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Cross-Network integration issues from DMPA

submitted by Sissy Iona, DMPA Coordinator

In support of the Observation Programme Area (OPA), the following DMPA activities are currently implemented and further needed for the improvement of coordination and integration among the observing networks:

I. OPA is needed to submit its panel standards to the IODE/JCOMM Ocean Data Standards Pilot Project to support real-time oceanography data provision. This will converge with the work of other ongoing Research Projects (eg the European Project Jerico, the recently funded SDN II, etc) for the development and implementation of common technical standards such SensorML, Observation and Measurements for metadata and data transfer.

II. There is a continually increasing need for aggregated data sets and products in the research and operational communities. We must ensure that common QC procedures, QC flags schemes and data exchange formats are used between the different observing networks (open-sea and coastal) at national, regional and international scale so as the data they deliver are comparable and coherent. Available QC software tools should be shared among Members. Matrixes on QC methods for several types of instruments/platforms (including update versioning), similar with those developed by the DBCP for drifters and fixed buoys, would actively contribute to the efficient management of the Essential Ocean Variables (EOVs).

III. Members of OPA are needed to assist in the preparation of the training material for the use of Table driven codes for marine meteorology and operational oceanography. Also, to report any difficulties during the BUFR implementation in order to be resolved during training. The training course (under OTA umbrella) is not feasible before October/November of 2011. Until then, introductory material and existing software for reading and writing BUFR can be distributed to the members. Bob Keeley has been contacted to prepare the introductory material targeted at oceanographic observations.

IV. The IODE Committee in its 21st Session approved the proposal by an *ad hoc* Task Team for the integration of the RNODCs and the SOCs for Drifting Buoys to a single system of dedicated centres contributing to the ODP, and with specialized functions (archive, QC, monitoring, etc). The *ad hoc* Task Team and representatives from the RNODC/DB, SOC/DB, the RTMC, PIs, DACs and GDACs will be invited by the IODE and the DMCG to draft a Recommendation for JCOMM-IV, including ToR of such centres, as well as background information.

V. The OPA Programmes and Teams to continue to provide their data sets to the IODE Ocean Data Portal (ODP) improving thus the interoperability between OPD and the WMO Information System (WIS).

VI. Members of OPA are needed to contribute to the missing chapters of the Data Cookbook for submitting marine meteorological data in real-time and in delayed mode.

Appendix A

Report by the Ad Hoc Task Team on Responsible National Ocean Data Centers (RNODCs) and Specialized Oceanography Data Centers (SOCs)

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1. Tasking:

Excerpt from JCOMM/DMCG-IV Report (Sec 8.1.3 (16)):

> "Recommendation 5.8: The Group considered that the status of IODE Responsible National Oceanographic Data Centres (RNODCs), JCOMM Specialized Oceanography Data Centres (SOCs), and the VOSClim Real Time Monitoring Centre (RTMC) should be addressed. It would be beneficial to develop a proposal for integrating them into a single system of dedicated centres contributing to the ODP, and with specialized functions (archive, QC, monitoring, etc.)."

2. Assumptions:

- This proposal is not responsible for providing any funding recommendations that will impact RNODCs and SOCs, or the RTMC. However, the proposal recommends: (a) integrating these centres into a more unified system of (tentatively) "Global Data Assembly Centres" (GDACs); (b) updating each of their Terms of Reference (ToR) to accurately reflect present and any agreed new functions; and (c) closer interoperability (as appropriate) with the IODE/JCOMM Ocean Data Portal (ODP) and with the JCOMM in situ Observing Platform Support Centre (JCOMMOPS).
- Primarily, two drifting buoy data management centres will be discussed in this proposal – the RNODC for Drifting Buoys, operated by the Integrated Science Data Management (ISDM) of the Department of Fisheries and Oceans, Canada; and the SOC for Drifting Buoys, operated by Météo-France.
- The VOSClim Real Time Monitoring Centre (RTMC) will only be discussed secondarily, because no significant changes are proposed to the current VOSClim provision of monitoring information and data to NOAA's National Climatic Data Center.[1]

