INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

Joint IODE-JCOMMON Steering Group on
Global Temperature-Salinity Profile Programme
Oostende, Belgium, 5 - 7 May 2010

Annual Meeting Report 2010

By Charles Sun

1. Opening of the session

The session opened at 1400 on 5 May 2010 at the Intergovernmental Oceanographic Commission (IOC) of UNESCO Project Office for International Oceanography Data Exchange (IODE), Oostende, Belgium. Dr. Charles Sun of the US National Oceanographic Data Center (NODC) chaired the meeting and welcomed participants (Annex 1). The local host, Mr. Peter Pissierssens, Head, IOC Project Office for IODE, explained the local arrangements.

Charles said that the meeting would have two sessions in the morning and afternoon with tea breaks and a lunch break around 12:00 pm and adjourn at 5:00 pm on Wednesday and Thursday and 3:00 pm on Friday. Dr. Ann Gronell Thresher and Mr. Bob Keeley would co-chair with Charles. Charles also said that several people would be absent from the meeting so agenda would be adjusted. He then introduced the provisional agenda to the group. The meeting participants adopted the final agenda (Annex 2). Ann was designated rapporteur.

2. Status of GTSPP

2.1. GTSPP Chair's report

Charles Sun gave the Chair's report. He reported that the purposes of the meeting were: A) Collaboration toward standardization of quality control procedures within the Global Temperature − Salinity Profile Programme (GTSPP), B) Exploring the feasibility of adapting objective analysis (OA)-like in RT QC test and applying the OA-like method for retrospective analysis of monthly T & S fields, C) Studying the requirements of serving the GTSPP data via the IODE Ocean Data Portal and/or WMO Integrated Global Observing Systems (WIGOS), D) Discussion on providing lectures on how to use the GTSPP data for the IODE training courses, and E)Seeking opportunities of cooperation among GTSPP, GOSUD (Global Ocean Surface Underway Data) and INIDEP (Instituto Nacional De Investigacion Y Desarrollo Pesquero; in English, National Fisheries Research And Development Institute).

Responding to the IODE's requests, he said that other topics for discussion would be products and how do we serve the GTSPP data via IODE OPD (Ocean Data Portal) and WIGOS. IODE wants to do training on how to use the GTSPP data and GTSPP needs to provide advice and help with these courses. He emphasized that, at the very least, a manual is required.

Charles debriefed the participants on the activities of GTSPP after the 20th session of IODE. The activities were: attended the Joint WMO-IOC Technical Commission on Oceanography and Marine Meteorology (JCOMM) Ship Observations Team meeting in May 2009, published a GTSPP community white paper and gave a poster presentation at the OceanObs'09 conference, which was held from 21 – 25 September 2009, Venice, Italy, hold an ad hoc GTSPP meeting in conjunction with the Argo data management team annual meeting in Toulouse, and completed a GTSPP annual report to the 2010 Session of the IODE Officers Meeting. The report summarized work plans from March 2010 to March 2011.

Discussions/Questions – Charles emphasized a formal citation for GTSPP data – currently users can only cite the web page. He reported that it is so hard for NODC to determine who is using data and how many. Loic reported that Coriolis uses data as well as provides the data – and they also serve the data to Mercator, and others. They use GTSPP to complete their data.

Mathieu Ouellet reported that ISDM (Integrated Science Data Management, Canada), formerly known as MEDS (Marine Environmental Data Service, Canada), monitors data volume, number of visits and data files downloaded, but information of where people is sensitive information and it is not clear whether it can be used. This could be one way to promote GTSPP. NODC has experience in this, so Charles will work with Mathieu Ouellet to create a useful product. We need to define what we need before we can build this. Bob reminded people that GTSPP and its data is in quarterly report for JCOMM so it's one product we already provided. Perhaps the data needs to be tagged as GTSPP instead of just in there anonymously. Mathieu Ouellet said that he has been tasked to find new sources of data for the portal and will talk to Charles about this offline.

Gopal asked if anyone has experience on how XCTD data were processed and if there is a standard procedure for doing it? The National Institute of Oceanography (NIO) of India manages it but doesn't have requirements. Lisa Lehmann said that Professor Dean Roemmich of Scripps Institution of Oceanography deployed 2 or 3 XCTDs pre transect but not many. NODC reported that they treat it as they treat CTDs

2.2. Data Assembly Centres Operating Issues and Concerns

Bob Keeley reported that volume of data through GTS from animals was increasing so 3-4 times the volume of data from XBTs. The animal-tagged data can't be distinguished from Argo or XBTs except for subtle differences. We need to use those differences to highlight the volume and sources of data from these animals. 31K Argo, 2700 XBTs, 9200 animal CTDs – significant and we need to acknowledge and separate that data out. GTSPP/NODC will work on it.

Thierry reported there are other sources too like fishing vessels, etc and no correct way to separate these from other observations. We need new WMO instrument codes for these. Mathieu Belbeoch wants to invent new method to identify data but Bob wants to retain table and that makes more sense. Mathieu Belbeoch doesn't want to keep asking WMO for new codes but Mathieu Ouellet pointed out that CTDs are one code only though XBTs have many codes. And animal recorders don't identify CTD types. We basically need to ask for more codes, not abandon the codes altogether. Maybe this isn't a table that's meant to be universal or used for anything other than real time data. It's a general code, not specific enough to be used for everything. The table is mixed and has grown and probably hasn't been particularly well populated beyond XBTs. What is the purpose of the table is needed to be defined. Once we define that, we can decide whether it works or needs to be updated. Bob would rather build on what we have than create something new. The question is whether we should add vocabulary or do something else. Is it just that it takes so long to get the codes? Once we have a code, we can update the data base. But it always comes after the data is delivered, not before so we're catching up after the number is created. How do we sort out the tables which have old, unused codes and redundant codes?

Greg Reed reported on the JCOMM activities. The JCOMM Pilot Project for WIGOS aims to integrate marine meteorological and other appropriate oceanographic observations into WIGOS. WIGOS is the WMO Integrated Global Observing System that will provide a single focus for the operational and management functions of all WMO observing systems and WMO co-sponsored observing systems. One of the key deliverables of the JCOMM Pilot Project for WIGOS is the documenting and integrating of instrument best practices and related standards among the marine meteorological and oceanographic communities through a JCOMM Catalogue of Practices and Standards. The Catalogue is on line at http://bestpractice.iode.org/ and has identified 62 documents which need to reviewed by relevant experts to identify deficiencies, duplication, discrepancies, potential for cross-referencing, and to make recommendations to address those issues. GTSPP can assist by reviewing the document*"GTSPP Real time Quality Control Manual*" published by IOC in 1990. Other documents which can be reviewed by the GOSUD group are *"Users guide for a thermosalinograph Installation aboard a ship"*published by IRD in 1999 and *"WOCE-SSS User's Manual"* published by IFREMER in 2002

3. Cooperation with GOSUD

3.1. Explore inclusion of GOSUD Sea Surface Salinity/Temperature in GTSPP

Cooperation between GTSPP and GOSUD to intake salinity data – Charles suggests we add GOSUD best copy data in GTSPP. Whatever that is and it will be defined by GOSUD what best copy means. GTSPP needs guidance from GOSUD. But Tim doesn't see it as part of GTSPP mission. Tim thinks best place for SSS is elsewhere. Norm points out that it will fit at this point at least. Bob – if we add SSS GOSUD data into GTSPP then we usurp GOSUD's role. Maybe we need to harmonize delivery to allow it to be easier to pull both types of data from different sources. Otherwise are duplicating effort. But Charles would like to serve salinity data of all types and all sources – we need common interface to allow data to be served from one site from both sources and both groups use similar methods. Thierry pointed out that NODC can do this but it's not role of GTSPP. But Charles acts in two roles and they overlap. Tim doesn't want either WOD or GTSPP to serve SSS data. Errors are larger, data is basically different. ICOAS can serve it better, perhaps. This should be discussed in the future.

