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)

Fourth Session
IOC Project Office for IODE, Ostend, Belgium
11−13 April 2018

UNESCO

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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 Fourth 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, 11 – 13 April 2018. The meeting was attended by seven participants in Ostend, while other five persons participated by Webex.

The objectives of the meeting were to: i) Review of GTSPP inter-sessional (2017 – 2018) activities, ii) Review of the governance of GTSPP, iii) Explore connections with external programs and seek future collaborations with them, and iv) 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 2019–2020 is shown in Annex III of the meeting report.

The participants planned for the next meeting to be held in the second quarter of 2019.

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1. OPENING OF THE MEETING

Dr Charles Sun, Chair, opened the meeting at 09:00 on 11 April 2018. He welcomed participants and noted that budget reductions were forcing creative solutions to meeting attendance. So, in addition to the seven people present, there were five persons who would join online through Webex. A complete list of the meeting participants is shown in Annex I of the meeting report.

Dr Sun reported that Mr Peter Pissierssens, Head, UNESCO/Intergovernmental Oceanographic Commission (IOC) Project Office for IODE and Coordinator, IOC Capacity Development, was not feeling well to attend the meeting in person but would be available in his office to answer questions reverent to the GTSPP operations.

The meeting agenda was adopted as published before the meeting (Annex II) but changes could be made as the necessity arises. 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.

Dr Sun reminded the participants of the objectives of the meeting:

- Review of GTSPP inter-sessional (2017 – 2018) activities.
- Review of the governance of GTSPP.
- Explore connections with external programs and seek future collaborations with them.
- Refine the GTSPP future directions.

2. REVIEW OF ACTION ITEMS FROM THE SG-GTSPP-III (2016) 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.

3. REPORT OF GTSPP ACTIVITIES 2017 – 2018

Dr Sun reported that GTSPP continued its daily operations to process and preserve both real-time and non-real-time temperature and salinity data and maintained the project Web sites by the U.S. National Centers for Environmental Information (NCEI) and Marine Environmental Data Section (MEDS) of the Oceans Science Branch, Fisheries and Oceans, Canada at https://www.nodc.noaa.gov/GTSPP/ and http://www.dfo-mpo.gc.ca/science/data-donnees/gtspp/index-eng.html, respectively. The Japan Meteorological Agency (JMA) continued to populate the outcomes of the comparison between observed versus model-simulated temperature data for the North Pacific Region at http://ds.data.jma.go.jp/gmd/gtspp/data/index.html.

He continued to report the two major GTSPP activities in 2017 were:

- The twenty-four session of the IOC Committee on International Oceanographic Data and Information Exchange (IODE-XXIV) held in Kuala Lumpur, Malaysia, between 28 and 31 March 2017 and

- The ninth (9th) session of the joint WMO/IOC JCOMM Ship Observations Team (SOT-9), held in London, United Kingdom, between 28 and 31 March 2017. In the absence of Dr Sun, Ms Rebecca Cowley gave the presentation of the GTSPP report to SOT-9.

  He informed the meeting participants that there were personnel changes in 2017:

- Ms Ayako Takeuch replaced Mr Yoshiaki Kanno as the GTSPP Point of Contact at JMA and assumed Yoshiaki's responsibility of a member of the steering group of GTSPP and
- Mr Christopher Paver of NCEI was invited to join the GTSPP steering group.

4. NATIONAL GTSPP PROGRAMME SUPPORT

4.1 AUSTRALIA

Ms Cowley reported that CSIRO, the Bureau of Meteorology (BoM) and Royal Australian Navy (RAN) all contributed to the Australian GTSPP program for XBTs during 2016-2017. Data was collected along several SOOP lines as shown below:

Line	Operator	Target sampling regime [High density (HD) or Frequently repeated (FR)]	Years run/time coverage	Number of profiles collected for 2016-217	Delayed mode (DM) or Real time (RT)
IX12	BOM/AOML	FR	1986-2015	0	RT & DM
IX22 / PX11	BOM	FR	1986-2014, 2016-present	1029	RT & DM
PX02	BOM	FR	1983-present	553	RT & DM
IX01	BOM/AOML	FR+*	1983-present	1956	RT & DM
IX28	CSIRO/SIO/AOML	HD	1993-present	490	RT & DM
PX30	CSIRO/SIO	HD	1991-present	428	RT & DM
PX34	CSIRO/SIO	HD	1991-present	171	RT & DM
	RAN	Ad-hoc	Ongoing	261	RT

(* FR+ Frequently repeated in spatial, but weekly temporal sampling)

Data undergoes automated QC at the time of collection and is then delivered in near-real time to the GTS in BUFR bulletins and JJVV bathy messages. Delayed-mode data is QCd by the relevant agency and delivered to Integrated Marine Observing System (IMOS) and NCEI on an annual basis.

All three agencies use the Turo Devil or Quoll systems. However, Sippican Mk21 systems continue to be used on some RAN ships.

