollution Monitoring Programme for Petroleum (MARPOLMON-P) and complements IOC Manuals and Guides 13 "Manual for Monitoring Oil and Dissolved/Dispersed Petroleum Hydrocarbons in Marine Waters and on Beaches." IOC Manuals and Guides No 15 describes methodology tested and shown to be appropriate for the sampling of the sea-surface micro-layer.	JCOMM cross cutting team on satellite data requirements	1985	water sampling; sea water; surface water; marine pollution; guides	http://unesdoc.unesco.org/images/0006/000659/065956eo.pdf	15		EN		

Marine Environmental Data Information Referral Catalogue. Third Edition	IOC	Marine information	The Marine Environmental Data Information Referral Catalogue contains technical descriptions of marine data holdings of participating organizations in standardized form. The purpose of MEDI is to enhance the service capabilities of marine data centres by providing users with information on the location and availability of environmental data held by organizations and institutions around the world.	IODE	1993	marine environment; oceanographic data; data exchange; guides; directories	http://unesdoc.unesco.org/images/0009/000953/095380mb.pdf	16	International Oceanographic Data and Information Exchange	EN		
GF3: A General Formatting System for Geo-referenced Data, Volumes I – VI	IOC	Geographical GIS	The General Format 3 (GF3) system was developed by the IOC Committee on International Data and Information Exchange (IODE) as a generalized formatting system for the exchange and archival of data within the international oceanographic community. It is a highly flexible, self-documenting system designed primarily for numerical data. It is not restricted to numerical data as the variety of structures available permit the inclusion of textual information in several ways.	IODE	1996	oceanographic data; data exchange; standards; guides	http://unesdoc.unesco.org/images/0007/000787/078735e.pdf	17	International Oceanographic Data and Information Exchange	EN		world wide

User Guide for the Exchange of Measured Wave Data	IOC	Waves data management	This Guide is intended to assemble in a convenient form the procedures and formats established to facilitate the international exchange of measured wave data. The information contained here is intended to be of assistance to the collector or user of the data and to the computer programmer developing software to prepare or read magnetic tapes containing the data. Part 1 below contains a discussion of the exchange scheme. An overview presented in Part 2. Part 3 provides detailed information on documentation, formats, parameter codes and the availability of software for wave data exchange. The procedures and mechanisms for international exchange of wave data, which are described here, have been developed by the Task Team on Wave Data Management and the Group of Experts on Format Development of the IOC Working Committee on International Oceanographic Data Exchange (WC-IODE). The Committee has given its approval to all of the procedures and formats contained here.	DMCG & ETWS	1987	oceanographic data; ocean waves; tsunami; data exchange; guides	http://unesdoc.unesco.org/images/0007/000785/078593eb.pdf	18	Data Management Coordination Group, Expert Team on Wind Waves and Storm Surges	EN		

Guide to Specialized Oceanographic Centres (SOC)	IOC	Specialized Oceanographic Centres (SOC)	The purpose of this Guide is to explain the role and functions of the Specialized Oceanographic Centres *(SOCs)* of the, Joint IOC-WMO Integrated Global Ocean Services System (IGOSS), to detail the two types of *SOCs* and to describe the procedure for establishing them.	JCOMM & IODE via DMCG	1988		http://unesdoc.unesco.org/images/0007/000795/079564eo.pdf	19	International Oceanographic Data and Information Exchange, Data Management Coordination Group	EN		
Guide to Drifting Buoys	IOC	Drifting buoy	The Guide to Drifting Data Buoys provides the meteorological and oceanographic communities of the world with up-to-date information regarding the hardware, operations and data telemetry, processing and dissemination of drifting buoys. The Guide assists countries which are not yet involved in the use of drifting buoys to collect ocean observations and which wonder whether this technology can meet their requirements.	JCOMM via DBCP	1988	oceanographic data; oceanographic buoys; guides	http://unesdoc.unesco.org/images/0008/000813/081353eo.pdf	20		EN		
GTSPP Real time Quality Control Manual	IOC	GTSPP water temperature profile quality control QC	This manual describes procedures that make extensive use of flags to indicate data quality. To make full use of this effort, participants of the GTSPP have agreed that data access based on quality flags will be available. These flags are always included with any data transfers that take place. GTSPP participants have agreed to retain copies of the data as originally received and to make these available to the user if requested.	GTSPP	1990	oceanographic data; information exchange; pilot projects; guides	http://unesdoc.unesco.org/images/0008/000878/087850eb.pdf	22		EN		

Guide to Satellite Remote Sensing of the Marine Environment	IOC	Satellite remote sensing observation marine	The purpose of this guide is to review the present state-of-the-art of remote sensing of the earth's surface from orbiting satellites. The uniformity of satellite coverage is one of its greatest advantages over conventional surface measurements: another is the facility of a spacecraft to build up a series of reliable, repetitive measurements to reveal changing patterns of behaviour. A satellite's view may be restricted to the sea surface but many details of the underlying deep-sea topography, coastal bathymetry, circulation patterns, ocean productivity and heat transport have been detected from space. Besides, the changes in the marine environment, which most affect human activities, tides, waves, storm surges, pollution and weather patterns, are to be observed at the surface.	JCOMM	1992	remote sensing; artificial satellites; marine environment; oceanographic measurement; guides	http://unesdoc.unesco.org/images/0009/000926/092618eo.pdf	24		EN		
Manual of Quality Control Procedures for Validation of Oceanographic Data	IOC	Quality control QC ocean data	This manual provides the reader with **a** selection of existing standards, procedures, and advice concerning data quality control, and data validation. Included are the parameters, which seemed to have adequately been developed for data QC standards based on experience. Standards are continuously being developed for a wider range of parameters, especially in the areas of marine chemistry, acoustics, biology, optics, and remote sensing.	JCOMM & IODE via DMCG	1993	oceanographic data; quality control; data analysis; guides	http://unesdoc.unesco.org/images/0013/001388/138825eo.pdf	26		EN		

Protocols for the Joint Global Ocean Flux Study (JGOFS) Core Measurements	IOC	Marine JGOFS flux	This manual describes the protocols approved by the international Scientific Steering Committee for the Joint Global Ocean Flux Study (JGOFS) for most of the 20 JGOFS Core Measurements. However, the methods for the analysis of various parameters of the seawater CO_2 systems are described in a separate handbook.	JGOFS	1994	water chemistry; chemical elements; salinity; sedimentation; oceanographic measurement	http://unesdoc.unesco.org/images/0009/000997/099739eo.pdf	29	Joint Global Ocean Flux Study	EN		
Oceanographic Survey Techniques and Living Resources Assessment Methods	IOC	Living resources survey	This manual presents oceanographic survey techniques and living resources assessment methods. It is the task of administrators and managers to seek a wise balance between the many conflicting demands being made on the coastal environment, ensuring that its limits of tolerance and its capacity for sustainability are not exceeded. In order to do this successfully they need a comprehensive management approach giving them a holistic view of the resources, the demands, and the various direct and indirect physical interrelationships. Integrated coastal area management is an approach that allows such a comprehensive and holistic view to be taken of the multiple, often conflicting, demands that are made on coastal resources. It provides decision-makers, planners and managers with a practical methodology for resolving conflicts and assigning priorities and for balancing	OCG	1996	oceanographic measurement; environmental monitoring; coastal zones; environmental management; marine resources	http://unesdoc.unesco.org/images/0010/001036/103685e.pdf	32	Observations Coordination Group	EN		

			protection and development.									

