Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

Joint IODE-JCOMM Steering Group for the Global Temperature-Salinity Profile Programme (SG-GTSPP)

Second Session
IOC Project Office for IODE, Ostend, Belgium
17−20 June 2014

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IODE-JCOMM/SG-GTSPP-II/3
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ABSTRACT

At JCOMM-I (2001) it was decided that the former WMO-IOC GTSPP Programme would become part of JCOMM. As such the Steering Group is now called the IODE-JCOMM Steering Group for the GTSPP. The Second Session of the Joint IODE-JCOMM Steering Group for the Temperature-Salinity Profile Programme (GTSPP) was held at the IODE project office for IODE in Oostende, Belgium, 17 – 20 June 2014. The meeting was attended by nine (9) participants in Ostend, while four (4) participated by Webex.

The objectives of the meeting were to: (i) Review of GTSPP inter-sessional (2012 – 2013) activities. (ii) Collaborate toward standardization of quality control procedures within GTSPP, (iii) Review the existing GTSPP data formats for improvements. . (iv) Review the GTSPP training materials prepared for the IODE Ocean Teacher Global Academy, (v) Explore connections with other programs such as GOSUD, IQuOD, OceanSITES, and WOD, and (vi) Refine the GTSPP future directions.

The document summarizes meeting discussion points, presentations given by both local participants in Ostend and remote participants via Webex. The GTSPP work plan for 2014–2017 is shown in Annex III of the meeting report.

The participants planned for the next meeting to be held in the second quarter of 2016.

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TABLE OF CONTENTS

page

ANNEXES

1. OPENING OF THE MEETING

Dr Charles Sun, Chair, opened the meeting at 09:00 on 17 June 2014. He noted that budget reductions were forcing creative solutions to meeting attendance. So, in addition to the nine people present there were four persons who would join online through Webex.

Mr Peter Pissierssens welcomed participants to the Project Office and provided information about working arrangements. He reminded the meeting that the next IODE plenary will be held in March, 2015 and it would be important for GTSPP to both prepare a work plan for the meeting and to consider what changes may be needed in GTSPP operations.

Dr Sun also welcomed participants. Meeting participants introduced themselves. A complete list of the meeting participants is shown in Annex I. Dr Sun reminded them of the objectives of the meeting.

a) Review of GTSPP inter-sessional (2012 – 2013) activities.
b) Collaborate toward standardization of quality control procedures within GTSPP.
c) Review the existing GTSPP data formats for improvements.
d) Review the GTSPP training materials prepared for the IODE Ocean Teacher Global Academy.
e) Explore connections with other programs such as GOSUD, IQuOD, OceanSITES, and WOD.
f) Refine the GTSPP future directions.

The agenda was adopted as published before the meeting (Annex II) but changes could be made as the necessity arises. Mr Keeley agreed to be rapporteur, and participants agreed to provide a brief text of their reports for inclusion in the meeting report. At the end of the meeting these would be reviewed to set the final list of actions, the parties involved in carrying them out and target dates for each. The final list, including a review and carry-over of tasks as necessary from the last meeting is shown in Annex III. The meeting was suspended for 1.5 days starting 19 June, to accommodate a GOSUD (Global Ocean Surface Underway Data) workshop.

2. REVIEW OF ACTION ITEMS FROM 2012 MEETING

A review of action items from the previous meeting was conducted. Completed items were removed, incomplete items modified appropriately and new items added during the course of the meeting. The action list is contained in Annex III.

Notes regarding some of the reported activities include the following:

a) Action 2: Mr. Tim Boyer remarked that all of the historical TIP (Tropical Buoy Implementation Panel) data reside in WOD so GTSPP need not use TIP website.
b) Action 4: A new variable to be used in the netCDF format (see discussions later) will record original data if changes, such as from calibrations, are made. Though inconsistent with Argo naming, the variables will be labeled as “PARM”_raw where “PARM” is the appropriate netCDF variable name.
c) Action 8: NODC agreed to assemble and maintain older versions of manuals and documentation of the project.
d) Action 20: AOML (Atlantic Oceanographic and Meteorological Laboratory) agreed to start including CRC values in data submissions to NODC.

3. REPORT OF GTSPP ACTIVITIES 2012 – 2013

Dr Sun reported that he attended an *ad hoc* session of the Joint JCOMM-IODE Steering Group for the Ocean Data Standards Pilot Project, 23 – 25 April 2012, Ostend, Belgium and organized the second IODE workshop on quality control of chemical and biological oceanographic data collections, 22 – 24 October 2012, Ostend, Belgium.

He was also invited to attend an *ad hoc* GTSPP consultation meeting, 5 – 9 November 2012 in Tianjin, China. At the consultation meeting, the National Marine Data and Information Services (NMDIS) in China agreed to allocate resource to implement the GTSPP Global Data Product Center (GDPC) activities as a pilot project beginning in 2013 for one year.

Dr Sun prepared the report of the GTSPP activities during 2012 and 2013 to the twenty-second session of the IOC Committee on International Oceanographic Data and Information Exchange (IODE-XXII) held in Ensenada, Mexico, 11-15 March 2013 and the seventh (7^{th}) session of the joint WMO/IOC JCOMM Ship Observations Team (SOT-7), Victoria, Canada, 22 – 26 April 2013. In the absence of Dr Sun, Mr Petit de la Villéon and Dr Ann Thresher gave the presentations of the GTSPP reports to IODE-XXII and SOT-7, respectively.

He also informed the meeting participants that there were personnel changes in 2013 and 2014. Ms. Melanie Hamilton, GTSPP Data Manager, retired from NOAA in early 2013. Mr Tim Boyer took over the responsibility of the GTSPP daily operations at the U.S. NODC. Mr Satoshi Ogawa, Point of Contact at JMA, left his position at JMA in April 2014, and Mr. Hiroshi Ohno took over the responsibility of Mr Ogawa since then.

4. REVIEW OF THE GOVERNANCE OF GTSPP

Dr Sun reported that the 22^{nd} session of the IOC Committee on International Oceanographic Data and Information Exchange (IODE) noted with satisfaction the work of GTSPP in establishing a long term temperature and salinity profile data structure and the close relationship with the World Ocean Database (WOD) and recommended the revised Terms of Reference (ToR) and General membership of GTSPP. He reminded the SG-GTSPP that the revised ToR states that “The Chair will be selected by the Steering Group and will be reviewed by them every two sessions” and he expressed his intention to continue his term of the Chair till 2016. He re-stated that the composition of the GTSPP steering group consists of three components, i.e. (1) Long-Term Archive (Continuously Managed Database) Center hosted by the U.S. NODC, (2) Data Assembly Centres in Australia, Canada, France, and USA-AOML, and (3) Data Product Center, currently, hosted by the Japan Meteorological Agency (JMA) of Japan and no immediate plan to alter the membership of the steering group of the GTSPP.

