**Intergovernmental Oceanographic Commission**
*Reports of Meetings of Experts and Equivalent Bodies*

# 8th workshop of the Global Ocean Surface Underway data Project (GOSUD)

IOC Project Office for IODE, Ostend, Belgium
18-19 June 2014

**UNESCO 2014**

IODE-GOSUD 8th
Oostende
English only


**ABSTRACT**

Following Recommendation IODE-XVI.10 (Lisbon November 2000): " … to acquire, quality control, store in standard format, and disseminate the collected underway sea surface salinity data…"the Global Ocean Surface Underway Data (GOSUD) Project was established.

The Global Ocean Surface Underway Data (GOSUD) Project is an initiative of the International Oceanographic Data and Information Exchange ( IODE) of the Intergovernmental Oceanographic Commission (IOC) programme designed as an end to end system for data collected by ships as they traverse their ocean tracks. The goal of the GOSUD Project is to develop and implement the data system for ocean surface data, to acquire and manage these data and to provide a mechanism to integrate these data with other types of data collected in the world oceans

The objectives of the meeting were to:

a.To assess the GOSUD activity since the beginning of the Project
b.To review the governance of the Project
c;To review the objectives of the Project
d.To elaborate the working plan for the 5 next years.
e.To identified a Steering Committee of 6-8 persons that are willing to contribute actively in the future of the Project
f.To propose a new chair person for the Project.
g.To propose a next meeting date within one year

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The document summarizes meeting discussion points, presentations given by both local participants in Ostend and remote participants via Webex. An action list is attached to the document.



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**8th GOSUD WORKSHOP**

1.0 Opening of the meeting
1.1. Welcome (Loïc Petit de la Villéon, Peter Pissierssens)
1.2. Meeting arrangements (Peter Pissierssens)
1.3. Adoption of the agenda (Loïc Petit de la Villéon)
1.4. Designation of a rapporteur

The meeting started at 09:00 on 19 Jun 2014 at the IODE Project Offices in Oostende, Belgium. Participants are listed in Annex 1. Peter Pissierssens welcomed everyone and described the working arrangements. The agenda was adopted as presented in meeting document and included in Annex 2. Keeley was appointed as rapporteur. Actions resulting from the discussions appear in Annex 3.

2.0 Assessment of the Project since the beginning (L. Petit de la Villéon)

L. Petit de la Villéon provided a brief review of the project. It began some ten years ago with co-chairs, one from the scientific community and one from data management. More recently, the project has had only a data manager as chair, and diminished representation from the science community.

L. Petit de la Villeon stated that the objectives of this meeting are:

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He noted that from his perspective, there was no clear objective to the project other than assembling data. Each contributor carries out its own program, some carrying out quality control and others not. Each then sends their data onto the GDAC in France. There is little to no co-ordination between contributor programs and little downstream interest in the use of the data. Without a co-chair to represent the science community, a strong science advisory component is lacking.

Connections have been made with the SAMOS programme, even holding a joint meeting. Although, there are strong overlaps in objectives, no strong connections have been developed yet. There was general agreement with this assessment.

Participants noted that SOT and specifically SOOP has responsibility within JCOMM to coordinate GOSUD observation activities, but that little time is spent doing so at meetings. In particular, agreement of sampling strategies was lacking and this should be pursued. It was agreed that a stronger presence at SOOP was needed (action 1).

In previous meetings, there was interest shown from the satellite communities, specifically those interested in SMOS and Aquarius.

It has been noted that now that the SMOS and Aquarius satellites are operating, there should be an increase in interest on in situ surface salinities. Data from Argo floats provide the global large scale coverage and TSG data give access to higher scales and repeated sections. GOSUD should be a partner to the present and future satellite programmes observing salinity

J. Trinanes asked who are using the data and for what purposes. What publications have resulted from analyses of underway data? The meeting agreed that these are good questions and that GOSUD should make efforts to answer.