Manual on Harmful Marine Micro-algae	IOC	Marine harmful micro-algae	The Manual is composed of four parts: Methods, Taxonomy, Monitoring and Management, and Resources. The Methods section covers oceanographic field sampling techniques, algal culture methods, cell counting, instrumental toxin analysis techniques for PSP, DSP, ASP, ciguatoxins, cyanobacterial toxins, as well as biochemical methods and mammalian bioassays for selected algal toxins. Cyst methodologies and methods of nutrient analysis, both macronutrients and trace metal micronutrients, are also included. The Taxonomy section starts with a general introduction on "what is a species", followed by detailed accounts on the taxonomy of dinoflagellates, haptophytes, diatoms, raphidophytes, cyanobacteria and cysts. The Monitoring and Management section covers environmental monitoring, management of shellfish resources, finfish aquaculture as well as epidemiology and public health. Finally, in the Resources section the reader will find a listing of algal culture collections, and addresses of international and regional age	JCOMM	1995	marine algae	http://unesdoc.unesco.org/images/0012/001220/122021eo.pdf	33		EN		

Environmental Design and Analysis in Marine Environmental Sampling	IOC	Observation analysis environment sampling	This manual illustrates new ways of understanding how pollutants affect marine biological systems. The IOC-IMO-UNEP/GIPME Groups of Experts on Effects of Pollution (GEEP) has been working for a number of years on to give a clear and important account of the key elements of good sampling design. Sampling design is a key but neglected aspect of chemical and biological effects monitoring.	JCOMM via DMCG	1996	environmental monitoring; marine environment; human activities effects; statistical analysis"	http://unesdoc.unesco.org/images/0010/001036/103684e.pdf	34		EN		
Methodological Guide to Integrated Coastal Zone Management	IOC	Marine coastal services	The main aim of this guide is to assemble and systematically analyse the data used to describe integrated coastal zone management system. The information which is produced does not only consist in indications backed by sets of figures of the present situation but should also throw light on missing data and provide forecasts on future trends. In the process of drawing up a sustainable integrated coastal zone management plan, the collection, grouping and analysis of data participates in the initial phase of the identification of the problems and the subsequent planning.	SCG	1997	coastal zones; environmental management; case studies; guides	http://unesdoc.unesco.org/images/0012/001212/121249eo.pdf	36	Services Coordination Group	EN		
Potentially Harmful Marine Micro-algae of the Western Indian Ocean	IOC	Harmful micro-algae Indian ocean		MAES	2001	marine algae; typology; marine pollution; toxicology; oceanographic research; Indian Ocean; guides	http://unesdoc.unesco.org/images/0012/001266/126624m.pdf	41	Expert Team on Marine Accident Emergency Support	EN		

Algorithms for the Computation of Fundamental Properties of Seawater (UNESCO technical papers in marine sciences, 44, 1-53, 1983)	IOC	Algorithm Seawater UNESCO		IOC	1983	algorithms; sea water; data processing; standardization	http://unesdoc.unesco.org/images/0005/000598/059832eb.pdf	44		EN		
The Voluntary Observing Ships Scheme – A Framework Document	JCOMM	SOT VOS VOSP ship observation	In view of the importance of VOS observations, and at the same time of the ongoing and increasing difficulties in VOS recruitment and maintenance, the JCOMM (formerly CMM) Subgroup on the VOS recognized the value of adopting a guiding strategy or framework document for the VOS. This document would provide VOS operators with a global framework in which to develop and maintain their national VOS programmes, and at the same time help to sensitize user groups and organizations to the VOS scheme in general, its structure, operations and value.	SOT	2008		ftp://ftp.wmo.int/Documents/PublicWeb/amp/mmop/documents/JCOMM-TR/J-TR-4-VOS-Framework-Document/JCOMM-TR-4-VOS-Framework-Document-REV1.pdf	4	Ship Observations Team	EN	WMO TD No. 1009, revision 1	
Voluntary Observing Ships (VOS) Climate Subset Project (VOSCLIM) – Project Document, Revision 2	JCOMM	SOT VOSClim ship observation climate		SOT TT on VOSClim	2002		http://www.jodc.go.jp/info/ioc_doc/JCOMM_Tech/TR05_2_VOS_Rev2.pdf	5	Ship Observations Team, Voluntary Observing Ship (VOS) Climate Project	EN	WMO TD No. 1122, revision 2	

Oceanographic and Marine Meteorological Observations in the Polar Regions - A Report to JCOMM	JCOMM	Sea-ice polar observation		OCG	200		STILL IN WORK	8		EN	WMO TD No. 1032
Estimation of extreme wind wave heights / by L.J. Lopatoukhin et al.	JCOMM	Extreme wind wave	This publication provides not simple estimates of extreme wind wave heights, but informative and authoritative support in their decision-making	ET-WS	2000		STILL IN WORK	9	Expert Team on Wind Waves and Storm Surges	EN	WMO TD No. 1041
Advances in the Applications of Marine Climatology – The Dynamic part of the WMO Guide to the Applications of Marine Climatology (REV. 1, June 2005, web)	JCOMM	Marine climatology		ET-MC	2005		STILL IN WORK	13	Expert Team on Marine Climatology	EN	WMO TD No. 1081 b

SIGRID-3 : A vector archive format for sea ice charts / developed by the International Ice Charting Working Group's Ad Hoc Format Team for the WMO Global Digital Sea Ice Data Bank Project	JCOMM	Sea-ice SIGRID charts		ET-SI	2004		STILL IN WORK	23	Expert Team on Sea Ice	EN	WMO TD No. 1214 b
Ice Chart Colour Code Standard	JCOMM	Sea-ice		ET-SI	2004		STILL IN WORK	24	Expert Team on Sea Ice	EN	WMO TD No. 1215 b
Verification of operational global and regional wave forecasting systems against measurements from moored buoys / by J. -R. Bidlot and M.W. Holt.	JCOMM	Wave forecast moored buoy		ET-WS	2006		STILL IN WORK	30	Expert Team on Wind Waves and Storm Surges	EN	WMO TD No. 1333

Techniques and Benefits of Satellite Data and Wave Models, J.-M. Lefèvre, J.-R. Bidlot and S. Abdalla	JCOMM	Satellite wave model		ET-WS	2006		STILL IN WORK	33	Expert Team on Wind Waves and Storm Surges	EN	WMO TD No. 1357
Application of collected data, Presentations at the DBCP Technical Workshop, Chennai, India, 18-19 October 2004	JCOMM	DBCP buoy observations	This is a collection of Presentations at the DBCP Technical Workshop, Chennai, India, 18-19 October 2004	DBCP	2006		ftp://ftp.wmo.int/Documents/PublicWeb/amp/mmop/documents/JCOMM-TR/J-TR-35/	35	Data Buoy Cooperation Panel	EN	WMO TD No. 1387
Application of collected data, Presentations at the DBCP Technical Workshop, Buenos Aires, Argentina, 17-18 October 2005	JCOMM	DBCP buoy observations	This is a collection of Presentations at the DBCP Technical Workshop, Buenos Aires, Argentina, 17-18 October 2005	DBCP	2006		ftp://ftp.wmo.int/Documents/PublicWeb/amp/mmop/documents/JCOMM-TR/J-TR-37/	37	Data Buoy Cooperation Panel	EN	WMO TD No. 1388