Dr Sun noted that there should be a formal way to determine membership on the Steering Group. He agreed to review the present mailing list and to initiate a discussion on this (action 19, 27).

5. NATIONAL GTSPP PROGRAMME SUPPORT

5.1 AUSTRALIA

Ms Cowley reported that Australia contributes mostly XBT data to GTSPP. CTD data does get to NODC via CCHDO or the CSIRO data centre yearly, but is not inserted onto the GTS. Other data types might get to GTSPP, but it is unlikely. The XBT program is run by three agencies in Australia - CSIRO, RAN (Royal Australian Navy) and BoM (Bureau of Meteorology). CSIRO and BoM operate the XBT lines, RAN drops XBTs from 8 ships in any location. All agencies use the Turo Devil or Quoll systems, and RAN operates two Mk21

systems. Both BoM and CSIRO have had trouble recruiting ships during 2013 to the PX02 and PX30 lines, but 2014 has seen some improvement with new ships on line. JJVV messages are sent to shore via email and then forwarded to the GTS from BoM. No QC is applied at this stage. After return to shore, every profile is visually QC'ed using Mquest. CSIRO's QC'ed data is then immediately made available via the IMOS portal. All Australian XBT data is collated yearly and sent to NODC and other partners. CTD data from WOCE voyages are submitted via the CCHDO in delayed mode only.

Ms Cowley also noted that there had been an error in CRC creation in software of XBT recorders, but this had been fixed in newer versions. Unfortunately, not all of these recorders had yet been deployed by BoM (action 7).

5.2 CANADA

Mr Ouellet reported on the activities of the Canadian Oceanography and Scientific Data (OSD) in support of GTSPP, which are to act as a data assembly centre for Global Telecommunication System (GTS) data. Canada's data contributions to the GTSPP CMD were covered in a separate report sent to the chair of GTSPP. The Japan GTS data stream was particularly useful to get access to data by Argo floats belonging to India.

The OSD (formerly called ISDM) acquires GTS data from 4 national met centers, one of which is Canada's. For GTSPP, the code forms of interest have always been TESAC, BATHY and BUOY code (only buoys with sensors at more than one depth).

For another consecutive year, the number of messages received from the GTS has increased. The number of messages per year reached 2.5 M in 2012 and continues to increase. There was however a decrease in messages received (and platforms transmitting messages) in 2013 within some observation programmes. For instance, the number of oceanographic profiles measured by sensors mounted on pinnipeds decreased significantly in both Northern and Southern distributions in 2013. Some TAO buoys which were reporting in 2012 stopped reporting in 2013.

An analysis done at OSD shows that ~5% of all platform measurements, representing 35% of all recent real-time GTSPP data, consist of single-point measurements and/or current velocity without any temperature or salinity information, measured by data buoys. Ouellet said that the choice of decoding all TESAC and BATHY code forms, plus the BUOY code forms with more than one depth, was made a long time ago and should be revised going forward, since the practices in using various code forms have evolved with time. The large volume of possibly out of scope data (for GTSPP) makes the processing slower, more and more difficult, not to mention that it obscures the good data when users extract or request GTSPP data. Ouellet asked that GTSPP reconsider the scope of its GTS real-time data based on parameters available (temperature or salinity) and type of measurement (profile) (action 28). Mr. Boyer commented that the costal fixed buoys data are managed (and served) by NDBC and thus were safe to remove from GTSPP.

During the presentation it was noted that one of the standard monthly reports at OSD (called PreInt) had ceased to work, and a question arose about the necessity for the report to continue. The meeting agreed that it should (action 12).

5.3 FRANCE

Mr Petit de la Villéon presented the Coriolis data centre’s report on GTSPP activities for the period April 2012-May 2014 (since the last report was published in April 2012). Coriolis is a French partnership of 7 research institutes which focus most of its activity on in situ operational

oceanography. Between April 2012 and May 2014, 70 508 new profiles from 208 platforms where collected, controlled and distributed. The Argo profiles managed by Coriolis are not mentioned in this report. Most of the vertical profiles were performed on research vessels, ships of opportunity, gliders, sea-mammals and fishing boats. The fishing boats were not individually identified. IFREMER managed the sensors that may be deployed on different boats.

Data issued to GTS

All profiles processed by Coriolis are distributed on the GTS by way of Meteo-France. This operation is automatically performed. After applying the automatic GTSPP QC procedure, the profiles are inserted on the GTS every two (2) hours. GTSPP profiles are inserted on the GTS 365 days per year, 24 hours a day.

Data issued to US-NODC after real-time QC

The vertical profiles are available in real-time from MyOcean, a project granted by the European Commission, in-situ thematic assembly centre. These data are publicly available at http://www.myocean.eu. However, a registration is required (http://www.myocean.eu/web/56-user-registration-form.php)

Data issued for delayed QC

All profiles are visually controlled by a Coriolis operator. XBT are particularly scrutinized by the experts of SHOM (Service Hydrographique et Océanographique de la Marine), the French Naval Hydrographic and Oceanographic Service.

A total of 70,508 new profiles from 208 platforms are available in six meds-ascii data files located at http://www.ifremer.fr/co/gtspp/2014/.

The SHOM and IFREMER are working on a synchronization of their respective databases. The SHOM agreed to provide public CTDs and XBTs from national cruises and foreign cruises performed in French territorial area. It is expected that hundreds of thousands new public vertical profiles should be available shortly.

5.4 JAPAN

Mr. Hiroshi Ohno explained the activities of the GTSPP data product centre (GDPC) for the North Pacific Ocean operated by the Japan Meteorological Agency (JMA) via internet. For the period from April 2012 to March 2014, GDPC recognized 199 cruises by 33 ships as SOOP line observations, and no remarkable biases were seen in this period. The detailed status of each cruise is summarized in the Monthly Reports which have been issued since April 2012.

He also introduced the work plan for the period from 2014 to 2016. Since the real-time BATHY/TESAC messages include too much erroneous data to detect the biases included in the observations, GDPC plans to improve the bias detection procedure by using GTSPP best copy in the Monthly Reports for more precise investigations.

Discussions following the presentation highlighted the interest in seeing the differences detected between model and observation values and in particular where those differences are large. Ohno noted that the URL of the GDPC will be changed in the third quarter of 2014. It was also remarked that some of the monitoring taking place at the GDPC, in particular the counts of data along lines, would seem to overlap activities done at JCOMMOPS. There was interest in seeing what if any differences there might be.