Mathieu Ouellet reported that ISDM has been integrating TRACKOB streams with other real-time streams in real-time objective analysis by using the In-Situ Analysis System (ISAS) developed by IFREMER. All TRACKOB underway thermosalinograph measurements are assigned an arbitrary depth of 3 m. The contribution of TRACKOB to the reduction of the a priori error variance (see Bretherton et al. 1976 for definition of quantity) using the correlation scales defined in ISAS is on average 0.3% over the whole Mercator grid (limited to 77ºN and 77ºS), and as high as 83% along the ship tracks. The objective analysis also reveals temperature or salinity offsets that may not be picked by the real-time GOSUD tests. In November 2009, a ship stopped its transmission of temperature on the GTS after ISDM notified them of an instrument malfunction.

3.2. Common Data Distribution (NetCDF) Format Attributes

The Climate-Forecast (CF) convention does NOT have standard way to name variables so we may be free to follow Argo. But Argo needs to add standard names attribute and everyone can then use the same structures/conventions.

GTSPP NetCDF files have different parameters and attributes/units. We need list of parameter names with different units for different names, perhaps. The attributes are the key – to hold units, or whatever. Need to look at BODC names too. Issues here are with level of detail and along with things missing.

T standard – is it ITS-90 now? Attribute called reference that lets you store the convention – ITS-90 or whatever. We should incorporate this in our new NetCDF. This will also be issue for salinity with TEOS 10.

Bob or successor to look at BODC names and may be able to guide us in this. Chair will ask again in 6 months for progress.

4. Cooperation With INIDEP

4.1. Status Report on the Aquarius/SAC-D Mission: Raul Guerrero

The Aquarius / SAC-D mission being developed by NASA and Argentina Space Agency – CONAE (Comisión Nacional de Actividades Espaciales; in English National Space Activities Commission) is the first satellite mission specifically designed to provide global view of salinity variability needed for climate studies. The objectives of the mission are to: A) Provide sea surface salinity (SSS) observations of the global ice-free ocean; B) Deliver SSS maps over a 3+year, with a 150 kilometer resolution; and C) Provide monthly global maps of SSS with an accuracy of 0.2 psu.

Raul presented the project: '*SSS variability in the South Western Atlantic using Aquarius data and in situ observations'* (funded in the framework of the '*Joint Process to Select an International Science Investigating Team for the Aquarius/SAC-D Observatory')*, Within this project, a plan that involves the developing of an operational system for real and delayed-time quality control, processing, storing and dissemination of TSG surface data has been presented. GTSPP, as proposed partner in the Aquarius project, offered help in emulating our actual CTD system data string to TSG data.

4.2. Areas of Common Interests of INIDEP and GTSPP: Raul Guerrero

INIDEP is the National Fishery Research Institute in Argentina. The Physical Oceanography Group (POG) primary task is the study of the environment and its relation to distribution, abundance and fluctuations of fishery stocks. In this framework the group is responsible for the organization and storage of the acquired oceanographic data. With three research vessels we monitor the Argentinean Continental Shelf and adjacent regions collecting mainly CTD and TSG data during 450 to 600 days per year. POG has implementing a standard protocol in the acquisition and processing of data throughout a system that compile and safeward Oceanographic Variables (SIAVO). The system synchronize land and on board terminals and perform header quality control tests. Delayed QC procedures are applied on individual profiles using the QCed module developed by the GTSPP (NOAA- NODC) group. Afterward QCedited TS profiles are stored and managed in a MS SQL-Server database, the Regional Oceanographic Data Base (BaRDO).

Up today, BaRDO has 29500 oceanographic stations, from which 20000 are from INIDEP research cruises (mostly with CTD). 3400 INIDEP generated stations corresponding to the period 1969-1992, are available for the scientific community at ftp://www.inidep.edu.ar/oceanografia.

The short and midterm goals of the group are, finish the QCed new version adapted to our requirements of lower thresholds, local climatology and bathymetry, and develop data and products outputs in different output formats. This goals are been planned with GTSPP group as a training exchange on software enhancement.

5. Standardization Of Quality Control

5.1. Atlantic Ocean QC : Molly Baringer

Molly Baringer reported on the activities of NOAA/AOML high density (HD) lines of the XBT network. HD data is collected and sent to Silver Spring for distribution. AOML performs real-time QC on the data and submits onto GTS. AOML performs a visual QC on all High Density XBT profiles. Scientific QC is completed with salinity estimated and dynamic height calculated for AOML format files. Raw and QC'd data are kept in *.NDC format and AOML format and distributed via www. Visual QC performed on the following tests: speed, position, time & date, gross test, constant, spike, jump, duplicate, regional range, Levitus climatology test, local climatology test, and bottom check. Comparisons between AOML HD QC, AOML Argo QC and CSIRO Argo QC were discussed.

5.2. Indian Ocean QC I: Ann Gronell Thresher

Currently, all Australian partners, Royal Australian Navy (RAN), Australian Bureau of Meteorology (BOM) and CSIRO Marine and Atmospheric Research (CMAR), use Devil systems to collect XBT data in Australia. Data is QC'd on board using automated routines, then delivered in real-time via either Iridium or Argos. Bathys are created and put on the GTS automatically when the ships are at sea. Data is then retrieved from the ships and returned to the home institute for Delayed Mode Quality Control (DMQC).

All QC based on the CSIRO Cookbook (available on the web at:
http://www.marine.csiro.au/~gronell/cookbook/csiro.htm
or
http://www.marine.csiro.au/~gronell/cookbook/CSIRO_XBT_Cookbook.pdf

BOM and CMAR use the software package "Mquest" to apply the cookbook flags and CMAR is taking over QC of the RAN data so all data from Australia will be consistent in treatment, format and QC.

DMQC follows the principles of scientific data QC established under WOCE. Every profile is looked at individually and compared to the CARS climatology. It is 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), including Argo buddies. Surface transients are removed (to 3.6m) and then faults and features are all flagged. The appropriate QC codes and flags are then automatically applied. This is all visible in the Mquest GUI.

Our philosophy is that DMQC should result in the best data quality possible. This means every profile must be checked individually, data should be flagged, not changed, a raw, unaltered copy is always kept, no good data should remain BELOW bad data and every feature or fault flagged should have a 'reason' recorded in the history.