Reports by Issuing Services made at the Second Session of the JCOMM Expert Team on Maritime Safety Services, Angra dos Reis, Brazil, 24-27 January 2007	JCOMM	Issuing services Maritime safety	This is a collection of Reports by Issuing Services made at the Second Session of the JCOMM Expert Team on Maritime Safety Services, Angra dos Reis, Brazil, 24-27 January 2007	ET-MSS	2007		ftp://ftp.wmo.int/Documents/PublicWeb/amp/mmop/documents/JCOMM-TR/J-TR-38-ETMSS-II_National_Reports/	38	Expert Team on Maritime Safety Services	EN	WMO TD No. 1398
Reports by Area Meteorological and Oceanographic Coordinators (AMOCs) made at the First Session of the JCOMM Expert Team on Marine Accident Emergency Support, Angra dos Reis, Brazil, 29-31 January 2007	JCOMM	AMOC	This is a collection of Reports by Area Meteorological and Oceanographic Coordinators (AMOCs) made at the First Session of the JCOMM Expert Team on Marine Accident Emergency Support, Angra dos Reis, Brazil, 29-31 January 2007	ET-MAES	2007		ftp://ftp.wmo.int/Documents/PublicWeb/amp/mmop/documents/JCOMM-TR/J-TR-39-ETMAES-II_National_Reports/	39		EN	WMO TD No. 1399

JCOMM Data Management Plan	JCOMM	Data management plan		DMCG	2008		STILL IN WORK	40		EN		WMO TD No. 1426
Proceedings of the Ice Analysts Workshop, Rostock, Germany, 12-17 June 2008	JCOMM	Sea ice analysis	These are the Proceedings of the Ice Analysts Workshop, Rostock, Germany, 12-17 June 2008	ET-SI	2008		ftp://ftp.wmo.int/Documents/PublicWeb/amp/mmop/documents/JCOMM-TR/J-TR-43-IAW-2008/	43		EN		WMO TD No. 1441
JCOMM Technical Workshop on Wave Measurements from Buoys, New York City, USA, 2-3 October 2008	JCOMM	Waves observations buoy	This is a copy of the presentations given at the JCOMM Technical Workshop on Wave Measurements from Buoys, New York City, USA, 2-3 October 2008	DBCP, ET-WS	2008		ftp://ftp.wmo.int/Documents/PublicWeb/amp/mmop/documents/JCOMM-TR/J-TR-47-WaveObs/	47		EN		WMO TD No. 1466
Procedures used at AOML to quality control real time XBT data collected in the Atlantic Ocean	SOOPIP			TC SOT	1994		STILL IN WORK			EN		AOML XBT QC procedures
SOOPIP Quality Control Cookbook for XBT data	SOOPIP			TC SOT	1994		STILL IN WORK			EN		CSIRO Marine Laboratories Report 221

SOOPIP User Guide for Thermosalinographs (TSG) Installation and Maintenance aboard Ships	SOOPIP	SOOPIP SOOP SOT TSG ship observation		TC SOT	1999		STILL IN WORK			EN		
SOOPIP XBT/XCTD Standard Test Procedures	SOOPIP	SOOPIP SOOP SOT XBT ship observation	The best way to assure a quality XBT or XCTD is to implement a standard set of procedures for testing the probes. This document proposes a three step process for insuring XBT/XCTD quality: Start with a set of specifications that must be adhered to, by either laboratory testing or documentation from the manufacturer, before proceeding onto the field evaluations. Next is a standard reliability testing procedure under normal ship of opportunity conditions, i.e. on a vessel underway. Finally and most important is a side-by-side comparison with a cable lowered high precision CTD as a field reference.	TC SOT	2000		http://www.jcommops.org/soopip/doc/manuals/soopog/XBT-XCTD-standard-test-procedures.doc			EN		
SOOPIP XBT best practices guide	SOOPIP	SOOPIP SOOP SOT XBT ship observation		TC SOT	2001		STILL IN WORK			EN		
Ships Observing Marine Climate - A Catalogue of the	SOT				1991		AWAITING COPY FROM WMO				MMROA Report No. 25	

Voluntary Observing Ships Participating in the VSOP-NA												
SOT Basic ship visit and rider rules	SOT	Ship VOS SOT observation	The guidelines pertain to any person who might have occasion to visit, install, repair or replace equipment, or ride on any Voluntary Observing Ship (VOS) participating in any program to collect scientific observations. The goal of the VOS Program has always been to minimize our shipboard impact as much as possible. These guidelines are not just for the novitiate "first timer", but also for those of us who have often visited or ridden on the same ship many times.	SOT	2003		http://www.jcommops.org/soopip/soopog-ship-visit.html			EN		
SOT Recruit presentation	SOT	Ship VOS SOT ship observation	These guidelines are not just for the novitiate "first timer", but also for those of us who have often visited or ridden on the same ship many times.	SOT	2008		http://www.bom.gov.au/jcomm/vos/download/sot-recruit-pps.zip		Ship Observations Team	EN		
Guide to Meteorological Instruments and Methods of Observation	WMO	CIMO instrument method observation best practice	SOT VOS recruit presentation	CIMO	2006			8	Commission for Instruments and Methods of Observation	EN		

Information for shipping	WMO	Ship shipping	This publication contains information on (i) Meteorological Broadcast Schedules for shipping and other Marine Activities (Meteorological Broadcasts by Radiotelegraphy and Radiotelephony, Meteorological Broadcasts by Radio-Facsimile, Global Maritime Distress and Safety System (GMDSS)), (ii) Coastal Radio Stations Accepting Ships' Weather Reports and Oceanographic Reports (List of Coastal Radio Stations, List of INMARSAT Coast Earth Stations (CESs)), (iii) Specialized Meteorological Services (Marine Meteorological Services Available for Main Ports, Ship Weather Routeing Services), and (iv) Visual Storm Warning Signals. Full information is given on the issue of meteorological forecasts and warnings to shipping and on the collection of ships' weather reports	SCG	2006		http://www.wmo.int/pages/prog/www/ois/Operational_Information/VolD_en.html	9	Services Coordination Group	EN	Volume D	
International list of selected, supplementary and auxiliary ships	WMO	Ship metadata	This edition contains information and instrumental metadata about the ships participating in the WMO Voluntary Observing Ships Scheme. This information has been supplied by the countries which have recruited ships within the framework of this programme, in accordance with regulation 2.3.3.3 and 2.3.3.4 as contained in WMO Publication No. 544 - Manual on the Global Observing System, Volume I, Part III	SOT	2005		STILL IN WORK	47		EN		
Technical Regulations	WMO				2006		AWAITING COPY FROM WMO	49				

WMO sea-ice nomenclature	WMO	Sea-ice nomenclature	Describes WMO Sea-ice terminology, and the international system of sea-ice symbols. It also provides for an illustrated glossary.	ET-SI	2006		STILL IN WORK	259		EN		
Manual on Codes	WMO	GTS codes format	Volume I of the Manual on Codes contains WMO international codes for meteorological data and other geophysical data relating to meteorology; it constitutes Annex II of the WMO Technical Regulations and has therefore the status of a Technical Regulation. It is issued in two volumes with separate covers: Volume I.1, containing PART A, and Volume I.2, containing PART B and PART C.	CBS JCOMM	2006		http://www.wmo.int/pages/prog/www/WMOCodes/ManualCodes.html	306	Commission for Basic Systems	EN		
Manual on the Global Telecommunication System	WMO	GTS		JCOMM via CBS	2007		STILL IN WORK	386	Commission for Basic Systems	EN		
Guide to marine meteorological services, 3rd edition	WMO				2006		AWAITING COPY FROM WMO	471				

Guide on the Global Observing System	WMO	Observing System GOS	As laid down in the Convention, one of the principal purposes of the World Meteorological Organization (WMO) is to facilitate worldwide cooperation in the establishment of networks of stations for the making of meteorological observations or other geophysical observations related to meteorology, and to promote the establishment and maintenance of meteorological centres charged with the provision of meteorological services. Another aim of the Organization is to promote standardization of meteorological observations and to ensure the uniform publication of observations and statistics. With a view to ensuring the required standardization of practices and procedures in meteorology, the World Meteorological Congress adopts Technical Regulations laying down the meteorological practices and procedures to be followed by the Member countries of the Organization. The Technical Regulations include manuals relating to various aspects of the Organization's activities and are supplemented by a number of guides	JCOMM via CBS	2007		ftp://ftp.wmo.int/Documents/MediaPublic/Publications/WMO488_GOSguide/488_Guide_2007.pdf	488	Commission for Basic Systems	EN	3rd edition	