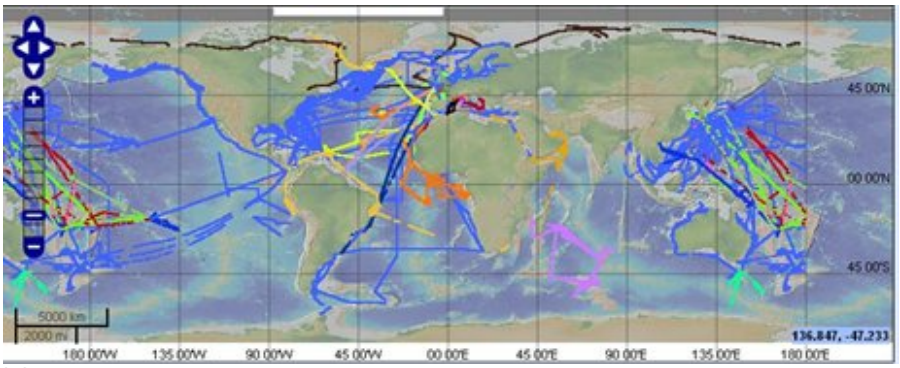
Relevant questions and discussions continued in agenda item 2.1.

2.1. Report from the chair (L. Petit de la Villéon)

L. Petit de la Villeon noted that various meetings in 2013 he had attended and reported about GOSUD activities, including IODE-22, SOT, and IMDIS. He reported that GOSUD is recognized as part of the global ocean observation programs. He reported also that some other programs collecting surface data such as SOCAT have shown interest to work in closer relationship with GOSUD (IMDIS conference). He remarked that GOSUD activities do not appear in presentations at scientific meetings.

He noted a lack of a recent Project Plan to describe such things as what are the GOSUD objectives, the policy for data collected either in both near shore and open ocean, and if all of the different variables besides temperature and salinity that can be collected with underway instrumentation are to be managed by GOSUD or simply temperature and salinity. He highlighted that managing more variables than only temperature and salinity is a key issue for the Project.

Data providers in France include IRD, SHOM, IFREMER and IPEV. NOAA in the USA provides only real-time data. The same is true for data coming from Belgium, Spain, Japan, and various EU programmes. There are links to some EU-MyOcean related programmes and some data also come from ferries mostly operating in the nearshore. The number of vessels providing data in the GDAC from last year is about 120 and this is diminished from previous years.



GOSUD network -66 vessels- June 2013-June 2014 (source http://www.gosud.org)

The GDAC is operated by France, with backup functions undertaken by the US NODC. The GDAC has developed a netCDF CF compliant data format for both real-time, delayed mode data, water samples analysis and meta-data (GOSUD V3). French vessels submit delayed mode data and use a common quality control tool to validate the data. Recently, the network of French ships has been enlarged but GDAC archives are still dominated by real-time data. The GDAC has improved the web access tool for the data.

Trinanes asked about whether data usage statistics are available such as who accesses the real-time and who the delayed mode data. Ouellet stated that there is a need to have a clear statement of what services GOSUD provides that cannot be obtained from other sources. Gaillard responded that in her opinion, real-time data are suitable for operational purposes, but delayed mode data from GOSUD are better suited for satellite validation among other things.

Other observations by participants included the feeling that it was to be expected that GOSUD garners fewer users because of its focus on a single instrument, and that there is no identified world wide group looking at surface salinity. Possible clients of GOSUD data could include ICOADS, CDIAC (if $pCO_2$ data are included in GOSUD archives) and the CLIMAR programme. Keeley suggested that one GOSUD member should be designated to identify country contacts based on data being reported in real-time, and to seek the delayed mode versions be submitted to the GDAC (actions 2, 3).

The meeting concluded that a revised Project Plan needed to be written, that addresses the points mentioned above, that includes a bibliography of publications that would provide both names of interested scientists using the data and the use to which the data are put (action 5). Also a larger presence in the scientific consciousness was needed (action 6).

2.2. Report from the JCOMM Observation Coordination Group. Recommendations. (Bob Keeley)

In early 2013, Keeley was contracted by JCOMM to prepare a report on the ease of access to data collections

co-ordinated by the JCOMM Observations Programme Area. The draft version was provided to NOAA, contracting on behalf of JCOMM, at the end of September 2013. Due to a number of factors, reviews of the various chapters, one including underway data, were not provided until April of 2014. These comments and suggestions were included as appropriate by Keeley and a final version delivered by the end of May 2014. Keeley suggested that GOSUD might be interested in the comments and recommendations pertinent to GOSUD. He noted that he was unsure of the current status and availability of the report (action 4).