In addition, metadata must be complete, particularly with regard to fall rate coefficients and serial numbers, we should all use a common quality flagging scheme (0-9) and histories should be documented, descriptive and understandable with minimal look-up tables.

Work into the future should include proper QC of all data collected from now, data collected since WOCE must be QCd to WOCE standards and we need to think seriously about the historical data that remains a largely un-QCd resource. There are procedures available to help with the latter process but resources are limited and we need to identify partners for the proposed "CLIVAR Ocean Reanalysis Dataset" (or whatever it ends up being called).

5.3. Indian Ocean QC II: V. V. Gopalakrishna

Gopal reported on the status of XBT / XCTD data collections along a few shipping lanes in the sea around India at monthly / fortnightly intervals. At all these XBT stations the National Institute of Oceanography (NIO) also collects sea surface salinity data in addition to the routine surface meteorological parameters. In addition to the regular XBT transects, NIO also deploys XBTs and collects sea surface salinity data whenever an opportunity arises in their other research cruises. NIO has learned the QC procedures for the XBT data at GTSPP Group at NODC (Charles Sun group) and quality controlled Indian XBT/XCTD data following those procedures and submitted the Non – EEZ data to NODC GTSPP group. NIO conducted four cruises onboard its research ships and collected XBT / XCTD & CTD data sets simultaneously at several stations in the Bay of Bengal and also in the Arabian Sea. Using these simultaneous data sets NIO has examined the temperature bias / fall rate equation validity for the Indian Seas. This is a collaborative research work with Tim Boyer (NODC) and Franco Reseghetti (Italian Scientist). The research outcome is formulated as a scientific paper and communicated to the Journal of Atmospheric and Oceanic technology (JAOT).

5.4. Pacific Ocean QC I: Lisa Lehmann, Dean Roemmich, and Glenn Pezzoli

The SIO HRX Program deploys over 6000 XBT's per year, as part of the global HRX partnership. We believe data quality begins at sea. We deploy from a stern-mounted auto launcher which can be re-positioned according to conditions. We do routine calibration of all

equipment to quickly identify problems. We have experienced ship-riders onboard to oversee data collection to diagnose and fix problems rapidly. We use immediate automated profile to profile checking to alert ship-rider to failures and unusual features for quick re-drops.
SIO delayed mode quality control consists of reading the ship-rider report to understand the cruise conditions. We check for and remove false splashes (aka Premature Launch). We re-navigate the drop position based on previous and post averaged GPS locations. We re-edit the data. It's important to understand in high resolution XBT transects that the neighboring profiles are the best source of QC. Climatology developed from our HRX transects is then used to look at profile quality. Buddies (profiles from previous cruises along same line within a selected space range) are looked at to determine if particular features are real. Knowledge of regional oceanographic features is also used to determine if particular features are real.

High Resolution XBT transects and Argo are a valuable combination scientifically for estimating the time-varying heat transport and storage in large ocean regions. Argo will be useful in quality control of HRX data by providing global climatologies of temperature and its variability, and across-track gradients to enable comparison along non-collinear HRX ship tracks. However, we need to identify and remove systematic errors (fall-rate, wire-related problems) for consistency of the datasets.

5.5. Pacific Ocean QC II: Shoichi Kizu

Shoichi Kizu of Tohoku University reported on the present status of measurement and data processing for PX-40, the Japan-Hawaii Monitoring Program (JAHMP). JAHMP started from October 1998 and were funded by JAMSTEC during 2003-2008. Tohoku University operates JAHMP in cooperation with Miyagi Prefecture (local government) and the crew of *Miyagi Maru*, a training ship owned by Miyagi Prefecture for providing training opportunity for two local high schools. The training ship conducts "far-ocean" training cruise to the central Pacific three times a year (usually Apr-Jun, Oct-Nov, and Jan-Mar). The PX-40 is operated on the way back from Honolulu where the ship stops after the fishery training for a couple of months. One transect normally takes about 11-12 days. The end port of the PX-40 has been changed from Misaki (near Tokyo) to Ishinomaki, near Sendai where the university is located. The fail rate of XBT deployments was typically a few of about 110-120 probe drops per cruise. The causes of failure were, for examples, wire contact to hull, launcher malfunctioning, and incomplete grounding (only occurred in initial phase). Resources continued to be a problem for XBT deployment for FY2011 and beyond. Data processing procedures include position check, visual inspection of individual profiles without climatology tests, de-spiking, replacing the first 19 temperature observations by the 20th one (equivalent to 6.5 m depth from the ocean surface), perform time-to-depth conversion by using the manufacturers' formula (H95) and then interpolate depths at 1 m resolution. Then, a low-passed Han filter was applied to the interpolated profiles for the GTSP and standard-depth reports only. Data reports are submitted to JMA for inserting to GTS, JODC and FRA and available at JAHMP Web site at http://www.pol.gp.tohoku.ac.jp/~kizu/jahmp/jahmp-e.htm. The activities of fall rate of XBTs and XCTDs and some related issues were presented at the meeting.

5.6. Mediterranean QC: Franco Reseghetti

Franco Reseghetti reported that the quality control procedures and flags adapted by his group were based upon IGOSS/UOT/GTSPP/Argo programs. Due to characteristics of Mediterranean seawaters, QC procedures are slightly different from the ones used in the World Ocean Database. The QC procedures are: 1) Initial visual check; 2) position control, gross range check & spikes analysis; 3) interpolation at 1 m interval, then Gaussian smoothing; 4) comparison with climatology; and 5) final visual check, providing an overall consistency. Franco raised a very important issue. He said that "The question is: how reliable is a XBT system?" Different recording system/probe types records slightly different recorded values. Calibration of recording system and probes were preformed every day. Metadata are sometimes absent or incomplete. He considered that the XBT system was not built as instrument for scientific research but widely used in oceanography. He warned that the use of XBT temperature profiles should be cautious, particularly in global warming analysis. The initial XBT direction within the water column of 100 meters depth strongly depends on the angle at the impact. Without pipe, lower launching positions seem to favor large impact angle. Therefore, higher platforms seem to be better. Deployment from container ships could be critical, since high platform induces higher entry speeds, which could produce wrong depth value. The impact of ship's wake and propellers on the XBT measurements still remain unknown. The fall rate problem is widely known but not the solution to the problem. The influence of viscosity on the motion is under examination. Thermal bias (and influence of electronics) is not negligible. The influence of the ship speed on the wire de-reeling (and the recorded values) is unknown. Other factors such as probe shape and dimensions, currents and atmospheric condition are still unknown.

Franco presented a new temperature climatology being developed for the Mediterranean Sea and raised a few common problems such as A) How many profiles per box and per month are good enough? B) How homogeneous are spatial and temporal distributions? Or How (really) representative are the calculated values? C) Criteria on selection or elimination of quality profiles; D) Transients: their significance and smoothing within an average value and E) Tests checking the robustness of the obtained climatology.