Pursuant to a decision made at the 18th IODE Session in 2005, the formal system of RNODCs was abolished (Resolution IODE-XVIII.2; ref. IOC 2005). In response to this decision, for example, the Japan Oceanographic Data Center (JODC) transferred capacity building activities of RNODC WESTPAC on oceanographic data management to Ocean Data and Information Network (ODIN) projects of IODE in the WESTPAC region and JODC has maintained the resources and expertise of IGOSS, MARPOLMAN and ADCP in order to support international activities related to those data, such as GTSPP and

[1] While the UK Met Office was not a member of this Ad Hoc task team, they were alerted: (i) that the RTMC would be discussed collectively with the RNODCs/SOCs, and (ii) that no significant changes to RTMC operations are currently envisioned.

CLIVAR etc.[2]

- However, the term "RNODC" continues to be recognized internationally and utilized by ISDM, and the important continuing functions of this (apparently) one remaining RNODC need to be smoothly transitioned into any agreed new unified system.

3. Definitions

- The RNODC for Drifting Buoys (RNODC/DB) at ISDM became an entity on behalf of the Intergovernmental Oceanographic Commission (IOC) and the World Meteorological Organization (WMO) in January 1986. To fulfill this role, ISDM acquires, processes, quality controls (QCs) and archives real-time BUOY (FM 18) messages reported over the Global Telecommunication System (GTS), as well as delayed mode data acquired from other sources. All data are made available to the international scientific community through online products, a web based request system or direct telephone and e-mail requests. We also note that the RNODC/DB also QCs, archives and makes available all moored buoy data reported in the BUOY code and BUFR (note: which codes however do not yet include *all* open ocean or coastal moored buoys internationally, since e.g. the NOAA National Data Buoy Center still uses the SHIP FM 13 code to report some coastal moorings).
- The SOC for Drifting Buoys (SOC/DB) is made of Météo-France teams in Toulouse and Brest, France as well as teams involved in Coriolis, an inter-agency program lead by the French Research Institute for Exploration of the Sea (Ifremer). Ifremer is also in charge of delayed mode aspects, portal to external users, etc. Daily collection and archiving of buoy reports from the global ocean is performed by Météo-France. Météo-France operates QC procedures on drifting buoy data. Warning messages are sent to a mailing list when a problem appears (e.g., bad location detected, wrong acceleration and loss of drogue, sensor drift) or when a modification seems needed (i.e., to recalibrate or to remove a sensor from the GTS), via the JCOMMOPS interface.
- The UK Met Office operates the Real-Time Monitoring Centre (RTMC) for Voluntary Observing Ship (VOS) Climate (VOSClim) ships, and in this role continues to transfer VOSClim ships' observations and the associated co-located model data to the Data Assembly Centre (DAC) at the NOAA National Climatic Data Centre (NCDC).[3]

4. Background

The IOC's International Oceanographic Data and Information Exchange (IODE) was

[2] The report from IODE-XIX (IOC, 2007) states: "At their February 2006 meeting the Officers had requested the former RNODCs to document the products and services that were provided by the RNODCs and to incorporate these, as relevant, in the terms of reference of the relevant ODINs. The following exceptions had been identified: RNODC for drifting buoys (Canada), JASIN (UK: to be closed), IGOSS (Japan, USA and Russia), MARPOLMON (Japan, USA and Russia), ADCP (Japan). The Officers had requested the centres that hosted the former RNODCs for drifting buoys (Canada), IGOSS (Japan, USA and Russia), MARPOLMON (Japan, USA and Russia) and ADCP (Japan) to continue their work until the next Session of IODE." However, the report from IODE-XX (IOC, 2009) does not appear to further address the issue of residual RNODC transition status.

[3] The Met Office also operates a Regional Specialized Meteorological Centre (RSMC), acting as WMO Commission for Basic Systems (CBS) Lead Centre for monitoring the quality of surface marine observations (routinely producing e.g. biannual quality reports as well as essential feedback to VOS operators regarding the quality of the data delivered by VOS ships).

established in 1961 to enhance marine research, exploitation and development by facilitating the exchange of oceanographic data and information between participating Member States and by meeting the needs of users for data and information products.