Manual on the Global Observing System	WMO	Observing System GOS	The Manual is designed: (a) To facilitate cooperation in observations between Members; (b) To specify obligations of Members in the implementation of the World Weather Watch (WWW) Global Observing System (GOS); (c) To ensure adequate uniformity and standardization in the practices and procedures employed in achieving (a) and (b) above. The Manual is composed of Volumes I and II, which contain the regulatory material for the global and regional aspects, respectively. The regulatory material stems from recommendations of the Commission for Basic Systems (CBS) and resolutions of regional associations, as well as from decisions taken by Congress (Cg) and the Executive Council (EC). Volume I of the Manual – Global Aspects – forms part of the WMO Technical Regulations and is referred to as Annex V to the WMO Technical Regulations. Volume II of the Manual –Regional Aspects – does not form part of the WMO Technical Regulations. The Manual specifies what is to be observed where and when in order to meet the relevant	JCOMM via CBS	2005		http://www.wmo.int/pages/prog/www/OSY/Manuals_GOS.html	544	Commission for Basic Systems	EN			

Manual on marine meteorological services (Volume I-Global aspects, Volume II-Regional aspects)	WMO				2006		AWAITING COPY FROM WMO	558				
Guide to wave analysis and forecasting, second edition	WMO	Wave analysis forecasting	This Guide provides guidelines on wave forecast methodology suitable for use by NMHSs in the provision of ocean wave forecast and hindcast services in support of the requirements of users in the whole range of maritime activities (shipping, fisheries, offshore mining, commerce, coastal engineering, construction, recreation, etc.).	JCOMM via ET-WS	1998		STILL IN WORK	702		EN		
Guide to the applications of marine climatology	WMO	Marine climatology IMMT IMMA MQCS MCSS GCC	This Guide provides a set of procedures for the collection, exchange, quality control, archival and processing of marine climatological data.(dynamic part of the guide available in electronic form via the Volume 25, Issue 7 of the International Journal of Climatology, Special Issue: Advances in Marine Climatology)	JCOMM via ET-MC	1994		STILL IN WORK	781	Expert Team on Marine Climatology	EN		
Reference Guide to the GTS Sub-system of the Argos Processing System	WMO	GTS Argos		TC DBCP	2005		STILL IN WORK	TD 2	Data Buoy Cooperation Panel	EN		
Guide to Data Collection and	WMO	Argos		TC DBCP	1995		STILL IN WORK	TD 3	Data Buoy Cooperation Panel	EN		

Location Services using Service Argos												
WOCE Sea Surface Salinity user's manual	WOCE			GOSUD	2006		STILL IN WORK		Global Ocean Surface Underway Data Project	EN	cordo-die-02-047	

APPENDIX D

An Oceanographer's and Marine Meteorologist's Cookbook for Submitting Data in Real Time and In Delayed Mode

The Bob's
On Behalf of the JCOMM and the OOPC

Draft 3.0
21 September, 2007

Executive Summary

A practical guide to facilitate submission of oceanographic and marine meteorological data in real time and in delayed mode is presented. The intent is that this will be a living document, updated and corrected based on user input in order to stay current and relevant.

Table of Contents

1. Introduction

A number of national, regional and international programmes are collecting oceanographic and marine meteorological data either in project-funded activities or in a monitoring mode. Some of these data are contributed to the international data systems and so become readily available either in real-time or delayed mode to other researchers. However, another fraction of these observations are accumulated in home institutions and are delayed or sometimes never reach the international community.

Those data that can be sent shortly after collection can contribute to real-time data exchange and thereby support the development of operational meteorological and oceanographic services. Those that arrive in delayed mode improve the base archives used to develop climatologies, extend time series, and contribute to studies of climate change, among other activities. Because of the paucity of marine data, all observations are valuable.

The intent of this document is to provide a practical resource to those who collect oceanographic and marine meteorological data to facilitate contribution of the data to the international community. The focus is on in-situ, directly observed measurements, rather than on remote sensing data (e.g. from satellites). The approach taken here is to provide several brief, informative primers on the data types covered in this document, example activities that use the data, and then on the pathways and protocols for submitting data, both in real time and in delayed mode. These primers are followed by “cookbooks” that provide the detailed procedures to provide data.

This document will be maintained electronically with additions made as required. The intent is to have frequent refreshes and additions to the recipes as users provide feedback and additional inputs. Please send input via email to (JCOMM-Ops point of contact or other?). This document will be kept up to date and available on the JCOMM-Ops web page (http: insert write URL).

2. Overview of Data Types Covered in the Document

The cookbook is organized according to types of data (broadly meteorological or oceanographic) and the delivery time frame (real-time or delayed mode). Each is then subdivided into recipes that address specific platform types and/ or instruments. The intention is that someone being encouraged to submit data can simply consult the appropriate recipe for the very practical details of what needs to be done and how.

All of the platforms referenced can operate to deliver data in real-time (usually within minutes to days of the observation being made). In some cases, such as profiling floats, that is the sole mode of operation. Real-time data transmissions use coastal radios, Inmarsat, Service Argos or Iridium satellite communication systems to provide all or a subset of data.

Real-time data have limitations that need to be recognized. Because of telecommunications, bandwidth or transmission costs, the high precision measurements of which the instruments are capable may not be sent ashore for distribution. Instruments may sample at a very high frequency but report some averaged quantity in real-time. Observations sent ashore in real-time may have errors due to instrument malfunction and drift or telecommunications problems. In making the data available quickly, it is usual to have automated data quality checking software looking for errors. These are not capable of finding the more subtle errors and so it is common for a higher error rate to be found in real-time data streams.

In some modes of data collection, usually in research projects, instruments collect data at a higher sampling frequency than is reported in real-time, or at a higher precision. In these cases, the data are often stored on-board and returned to the operational centre. The data then pass through delayed mode processing to carry out calibrations, check for possible errors and form the subject of research. These delayed mode data are of the highest quality, highest resolution data available. However, the delays in data reaching archives and becoming available to a wide user community can be months or years.

2.1 Marine Meteorological Data Sets

Marine meteorological observations come from a variety of platforms. The following sections discuss characteristics of the major types. Higher sampling rate data may be stored on board and available for submission later in delayed mode. This is true for research buoys, for example, that record surface meteorology as one-minute averages but do further averaging to produce one-hour averages for telemetry.

2.1.1 Ships

Merchant ships that serve as Voluntary Observing Ships (VOS), naval and Coast Guard vessels, research ships, fishing vessels, and vessels of other national agencies collect observations that include wind speed and direction, air temperature, sea temperature, a humidity variable (dew point, wet bulb, relative humidity or absolute humidity), barometric pressure, incoming shortwave or solar radiation, incoming longwave or infrared radiation, cloud cover (type, amount, at different elevations), surface wave and swell, and sea ice.

Some of these, notably a number of research vessels carry automated meteorological stations that sample at high frequency and high precision. Refer to various types – Taylor et al VOS-NA, ASIMET type, Autoimet, etc

2.1.2 Moored buoys

National weather agencies and diverse research programs maintain for different periods of time-moored buoys to collect marine meteorological data. Examples include the equatorial moorings in both Pacific and Atlantic Oceans as well as moorings in place in the Indian Ocean. Some nations also maintain networks of coastal buoys that gather data at high frequency. All of these data reach the national weather agencies. Ocean research programs also deploy moored platforms and in most cases these, too, record meteorological information. It is not the case that all of these data get to national agencies.