5.7. Real-time SEAS Data QC: Joaquin Trinanes

Joaquin Trinanes of AOML gave a presentation on the SEAS, a real–time ship and environmental data acquisition and transmission system. Approximately more than 100,000 XBTs are deployed annually, but only 25,000 make it to the GTS. AOML helps deployment of other platforms such as drifter, floats, etc and is involved in one ore more aspects (purchasing probes, deployment, transmission, quality control, etc.) of approximately 80% if the XBT deployments. Transmission in real-time is critical. The XBT template is in a transition to BUFR. He also highlighted a few recommendations from the OeanObs09: A) Explore possibility of having XBT transects in marginal seas; B) Analyze and evaluate the correct temporal and spatial sampling of each deployment mode; C) Evaluate effectiveness of Argo floats to duplicate XBT-derived signals.; D) support technological improvement of XBT launcher and transmission systems; E) Establish community-based procedures to calibrate XBTs with CTDs when research-quality data are collected; F) Establish consistent data QC procedures; G)Make recommendations on what parameters (FRE coeffs, recording device, ship speed, launcher type, launcher height, etc.) must be included in the metadata; H) Complete high quality, historical, and global XBT data base; I) Continue strong emphasis of XBT data analysis for scientific studies and increase its operational applications. J) Support strong presence of XBT science and operational results in scientific and operational meetings; and K) Recommend the creation of an international panel for upper ocean thermal observations to support and evaluate recommendations of the integration of the different platforms, including XBTs**.** He said that not enough funding to maintain all transects in the North Pacific. Problems with XBT deployment logistics may translate into problems in other platforms (deployment of drifters and floats). He continued to describe the procedures of transmitting XBT data into GTS and automatic QC and visual QC software. AOML generate SEAS monthly and annual reports.

5.8. Real-Time Data DAC QC: Mathieu Ouellet

5.8.1. Status of Real-time Quality Control at ISDM

Mathieu Ouellet reported that ISDM has performed quality control on over 2.16 million stations of temperature and/or salinity and/or current GTS messages (BATHY and TESAC) reported by moored buoys and thermistor chains (92%), profilers such as Argo floats (5%), autonomous pinnipeds (2%), ships (1%), ice-tethered profilers (<1%) and gliders (< 1%) in 2009. The information pertaining to the platforms' tracks is quality controlled as well. The quality control is performed three times a week and data streams are uploaded to an FTP server for download by NODC, IFREMER and China's World Data Center. All profiles underwent a series of automatic tests described in the GTSPP manual, and all profiles except ~500 000 profiles from moored buoys and thermistor chains were also visually examined by an operator at ISDM.

5.8.2. Data Volume and its impact on quality control

The volume of data to visually QC increased by 28% compared to 2008, mainly due to increasing messages from automated buoys such as moorings and thermistor chains. With an average of two variables per profile, this represents a total of ~3 million "screen shots" that were examined by an operator working at ISDM. The best solution appears to quality control moored buoys and thermistor chain data, some of which transmit as often as once an hour, as time series. The challenge in moving towards a time series quality control for all frequently reporting instruments is with multi-sensor (multi-depth) arrays. Each sensor from a thermistor chain, for instance, must be treated as a time series. Since the sensor depths change in time following the short term fluctuations of sea level, one must either count the number of sensors reporting "from the top", or do a statistical analysis of each sensor's mean depth, or use metadata information on the sensors to assess which variables correspond to which sensor and thus construct the time series for quality control.

5.8.3. Performance of automatic tests

Of the climatology tests listed in the GTSPP REAL-TIME QUALITY CONTROL MANUAL under group 3, ISDM has been using the Levitus Seasonal Statistics. Given the location of the majority of data transmitted on the GTS nowadays, namely moored buoys next to coastlines, this test has been failing ~15% of the time.

5.8.4. Summary

Given that the number of messages received increases steadily every year, ISDM can only continue to quality control all temperature, salinity and current data transmitted over the GTS by adopting a time series view for the moored buoys and thermistor chains. Performing the Levitus Seasonal Climatology test gives a high rate of failure that does not necessarily represent actual problems with the data. ISDM should adopt a better resolution climatology, at least in time if not spatially, by using the Levitus Monthly Climatology. However, certain inland moored buoys will not be represented by this climatology either. The GTSPP tests were not designed for freshwater or brackish water buoys and regional solutions, such as adopted for the Red Sea and Mediterranean Sea should be examined if U.S. coastal buoys are to remain examined by GTSPP.

5.9. Delayed-modes DAC QC I: Thierry.Carval
Thierry Carval gave a presentation on the Coriolis activities related to GTSPP. Between January 2009 and April 2010, there were 24 030 profiles from 85 platforms collected, controlled and distributed. There were 12 vessels transmitted XBTs and four research vessels, seven gliders, and 27 sea mammals transmitted CTDs in 2009. Twenty-five fishing boats equipped with Recopesca sensors. Numbering (identification) of gliders is difficult. Use WMO numbers generally but not on GTS so don't need numbers yet. Sea mammals are also a problem in terms of identification. Fishing vessels have Recopesca sensors that measure temperature, salinity and depth on fishing nets. Operator connects via mobile phone to return data to shore (and store data while out of range). Coriolis Real-Time QC manuals were based upon Argo real-time QC. The French navy XBTs operators records and checks more metadata than other French operators. These additional metadata are: XBT serial number, weather condition, sea state condition, salinity water samples, and fall rate coefficient. Thierry asked if the above metadata information should be added to the GTSPP data. Thierry introduced a new visual QC tool, known as "SCOOP2". SCOOP2 performs Argo-like real-time QC and also serves the data via web site data selection tool. A few quality control issues were raised when they tried to use the data for their new climatologies, the issues were: A) For European Operational Oceanography users (MyOcean project), Coriolis is working the CORA global climatology for temperature and salinity. The use of GTSPP profiles is crucial for this climatology; B) Probably bad data flagged as good data and Errors in metadata: incorrect instrument types; and C) some problems may come from an incorrect use of GTSPP ASCII files by IFREMER. A few suggestions for future GTSPP works are the options to improve the quality of GTSPP data set. A new recruit from IFREMER will perform a quality control on those historical data and perform objective analyses; Can we agree on a feedback mechanism so that this work is not lost for the community? Can we standardize the QC feedback as we did with Argo? Coriolis is proposing to do historical QC using objective analysis. At what level? And how do they communicate results to GTSPP? The GTSPP Chair will work with Coriolis to develop a feasibility study plan for adapting above suggestions.

5.10. Delayed-modes DAC QC II: Lic.Raul A. Guerrero
Raul A. Guerrero reported the quality control system, SIAVO, and procedures at INIDEP. SIAVO is a Windows-based system. It integrates information from: CTD, GPS, met. station, depth sonder. It calls specific software for acquisition and processing (eg. SBE modules) and generates Cruise and General auditory. INDIP adapated the GTSPP QC editor developed by NODC and customized to replace the default global climatology− World Ocean Atlas 2005 by local climatology. Bob suggested that regional QC checks should be incorporated into qc manual to guide people working with global databases. These are under test now but being improved and when they are confident they are useful, these should be added to the manual

5.11. Delayed-modes DAC QC III: Mingmei Dong
Ms. Mingmei Dong was unable to attend the meeting. China's report was given by Charles. China is using GTSPP QC flags (0-9) and retains the definitions of the flags. The National Marine Data and Information Service (NMDIS, China) has finished DMQC of GTSPP 2009 data. In general, about 20% stations have no temperature and salinity observations; about 5%

stations failed on land test.; quite a lot buoy data in Pacific is constant while depth extends from 0m to 500m; some temp data observed in American west coast in Feb is constant while depth extends from 0m to 500m. Charles will clarify these findings with NMDIS later.