2.3. The users point of view (Gilles Reverdin

Reverdin informed the meeting about work he was doing with TSG data from the Atlantic Ocean and looking at ways to reduce uncertainties in surface salinities. He is using surface salinities coming from GOSUD (some from NOAA, AWI and others) as well as data from SAMOS and SOCAT. He is also looking at surface salinities derived from sensors on surface drifters. One of the uncertainties derives from the fact that observations are made at different depths below the sea surface. In all locals except those that are highly stratified, this varying sampling depth does not appear to have a strong impact. He has determined that in about 90% of the cases, the contribution in uncertainty is about 0.02 psu. As it is known that there are strong salinity signals on the order of 0.1 psu, the impact of depth variations in sampling should not have serious effects on uncertainties. Another factor is sufficient water flow through the conductivity cell of the TSG. One way to judge water flow is to look at the temperatures reported on intake compared to those observed by the TSG. If these are too different, it is likely that water flow is insufficient. One can also cross validate with CTD observations, and compare to satellite observations as long as the region in which the TSG is operating is rain free, and there is not strong small scale features in the salinity signal. Nearby Argo floats (within about 100 km or less) with temperature differences with the TSG of <0.1 C can also be used. In such situations monthly statistics can be calculated with standard deviations of 0.1 C for temperature and 0.15 psu for salinity. Biases appear to be about 0.05 psu except in regions with high variability. Overall he found about 60% of data are usable if certain other measurements, such as intake temperatures, are also provided with TSG observations. Data from ships with PI validation (though not every one and it is difficult to determine which are suitable) can produce useful monthly variability maps, with a consistent negative bias. Overall he states that data in the archives at present, both real-time and delayed mode, are unreliable largely because additional information needed to validate the observations are not present. When PIs regularly manage the data, the resulting data are usable, though not without some reservations. Flow rates are important, and additional measurements, such as water temperature on intake, must accompany TSG observations. Data sets in the GOSUD archives are too discontinuous to allow reliable comparisons and validations with other surface salinity measurements, such as from Argo. Water flowing to the TSG must come from within 5 m of the surface. Finally, it is much harder to use data from SAMOS and the US R2R archives because of the very high temporal sampling these contain and the quite different sampling strategies employed by the different vessels.

The meeting decided that such information on sampling as provided by Reverdin, should be translated into an updated BUFR template for surface underway data (action 7). In addition, appropriate text to help standardize sampling should appear in the GOSUD Project Plan. For example, information on last calibration dates for the TSG, depth of sampling, intake water temperatures, flow rates, averaging techniques, as well as recommending one minute averaging rather than retaining the very high time resolution such as in SAMOS.

3. Contributions
3.1. USA (Joaquin Trinanes)

Trinanes told the meeting that TSG data collected by NOAA (10 SOOP and 10 NOAA vessels in 2013-2014) are used in pCO2 studies, in the determination of boundary / frontal regions, and in climate and forecast models. They now provide near real-time fields of CO2 fluxes and assessments of acidification. TSG measurements are also use in calibration of SMOS and Aquarius data. Data arrive at AOML in zipped files, are passed through quality control procedures developed by AOML and are sent to GOSUD and archived at the US NODC in near real-time. Sending data to the GTS was stopped about 4 years ago because the activity was unfunded. As well it was found that modelers do not use TSG data because the data are not trusted. However, TSG data can be useful and it is important to inform the wider community of this. At present there are no recommended lines for sampling as is done for XBT sampling. He also noted that calibration information on TSGs is now automatically logged by NOAA.

The meeting remarked that this latter point kept arising in these discussions and so must be addressed in both the new Project Plan and in advertising GOSUD. The importance of calibration information should be

emphasized in the Project Plan and included in any updated BUFR template. In this latter regard, it is suggested that a modeler be consulted to determine what information is required to assure the reliability of the TSG measurements.

3.2. Australia (Ann Thresher)

Thresher noted that Australia operates TSGs and collects water samples for calibration purposes at CSIRO. They submit the collected data through a quality control process they have developed. Data come from the ship Southern Surveyor, the Aurora, and soon from another (commissioned to replace the Southern Surveyor. They collaborate in operations of the TSG on the French vessel l'Astrolabe. Those data are used to produce hourly values for the GTS averaged from the last 5 minutes of each hour. Delayed mode data are calibrated once a year. The data are archived in the AODN and documentation of data processing is available from the AODN website. Data are not sent to GOSUD.