The observation regime is one in which instruments are operated automatically and often for extended periods of time. Data are typically transferred ashore through telecommunications systems, often satellite systems.

2.1.3 Drifting buoys

Surface drifters have been in large-scale use since the early 1980s. Typically, they report a suite of atmospheric variables including air temperature, air pressure, pressure tendency, and some are now being deployed with wind sensors.

The JCOMM Drifting Buoy Cooperation Panel oversees the deployment and operation of the data collection in the open ocean. This group is an affiliation of operators that negotiates telecommunications costs, promotes standards for data formats, works to improve instrumentation, and coordinates deployments to achieve global coverage and a number of other functions. However, there are also other drifter deployments, usually for short time scale operations such as for search and rescue or targeted research. While the pathways for global distribution of data collections overseen by DBCP are well established and functioning, in many cases there are no pathways for the short time scale operations.

2.2 Oceanographic Data Sets

Oceanographic observations are made from ships, from moored buoys, from drifting surface buoys, from profiling floats (including ocean gliders).

Higher sampling rate data may be stored on board and available for submission later in delayed mode. This is true for research ships, for example, that record sea temperature profiles at 1m or better resolution, but report data in real-time only at inflection points in the profile.

2.2.1 Ships

Merchant ships that serve as Ship Of Opportunity Programme (SOOP), naval and Coast Guard vessels, research ships, fishing vessels, and vessels of other national agencies collect observations that include sea temperature, salinity, currents (speed and direction), dissolved oxygen, other chemical variables such as nutrients, information about pollutants such as oil, biological information such as types and abundance of fish or plankton, sea bottom types, etc. Though the range of variables collected by ships is large, the number of ships doing so is smaller than for meteorological variables. Research vessels play an important role in these observations since a large fraction of the data collected are from research cruises.

2.2.2 Moored Buoys

National weather agencies or diverse research programs may operate moored platforms collecting oceanographic information. The buoys operated by national agencies often are maintained for extended periods of time while those for research purposes may function for the life of the project only. The open ocean moorings in the equatorial oceans often use subsurface instruments to report ocean temperature and sometimes salinity profiles. Coastal buoys may collect other information including currents, light levels at different depths, particle counters, etc. Many of these gather data at high frequency but report average quantities in real-time.

The observation regime is one in which instruments are operated automatically and often for extended periods of time. Data are typically transferred ashore through telecommunications systems, often the satellite systems.

2.2.3 Drifting Buoys

Surface drifters report a suite of oceanographic variables as well as atmospheric ones including sea surface temperature and salinity. Some are deployed with subsurface instrumentation as well that measures usually temperature and sometimes salinity.

The JCOMM Drifting Buoy Cooperation Panel oversees the deployment and operation of the data collection in the open ocean. This group is an affiliation of operators that negotiates telecommunications costs, promotes standards for data formats, works to improve instrumentation, and coordinates deployments to achieve global coverage and a number of other functions. However, there are also other drifter deployments, usually for short time scale operations such as for search and rescue or targeted research. While the pathways for global distribution of data collections overseen by DBCP are well established and functioning, in many cases there are no pathways for the short time scale operations.

2.2.4 Profiling Floats (and gliders)

The recent developments of mass produced, standard models of autonomous profilers has opened a new chapter in ocean observations. The profiling instruments are able to descend up to about 2000m and ascend to the surface on a predetermined schedule sampling temperature salinity, and occasionally water properties. Some are outfitted with wings (gliders) that allow them to direct their movements during ascent and descent to a degree. These instruments can operate unaided for years. Newer models are being tested that permit two-way communications so that on-board programming can be altered to change the characteristics of the sampling.

3. Overview of Activities Seeking Real Time Data Inputs

There are two reasons to encourage real-time data inputs. The first is simply as a way to make data available as quickly as possible after collection to users who require them, as discussed below. The second is that data reported in real-time act as a notification of a data collection activity from which delayed mode data may be expected. It is a way for the international data system to be aware on a large scale about data collection activities taking place, without necessarily direct involvement in each programme.

The clients for real-time data include the operational meteorological and oceanographic communities. These groups, epitomized by national weather centres, use in-situ observations as an input to computer models. Models are used to fill in gaps in the observations to show both the current and predicted state of the ocean and atmosphere. The predictions can be from short time scales of hours to days, to seasonal or longer. More and more meteorological models are being connected to oceanographic models and in-situ data keep the models aligned with reality.

Real-time data are used directly in hazard warning or mitigation situations. For example, real-time sea level observations are used to gauge the level of possible flooding, or simple to ensure the safety of shipping in confined waters.

4. Overview of Activities Seeking Delayed Mode Data Inputs

Delayed mode data are used in many different circumstances. Because of their high quality and high resolution, they form the backbone of research. They contribute to analyses of trends over time and to the formulation of climatologies. Climatologies have many uses including the assessment of how typical are recent observations and so their reliability, and to assist in preparing data for ingestion by models.

Delayed mode data are also of importance in calibrating real-time observations. In the Argo program, for example, high quality, delayed mode temperature and salinity observations from CTDs are used to assess the real-time data collected by profiling floats and to make adjustments for instrument drift. These are crucial for finding the more subtle errors

Modellers often will carry out re-analyses of historical data to build reference data sets. These make use of the high quality delayed mode data that have replaced real-time observations. These can be particularly valuable in assessing extreme events and developing better performing models.

5. Primer of Data Formats

5.1 Real-time Data

Virtually every instrument making observations produces data with a unique structure. In order for these to be usable, the data must be converted to formats that are more general. Unfortunately, there is no single standard for data delivery. However, the most well controlled deliveries are those associated with real-time data.

Most oceanographic and meteorological data delivered in real-time are reported through the Global Telecommunications System (GTS) operated by the World Meteorological Organization (WMO). There are two types of data structures for reporting data.

The older form is called Traditional Alphanumeric Codes (TACs). These are character-based forms, whose structures are rigidly set and maintained by WMO committees. They have been in operation for decades. A comprehensive list of these is provided by WMO (see Manual on Codes at http://www.wmo.int/pages/prog/www/WMOCodes.html#Operational).

Although TACs are relatively easy to learn, they are inflexible to changing requirements, and place a heavy maintenance burden on encode and decode software.

TACs are being phased out by WMO in favour of Table Driven Codes (TDCs). The earliest version, called Binary Universal Form for the Representation of meteorological data (BUFR), is based on a number of tables listing variables and setting the number of bits used to send the information. A character form was developed later and is called CREX. (See the same URL as above but reference BUFR).

The advantage of BUFR is that a simple addition to a BUFR table allows new variables to be reported. This is a much simpler and flexible process than available for TACs.

It is becoming popular to report data in real-time through the Internet by placing updates on web sites. Other technologies also exist that allow data to be sent through a subscription like service, or for users to regularly pull data from a site where data are made available. Data made available this way are often available only to restricted audiences. In a re-development of its data transmission systems the WMO Information System (WIS) will support GTS-like operations for time critical data and support request-reply operations for data that have less time critical characteristics. Since this is only developing at this stage, no more will be mentioned of WIS in this cookbook.

5.2 Delayed Mode Data

Delayed mode data appear in data structures that are nearly as varied as those that are delivered from instruments. Depending on operations of archive centres, they may be flexible in accepting data in many data structures or more rigid, and require data to arrive in only a few. There has been little success in standardizing these operations.