6. GTSPP Data Management

6.1. Continuously Managed Database (CMD) Centre

Norm Hall of US National Oceanographic Data Center presented GTSPP Quality Control software, called "QCed (Data Quality Cruise Editor)". This "QCed" Software is written in IDL (interactive data language) that allows an operator to view and edit temperature and salinity data from files in the GTSPP ASCII format.

6.2. Unique Data Identifier CRC Implementation

The concept of the CRC (cyclic redundancy check) strategy was discussed at a GTSPP meeting in Hobart, 2002. It was suggested by our colleagues in Australia. The US SEAS program worked with MEDS to develop and incorporate the CRC into the US SEAS system in 2003. NODC has received BATHY+CRC ID records from MEDS and the SEAS real-time archive messages from the US SEAS program since the CRC became "operational" in 2005.

6.3. GTSPP Data Format Issues: Ann Thresher

The GTSPP ASCII, commonly known as the "MEDS ASCII (MA)", has served us well for 20 years. MA has advantages:

- ASCII – readable
- Concise
- Complete at the time it was designed
- Could be expanded to hold more information when required

It also has disadvantages:

- Complex and hard to use
- TOO concise – now need more than 2 or 4 characters for some fields
- Limited expansion possible
- Metadata often hard to find within the structure

Ann suggested that GTSPP should propose to redesign the current NetCDF format used by GTSPP to free it from the restrictions of MEDS ASCII. This format will need to be better organized in compliancy with the COARDS/CF conventions, handle a larger range of data types (including fish data and mammal recorders), contain more metadata that is easier to find, parallel the Argo NetCDF format so users can find data more easily and can be used as the new data exchange format to replace MA.

A suggestion is that GTSPP uses a sectional design with a metadata section that can hold instrument specific metadata (the XBT data section can be different from that used for animal recorders…), a profile ID section that can capture the range of current 'unique IDs' that are associated with a given profile (NOID, CSID, CRC, MEDS Station number…), a profile data section that parallels the Argo structure with raw, adjusted, and QC fields for each parameter (and perhaps with calibration or error information, comments and notes), and a complex history section that captures whatever has been done to the profile during processing and QC.

The history section is perhaps the most complex and hardest to design. It will contain the unlimited dimension (NHISTS) for the file and needs to be structured to include many of the things currently in the Pcode section of MA. It will also hold a complete record of every test performed and/or failed by the profile, including why the profile has failed a particular test (with a reference for the QC system used).

A suggested (but still unsatisfactory) structure is:

Operator	QC software/tests	version	test	Result flag (0-9 or	depth	Text field?
CSIRO	MQUEST CSCB	1.0	IPR	3	45.7	Insulation penetrati
NODC	QCP$	????		143567	0.0	Tests passed
NODC	QCF$ (specific test?)	???	T Range	4	66.9	Test failed

Suggestions are welcome. A working group has been set up that will include Ann Thresher, Charles Sun, Norm Hall, Derrick Snowden, Thierry Carval or a representative chosen by him, and a representative of ISDM. A good starting point would be the OceanSITES documentation also currently under review.

6.4. GTSPP Notes

Tim Boyer of US NODC thanked Charles Sun for finding space for Tim to deliver his presentation. His two main themes of the presentation were:

A) The US NODC has been working to synchronize the two main profile databases public available there, the World Ocean Database (WOD) and the GTSPP database.

As of mid-May, all real-time and delayed-mode XBT, CTD, XCTD, glider, and elephant seal data from GTSPP are in WOD. This will make it easier for users to be secure that whichever database they access at NODC, they will have all relevant data. This synchronization procedure will be repeated quarterly, and eventually monthly. A big project remains ahead to make sure all GTSPP data in WOD is the same as GTSPP data in the GTSPP database. Over the years, different quality control has caused the databases to diverge. The final step is to engineer each database so that all necessary data can be accessed through either portal.

B) GTSPP needs to pull back to its core mission of supplying quality XBT and CTD data in near-real time, coordinating with programs which supply these data, and supplying users with concise unambiguous information about these data.

The GTSPP database has in recent years been overwhelmingly populated with coastal moored buoy data at high time frequency and usually just one depth. These data are not necessary for GTSPP and make it very hard to work with GTSPP data for users. Further, many errors and inconsistencies exist in the present database which demand further attention to make the data more easily useable. Solution: I) stop accepting coastal moored buoy data; II) don't accept new sources of non-profile data (such as thermosalinograph data); III) concentrate on the core data types which are unique to GTSPP and of most benefit to the user community.

6.5. XBT Metadata Template

Charles reminded the meeting participants that a discussion paper, titled with "META-T Categorization for XBT data", is available for review. The paper is attached in Annex 3 of this report. It contains a list of metadata discussed at an ad-hoc meeting in conjunction with the first XBT Fall Rate workshop, Miami, 10-12 March 2008.

6.6. BUFR Template Requirement and Unique Identifier in the BUFR Template

Joaquin reported that the CRC may not necessarily once we move to BUFR (Binary Universal Form) because it's sent with the message and attached to the profile so matching is easier. AOML cannot send serial numbers but can only supply range of serial numbers. Because we don't need to calculate a CRC, we can put in any unique id in this field but CRC makes sense. We'll still use our own id for the database. Interesting – required T in degrees K.

7. Cooperation With JCOMM/SOOPIP and NOAA/ Climate Observation Office

7.1. Report on the yearly survey for SOOP 2009

Mathieu Belbeoch reported that JCOMMOPS received 3601 metadata reports from the Bureau of Meteorology (BOM) and CSIRO of Australia; 646 reports from France; 470 reports from Germany; and 6758 and 724 reports from USA and India, respectively. Reports from MOON (Mediterranean Operational Oceanography Network), France and Japan did not submit their metadata reports. He said the purpose of metadata submissions on a monthly basis would permit a better tracking of SOOP (Ship of Opportunity Programme) activities. The format of metadata submission can be found at http://www.jcommops.org/doc/metadata/submission_format.html.

7.2. Monthly Report on T-S Profile Sampling Performance

Every month ISDM performs a report on instrument performance per platform. Platforms who report 10% (or more) of their profiles with suspicious or erroneous data are examined in detail and a root cause determination of the problems is attempted. This constitutes the bulk of the monthly report. Statistics for all reporting platforms, with their latitude / longitude sampling limits, total and average # messages reported and number stations which failed a data quality, position or time test (either visual or automatic) or had their QC flag changed, are assembled. Statistics on code usage (improbable recorder type / profiler combinations, missing metadata, using obsolete formats) are also compiled. Statistics of ships sampling along SOOP lines are also produced. The report is available at ftp://ftp.meds-sdmm.dfo-mpo.gc.ca/pub/ShipReport and users from a mailing list are notified at every monthly update. Please write to mathieu.ouellet@dfo-mpo.gc.ca to be included on the mailing list. In 2009, systematic problems were identified with a platform during the production of this Monthly report. The platform was transmitting false undersea data due to a software failure. Transmission stopped upon notification.