The main objectives of the IODE Programme are:

- To facilitate and promote the exchange of oceanographic data and information;
- To develop standards, formats and methods for the global exchange of oceanographic data and information;
- To assist Member States to acquire the necessary capacity to manage oceanographic data and information and become partners in the IODE network.

The IODE system forms a worldwide oriented network consisting of Designated National Agencies (DNAs), National Oceanographic Data Centres (NODCs), RNODCs (abolished formally by IODE-XVIII in 2005, as discussed above) and World Data Centres for Oceanography (WDCs). During 40 years, IOC Member States have established over 80 oceanographic data centres or DNAs. This network has been able to control the quality of, and archive of millions of ocean observations, and makes these available to Member States.

Worldwide marine meteorological and oceanographic communities are working in partnership under the umbrella of the WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM), in order to respond to interdisciplinary requirements for met/ocean observations, data management and service products. JCOMM data are used for research and monitoring of ocean processes at global and intermediate scales. There is a need to support international science or service programmes with a variety of operational data services. For these reasons, Specialized Oceanographic Centres (SOC) fill an important element of JCOMM's data processing and services – by monitoring and archiving data and products of a regional or ocean basin scale of interest.

A "Data Type SOC" is a specialized centre which is established to collect and process data to a certain standard and deliver either quality controlled data sets or standard data or data information products to its users. The need for such a SOC is considered "permanent" since it is established to meet ongoing JCOMM requirements.

In 1988, the IOC-WMO put out a Guide to IGOSS (now JCOMM) Specialized Oceanographic Centers (SOCs) (IOC-WMO, 1988). Similarly, the network of RNODCs of the IODE system was described in the IOC Guide for Responsible National Oceanographic Data Centres (IOC, 1982). The RNODCs had a similar role and place in the IODE system to the SOCs role in the Joint IOC-WMO Integrated Global Ocean Services System (IGOSS). In some cases, when a RNODC and a corresponding SOC are involved in the same programme, the activities of both centres should be closely co-ordinated to maximize efficiency and minimize the users' task of obtaining similar data from two sources. When a corresponding RNODC exists, the SOC will submit the operational ocean data originating from the IOS (and other operational sources) to that RNODC in computer-compatible form. Formats and quality control procedures are specified for data exchange between JCOMM and IODE centres.

RNODCs operating in the IODE system have a primary responsibility to provide for the long term archival of oceanographic data and data products in the World Data

Centres (note: eventually to be transitioned into a new World Data System, WDS). In contrast, SOCs have a primary responsibility to make data and data products available to users in an operational time frame.

It was a goal of the JCOMM system to transfer the data from the JCOMM SOCs to the IODE RNODCs by the time a given observation is no longer "operational." We note however that operational timeframes can be considered to range from a few hours to one month (30 days) depending on the parameter and process being monitored or studied, thus potentially complicating the delivery of data (since e.g. BUOY GTS reports actually contain a set of different observations with different operational requirements) and raising questions about the optimal approach to support a mixture of user applications. Later on, the JCOMM system should be receiving non-operational data from other sources and should be able to provide more comprehensive data sets to users.

5. Proposal

While the 1988 recommendations for RNODCs and SOCs provided useful guidance for collaboration between the two centres, the increase in observations and new methods for supporting similar capabilities require new guidance. This proposal recommends consideration of a generally similar management scheme for drifting buoy data centres that successfully exists within Argo Float data centres and OceanSITES moored reference station data centres. The Global Temperature and Salinity Profile Program (GTSPP) will be referenced as a good example of the collaboration program between IODE data centers and SOCs (Table 1).

Table 1. Current Data Management Centers for data from Argo, OceanSITES, drifting buoys, other coastal and open-ocean moored buoy systems, and GTSPP.