In terms of distributing delayed mode data, recent years have shown some convergence. Within the meteorological community, GRIB is used to exchange gridded fields. In oceanography, netCDF is beginning to be popular for gridded fields and has been used in the past to send point observations as well, though it was not well suited to this purpose.

For marine meteorology, the data system built to handle data from Voluntary Observing Ships (VOS) uses the International Marine Meteorological (IMM) format for distributing data.

6. Real-time Oceanographic and Marine Meteorological Data Submission Pathways and Protocols

6.1 General Information

6.1.1 What is the GTS?

The Global Telecommunications System (GTS) is the communications network operated by national meteorological services of countries. The rules and regulations of its operation are governed by the World Meteorological Organization (WMO) located in Geneva. It is the network by which most of the meteorological data that are collected by nations are exchanged between countries around the world. It is the chief source of data that are used in the national weather prediction models operated by country's meteorological services.

6.1 2 How does the GTS work?

Data are bundled singly or multiplied into bulletins. These have a prescribed structure that must be met. For data transmitted in character codes, the structure of the bulletin conveys some information about what kind of data are contained inside, and from what region of the world the data originate. Data sent in binary form travel on the GTS under different bulletins that convey different information from the bulletins carrying character codes. For oceanographers, it is simpler to talk to the local meteorological contact to get advice.

6.1 3 What observations should or can go to the GTS?

There is a large suite of meteorological variables that can be sent on the GTS even in the older character code forms. Table driven code forms allow for even more variables and additional information about the sampling used.

Oceanographic data may be sent in a more limited set of older character code forms and a very limited number of variables are handled. The table driven code forms permit more variables to be sent.

The URL given in section 5.1 provides comprehensive lists of variables allowed on the GTS.

6.1.4 How do data get onto the GTS?

Only national meteorological services have direct access to the GTS. That means to get data onto the GTS, an arrangement has to be made with your country's meteorological service to allow you to provide data that they insert onto the GTS on your behalf. Arrangements are different in each country, but the data are always inserted onto the GTS only by the national meteorological service.

6.1.5 How fast do observations need to get to the GTS?

Meteorological observations are usually inserted onto the GTS as soon as possible after measurement. Since they are used by many countries in numerical weather forecasting, the most recent data are extremely important for input to the models.

For oceanographic purposes, there is an agreement that observations up to 30 days old can go onto the GTS. This delay period represents a common understanding of the time utility of observations contributing to real-time operations. In recent years, there has been both an emphasis on getting data distributed more quickly and success in doing this. The ideal is to provide the data as soon as they are available.

6.1.6 Who do I contact?

If you are intending to transform observational data into either TACs or TDCs, you will need to make contact with your country's national meteorological service to find out how to physically move the data to them, to determine what help they can provide in transforming your data into GTS compliant forms, to verify that your messages were built correctly, to get their advice on what bulletins should contain the data, and perhaps other considerations as well.

6.1.7 What about data quality?

Some groups will insert data onto the GTS with no checking of data quality having been carried out. Others undertake some quality checking. In most cases, the quality checking is done quickly, and often using automated procedures. For this reason, the quality of data on the GTS cannot be considered as good as would be true if more time were available.

Because of the time constraint, it is seldom possible to carry out instrument calibrations, corrections to times for clock errors, and only simple position checks.

In most of the TACs, there is no way to indicate the quality of the data being distributed on the GTS. Usually, if quality control is carried out, observations that fail the tests are removed from the data stream going to the GTS.

If TDCs forms are used, it is possible to send both the observations and quality indicators. Data providers may choose to remove measurements that fail tests or simply set a quality flag indicating their poor quality, but send the complete set of measurements made.

Users of real-time data realize that they are trading high accuracy for timeliness.

6.2 Moving data to the GTS

6.2.1 Getting data ashore.

The data should come from the offshore platform as quickly as possible. In some cases, the data come ashore through a telecommunications system such as Services Argos, Iridium, Inmarsat, or even email. Numerical weather prediction centres often ignore meteorological data that are not distributed on the GTS within a few hours of observations...

For oceanographic data, it may be more convenient or acceptable for a cruise of short enough duration to bring all of the data ashore at the end of the cruise. While it is preferred to have the data distributed to the GTS in the shortest possible time after measurement, as long as the time between oceanographic observations and placing on the GTS is less than 30 days, the data are valuable in real-time.

It is often the case that some reduction in resolution either the precision of the measurement, or the spatial or temporal resolution is done. Often this is to reduce the quantity of data that are sent through communications systems to reduce transmission costs to a land station. However, the GTS is capable of handling relatively high-resolution data, if they can be sent ashore. For example, sending XBT data at 1 m intervals from the surface to 800 m poses no difficulty for the GTS transmission.

All code forms (TACs or TDCs) for ocean profiles have the ability to indicate if the depths reported for the observations are "selected" or "significant". A profile with selected depths is one where the depths at which observations are reported are selected independently of the shape of the profile. A profile with significant depths has used some algorithm, such as the "broken pipe" method, to reduce the number of depths required while still reproducing the features of a profile to some pre-selected accuracy.

6.2.2 What to do after the data are ashore?

For some kinds of data, such as from surface drifters that report using Service Argos, buoy operators need only give permission to Service Argos to distribute their data on the GTS. Then, with the necessary information to decode the communication from the buoy itself, Service Argos takes care of the rest. This may also be true for data sent through the Iridium system.

For other kinds of data, what you need to do depends on what facilities exist in your country. In some, the national ocean data centre will accept the data and do all of the necessary work to convert the data to the format required by the GTS. Normally they will also send the data to the national meteorological service for insertion onto the GTS. It is best to contact the data centre ahead of time to discuss formats for the data coming to the centre, and mechanisms to pass the data from the place where the data come ashore.

In Canada, for example, the national oceanographic data centre accepts data arriving in an agreed email format, data already formatted to comply with GTS rules, or data sent in other formats. They convert the data to an internal data structure, pass them through a quality check, reformat to the appropriate TAC, send the data to the GTS and then monitor that the data were distributed on the GTS. In Australia, there is a similar process, but it is a shared oceanographic and meteorological service that performs the same function. Other countries have different capabilities.

6.2.3 Who do I talk to for help?

If you do not know who to talk to in your own country, there are a couple of choices. If you have a national oceanographic data centre, contact them to find out what services they can offer (see URLs provided in section 7). Alternatively, you can contact the JCOMMOPS Technical Coordinator (see Contacts at http://wo.jcommops.org/cgi-bin/WebObjects/JCOMMOPS). Although they may not know precisely whom you should talk to, they will know the coordinator in your country, and that person should be a useful place to start.

6.3 Getting data from the GTS

If you are part of your national meteorological service, you should already know what branch of your service manages GTS data.

If you are outside of a national meteorological service, you should contact your national meteorological service to ask if they can provide the data to you. You will need to discuss the format of the data extracted from the GTS and coming to you. You may need to write software to read the various data formats (see the descriptions above).

If you are interested in oceanographic data, another possibility is to talk to the national ocean data centre in Canada (http://www.meds-sdmm.dfo-mpo.gc.ca/meds/Contact_US/Request_e.asp). They already acquire all of the ocean profile data reported in TACs (BATHY and TESAC) as well as all surface drifter data (BUOY), and along track observations (TRACKOB) from everywhere in the world. These data are decoded, and combined into a consistent format, with quality control procedures applied and quality flags attached. For the profile data, files are produced 3 times a week and can be automatically forwarded to a user through an ftp process.

Some wave data (WAVEOB) are reported on the GTS. If wave data are required, it is likely simpler to go to national wave data web sites rather than attempt to get the data from the GTS.