7.3. Ocean Observations Panel for Climate Subsurface In-Situ Network Monitoring

Bob reported that the Ocean Observations Panel for Climate (OOPC) is trying to monitor ocean changes. GTSPP data were used in the calculation of the climate-related index, such as transport index. However, GTSPP's contribution is largely invisible. GTSPP is also used for heat content calculations but still largely invisible.

8. Retrospective Monthly Temperature And Salinity Analysis

8.1. Approach I – Objective Analysis

Charles Sun invited Mr. Mathieu Ouellet of the Integrated Scientific Data Management of Canada to brief the GTSPP group on adapting the ISAS developed by IFREMER for integrating and gridding of in-situ temperature and salinity data on a ~30 days time range from a variety of platforms. The system performs objective analysis on anomalies (observed field minus climatology), using predefined temporal and spatial scales on individual 2D depth layers, and then re-adds the climatology. One can construct 3D fields of temperature and salinity by performing the analysis on a number of levels from 0 m to 2000 m depth, wherever sampling is sufficient. ISDM currently uses ISAS to perform routine analyses of all incoming data, most from the GTS, and performs the analysis on 59 levels.

ISDM has been performing monthly objective analyses in delayed-mode, using data from TESAC, BATHY, DRIBU and TRACKOB streams. Rather than inspecting all levels individually, ISDM designed two quantities that can be examined in 2 dimensions while revealing information on the whole field:
1-maximum of absolute value anomalies (of either temperature or salinity) over all levels
2-root-mean-squared of anomalies (of either temperature or salinity) over all levels
By "anomaly", here, is meant the fields as interpolated before re-adding the climatology. The two above defined quantities are plotted as a field using a colour map scaled to the maximum value.

Using a navigation tool, the quality control operator can zoom and inspect the colour coded areas and, by clicking the mouse button, select a zone for which the profiles contained therein will appear in another window, along with a legend indicating the platform name and ISDM station number. The user can then evaluate which profiles are wrong and flag them accordingly. The method is iterative; after having flagged the most obvious profiles, the objective analysis can be redone for the area which contained the suspicious profile(s). The two fields described above, absolute maximum and root-mean-squared can be re-examined after having re-ran the objective analysis.

This method therefore uses the a climatology, which is derived from Levitus WOA with some improvements made by IFREMER, but also allows visual comparison of neighboring profiles to help make the judgment between instrument malfunction and natural variability. Zones of high vertical maximums or high root-mean-squared anomalies, if homogeneous and profiles from independent floats, are likely the result of high variability.

This method allows catching errors which hadn't been seen at the time of profile-by-profile visual and automatic quality control. In addition to this visual method, ISAS has a built in system that reports "alerts" according to several statistic criteria. Coriolis (IFREMER) currently uses those alerts for quality control purposes. ISDM is currently not using these alerts but will likely start in a near-future.

To generate an analysis containing all available information from a given month, typically 1 month after the end of the given month (the time allowed to do the drifting buoy quality control), takes ISDM ~12 hrs on the server currently available. The visual quality control of the 2D fields can take up to 2 hrs if there are several iterations to be made.

One limitation with this method is the finiteness of the temporal e-folding scale, which is ~21 days. Monthly analyses give more weight to data observed near the middle of the month. Therefore, data problems occurring toward the end of the months or the beginning of the months have a better chance to remain undetected. The solution to this would be to perform semi-monthly analyses centered at intervals separated by ~2 weeks, with an overlap of 2 weeks, but this would double the effort at hand.

8.2. Approach II – Optimal Spectral Decomposition

Dr. Peter Chu of the Naval Postgraduate School was invited by Charles to give a presentation about his recently published work on the new data analysis scheme to help with QC. A new data analysis/assimilation scheme, optimal spectral decomposition (OSD), has been developed to analyze fields from noisy and sparse raw data using two scalar representations for a three-dimensional incompressible flow. The analysis procedure is divided into three steps: (a) determining a set of basis functions (i.e., the Eigen functions of the Laplacian operator) from the knowledge of boundary geometry and conditions, (b) optimizing the mode truncation, and (c) calculating the spectral coefficients using the observed GTSPP data from solving large ill-posed algebraic equations with filtration procedure with special regularization. The capability of the method is demonstrated through reconstructing a 2D circulation on the Texas-Louisiana continental shelf from drifter data, deep circulation in the North Atlantic from the Argo data, and global surface circulations from the satellite altimetry data.

9. Other Business Including Additional Partners Should be Pursued.

Charles proposed to create scientific committee to guide our product delivery/development – like Argo Science Team. GTSPP had that in WOCE (World Ocean Circulation Experiment) but WOCE ended and people moved on. The GTSPP steering group agreed with his proposal and thought it would be helpful guidance but need to identify people and get people interested. Dr. Peter Chu of the Naval Postgraduate School agreed to lead science group. Charles also suggested IT group to provide guidance.

10. Next Meeting Date/Place

The next meeting was discussed. Charles proposed to have a three-day GTSPP meeting every other year beginning 2012. The IODE project office offered to host next meeting in late summer or early fall 2012. Charles accepted IODE’s offer and will plan a more focused meeting next time.

11. Closing

The Meeting closed at 3:00 pm on 7 May 2010 with the chair thanking Mr. Peter Pissierssens and Mrs. Kristin de Lichtervelde for providing meeting arrangements and logistics. A photo of gift of appreciation presentation is attached in Annex 4. The Chairperson thanked the participants of the meeting, his co-chairs, and congratulated the Team for the meeting’s achievements.

Annex 1: List and Group Picture of Participants

Baringer, Molly	AOML	Molly.Baringer@noaa.gov
Belbeoch, Mathieu	JCOMMOPS	belbeoch@jcommops.org
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Trinanes, Joaquin	AOML	Joaquin.Trinanes@noaa.gov
Thresher, Ann	CSIRO Marine Research	Ann.Thresher@csiro.au

Figure 1 Photo of the GTSPP meeting participants from left to right: Peter Pissierssens, Mathieu Belbeoch, Thierry Carval, Shoichi Kizu, Joaquin Trinanes, V. V. Gopalakrishna, Loic Petit De La Villeon, Charles Sun, Molly Baringer, Mei-Lin Chen, Franco Reseghetti, Ann Thresher, Tim Boyer, Norm Hall, Raul Guerrero, Bob Keeley, Mathieu Ouellet, Greg Reed, Lisa Lehmann. (Peter Chu not presenting)

Annex 2: Meeting Agenda

GTSPP Annual Meeting 2010

Final Agenda

PLACE: UNESCO/IOC Project Office for IODE
Wandelaarkaai 7 - Pakhuis 61
B-8400 Oostende,
Belgium