Program	Summary
Argo Program	An internationally coordinated activity directed at characterizing both the temperature and salinity structure of the mid- and upper- ocean and the advective field at mid-depth through deployment of autonomous profiling floats. The assembly of data in the Argo program is a distributed responsibility. In many cases, individual countries have established data Centres to handle the data collected by floats that their countries have contributed. In other cases, agencies within countries or groups of countries have also contributed floats to the Argo program but they make use of existing data processing Centres.
OceanSITES	OceanSITES is a worldwide system of long-term, deepwater reference stations measuring dozens of variables and monitoring the full depth of the ocean from air-sea interactions down to 5,000 meters. Since 1999, the international OceanSITES science team has shared both data and costs in order to capitalize on the enormous potential of these moorings. OceanSITES moorings are an integral part of the Global Ocean Observing System. They complement satellite imagery and ARGO float data by adding the dimensions of time and depth. The assembly of data in the OceanSITES program is a distributed responsibility. In many cases, individual countries have established data Centres to handle the data collected by moorings that their countries have contributed. In other cases, scientists or universities have also contributed moorings have also contributed moorings to the OceanSITES program but they make use of existing

	data processing Centres.
Drifting Buoy Centres	The management of the surface drifter data stream is relatively simple (but fragmented). The largest fraction of surface drifter data circulates on the GTS, the system operated by the WMO for broadcasting meteorological and oceanographic data to centres around the world. This distributed system has been promoted by the Data Buoy Cooperation Panel (DBCP) as a way to ensure widespread distribution of the observations. In recent years, some countries have provided internet access, in addition to distribution on the GTS, to the data collected by the buoys they operate. Data Centres capture all of the data from the GTS to hopefully ensure a complete (global) and long-term archive of the data and provide dissemination to users. We note however that the completeness of data receipts at different GTS centres has long been known to differ for operational and other reasons. Ideally therefore GTS receipts from different centres should be combined systematically to obtain the most complete and accurate data mixture possible.
Other Moored Buoy Centres	The management of data from moored buoy arrays presently appears to be the most fragmented, with near-coastal arrays (e.g. that operated by NOAA/NDBC around the US) possibly inherently less suitable for international management, owing to national coastal data management considerations and currently higher priorities within JCOMM and other international bodies for open-ocean observations. In contrast however, meteorological (and oceanographic) data from the tropical moored buoy arrays—specifically the Tropical Atmosphere Ocean/TRIangle Trans-Ocean buoy Network (TAO/TRITON) array in the Pacific, the Prediction and Research Moored Array in the Atlantic (PIRATA), and the Indian Ocean Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA)—are of critical importance to weather prediction and climate research applications. Presently data from these arrays (with some overlaps with OceanSITES) is managed separately at locations such as NOAA/NDBC, NOAA/PMEL, and the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), also with possible management differences depending on whether a given installation is considered “research” or “operational.”
GTSPP	GTSPP is a cooperative international project promoted by IOC and WMO, aiming to develop and maintain a global ocean Temperature-Salinity resource. Making global measurements of ocean temperature and salinity (T-S) quickly and easily accessible to users is its primary goal. It uses the GTS to acquire near real-time data (BATHY/TESAC) handled by ISDM with cooperation of 4 GTS centers in Canada, US, Germany, and Japan. Historical data are acquired either from other NODCs or from cooperation projects. US NODC provides data processing service for historical data and maintenance of Continuously Managed Database. GTSPP clients can use data that are both up-to-date and of the highest quality from US NODC anytime. US NODC recently started data service of GTSPP by ODP.

The Ad Hoc Task Team recommends that the RNODC/DB and the SOC/DB develop a data management scheme similar to Argo and OceanSITES. These data are

processed and distributed through a network involving different components that contribute to the overall data management system.

Figure 1 provides a visual summary of the data flow from either Argo or OceanSITES data management systems. The primary data flow is from the scientists or agencies who deploy the floats, to data centers who collect, qualify and processes the data to global data centers who serve as local distribution points on the Internet.