5.5 USA

5.5.1 NOAA/NODC

Dr Sun reported that the U.S. National Oceanographic Data Center (NODC) continued to provide services for maintaining the GTSPP Continuously Managed Database (CMD), known as the GTSPP archive, during the GTSPP inter-sessional period 2012 – 2013.

The number of real-time data handled was 5,241,829 covering the period of 2012 – 2013, an increase of about 14% form the period of 2010 – 2011. The increase was coming from fixed buoy arrays (increased by 235,897 records) and profiling floats (increased by 7,850 records). The number of active real-time XBT messages in the CMD was decreased to 31,346 from 35,298 in the period of 2010 – 2011.

The number of the delayed-mode measurements added to the archive was 61,782 in 2012. In 2013, the sequestration of the U.S. Government funds and other near-term resource uncertainties caused the U.S. NODC tentatively suspended processing delayed-mode data. However, US NODC was able to resume the delayed-mode data processing and loaded about 5,341 profiles to the CMD in May 2014.

Both near real-time and delayed-mode, full resolution profiles of XBT's from the AOML's SEAS program were accessioned and archived at the U.S. NODC. Other delayed-mode data of full resolution profile data submitted by the Australian Bureau of Meteorology, Royal Australian Navy (RAN) Hydrography & Metoc Branch, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia and the Scripps Institution of Oceanography in the U.S were accessioned and archived as well.

The U.S. NODC also continued to assemble and disseminate the plain ASCII format version of the real-time profile data sets from the CMD three times a week and the netCDF and spreadsheet formats of the real-time data are populated on every Wednesday. Best-copy data are also assembled monthly, providing the most complete data sets of low resolution profiles and high resolution profiles without duplication. It is important to remember that these product files are not archived, as they are a reflection of a continuously managed and updated database.

The usage statistics of the GTSPP data transferred for 2013 increased to 1.850TB from 1.193TB in 2012; while the number of distinct Web hosts served was 14,252 and 19,629 in 2012 and 2013, respectively.

Dr Hall described the transition of the GTSPP database from Oracle to PostgreSQL . It was accomplished in three steps: Back-up from Oracle and copy to PostgreSQL (June 2013); Operating in parallel (August 2013); Oracle abandoned (February 2014). A new automated backup and update procedure runs once a week.

Previously, both Real-Time (RT) and Delayed Mode (DM) Database Ingest involved a lot of manual work (by Melanie Hamilton), and redundant operations for GTSPP and WOD. Matching was (and is now) done only within the GTSPP database, and external files of data retrieved from the database serve as the source of RT data to supplement WOD.

In the improved present data flow, the Archive and RT Database loading are now automated. DM data are still handled manually, GTSPP matching is still only within the GTSPP data schema, and WOD access to Real-Time data is still by way of GTSPP product files. In the planned future system, DM data will be ingested only into WOD, interactions between GTSPP and WOD will be facilitated, the match process will act on both databases, WOD will import

appropriate RT data directly from GTSPP, and data retrieved from both GTSPP and WOD will be served through the NODC Geoportal in netCDF format.

Interim manual loading of Delayed Mode data to GTSPP has resumed in recent months, with no significant problems encountered, with the exception of AOML-SEAS files, for which a possible processing flow scheme has been designed to allow WOD QC flags to be mapped to GTSPP. The advantages and disadvantages of this method were discussed.

Matching on the DM data loaded so far has found that a substantial number of Australian DM stations matched no RT stations, and none of the Australian CRC values matched between RT and DM. Almost 99% of the SIO DM data matched RT data by time and position.

5.5.2 NOAA/AOML

Ms Yeun-Ho Daneshzadeh reported that the global XBT network (Figure 1), formed by repeat transects recommended by the scientific community is a multi-national (US, France, Australia, South Africa, Brazil, Germany, Japan, Argentina, and Canada), multi institutional effort. There are 27 XBT transects that are maintained exclusively by NOAA AOML or by its US or international partners and in which AOML plays an active and continuous role in the deployment of XBTs, or transmission, data quality control, or data distribution of XBT observations.

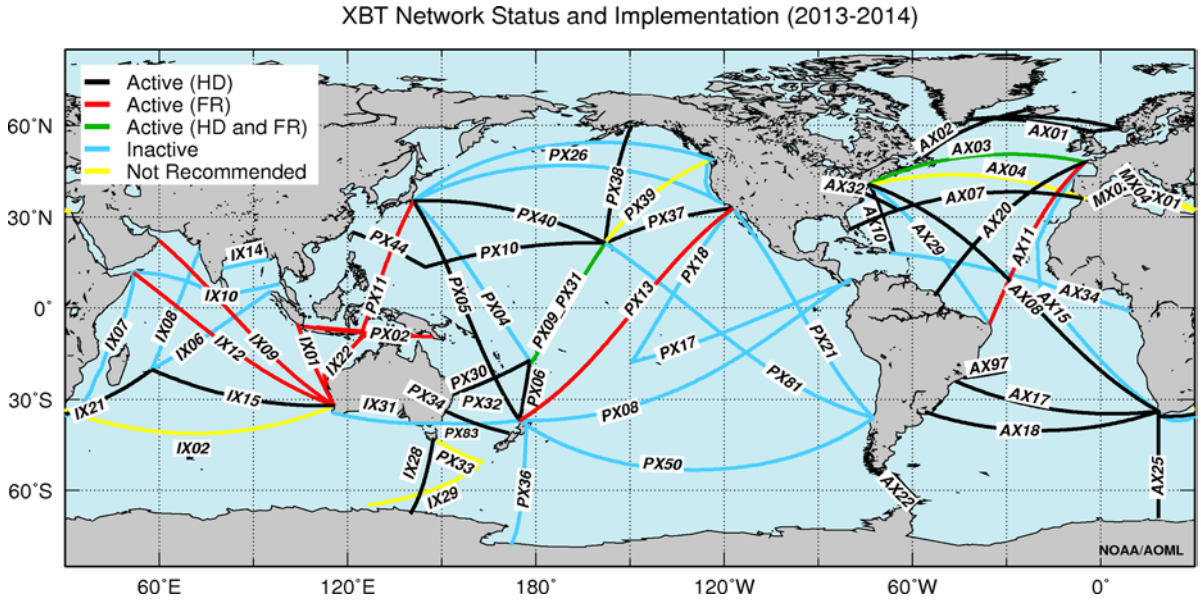

Figure 1 Location of the High Density and Frequently Repeated XBT transects implemented in 2013-2014.