DATE: 5 – 7 May 2010

Wednesday, 5 May 2010

1. 14:00 OPENING OF THE SESSION (10 min.)
1.1. Session arrangements [Charles SUN]
1.2. Adoption of the Agenda [All]
1.3. Designation of a Rapporteur [All]
1.4. Local arrangements [Peter PISSIERSSENS/Kristin DE LICHTERVELDE]
2. 14:15 STATUS OF GTSPP (45 min.)
2.1. GTSPP Chair's Report [Charles SUN]
2.2 Data Assembly Centres Operating Issues and Concerns [All]
15:00 – 15:30 COFEE BREAK
3. 15:30 COOPERATION WITH GOSUD (30 min.)
3.1. Explore inclusion of GOSUD Sea Surface Salinity/Temperature in GTSPP [Charles SUN, Loic PETIT DE LA VILLEON] (15 min.)
3.2. Common Data Distribution (NetCDF) Format Attributes [Joint Discussion with the GOSUD group; Continue the discussion, if needed or summary report of the discussion] (15 min.)
4. 16:00 COOPERATION WITH INIDEP (60 min.)
4.1. Status Report on the Aquarius/SAC-D Mission [Raul GUERRERO] (45 min.)
4.2. Areas of Common Interests of INIDEP and GTSPP [Raul GUERRERO] (15 min.)
17:00 Adjourn

Thursday, 6 May 2010

5. 09:00 STANDARDIZATION OF QUALITY CONTROL [Session Co-Chairs: Ann THRESHER and Charles SUN]
5.1. Atlantic Ocean QC: Molly BARINGER (20 min.)
5.2. Indian Ocean QC I: Ann GRONELL THRESHER (20 min.)
5.3. Indian Ocean QC II: V. V. GOPALAKRISHNA (20 min.)
5.4. Pacific Ocean QC I: Lisa LEHMANN (20 min.)
10:30 – 11:00 COFEE BREAK
5.5. Pacific Ocean QC II: Shoichi KIZU (20 min.)
5.6. Mediterranean QC: Franco RESEGHETTI (20 min.)
5.7. Real-time SEAS Data QC: Gustavo GONI (20 min.)
5.8. Real-Time Data DAC QC: Mathieu OUELLET (20 min.)

12:30 – 13:30 LUNCH BREAK

5.9. 13: 30 Delayed-modes DAC QC I: Loic PETIT DE LA VILLEON (20 min.)
5.10. Delayed-mode DAC QC II: Raul GUERRERO (20 min.)
5.11. Delayed-mode DAC QC III: Mingmei DONG (20 min.)
5.12. General Discussion (30 min.)

15:00 – 15:30 COFEE BREAK

6. 15:30 GTSPP Data Management [Session Chair: Robert KEELEY]
6.1. Continuously Managed Database (CMD) Centre: Norman HALL (20 min.)
6.2. Unique Data Identifier CRC Implementation [Norm HALL] (20 min.)
6.3 GTSPP Data Format Issues [Ann THRESHER] (20 min.)
6.4 GTSPP Notes [Tim Boyer] (20 min.)
17:00 Adjourn

Friday, 7 May 2010
6.5. 09:00 XBT Metadata Template [Joaquin TRINANES] (20 min.)
6.6. BUFFUR Template Requirement [Joaquin TRINANES] (20 min.)
Unique Identifier in the BUFFUR Template [Robert KEELEY] (10 min.)
7. COOPERATION WITH JCOMM/SOOPIP AND NOAA/ CLIMATE OBSERVATION OFFICE [Session Chair: Robert KEELEY]
7.1. Report on the yearly survey for SOOP 2009 [Mathieu BELBEOCH] (20 min.)
7.2. Monthly Report on T-S Profile Sampling Performance [Mathieu OUELLET] (20 min.)
7.3. Ocean Observations Panel for Climate Subsurface In-Situ Network Monitoring [Robert KEELEY] (10 min.)

10:30 – 11:00 COFEE BREAK

8. 11:00 RETROSPECTIVE MONTHLY TEMPERATURE AND SALINITY ANALYSIS [Session Chair: Charles SUN]
8.1. Approach I – Objective Analysis [Mathieu OUELLET] (45 min.)
8.2. Approach II – Optimal Spectral Decomposition [Peter CHU] (45 min.)

12:30 – 13:30 Lunch Break

9. 13:30 GTSPP FUTURE PLANS [Session Chair: Charles SUN]
9.1. Contribution of GTSPP data to the IODE ODP project [Greg REED] (30 min.)
9.2. GTSPP Data User Expectations: Feedback from the OceanObs'09 Conference [Robert KEELEY] (30 min.)
9.3. Plan of providing lectures on how to use the GTSPP data [Charles SUN] (15 min.)
9.4. Other business including additional partners should be pursued [All] (10 min.)
9.5. NEXT MEETING DATE/PLACE [All] (5 min.)
10. 15:00 CLOSING OF THE SESSION

Annex 3: META-T categorization for XBT data

The list of metadata below was discussed at the XBT Fall Rate workshop, Miami, 10-12 March 2008 by a sub-group comprised of the following individuals:

Joaquin Trinanes (joaquin.trinanes@noaa.gov),
Charles Sun (charles.sun@noaa.gov),
Ann Thresher (ann.thresher@csiro.au),
John Gilson (jgilson@ucsd.edu),
Derrick Snowden (derrick.snowden@noaa.gov),
Hester Viola (viola@jcommops.org),
Gustavo Goni (gustavo.goni@noaa.gov),
Juan Delgado (juan.delgado@noaa.gov)
Etienne Charpentier (echarpentier@wmo.int)

Once approved by the group above, the list will be passed to the META-T Pilot Project and the SOT Task Team on Codes. It will then go to the JCOMM Data Management Programme Area Task Team on Table Driven Codes which will make a consolidated proposal to the CBS Expert Team on Data Representation and Codes (ET/DRC).

1) Category 1 metadata

The Group agreed that separate XBT and XCTD BUFR templates should eventually be designed to take into account the following XCTD specificities:

Salinity measured by XCTD, not by XBTs; specific water conductivity requirements
Different sampling rates leading to different resolutions for the depth.
Higher accuracy temperature sensors for XCTDs

The Group therefore agreed to focus on the XBT template requirements.