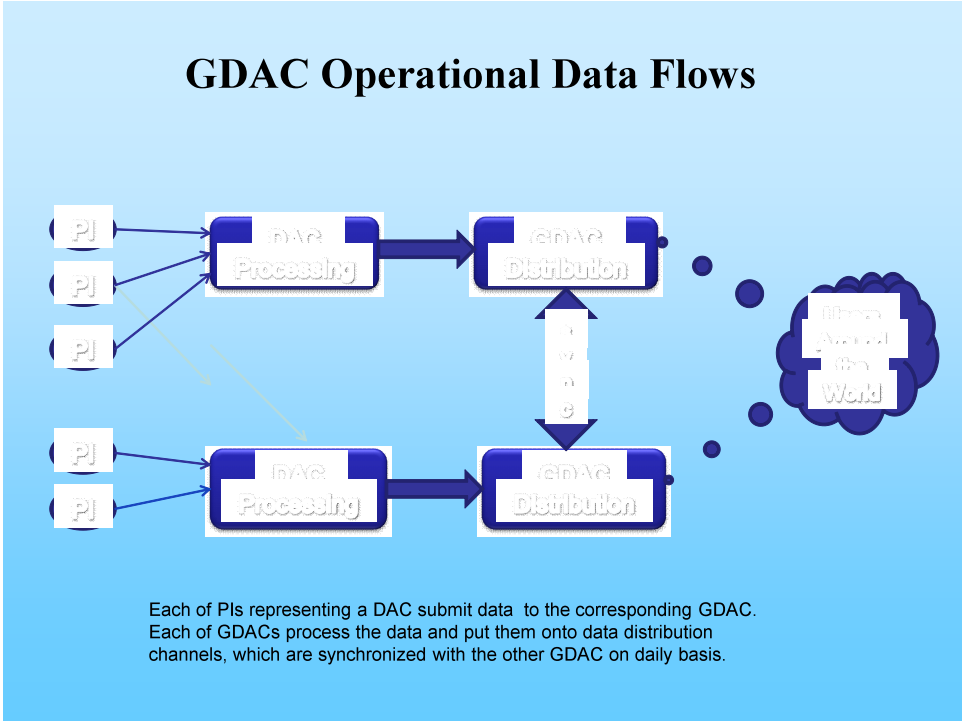

Figure 1. A visual summary of the data flow from either Argo or OceanSITES. While not shown on the figure, GDACS are also intended to serve as the regular pipeline to WDCs and/or NODCs for permanent data archival.

Under the Argo and OceanSITES data management systems, the main roles and functions of the Principle Investigator (PI), Data Assembly Centre (DAC) and Global Data Assembly Centre (GDAC) in the proposed data management scheme are listed below:

- The Principle Investigator (PI):
  - Maintains specific floats or platforms (one or more sites),
  - Determines what observations are released to the Global Telecommunications System (GTS),
  - Assures that the platform is available and provides reliable information,
  - Provides the DAC with the observations (data) in any format the DAC is willing to take, and the metadata necessary to serve as an Argo or OceanSITES platform, and
  - QCs post-recovery data according to agreed procedures.

- The Data Assembly Centre (DAC):
  - Sets up the “local” server according to the specifications approved by a data management group,
  - Guarantees data availability from the PI platforms,
  - Translates the data to the agreed upon format,
  - Quality Controls real-time data according to the minimum agreed procedures,

        - Provides the observations via the Global Telecommunications System (if requested by the PI),
        - Provides the data on a server for access by the GDACs
        - Organizes the data processing, formatting, data transfer and update with the PIs.

- The Global Data Assembly Centre (GDAC):
    - Provides the public, researchers, modelers, etc. with a virtual or centralized access to the data that are served by the DACs,
    - Ensures no data are excluded at the GDAC level, and full high-frequency data sets are available,
    - Keeps only the best version of the data. Additional products like interpolated data are separate optional sets,
    - Check all files daily using the "File Checker" software,
    - Maintains the Argo or OceanSITES catalogue, and
    - Synchronizes the catalogues with the second GDAC periodically (at least daily).
    - Responsible for permanent archive of the data.
    - Provides feedback to JCOMMOPS via Data Buoy Cooperation Panel Meetings.
    - Provide technical advice and support for QC and processing of drifting buoy data to DACs and PIs.
    - Will monitor circulation and data management status of drifting buoy data and will report to JCOMM/DMCG and provide advice to improve drifting buoy data circulation and management.

While the PI, DAC, and GDAC roles and functions will not be exactly the same as listed above (and illustrated in Figure 1), the Ad Hoc Task Team recommends that the RNODC/DB and SOC/DB become Global Data Assembly Centers for all drifting buoys – in a similar role that the Argo and OceanSITES GDACs server for their programs. Note that in both the Argo and OceanSITES case, GDACs serve as a DAC for some systems.