All AOML and Scripps data are transmitted into the GTS 100%. Starting in Jan 2013, NOAA/AOML has been transmitting more than 15K XBT profiles in BUFR to the GTS. This process is independent of the transmission in BATHY format and includes: 1) Get the XBT Data; 2) Access the associated metadata; 3) Encode into BUFR; 4) Decode it to ensure the previous process succeeded; 5) Add bulletin header; 6) Send it to the GTS. Additionally we are retrieving the bulletins from the GTS to compare with the original ones and ensure the data flow is correct and traceable.

BUFR and BATHY data delivery to the GTS run in parallel. AOML is ready to stop TAC (Traditional Alphanumeric Codes) transmissions of XBT data once migration is considered finished and user requirements adapt to new regulations and formats.

AOML and Scripps XBT profiles undergo near-real time automatic quality control (AQC) procedures at AOML. The profiles that fail the AQC are submitted to visual quality control (VQC) using a MATLAB based code developed at AOML, in which a trained operator decides whether or not to send the data to the GTS. Probe failure (as measured by the AQC) remains consistently between 5% and 10% with greater higher failure rates at higher latitudes during winter months. Approximately 85% of the profiles that fail the AQC were approved during the VQC. Typically about 95% of all profiles are approved during the quality control process and submitted to the GTS. In addition, all the XBT data obtained are submitted to NODC for archival and distribution.

All Atlantic Ocean High Density XBT data collect by AOML or AOML partners undergo delayed mode quality control. For this quality control, bad profiles are identified, spikes are removed and profiles are evaluated for representativeness of the surrounding physical oceanography issues known for the region. For example, subsurface temperature inversions found near the high salinity/higher temperature Mediterranean outflow might fail automatic quality control procedures, but are perfectly acceptable, expected oceanographic profiles. Occasionally, some data are filtered to remove the small-scale unphysical electrical noise that can occur in the profiles. All modifications to the XBT profiles are logged and available via the AOML web site. Final quality controlled profiles are delivered to NODC for archival and replacement into the “Best Quality” GTSPP data set, typically with one-two months of the data being collected.

Major challenges and difficulties are:

a) Budget constrains in the US.
b) Limited budget available to contribute with probes and equipment to international collaborators.
c) Transect AX18 (Buenos Aires to Cape Town) continues to be a challenge as it is difficult to find and recruit ships doing this route.
d) Communicate to the scientific and operational communities the new goals of the XBT network given the full implementation of Argo.
e) Training people is also another issue that AOML encounters.
f) Delivering of the XBT pallets are also challenging task for a certain country.

6. IQUOD CONNECTION

Ms Rebeca Cowley explained that the International Quality-Controlled Ocean Database (IQuOD) Initiative aims to produce a freely-available, global subsurface ocean temperature profile (initially) database with uncertainties assigned to each observation. The IQuOD database will meet the exacting needs of climate variability and change studies, model assimilation and validation work and allow for separation of anthropogenic and natural drivers in climate modes of variability (ENSO, NAO, IOD, SAM etc).

The focus of the project will initially be on historical (pre-1990) temperature records, but will expand to modern data and other data types (e.g. salinity) in the future. The project is being developed with an international group of data users, producers, oceanographers, modellers and quality control experts. IQuOD will have internationally agreed-upon automated and visual QC methods that will be consistently applied to the database. Metadata rescue, data rescue and capability development (training in the IQuOD visual QC techniques) will also be an important part of the project. It is estimated that ~40% of all profile data will need to be visually QC'ed and this will be the most expensive and difficult part of the process. IQuOD will provide international standards for automated and visual QC of ocean temperature profile data and a template for future QC efforts. More detail can be found at: www.iquod.org.

Subsequent discussion noted there is great value in GTSPP cooperation with this initiative. action 21, 22) In addition, the meeting requested the Director of the IODE Project Office to contact the chair of IQuOD to seek the submission of a document to the next IODE meeting explaining the project (action 33).

7. REVIEW OF GTSPP QC TESTS AND ISSUES

Dr Ann Thresher described CSIRO DMQC processes. She noted that for Australia's XBT program, data are collected either by the crew (frequently repeated XBT lines) or ship riders (high density XBT lines). The full resolution data are either collected by a Port Meteorological Officer then sent to the Bureau of Meteorology (BOM) or the ship rider brings the data back to CSIRO. Data are then converted from the Devil or Quoll format to the CSIRO internal netCDF and loaded into MQuest for manual QC. All Delayed Mode QC is based on the CSIRO Cookbook – available on the web at either:

http://www.marine.csiro.au/~gronell/cookbook/csiro.htm, or,

http://www.marine.csiro.au/~gronell/cookbook/CSIRO_XBT_Cookbook.pdf

BOM and CSIRO use the Matlab-based software package "Mquest" to apply the Cookbook flags; CSIRO also applies DMQC to the RAN data.

The CSIRO philosophy is that:

a) DMQC should result in the best data quality possible
b) Every profile must be checked individually
c) Data should be flagged, not changed with some minor exceptions (short spikes where interpolation is acceptable, high frequency noise where filtering is effective)

CSIRO flags 'features' as well, using climatology, CARS (CSIRO Atlas of Regional Seas) to aid QC. All data are directly compared to buddies from the same voyage (+/-1,2 or 3 profiles) and can be compared to buddies from the same area (0.1 – 5+ degree circle radius) or time frame (year or month) – these can be from other databases including Argo profiles. Surface transients are removed (to 3.6m), faults and features are all flagged and the appropriate QC codes and flags then automatically applied.

This GUI (Figure 2) provides the ability to detect anomalous speeds (a warning shows at the bottom of the profile) or repeat profiles. It also allows a user to see and select metadata, other profiles and to detect bad data that might have been missed.

The basic rules followed are:

a) No good data should remain below bad data
b) A raw, unaltered copy is always kept
c) If data are changed, the original value must be kept in the history record
d) Every feature or fault flagged should have a 'reason' recorded in the history (a good place is needed to put this information)

Finally data are extracted to MEDS-ASCII or the database is tarred and zipped (for delivery in near real-time). CSIRO then submits these data, once a year, to partners and GTSPP/NODC. The meeting discussed a more frequent update of GTSPP/NODC and agreed to action 29.