The Group agreed that the following META-T category 1 metadata should be included in the new future BUFR template for XBT data1:

Field	Coding[2]	Comment
GTSPP flag for global water pressure profile	[008080] (qualifier, value= 0 "total water pressure profile") [033050]	A value should be added in the corresponding code table [033050] to code the descriptor with a value alerting users about the quality of XBT data, e.g. "caution; good for operational use; check literature for other uses"

[1] This unordered list does not constitute a BUFR template
[2] BUFR descriptors are indicated in brackets, e.g. [008080]

GTSPP flag for global water temperature profile	[008080] (qualifier, value=1 “total water temperature profile”) [033050]	Same as above
Unique ID for the profile	New descriptor 32 ASCII characters	Hash-function vs. CRC to be investigated for computing the unique ID.
Ship’s call sign	[001011]	9 characters max
IMO Number. Unique identifying number assigned by Lloyd's Register to the hull of the ship	New descriptor Numeric (integer), 0 to 99999999999	Optional additional ship identifier
Ship transect number according to SOOP[3]	[005036]	
Speed of motion of moving observing platform	[001013]	
Direction of motion of moving observing platform	[001012]	
Method of removing platform direction and speed from current	[002040]	
Height of the XBT/XCTD launcher	New descriptor meters, resolution 5m 0 to 50m	
Water temperature profile recorder type	[022068]	
Instrument type for water temperature profile measurement	[022067]	
XBT/XCTD launcher type	New descriptor and code table	See new code table proposed below
Software version of profile recorder	New descriptor 6 ASCII character	
Autolauncher software version number	New descriptor 6 ASCII character	
Instrument manufacturer's serial number	New descriptor[4]	32 characters max. Obtained from Bar code information
XBT manufacturing date	[008021] (time significance; qualifier value= new value in code table “XBT manufacturing date”) [301011] (date)	Batch date obtained from Bar code information made available by the manufacturer on the probe’s package
SOOP Line number	[001080]	
Indicator for digitization	[002032]	

[3] integer, assigned by the operator, incremented for each new transect (i.e. all drop have the same transect number while the ship is moving from one end point of the line to the other end point; as soon as the ship arrived to port and goes back to start a new transect then transect number is incremented), initial value and subsequent values for transect numbers do not matter provided that each new transect by a ship on a line has a transect number higher than previous transect numbers for the same line and the same ship. In case a single cruise follows more than one SOOP line in a row, then transect number should be incremented each time the cruise changes line.

[4] Note to be added in the BUFR template to indicate that this is the XBT probe serial number.

Method of current measurement	[002030]	
Height of sensor above local ground (or deck of marine platform)[5]	[007032]	
Method of sea surface temperature measurement	[002038]	Note part of the sequence [002056] in the observational data

Proposed new code table for XBT/XCTD launcher types

Code	Launcher
0	Unknown
1	LM-2A Deck-mounted
2	LM-3A Hand-Held
3	LM-4A Thru-Hull
4-9	Reserved
10	AL-12 TSK Autolauncher (up to 12 Probes)
11-19	Reserved
20	SIO XBT Autolauncher (up to 6 probes)
21-29	Reserved
30	AOML XBT V6 Autolauncher (up to 6 Deep Blue probes)
31	AOML XBT V8.0 Autolauncher (up to 8 Deep Blue probes)
32	AOML XBT V8.1 Autolauncher (up to 8 Deep Blue&Fast Deep probes) - This system is currently being fabricated
33-254	Reserved
255	Missing

Note: There are additional projects related to the development of XBT autolaunchers, e.g.

- CSIRO- Autolauncher for the Devil system.
- MFSTEP Autolauncher - Prototype that required improvements and is not fully operative(up to 8 probes).

2) Category 2 metadata (not for inclusion in BUFR template):

The Group agreed that the following Category 2 metadata should be considered by META-T (not for inclusion in the BUFR template but to be provided in delayed mode via the META-T servers):

Telecommunication system used
Recorder version number
Ship name
Telecommunication ID number
Fall rate equation coefficients

[5] Height of sensor above local ground (or deck of marine platform) is the actual height of sensor above ground (or deck of marine platform) at the point where the sensor is located. We are referring to the air temperature sensor here.

3) Observational data:

The Group also agreed that the following observational data should be included in the BUFR template for XBT data:

Field	Coding	Comment
Date	[301011]	
Time	[301012]	
Lat/lon, high accuracy	[301021]	10^{-5} resolution
Wind speed	[011002]	
Wind direction	[011001]	
Direction of current	[022004]	
Speed of current	[022031]	
Waves	[302021]	[022001] Direction of waves [022011] Period of waves [022021] Height of waves
Sea Surface Temperature	[302056]	[0 02 038] Method of sea surface temperature measurement [0 22 043] Sea/water temperature
Water temperature profile	[106000] Delayed replication of 6 descriptors [031001] Replication factor [008080] (qualifier, value=new value in code table “depth at a level”) [033050] GTSPP flag for depth [007063] Depth below sea surface [008080] (qualifier, value=11 “water temperature at a level”) [033050] GTSPP flag for water temperature [022043] Subsurface sea temperature	Resolution of depth: 0.01m Resolution of T: 0.01C
Total depth of water	[022063]	
Dry-bulb temperature (scale 2)	[012101]	
Dew-point temperature (scale 2)	[012103]	
Height of anemometer above station platform	[007032]	

Annex – existing BUFR template for XBT/XCTD data

Descriptor	Order	Forced value	Forced missing	Name	Comment
001003	1			WMO region	
001020	2			WMO region sub-area	
001005	3			Buoy/platform identifier	
001011	4			Ship call sign	
001019	5			Ship name	
001080	6			Ship line number according to SOOP	
005036	7			Ship transect number according to SOOP	
001036	8			Agency in charge of operating the observing platform	Important field
301011	9			Date	
301012	10			Time	
301021	11			Latitude and longitude (high accuracy)	
007030	12			Height of station above MSL	
002040	13			Method of removing platform direction and speed from current	
022067	14			Instrument type for water temperature profile measurement	
022068	15			Water temperature profile recorder type	
008080	*16*	*0*		*Qualifier for quality class*	*Value: 0=global water pressure profile*
033050	*17*			*Global GTSPP quality class*	*For global water pressure profile as qualified above*
008080	*18*	*1*		*Qualifier for quality class*	*Value: 1=global water temperature profile*
033050	*19*			*Global GTSPP quality class*	*For global water temperature profile as qualified above*
008080	*20*	*2*		*Qualifier for quality class*	*Value: 2=global water salinity profile*
033050	*21*			*Global GTSPP quality class*	*For global water salinity profile as qualified above*
008080	*22*	*3*		*Qualifier for quality class*	*Value: 3=global water conductivity profile*
033050	*23*			*Global GTSPP quality class*	*For global water conductivity profile as qualified above*
025100	24			XBT/XCTD fall rate equation coefficient a	
025101	25			XBT/XCTD fall rate equation coefficient b	
022063	26			Total depth of water	
302021	27			Waves	
306004	28			Sea temperature and salinity profile	*Sequence containing the profile itself*
002030	29			Method of current measurement	
306005	30			Time/duration of current measurement, depths/directions/speeds	
007032	31			Height of thermometer above station platform	Here height of thermometer
012101	32			Dry-bulb temperature (scale 2)	
012103	33			Dew-point temperature (scale 2)	
007032	34			Height of anemometer above station platform	Here height of anemometer
011001	35			Wind direction	
011002	36			Wind speed	

Note: A supplementary descriptor for a unique observation identifier may be added later after definition in coordination with DBCP/SOOP.

Annex 4: Photo of Gift Appreciation Presentation

Figure 2 On behalf of the GTSPP Steering Group, Dr. Charles Sun (right), GTSPP Chair, presented gifts of appreciation to Mr. Peter Pissierssens (left) and Mrs. Kristin De Lichtervelde (center) for providing meeting arrangements and logistics for the GTSPP meeting.