The meeting requested Thresher to help in the identification of an appropriate contact for TSG data in Australia so that the data can be sent in delayed mode to GOSUD (action 2).

3.3. Japan

As there was no Japanese representative, Petit de la Villeon simply noted that two vessels operated by the Nippon Corporation provide data on the GTS.

3.4. France (Loic Petit de la Villéon)

Petit de la Villeon provided information about how France collects and manages TSG data. The data are acquired from IRD and Coriolis. Twelve research vessels, some operating in the ocean and some from coastal waters, collect TSG data submitted to GOSUD. One in the Bay of Biscay and another in polar seas also contribute. The IRD network is composed of merchant vessels and managed by IRD. Data from these vessels arrive in real-time or near real-time and their sole purpose is to ensure the operating of the TSG. The data are processed in delayed mode with quality control and calibrations applied before they are sent to GOSUD. Data from the GOSUD archives, operated by IFREMER/SISMER are delivered to users in GOSUD version 3 format in netCDF.

Trinanes asked if GOSUD was going to develop offering web services for the data. Petit de la Villeon replied that such services are available through MyOcean. Thresher thought that the maps shown of l'Astrolabe cruises did not appear to have enough repeats. She and Petit de la Villeon will investigate this.

3.5. DM Processing from Research and sailing ships(Fabienne Gaillard)

Gaillard noted that the delayed mode processing at her agency is the same as done by IRD. Data are collected at full resolution (every 6 seconds) and water samples are collected once each day. TSG calibrations are done once a year; it used to be twice a year, but experience showed that this frequency was not needed. In her experience, it is simpler to work solely with the high resolution, delayed mode data files, rather than a combination of real-time and delayed mode. Argo data are used to check the reasonableness of the TSG values. Two minute median values are computed and adjusted by calibrations if needed before data are sent on to the GOSUD archive. Sailing vessels are also used to collect data, some fitted with two independent TSGs to ensure good values when the vessel is heeled over with the wind. The TSG uses an SBE-45 instrument on these vessels. A NKE-STPS data logger, recording at 0.2 psu accuracy, is used to record measurements. Tall ships also collect TSG data, but it is difficult to get water sampling done from these vessels. Reasonable agreement was found between NKE collected data and SMOS satellite tracks, as well as Argo floats within 50 km of the TSG.

Trinanes asked if a conventional TSG was installed beside the SBE-45 to allow for a comparison. Gaillard remarked that the SBE-45s are newly deployed, so that while this is contemplated, it has not yet been done. She said there is a target to complete delayed mode data processing to the data up to the end of 2013 by the end of 2014. Responding to a question about data quality, she remarked that sometimes the real-time data are good, but sometimes not. This is dependent on where the ships are operating, and the type of vessels. Generally data from research vessels are more reliable.

3.6. China (Fengying Ji)

It is known that Chinese vessels collect TSG data, but they do not appear on the GTS nor are they submitted to GOSUD. Taking advantage of the presence of a Chinese representative, the meeting requested her to look into what could be done to move data from China to GOSUD in real-time, through the GTS), and or in delayed mode (action 8).

4. Review of the governance and the objectives (discussion led by Bob Keeley, all)

Discussions in other agenda items covered much of the intention for this item. The meeting noted that in addition to the other points noted, that a centralized surface salinity archive, such as GOSUD is appreciated. Other archives, for example Argo, contain surface salinity measurements. GOSUD provides an archive of measurements from surface underway collections, data that are not available in any other consolidated archive. However, it is known that there are still additional sources of TSG data, such as noted in the previous agenda item, and that these should be pursued. In addition, data quality seems highly dependent on the operator of the TSG. Some of this can be mitigated by the addition of appropriate metadata, or other measurements as noted before. Such information should be noted in the Project Plan (action 5), and incorporated in any BUFR template.

Other kinds of data are collected coincident with the temperature and salinity produced by the TSG (for example pCO2, fluorescence, oxygen, etc.). The question was raised whether GOSUD should be actively pursuing and archiving these as well. Some of these other variables end up being more carefully processed and placed in other archiving systems as for example pCO2 data in CDIAC. However, this is only true for certain of the measurements collected. The meeting recommended that GOSUD should accept and archive these other measurements. Where there are other archives that hold higher quality versions of some of the variables, these should be pointed to on the GOSUD web site. Appropriate discussion of this question needs to be included in the Project Plan (action 5).