This proposal, if accepted and implemented, is envisioned to have the following potential benefits: As drifting buoy GDACs, both agencies agree to manage the international archive of all surface drifter data – and synchronize the catalogues on a regular basis. Even though the National Centres keep master copies of both data and metadata for the drifters for which they are responsible, the GDACs are the source from which all users should obtain their data. By centralizing this function, users can be assured that they are receiving the most up-to-date versions and that the data they receive is the same as what all others would receive. The choice of which GDAC server to access could be determined by its proximity to the user while attempting to alleviate the load put on either server. Having two redundant GDACs helps ensure that each of the two GDAC servers receive data directly from their DACs with the latest version of the drifter data and metadata. Both servers are updated simultaneously in order to ensure consistency between the two datasets. Each file is the responsibility of a single DAC (i.e., the data provider) who guarantees the quality and integrity of the data. One DAC is already responsible for most of these operations, the Atlantic Oceanographic and Meteorological Laboratory (AOML) in Miami, FL. AOML formed the Global Drifter Program's Drifter Data Assembly Centre (DAC) to apply delayed mode quality control (QC) to the surface drifter data. Due to the change of GTS routing rule, a problem occurred at ISDM which caused some data to not be received by the Center. For this problem, it is encouraged that other GTS centers exchange their received FM18 with ISDM as done in GTSPP. The RNODC/DB continues to receive and archive the real-time data and servers as a

long-term archive for the delayed mode data.

6. Proposed Implementation Workshop

To discuss this proposal and its implementation, the Ad Hoc Task Team recommends that representatives from the RNODC/DB and SOC/DB schedule a workshop with representatives from this Task Team, the RTMC, PIs, DACs and GDACs to discuss the implementation of such a system, determine the Information Technology impacts for both Centres, and develop a timeline for achieving Initial Operational Capability (IOC) and Full Operational Capability (FOC).

SOC has real-time services and clients, generally operational up to 30 days. ISDM has different delayed mode services. AOML has other clients for the more refined SVP products. Such differences should be considered at the workshop when the implementation plan is discussed. The following are suggested as additional specific elements of the proposal for discussion at the workshop:

- SOC/DB will be a Real-Time GDAC for the data within 30 days.
- ISDM will be a Delayed Mode GDAC for the data 30 days passed and received from Real-time GDAC.
- AOML could be a special analyzed GDAC to assist other data centers including GDACs and other projects to develop special products and QC procedures/techniques.

It is also expected that an installation plan of ODP servers in the system will be discussed at the workshop considering the capacities of the centers which will participate in the system.

References

IOC, 1982: Manual on International Oceanographic Data Exchange: Annex II: Guide for Responsible National Oceanographic Data Centres. IOC Manuals and Guides #9 [available from: http://www.jodc.go.jp/info/ioc_doc/html/manuals.htm].

IOC-WMO, 1988: Guide to IGOSS Specialized Oceanographic Centres (SOCs). IOC-WMO Manuals and Guides #19 [available from: http://www.jodc.go.jp/info/ioc_doc/html/manuals.htm].

IOC, 2005: IOC Committee on International Oceanographic Data and Information Exchange, Eighteenth Session, Kursaal, Ostend, Belgium, 26-30 April 2005. Intergovernmental Oceanographic Commission, Reports of Governing and Major Subsidiary Bodies.

IOC, 2007: IOC Committee on International Oceanographic Data and Information Exchange, Nineteenth Session, Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, 12-16 March 2007. Intergovernmental Oceanographic Commission, Reports of Governing and Major Subsidiary Bodies.

IOC, 2009: IOC Committee on International Oceanographic Data and Information Exchange, Twentieth Session, China People's Palace Beijing, China, 4-8 May 2009. Intergovernmental Oceanographic Commission, Reports of Governing and Major Subsidiary Bodies.

US NODC: Homepage on Global Temperature-Salinity Profile Program, http://www.nodc.noaa.gov/GTSPP/gtspp-home.html

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