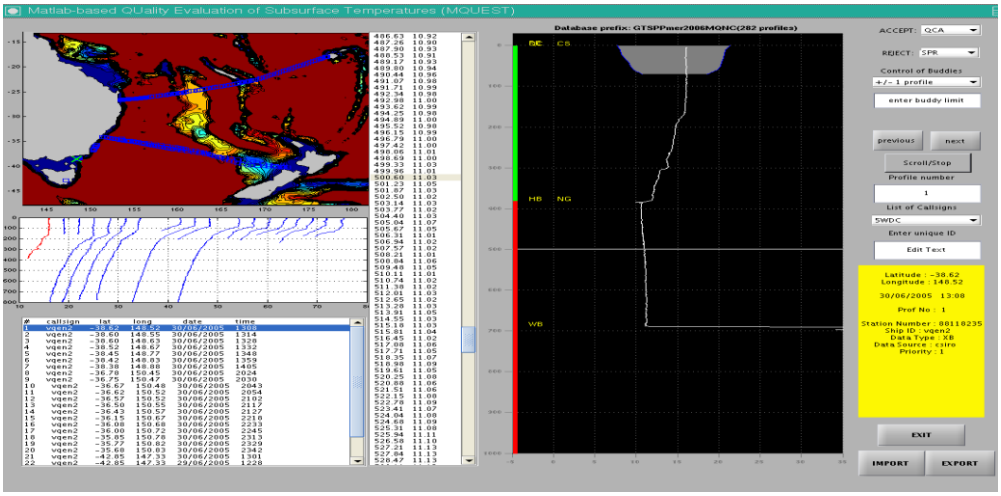

Figure 2 Screen shot of the Mquest

XBT Data Acquisition system tests by CSIRO were then described. After questions from the French Hydrographic office (SHOM), it was realized that the systems currently being used needed verification that their timing was correct. In other words, were the data being reported at the right depth or were points being lost somewhere in the profile? This was a problem initially with the MK12 which resulted in large offsets because points were dropped at the beginning of each profile. It was decided to test a SIPPICAN MK21 as well as the available TURO Devils and Quolls in the lab.

A box was built to switch temperature at known times and all available systems were tested. Results were mixed, giving small depth offsets for Turo system combinations, (though never more than 1.3 m and usually 0 or 0.7m) and larger, though consistent, depth offsets for the MK21 system (they show a slope of temperature transition starting more than 2m from the actual temperature transition and often reporting the new temperature before the box has actually switched). Subsequently, two more systems at SHOM were tested and produced similar results. Given that multiple Turo systems and 3 Sippican MK21 systems (as well as a MK12 system) have been tested these results are considered robust.

Both of these behaviours result in depth biases. The Turo software has now been compensated for the hardware offsets. CSIRO is in discussion with Sippican about the MK21 results. GTSPP and the XBT fall rate community will need to discuss how to deal with this issue in the archives and going forward.

The meeting took particular note of the importance of the XBT results and requested advice to be provided to NODCs who will attend the next IODE meeting (action 33). It also requested the appropriate group dealing with XBT issues be notified (action 32).

Ms Daneshzadeh explained that at AOML the automated QC was very similar to that executed by GTSPP and Argo. They used a comparison field, prepared by Baringer, to check the observations. They also used previously collected data on the same sampling line for comparison. She remarked that it is not uncommon to see temperature offsets from one station to the next. Delayed mode data are sent to NODC in 2 months after collection.

Mr Ouellet informed the meeting that OSD was handling some glider data, passing them through automatic QC and sending them over the GTS. A position and time for each “station” was interpolated from the start of the dive until it resurfaced. The down dive was used as the “profile” reported.

In subsequent discussions, a variety of other issues were raised. These include:

a) The testing at CSIRO has some differences to testing by other partners of GTSPP. It was felt that there is a need to standardize on at least a minimum set of tests.
b) NODC sometimes finds formatting problems in files. Usually these are dealt with by software patches at NODC. The meeting recommended that when such issues are encountered, the originator be notified so that they can effect changes (action 23, 31).
c) The meeting agreed on the use of a QC flag = “8” to indicate interpolated values. Documentation describing how to describe how the interpolatin is done, and if there is filtering need to be produced. The QC Manual and Data Users Guide will need to be updated to reflect this (action 24).
d) It was agreed to discontinue the use of Q_Record. For this point forward, the field should be filled with the “blank” character (action 25).
e) The “Update” field is not fully used by CSIRO. They agreed to make appropriate changes (action 30).
f) Sometimes, a measured value is removed, such as by CSIRO in the top few metres of an XBT profile) and replaced by a fill value, with the QC flag being set to “5” to indicate a change was made. Some users assume that a changed value means the new value is good. Documentation is needed to explain that a flag indicating a change may simply mean a fill value was added (action 26).
g) There is a need to assign different QCP, QCF codes for Argo data (action 3).
h) There is some reconciliation of platform identifiers needed between IFREMER , NODC and OSD (action1, 9)
i) IFREMER agreed to forward to OSD the data from CORA (Coriolis data set for ReAnalysis) on a regular basis (action 14).

Dr Sun remarked that he was interested in exploring the use of EOFs to help detect anomalous data (action 13).

8. REPORT ON BUFR FORMAT MIGRATION

Mr Trinanes reported that procedures to encode XBT profiles into BUFR format have been enhanced in order to more effectively integrate and manage metadata. Currently, every single profile collected at AOML and passing the QC is being put on the GTS in BUFR format and it is tracked from the pre-BUFR level to the GTS output. The latter is compared with the original bulletin in both its encoded and decoded forms.

AOML participated, in collaboration with the National Oceanography Centre (UK), in the validation of BUFR common sequence 3 15 007, for the representation of temperature, salinity, depth (CTD) and current profile data. This is one of the templates proposed by JCOMM in the context of migration to table-driven code forms.

Annual and semestrial XBT reports summarizing and documenting XBT deploying efforts by AOML are being generated along with other national and international partners. They are created using and combining profile information from multiple data repositories such as AOML, NODC and Coriolis.

Mr Ouellet reported that at OSD, decoding of BATHY equivalent BUFR messages was tested in 2013, variables were mapped to pcodes and MEDS-ASCII format. They are expecting to be operational by end of 2014. They will create a new STREAM_IDENT(3:4) code to identify these data. No attempt will be made at tagging equivalent BATHY vs. BUFR messages. Both streams will be sent to US-NODC.

Encoding of the BATHY equivalent and the TESAC equivalent proposed template was successfully tested. The next step is to require data originators in Canada to send more metadata and possibly data for transmission on the GTS. The current practice consists for them to send only the fields that usually go in BATHY and TESAC code forms.

IOS* header messages (these are the ones on the GTS that contain data in BUFR) are coming to OSD through Environment Canada's Canadian Meteorological Centre (Dorval, QC, Canada) via the Canadian Ice Service. IOB*, IOP* and IOZ* header messages are also coming because of other responsibilities that OSD are fulfilling.

From the IOS* messages, an average of 1500 BATHY equivalent BUFR messages are incoming per month from Japan (RJTD) and NWS NOAA USA (KWBC) nodes. The KWBC messages come with unknown bulletin headers IOSX01.