7. Delayed-mode Oceanographic and Marine Meteorological Data Submission Pathways and Protocols

The international exchange of delayed mode ocean data is coordinated through the International Oceanographic Data and Information Exchange (IODE, http://www.iode.org/) of the Intergovernmental Oceanographic Commission (IOC). The IODE system forms a worldwide network consisting of DNAs (Designated National Agencies), NODCs (National Oceanographic Data Centres), SODCs (Specialized Oceanographic Data Centres) and WDCs (World Data Centres – Oceanography). Currently there are over 60 oceanographic data centres in as many countries (see http://www.iode.org/index.php?option=com_content&task=view&id=61&Itemid=103).

NODCs provide national points of contact for researchers to both provide data to and access data from international sources. Each NODC operates under national arrangements for the kind of data they handle and how their operations are structured. Points of contact for each can be found at http://www.iode.org/index.php?option=com_content&task=view&id=9&Itemid=38. Researchers wishing to contribute data should contact their national data centre first.

If a country does not have an NODC, contact can be made to the IODE Project Office established in Ostend, Belgium (http://www.iode.org/index.php?option=com_content&task=view&id=46&Itemid=84). The office manager can assist in arranging for transfer of the data to an appropriate archive centre.

8. Cookbook 1: Recipes for Submitting Marine Meteorological Data in Real Time

Recipe 1: VOS

Via Service Argos/GTS
Via Iridium ?

Recipe 2: Research Ship
Recipe 3: Naval Vessel
Recipe 4: A Buoy with Service Argos Telemetry
Recipe 5: A Buoy with Iridum Telemetry

9. Cookbook 2: Recipes for Submitting Marine Meteorological Data in Delayed-Mode

Recipe 1: Moored Buoy
Recipe 2: Drifting Buoy
Recipe 3: VOS
Recipe 4: Research Ship
Recipe 5: Naval Vessel

10. Cookbook 3: Recipes for Submitting Oceanographic Data in Real-time

Recipe 1: Lowered Instrument (CTD, Bottle, XBT, etc.) Data

General Information: Measurements such as those made with in-situ instruments deployed from ships may require a multi-step process to get the data distributed in real-time. The JCOMM Ship Observation Team (see http://www.jcommops.org/sot/) coordinates activities for ships participating in the Ship Of Opportunity Programme (SOOP – see http://www.jcommops.org/soopip/). There is much useful information at the SOOP web site even though the SOOP does not cover all platforms collecting data of this type.

Step 1:

In order to report data on the GTS, the ship must use an identifier called a call sign. This is assigned to a ship by each country with due notification provided to the ITU (International Telecommunication Union - http://www.itu.int). Each country has a member and this information is available from the ITU web site. They can help if you need to set the ship's identification.

Step 2:

The data gathered on board the platform needs to be sent ashore. The ship can use the facilities promoted by the SOOP. To do so, refer to the section on "Telecommunications" at the SOOP web site.

Alternatively, countries may choose to get data ashore through other methods. For example, in Canada, data collected from research vessels operated by the Canadian Government will sometimes send the data ashore through email. Alternatively, for cruises of short duration (shorter than the 30 day cut off for ocean data on the GTS), the cruise operator will bring the data back to port before any preparation for dissemination occurs.

Step 3:

After the data come ashore, they must be converted to the appropriate character code form (usually BATHY or TESAC) or into BUFR. If you use the facilities described at the SOOP web site, and the data go to a national meteorological centre, there should be nothing more to do. Consult with the SOOP Coordinator (on the SOOP web pages under "Participants and Contacts").

Step 4:

If you choose not to use the facilities of SOOP, then you will need to arrange to convert the data into appropriate data formats for the GTS. These were generally described in section 5.

If you are going to transform the data into TACs (character code forms) then you will need to look at the BATHY and TESAC code forms. Use the link given above to WMO and click on Manual on Codes, then Part A. Alphanumeric Codes. Alternatively, you can go to the web site maintained by Canada's Integrated Science Data Management group (Canada's ocean data archive) (see http://www.meds-sdmm.dfo-mpo.gc.ca/meds/Prog_Int/J-COMM/J-COMM_e.htm and click on the code form of interest). This latter site is not the official version, so if there should be any differences between information found at WMO and that found at ISDM, the authoritative source is WMO.

If you are going to use BUFR, the same link given in section 5 takes you to the various pages describing BUFR. This is a significantly complicated code form and you are advised to consult with your national meteorological centre for advice. An initial point of contact could be to use your country's SOT co-ordinator or the JCOMM contacts (see http://www.jcommops.org/contacts.html).

Example:

Over time Canada's ocean data centre, ISDM, has assumed responsibility for coordinating the submission of ocean profile data from its research vessels to the GTS. The data are sent to ISDM, usually by email, and they carry out preliminary quality checking, format conversion and posting to the GTS through uploading of files to the meteorological agency in Canada who then place the data on the GTS. You can contact them through the "Services" link at http://www.meds-sdmm.dfo-mpo.gc.ca/meds/Home_e.htm for more details.

Recipe 2: Profiling Float Data via Service Argos or National Systems

General information: The Argo programme is well coordinated internationally with the Argo Data Management Team managing all the aspects of handling the data. For information about the programme itself, see http://www.argo.ucsd.edu/index.html. For information about the data management component, see http://www.coriolis.eu.org//cdc/argo_rfc.htm. You should also read the Argo Data Management Handbook available at http://www.coriolis.eu.org/cdc/argo/argo_data_management_handbook.pdf.

Step 1:

Before your profiling floats can report data in real-time they need to be assigned a unique WMO identifier. Each country has been assigned a block of numbers and the country coordinator can provide identifiers for you. To see who your country's national coordinator for Argo is, see http://wo.jcommops.org/cgi-bin/WebObjects/Argo and choose "Contacts" then "Argo National Focal Points". If your country has never deployed Argo floats before, contact the Argo Technical Coordinator at the same link. Note that these identifiers are never reused; when a float dies, its identifier dies with it.

Step 2:

Service Argos provides two services for profiling float operators. For the first service, they provide telecommunications facilities to relay data from the float to shore. In order to do this, your float must be equipped with an Argos transmitter and you must have an account at Service Argos. Consult Service Argos personnel at http://www.cls.fr/html/argos/welcome_en.html or speak to the Argo Technical coordinator through the Argo Information Centre (AIC) web site given in Step 1.

Step 3:

The second service offered by Service Argos is to decode the messages coming from your float, apply the standard Argo quality control tests, reformat to TESAC code form and insert the data onto the GTS. For details of how to initiate this, again speak to a representative from Service Argos or the Argo Technical Coordinator. If this is your choice, once you have arranged with Service Argos, you have nothing more to do to get the data distributed.

Step 4:

In addition to sending data to the GTS, Service Argos also will transform the data into the standard exchange format for Argo and forward the data to the Global Data Assembly Centers. These centres, one in France and one in the U.S.A., provide mirror sites where users can find Argo data. For more information about these centres, see the link in Step 1 describing the data management system.

Step 5:

Some countries choose to do their own processing of data received from the floats and take care of getting the data to the GTS. Your country may be one of these and so it is worthwhile talking to your Argo national coordinator (see Step 1). If your country does its own processing, the Argo National Focal Point will put you in touch with the processing facility.

Recipe 3: Profiling Float Data via Iridium

Recipe 4: Moored Buoy Data via Service Argos

General Information: The Data Buoy Cooperation Panel (DBCP: http://www.jcommops.org/dbcp/) oversees the operations of drifting buoys. Anyone contemplating deploying drifting buoys should contact the chair of the Panel or the DBCP Technical Coordinator available through the web address given above.