The meeting also recalled discussions of data quality. The Project Plan should discuss this issue as well. It should provide a recommendation of the minimum metadata needed to accompany TSG measurements. It should also recommend that when data are submitted, appropriate documentation on the processing that the data have undergone should also be available, either accompanying the data or available at a URL. Finally, if there are archives of the full resolution data available, from which the data set sent to GOSUD is derived, appropriate pointers to these archived should be attached to the received data.

5. Data management
5.1. Report from RT DAC - Canada (Mathieu)
Ouellet presented statistics on real-time TRACKOB processing in Canada covering the 2012-2013 time frame. He noted that there has been more data reported than previous though data volumes were reduced in 2013, but coming from fewer GTS insertion points. Part of the drop appears to be a consequence of the Australian ship, Aurora, stopping transmissions. In addition there were many fewer reports from ships associated with the Seakeepers group. Reductions were noted from France in 2011, and Germany in 2012, but the reasons are not known. Canada has some simple monitoring tools, but he suggested that a new Project Plan (action 5) should suggest standardized monitoring tools to be sure that statistics reported from partners are comparable.

5.2. Report from the GDAC (Loïc Petit de la Villéon)

This was covered in agenda items 3.4 and 3.5.

5.3. Report from the US-NODC (Steve Rutz)

The US NODC mirrors the netCDF data files found at the GDAC in France. There are plans to ingest the data from these files into NODC archives, but that has not yet happened. Also, the R2R program in the US will soon be providing TSG data and these can contribute to the GDAC holdings (note comments above about the time resolution of these data). In 2009 an automated procedure began for the ingest of SAMOS data in netCDF files into the NODC accession holdings. As yet these are not inserted into the general data archives. Automation has also allowed the ingesting of logs from 44 NOAA vessels into accession holdings. There are discussions with

AOML about the joint production of a surface salinity product. It is not clear if the product will utilize only US sources, or cast a wider net.

The meeting suggested that NODC should bring the GDAC into discussions of an SSS product so that overlaps in activities are avoided, and there can be increased data sharing. The same sentiment was expressed about discussions with Gaillard. Other possibilities in overlapping activities include data assembly. The overall attitude of the meeting was that closer discussions between the NODC and GDAC would be to everyone's benefit (action 9).

5.4. GOSUD V3 format revision (Loïc Petit de la Villéon)

The latest version of the format for real-time transmission is built to contain2 to 5 minute median filtered temperature and salinity observations. The values are accompanied by a ship call sign, date of instrument change, water intake depth, instrument serial number and last calibration date of the TSG. There has also be consideration to align the metadata content with the present BUFR template for underway data.

For delayed mode data distribution, the netCDF format is fully CF compliant. At present the format description is not present on the GOSUD web site but should be up soon. The format allows for information about the depth of water intake, water sample analyses, co-located Argo and CTD data, and other metadata. Data are split into separate files for a single cruise and sensor. Again there was an alignment with the current BUFR template. Code tables are used to identify institutes, ships and other parameters.

The meeting remarked that the present template for underway data is seriously lacking metadata and associated measurements (e.g. Water intake temperatures). This was noted earlier resulting in action 7.

There is a need for international standardization of certain code tables that appear in the netCDF format, in particular for institutes. The meeting suggested this should be addressed (action11). The meeting noted that ICES codes should be used for ships rather than IMO identifiers, since the later do not cover naval vessels and some do report underway data.

In a quick review of the format the meeting suggested removing “optional” categories for parameters. In effect, if data providers have the information, they should feel encouraged to include it, and if they do not have the information, then the fields will be empty. Some comments on style suggested use of all lowercase characters. A suggestion was also made to have the format conform to ACDD (Attribute Convention for Data Discovery). This places general location and time information in the global variables section which can then be accessed by ACDD compliant software tools. It was also suggested that WMO code table 1770 for instrument be used. Finally it was suggested that these comments be considered for a revision of the format, and the next version be more widely circulated for comments.

5.5. Quality control tools

France briefly noted that the tool (TSG-QC) they developed for quality control is in Matlab and is freely available and distributed. France also informed that the next version of CORA (COriolis dataset for Re-Analysis) will include surface salinities. AOML also has quality control tools they developed independently. The meeting suggested an intercomparison of outputs using the same input data set (action 10). The meeting was also informed of the start of IQuOD, a group to examine quality control techniques internationally. One of the task teams will deal with documenting the uncertainties in ocean data. There are bound to be overlapping considerations relevant to GOSUD on surface salinity measurements. The meeting agreed that IQuOD developments should be followed closely.