There are 1500 TESAC equivalent BUFR messages incoming as well, from Japan (RJTD) and NDBC NOAA USA (KWNB). The KWNB messages are arriving with unknown bulletin headers IOSX05.

Discussions noted that BUFR templates can carry much more metadata than BATHY and TESAC code forms. There was uncertainty if the exchange of data between GTSPP partners by using MEDS-ASCII was up to the task (see netCDF discussions later). It was also noted that Master Table 10 (MT10) devised some years ago was in need of updating because of changes in BUFR. If this is done, AOML is prepared to create a UML compliant description which eases the creation of BUFR messages using MT10 (action 10). The BUFR template for underway data, TRACKOB, has insufficient metadata and needs revision. This is a task to refer to GOSUD.

9. REPORT ON THE GTSPP GLOBAL DATA PRODUCT CENTRE PILOT PROJECT

Dr Ji of the National Marine Information and Data Service (NMDIS) in China gave a presentation on the status of the GTSPP Global Data Product Centre (GDPC) Pilot Project conducted by the NMDIS in 2013. The objectives of the GDPC Pilot Project were:

a) Produce monthly maps of optimally interpolated T-S fields,
b) Monitor the oceanic T-S condition in response to the climate changes,
c) Perform QA of the GTSPP data in NMDIS,
d) Provide initial and boundary conditions for ocean assimilations, and,
e) Provide reference data sets for ocean model skill assessment and/or data quality controls.

She described briefly the algorithm of the so-called Optimal Spectral Decomposition (OSD) method developed by the Naval Postgraduate School at Monterey, CA, and illustrated the procedure of using the algorithm to produce 1 x 1 degree gridded maps of ocean temperature and salinity fields. Figure 3 shows the gridded sea surface temperature fields, produced by the OSD, for the Indian, Pacific, and Atlantic oceans from left to right, respectively.

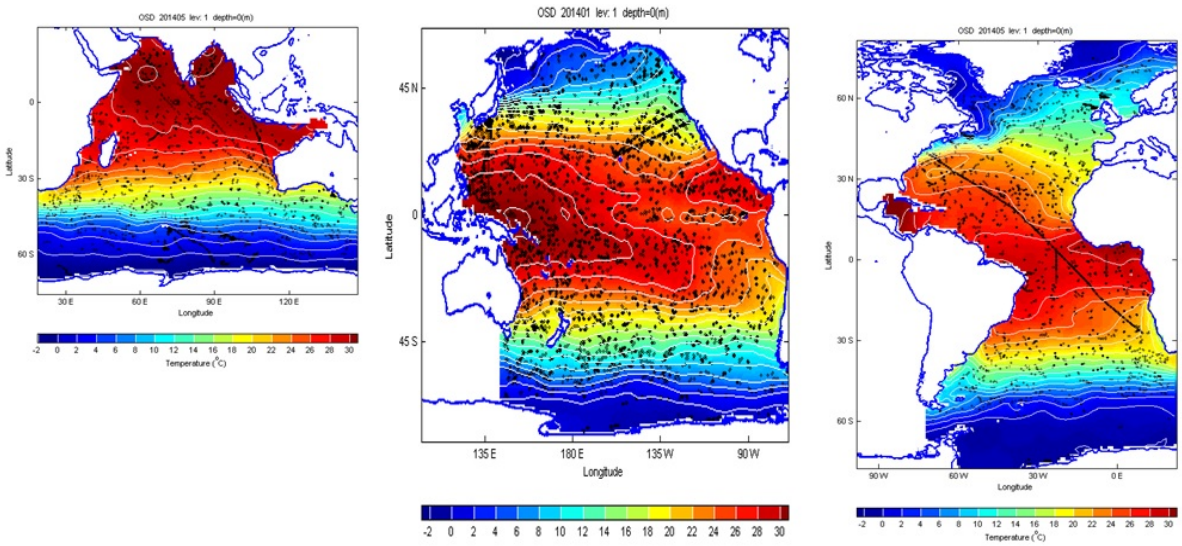

Figure 3. The sea surface temperature maps produced by using the method of optimal spectral decomposition for May 2014.

The discussion remarked that OI fields are also produced by OSD from real-time data, as does Coriolis. Participants wondered if a comparison of these differently derived fields showed significant differences with respect to those prepared by China. As well, the DIVA (Data-Interpolating Variational Analysis) software (by the University of Liege) prepared in the context of the SeaDataNet2 project. This uses variational techniques and a comparison to fields produced with this software could also be interesting. Finally, there is a technique called Optimal Spectral Decomposition that can also be used. Again a comparison would be of interest (action 35, 36).

10. REVIEW OF GTSPP TRAINING COURSE MATERIAL

Dr Sun reported that he informed the meeting participants that a set of the GTSPP training course material, which includes a set of presentation slides and the revised GTSPP data user's guide, were placed at the U.S. NODC's FTP site for group internal review prior to the meeting. The targeted audiences include, but are not limited to, the following:

a) Marine and coastal scientists,
b) Oceanographic data managers,
c) Academic professors,
d) Government officers,
e) Environmental scientists with knowledge of essential marine parameters, and,
f) Students in the oceanographic or meteorological sciences.

The Web pages designed for the GTSPP training course are available at http://www.nodc.noaa.gov/GTSPP/training/.

11. GTSPP DATA FORMAT REVISION

Dr Sun explained that a new data distribution form (V4.1) of netCDF was going to be used in the plans of merging WOD and GTSPP data bases. The meeting noted that it wanted reassurance that all of the information currently contained in the GTSPP format was contained in this new form and would be preserved in the merger.

After much discussion, and noting that the MEDS-ASCII form was challenged by the increasing metadata content, particularly as a consequence of new BUFR templates, it was decided that a netCDF V4 format should be devised for data exchange between GTSPP partners. A netCDF V3 form should continue to be used for distribution to GTSPP users since the tool set was limited for V4 and was less well understood (action 5, 6).

Contents of the netCDF forms should:

a) be able to contain calibration information
b) references and use of existing WMO or other code tables where possible – do not invent new ones.
c) Common variable names across GTSPP, GOSUD and OceanSITES should be used whenever possible (action 37).
d) AOML was revising their data base and their developments should be reviewed to ensure all metadata content was preserved in the new netCDF forms (action 17).
e) OSD to complete the mapping of existing pcodes used in the present GTSPP format to netCDF variable names (action 18).
f) Surface ocean and meteorological variables should be added into the net netCDF format (action 38).
g) a common way to identify data providers between GOSUD, OceanSITES and GTSPP be accommodated (action 39).
h) Existing MEDS-ASCII fields for Q_Record, Deepest_Depth, Iumsgno, Mkey, One_Deg_Sq can be dropped.
i) Include a “raw” profile type (see earlier discussion)
j) Support a fill value and a missing value in the format.