Step 1:

Before you can distribute data in real-time on the GTS, you must have a World Meteorological Organization (WMO) identifier given to your buoy. More explanation of what is a WMO identifier and how to get one is provided at http://www.jcommops.org/wmo_numbers.html. If this is unavailable, you can contact the DBCP Coordinator at the link provided above.

Step 2:

When Service Argos manages the insertion of the data onto the GTS, a buoy operator needs to provide sufficient information to tell them how to extract the data from the message sent by the PTT. Service Argos then configures their decoder to be able to read the data transmission from the buoy to extract the observations made, reformat the data to appear on the GTS in both BUOY code (a character code form) and BUFR (the binary code form).

Recipe 5: Moored Buoy Data via Iridum

Recipe 6: Drifting Buoy Data via Service Argos

General Information: The Data Buoy Cooperation Panel (DBCP: http://www.jcommops.org/dbcp/) oversees the operations of drifting buoys. Anyone contemplating deploying drifting buoys should contact the chair of the Panel or the DBCP Technical Coordinator available through the web address given above.

Step 1:

Before you can distribute data in real-time on the GTS, you must have a World Meteorological Organization (WMO) identifier given to your buoy. More explanation of what is a WMO identifier and how to get one is provided at http://www.jcommops.org/wmo_numbers.html. If this is unavailable, you can contact the DBCP Coordinator at the link provided above.

Step 2:

When Service Argos manages the insertion of the data onto the GTS, a buoy operator needs to provide sufficient information to tell them how to extract the data from the message sent by the PTT. Service Argos then configures their decoder to be able to read the data transmission from the buoy to extract the observations made, reformat the data to appear on the GTS in both BUOY code (a character code form) and BUFR (the binary code form).

Recipe 7: Drifting Buoy Data via Iridum

Recipe 8: Data via National Services

Some countries prefer to manage sending data in real-time through their own national services rather than commercial services such as Service Argos or Iridium. Examples of this can be found in the Argo programme (managing profiling float data) where some countries have built their own processing capabilities to receive data through the telecommunications facility that manages to retrieve data from the float to shore (either Service Argos, Iridium, or whatever other means they have). In these cases, national services are responsible for all of the processing including creating the TESAC (soon to be BUFR) message type.

Contact your national weather service or national ocean data centre to see what capabilities they have.

11. Cookbook 4: Recipes for Submitting Oceanographic Data in Delayed Mode.

Recipe 1: Lowered Instrument (CTD, Bottle, XBT, etc.) Data

General information: Section 7 provides information about the international system for managing ocean data. The links provided there would allow you to determine if your country has a point of contact, and where they are situated.

Step 1:

Each national data centre operates under nationally set mandates and procedures. After contact is made, they will explain what the procedures for submitting data to the centre are and what they do with the data that are received. Some centres accept data in a limited number of formats and others are more liberal. The first step is to determine what data formats are mutually acceptable and by what means the data can be moved.

Step 2:

Data centres are sensitive to the needs to protect data from general distribution in some cases and for some period of time. Many countries have policies to govern this aspect. It is important to ask about these policies if you are concerned about immediate redistribution of the data you provide.

Step 3:

If it is important in the future to be able to identify the data as collected in the context of a particular project or some other association, then inform the data centre that this is a requirement and ensure that they know the correct term to attach to the data.

Step 4:

Once data have been delivered to a data centre, they will “unpack” what was sent. They will look ensure that information needed by others to interpret the data has accompanied the data. Some centres will also pass the data through procedures to look for unusual values. If they find information is missing, or some unusual measurements, they will come back to talk to you to resolve the questions.

The type of information that is important to have includes the instrumentation used, descriptions of how the instruments were deployed, the names of the measured variables, the units of measurement, the precision and accuracy of the measurements, their complete location (both horizontal and vertical dimensions) and precise time, details of any processing such as averaging, calibration, etc. that may have occurred, and so on. Whatever information is needed by someone else to correctly use the data should be provided.

Step 5:

If for some reason your national centre is unable to manage the data you wish to provide, the next point of contact should be one of the World Data Centres (http://www.ngdc.noaa.gov/wdc/). They operate in similar ways to national centres and so you will have the same basic steps to follow as described above.

Recipe 2: Profiling Float Data

General Information: The only data returned from profiling floats comes through telecommunications facilities and so the data received in real-time are the only data received. However, in applying the real-time quality control procedures, some measurements may be excluded from real-time distribution. As well, the data reported on the GTS in TESAC code form may have a lower precision than is available from the instruments.

Step 1:

Each country is responsible for ensuring data from their profiling floats pass through delayed mode quality control procedures agreed to by the Argo Data Management Team and the Argo Steering Team. These procedures are described at http://www.coriolis.eu.org//cdc/argo_rfc.htm. After this is completed, the data should be submitted to the Argo Global Data Assembly Centers.

Step 2:

If your country already has a processing facility for real-time data, then it is possible that they also carry out the delayed mode quality control as well. If they do not, they will know who carries out this function for your country. Consult your Argo National Focal Point (see http://wo.jcommops.org/cgi-bin/WebObjects/Argo and choose “Contacts” then “Argo National Focal Points”) or your national data management contact (see http://www.coriolis.eu.org//cdc/argo_rfc.htm and select “Argo DM Members”).

Step 3:
If your country has never deployed floats before, consult the recipe that describes how to provide data in real-time.

Step 4:
It may happen that the facility managing the delayed mode Argo data do not routinely forward the data to your country’s national ocean data centre. Ask your Argo National Focal Point if this occurs routinely. If it does not, contact your national data centre (see the information in section 7) and request that they work with the Argo data processing facility to ensure your float data get to the national archives. If you have no national data centre, consult the IODE Project Office through the link provide in section 7.

Recipe 3: Moored Buoy Data
Recipe 4: Drifting Buoy Data

General information: Section 7 provides information about the international system for managing ocean data. The links provided there would allow you to determine if your country has a point of contact, and where they are situated.

Step 1:
Each national data centre operates under nationally set mandates and procedures. After contact is made, they will explain what the procedures for submitting data to the centre are and what they do with the data that are received. Some centres accept data in a limited number of formats and others are more liberal. The first step is to determine what data formats are mutually acceptable and by what means the data can be moved.

Step 2:
Data centres are sensitive to the needs to protect data from general distribution in some cases and for some period of time. Many countries have policies to govern this aspect. It is important to ask about these policies if you are concerned about immediate redistribution of the data you provide.

Step 3:
If it is important in the future to be able to identify the data as collected in the context of a particular project or some other association, then inform the data centre that this is a requirement and ensure that they know the correct term to attach to the data.

Step 4:
Once data have been delivered to a data centre, they will “unpack” what was sent. They will look to be sure that information that is needed by others to interpret the data has accompanied the data. Some centres will also pass the data through procedures to look for unusual values. If they find information is missing, or some unusual measurements, they will come back to talk to you to resolve the questions.

The type of information that is important to have includes the instrumentation used, descriptions of how the instruments were deployed, the names of the measured variables, the units of measurement, the precision and accuracy of the measurements, their complete location (both horizontal and vertical dimensions) and precise time, details of any processing such as averaging, calibration, etc. that may have occurred, and so on. Whatever information is needed by someone else to correctly use the data should be provided.

Step 5:
If for some reason your national centre is unable to manage the data you wish to provide, the next point of contact should be the Specialized Oceanographic Data Centre for drifting buoy data located in Canada (http://www.meds-sdmm.dfo-mpo.gc.ca/meds/Prog_Int/RNODC/RNODC_e.htm).

Appendix I. Contact Information at Operational Centres

Contact Info for Operational Centers who want data in real time or delayed mode

Appendix II. Contact Information at Archive Centres

Contact Info for various National and International Archives and activities that want delayed mode data