6. Designation of a steering group

The current chair led a discussion on the reconstitution of a steering group for GOSUD. Generally it was thought that representation from SAMOS and SOCAT would be useful, and that there should be a strong user/scientific presence. In addition, representation from countries providing data in both real-time and delayed mode should be invited (action 12).

7. Designation of a new chairperson

Fabienne Gaillard was accepted as a new co-chair. Loic Petit de la Villeon agreed to stay on until such time as his replacement could be found (action 12).

8. Closure

The meeting closed at 12:00 on June 20.

**Annex 1: Participants**

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**Annex 2: Agenda**

1.0 Opening of the meeting
1.1. Welcome (Loïc Petit de la Villéon, Peter Pissierssens)
1.2. Meeting arrangements (Peter Pissierssens)
1.3. Adoption of the agenda (Loïc Petit de la Villéon)
1.4. Designation of a rapporteur
2.0 Assessment of the Project since the beginning
2.1. Report from the chair (Loïc Petit de la Villéon)
2.2. Report from the JCOMM Observation Coordination Group. Recommendations. (Bob Keeley)
2.3. The users point of view (Gilles Reverdin / Thierry Delcroix)

3. Contributions
3.1. USA (Joaquin Trinanas)
3.2. Australia (Ann Thresher)
3.3. Japan
3.4. France (Loic Petit de la Villéon)
3.5. DM Processing from Research and sail (Fabienne Gaillard)
3.6. China (Fengying Yi)

4. Review of the governance and the objectives (discussion led by Bob Keeley, all)

5. Data management
5.1. Report from RT DAC - Canada (Mathieu)
5.2. Report from the GDAC (Loïc Petit de la Villéon)
5.3. Report from the US-NODC (Steve Rutz) – connected on-line
5.4. GOSUD V3 format revision (Loïc Petit de la Villéon)
5.5. Quality control tools

6. Designation of a steering group

7. Designation of a new chairperson

**Annex 3: Actions**
**GOSUD Actions from Jun 2014**

| No. | What | **Who** (first named is lead) | **Completion Date** |
|---|---|---|---|
| 1 | Plan for a larger presence for TSG at the next SOOP meeting | Chair | Next SOOP meeting (Apr 2015) |
| 2 | Identify points of contacts in countries that contribute data in real-time or delayed mode. | Chair | Jan 2015 |
| 3 | Use RT data stream to identify and contact for delayed mode data provision. Mathieu, Loic to provide list of ships reporting through GTS nodes; use points of contact | Ouellet, Petit de la Villeon,, national points of contact | Next GOSUD |
| 4 | Contact Candyce Clark, Nadia Pinardi to determine release of Keeley's JCOMM report. Report to chair GOSUD | Keeley | Done 30 Jun 2014: Report to be placed on JCOMM web site shortly |
| 5 | Publish a new GOSUD Project Plan that addresses issues highlighted at this meeting (see suggested content in meeting notes) | Chair, AOML, Keeley | IODE-23 (Mar 2015), SOT-8 (Apr 2015) |
| 6 | Present GOSUD at appropriate scientific or other (CLIMAR, SAMOS,...) meetings | Chair or members | As appropriate |
| 7 | Develop new underway data BUFR template with expanded metadata and data and get WMO approval for use (see meeting report for some suggested content) | Trinanes, Keeley, Reverdin, Berry | Next meeting |
| 8 | Ask China to provide to GOSUD whatever TSG data and information they have | Fengying | Jun 2015 |
| 9 | Conduct discussions with US NODC regarding planning and development of data assembly, archiving, dissemination, products in the Ocean Archive System. | Gaillard, Rutz, Petit de la Villeon, AOML? | Before Dec 2014 |
| 10 | Conduct intercomparison of standard operating procedures of France and AOML QC | Bringas, IRD? | Dec 2014 |
| 11 | Encourage IODE develop a standard code table of international institute codes building on SDN tables | Petit de la Villeon | Sep 2014 |
| 12 | Reconstitute SG membership and seek DM co-chair replacement | Gaillard, Petit de la Villeon | IODE-23 |