12. GOSUD, OCEANSITES, WOD CONNECTIONS

Dr Hall provided information about the pending merger of WOD and GTSPP operations. This is an internal NODC matter. From a GTSPP perspective, the project must be confident that there will be no negative impacts on GTSPP operations and objectives. Sun remarked that he wanted surface ocean and meteorological variables included in a netCDF distribution format and a common naming of variables between the programmes (see bullets above).

Mr Tim Boyer reported that the U.S. NODC has constructed a PostgreSQL database to take over the duties of the GTSPP CMD. This PostgreSQL database was constructed so it could also accommodate the WOD. GTSPP CMD and WOD would not be part of the same database, but they would share the same architecture. In order for WOD to inhabit the PostgreSQL architecture, this architecture would need to become the input/output for all of the software built up over the years for performing quality control, data searches, and calculations within WOD. Work on connecting GTSPP data architecture to the WOD software was delayed for about 6 months. This delay was caused by a needed switch of WOD software to work with the GNU gfortran compiler (replacing the outdated g77 compiler). This switch was completed in April, 2014. Once the GTSPP CMD’s architecture is set up as the input/output for WOD software, tests will be performed to see if the speed of the architecture input/output is sufficient to realistically support WOD operations. If it is, the next phase, movement of WOD to the PostgreSQL database will commence.

Inhabiting the same database structure does not mean WOD and GTSPP are integrated. Both WOD and GTSPP have unique requirements. For instance GTSPP must retain history records with conversion routines and quality control routines used. Further GTSPP retains codes, such as originators database identifiers, which are not always kept in

WOD. These are just two examples. So, if WOD and GTSPP are not integrated by inhabiting the same database, they can still be integrated from a user's perspective.

The U.S. NODC is working on a system whereby a 'best copy' of ocean profile data will be virtually constructed on demand. This will be accomplished through the NODC Geoportal and THREDDS server. When a user comes to NODC and asks for 'subsurface temperature data' through the geoportal (with any other subsetting requests, such as geographic area), they will be returned a choice of 'best copy', 'WOD', 'GTSPP', 'Argo', …, individual data submissions, where … denotes other large data sets of note with instituted quality control and format requirements (i.e. OceanSITES). Individual data submissions will be all data packages sent to NODC regardless of quality control or format specifications. The best copy will be constructed from all data unique to WOD, GTSPP, Argo, etc. and any overlapping data will be added based on an algorithm – for example, all Argo float data from Argo, all historical data (excluding Argo) from WOD, all data since last update of WOD from GTSPP. In this way, a user will not need to know the details of the individual datasets; they will receive the 'best copy' based on the setup algorithm. If they specifically want GTSPP data, they can choose that instead, or any other specific dataset. For those datasets which are in netCDF, the 'best copy' will combine the requested data together and deliver as a download or directly to a user's application. At this point, and for the GTSPP steering group meeting, a demonstration of this concept will be shown. The demonstration will only include WOD and GTSPP 2014 data. Progress toward realization of the concept, and to realization of integration of WOD and GTSPP will depend on NODC resources.

With respect to OceanSITES, this was the most challenging since it encompasses biological and chemical data as well as physical oceanographic data. NDBC and IFREMER/Coriolis are GDACs for OceanSITES, and NODC operated the long term archive. It is well placed, therefore, to marry concerns across all programmes (action 15).

13. GTSPP FUTURE PLAN

Dr Sun had prepared a draft document of a future plan for GTSPP. The meeting requested that this be finalized and distributed (action 41). Considerations for content should include the following.

a) Inclusion of glider data in GTSPP archives. If included, how are profiles constructed from the diving and rising trajectories of gliders. Also, how does GTSPP pursue glider data when the various groups using them. Also should real-time profiles from these platforms be encouraged?
b) CTD data from Australia should come to GTSPP not just to CCHDO.
c) Ensure that the criteria for inclusion of data in GTSPP are clear.
d) Collaboration with IQuOD should be mentioned.
e) Consider training material and its placement in OceanTeacher at IODE
f) Comment should be included about the importance of GTSPP helping data centres be closer in contact with data collection community and research groups.
g) Remark that GTSPP provides an easily accessible window for oceanographers to real-time data transmission on the GTS.
h) Provide an updated diagram of contributors, users.
i) Ensure comments are made about the unique contribution of GTSPP in today's data management environment.
j) Data should receive a DOI (action 40)

In general terms the meeting noted that some web pages needed revisiting and updating of content (action 11), and that the URL of www.gtspp.org needed to be renewed (action 16).

14. REVIEW OF ACTION ITEMS FROM THE MEETING

The meeting reviewed action items formulated during the meeting and carried over from the previous meeting. These are listed in Annex III of the report.

15. ADOPTION OF THE WORKPLAN (2014–2016)

Dr Sun noted that the GTSPP future work plan shall cover 2017 in order to be in line with the IODE-XXIII work plan. He anticipated that the GTSPP will conduct the action items (Annex III) from the meeting during the next inter sessional period and continue its functions including, but not limited to,

a) Real-time data acquisition from the Global Telecommunication System,
b) Submission of the delayed-mode data from the GTSPP participants,
c) Providing data services by the U.S. NODC and the OSD in Canada,
d) Publishing the description of the CRC method of deriving a unique identifier,
e) Preparation of GTSPP training courses,
f) Convening an ad hoc GTSPP netCDF exchange format working group meeting in conjunction with other meetings such as Argo and IQuOD in 2015, if necessary,
g) Working with the IODE/JCOMM Ocean Data Standard and Best Practice (ODSBP) Programme to publish the GTSPP CRC document in 2015, and,
h) Publishing the GTSPP Continuously Managed Database (CMD) system document in 2017.

16. CLOSING OF THE MEETING

The meeting was closed at 15:00 on 20 June 2014. The next meeting is expected to be held in June 2016.

ANNEX I

LIST OF PARTICIPANT

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ANNEX II

AGENDA

1. OPENING OF THE MEETING
1.1 Welcome
1.2 Meeting arrangements
1.3 Adoption of the agenda
1.4 Designation of rapporteur

2. REVIEW OF ACTION ITEMS FROM THE 2012 (FIRST) MEETING

3. REPORT ON GTSPP ACTIVITIES 2012 – 2013

4. REVIEW OF THE GOVERNANCE OF GTSPP

5. NATIONAL GTSPP PROGRAMME SUPPORT
5.1 AUSTRALIA
5.2 CANADA
5.3 FRENCH
5.4 JAPAN
5.5 USA

6. IQUOD CONNECTION

7. REVIEW OF GTSPP QC TESTS AND ISSUES

8. REPORT ON BUFR FORMAT MIGRATION

9. REPORT ON THE GTSPP GLOBAL DATA PRODUCT CENTRE PILOT PROJECT

10. REVIEW OF GTSPP TRAINING COURSE MATERIAL

11. GTSPP DATA FORMAT REVISION

12. GOSUD, OceanSITES, WOD CONNECTIONS

13. GTSPP FUTURE PLAN

14. REVIEW OF ACTION ITEMS FROM THE MEETING

15. ADOPTION OF THE 2014 – 2016 WORKPLAN

16. CLOSING OF THE MEETING

ANNEX III

ACTION LIST

No.	Action	Who	Target Date
1	Compare list of platforms identifiers and resolve any problems that are found	OSD, NODC/WOD	Aug 2014
2	Historical TAO data to be assembled from DBCP web sites and incorporate in GTSPP – WOD merging activities at NODC	NODC	Next meeting
3	Generate new surface code of QCP and QCF for Canadian Argo TESAC messages. The Argo data in the CMD will also need to be changed to use the correct surface code.	OSD	Next meeting
4	Develop a draft GTSPP exchange format in netCDF-3 that addresses as many weaknesses in MEDS ASCII as possible. (Implement new variables for depth/pres, temp, psal called <PARM>_raw, in new netCDF exchange format of GTSPP)	OSD (lead), CSIRO, AOML, NODC	Dec 2014
5	Document, adopt and implement use of netCDF for GTSPP data exchange among partners	GTSPP	Follows after item 4 completed.
6	Develop a GTSPP exchange format in netCDF-4 that solves the problems of netCDF-3 (resulting from one unlimited dimension)	AOML (lead)	Next meeting
7	Report on BOM deployment of new XBT recorders with corrected CRC calculation.	CSIRO	Next meeting
8	Update QC documentation (as required) and provide copy to Chair for preservation of all versions.	CSIRO, OSD, AOML, NODC, IFREMER	Next meeting
9	OSD to send to IFREMER a list of previous EXGL* (glider) and IF* (mammal) TESAC messages with coordinates in order to replace the platform identifier with WMO number when possible and identify duplicates	IFREMER (lead), OSD	Jan 2015
10	Request Dave Berry of JCOMM TT-TDC to update MT10. Follow this as appropriate with UML compliant form.	AOML	Jul 2015

11	As required, revise GTSPP web pages offered by SG members and create a home page at IODE-PO considering suggestions and comments from SG members.	Chair (lead), IODE-PO, CSIRO, OSD	Next meeting
12	Run monitoring software on a monthly schedule to track observation availability in CMD.	OSD	Sep, 2014
13	Consider the use of EOFs as a way to identify suspect profiles.	Sun	Next meeting
14	Start delivery of CORA data set to GTSPP	IFREMER	Aug 2015
15	Determine how to include data from OceanSITES into the archive at NODC	NODC, WOD	Next meeting
16	Renew www.gtspp.org.	IFREMER, NODC	Aug 2014
17	Report on database development with SG to ensure all their needed attributes are also appearing in GTSPP exchange format.	AOML	Next meeting
18	Complete task of displaying the mapping between existing pcodes and other code fields to (new) netCDF variables using more descriptive names and clear definitions.	OSD (lead), NODC	Next meeting
19	Chair to review membership on discussion group mailing list and an issue tracker for GTSPP.	Chair, IFREMER	Aug 2014
20	AOML to implement inclusion of CRC values to NODC in data submissions in new exchange netCDF format (related to item 4)	AOML	Jun 2015
21	Include collaboration activities with IQuOD in GTSPP work plan for presentation at IODE-23	Chair	Dec 2014
22	Encourage and assist IQuOD to present description of activities and recommendation to IODE to become an IODE project.	Chair	Dec 2014
23	Send noted user “error issues” to GTSPP partners and partners resolve them	Chair, relevant partners	Next meeting
24	Document meaning and implement use of QC flag “8”	GTSPP Group	Dec 2014
25	Document and implement discontinuance of use of Q_Record by GTSPP (fill in as a blank character)	Chair	Dec 2014

26	Update the GTSPP data user's manual to inform the GTSPP users if QC=5, check the value of variables is not missing value.	NODC	Dec. 2014
27	Steering Group (SG) to specify and document conditions to be met for membership on SG	Chair (lead), SG	Next meeting
28	Develop criteria for data on the GTS to be included in GTSPP data stream (e.g. proximity to coast, one or no T or S at depth, new platforms such as gliders, ...)	OSD (lead) NODC	Dec 2014
29	CSIRO, IFREMER to send data immediately after update	CSIRO (lead), NODC, IFREMER	Next meeting
30	CSIRO to consider and implement as appropriate use of the "Update_Flag" field to the MEDS ASCII to distinguish updates, deletes, replace actions	CSIRO	Next meeting
31	NODC to report list of "peculiarities" in CSIRO data submissions so that these can be fixed	NODC, CSIRO	ASAP
32	Report apparent recorder problems discovered by SHOM to SOT and to appropriate "XBT fall rate group"	CSIRO	ASAP
33	Coordinate with IQuOD Chair to request "XBT fall rate group" to prepare document for IODE of the recorder problem and suggested instructions to NODCs of important additional metadata to assemble with submitted XBT data	Chair	Dec 2014
34	Contact NMDIS to re-convene the regional GTSPP training course in Tianjin in Fall 2015	Chair	Aug. 2014
35	Contact NMDIS to continue the GTSPP GDPC pilot project and creation of the global temperature and salinity fields.	Chair	Aug. 2014
36	Conduct a comparison of available OI fields, variational technique of DIVA with Optimal Spectral Decomposition (OSD)-derived fields produced by NMDIS	NMDIS (lead) with assistance from IFREMER	Next meeting
37	Use common netCDF names in global attributes of GTSPP, GOSUD, OceanSITES netCDF fields	Sun	Dec 2014
38	GTSPP add surface ocean and met variables into netCDF data files (insert in exchange format item)	OSD (lead), CSIRO,	Follows after item 4

		AOML, NODC	completed.
39	GOSUD, GTSPP, OceanSITES working group to agree on how to identify data providers (institution codes) in netCDF in common way (dependent on new netCDF format)	Petit de la Villeon, Cowley, NODC	Dec 2014
40	NODC implement creation of GTSPP with a DOI (include GTSPP as part of the DOI)	NODC	Next meeting
41	Complete and publish revision of GTSPP Future Document	Sun, Keeley	Dec 2014