The major issues for the last two years for SOOP XBT deliveries include shipping route changes and delays in the delayed mode QC'd data reaching IMOS in a timely manner.

In addition, the RAN remains unable to make their full resolution data publicly available. Data from 2015 to the present is not included in delayed mode in Australian GTSPP data submissions. However, real-time data are submitted to the GTS, through the Bureau (JJVV and BUFR) for some RAN ships. Support for the XBT program continues from RAN, with provision of probes yearly to BOM and CSIRO.

Delayed-mode CTD data from the *Investigator* are submitted to NCEI annually. All data and information on publications and data products is available at IMOS: http://imos.org.au/

4.2 CANADA

Mr Ouellet reported about Canada's national activities and about MEDS' international activities in as an assembly center for near real-time GTSPP data for the period from November 2016 to March 2018 inclusive (intersessional period).

National activities statistics are reported in the "GTSPP national report for Canada" submitted independently. Notable activities this year include the broadcasting of new instruments consisting of fixed site profilers mounted on moorings topped by a type of buoy developed in Canada called the Viking buoy. In the intersessional period, such instruments were deployed at 8 locations on the East Coast of Canada and the data from 3 of them were transmitted on the GTS in TESAC as test. Transmission is expected to start full-time once the General notifications have been sent and buoys are re-deployed seasonally. Overall, data from at least 22 ships and one helicopter used for research/monitoring, and an unknown number of Royal Canadian Navy ships (XBT), were sent to the GTS and/or to GTSPP directly. MEDS also transmitted data from 103 Argo Canada / Argo-equivalent profilers and 4 gliders. Two gliders belong to the Ocean Tracking Network and the Marine Environmental Observation Prediction & Response Network (MEOPAR) and the other two are new acquisitions by Fisheries and Oceans Canada. All data issued to the GTS were also sent to GTSPP. Some ship data were issued to GTSPP directly, and not to the GTS, because they were received at MEDS after 30 days of collection date. Over 15000 BATHY and TESAC messages were sent. All data had real-time QC tests applied. Aside of data collected by Argo, MEDS has not yet started sending Canadian data in BUFR on the GTS.

International activities consisted in acquiring, decoding and quality controlling GTS data in BATHY and TESAC code forms, and the data in BUOY code form with temperature or salinity reporting at more than one depth. Mr. Ouellet showed maps and diagrams comparing the BATHY and TESAC data received for months Nov-Dec and Jan-Mar of the intersessional period with equivalent periods of previous years. Stacked bar charts covering the intersessional period, broken down by platform type or GTS insertion location, showed a consistent picture in terms of number of profiles and unique platforms. Over 4000 platforms reported every month, dominated by autonomous vertical mainly of the Argo programme. The number of profiles reported by month oscillated around 0.25M, with minimums in February and maximum in August 2017 (almost 0.3M). The number of profiles is again heavily dominated by coastal fixed stations and pseudo-profiles of tropical moored buoys and observations moored buoys encoded by NDBC in TESAC code form, who report at a higher frequency.

Mr Ouellet also reported on the status of TAC to BUFR conversion from an international perspective, for all data types except Argo.

Ships - Australia, USA (NOAA National Weather Service) and Japan reported XBT data from ships both in BUFR and traditional alphanumeric code (TAC) forms. Only 5 ships whose data are encoded by U.S. NOAA NWS (out of 51), and 1 ship by Australia (out of 16), reported data in TAC only. One ship whose data is encoded by US NOAA transmitted in BUFR only. France, Canada, Korea, Brazil, U.S. NOAA NDBC and the U.K. did not transmit any BUFR data from ships.

Gliders - NDBC reported data from 51 gliders in BUFR only, using a non-standard element sequence, and data from 17 other gliders in TAC. US NOAA NWS, Canada and the U.K. transmitted glider data in TAC only.

Issues of BUFR encoding were addressed, such as the additional text following ship_or_mobile_land_station_identifier in Australian messages, or the retransmission of TAC data in BUFR by U.S. NOOA NWS, which was fixed shortly before the meeting.

Mr Ouellet intends to start acquiring Argo data in BUFR format in the GTSPP RT stream when the transmission of this data in TAC ceases, and to start acquiring glider data transmitted in BUFR, during the next intersessional period.

Mr Ouellet reported on the work plan for MEDS for the next intersessional period and on a modernization project going on in Canada to ensure MEDS' international contribution to GTSPP for the long-term. The project involves rewriting the GTSPP auto QC tests. It will likely make use of MongoDB on the Microsoft Azure cloud.

Mr Ouellet reported on the activities of the MEDS in support of GTSPP, which are to act as a data assembly centre for Global Telecommunication System (GTS) data.

From January 2015 to October 2016, MEDS acquired, decoded and quality controlled an average of 24500 observations per month from BATHY and TESAC messages from four GTS nodes (Japan, Germany, USA and Canada) and BUOY messages (with more than one depth) from Canada GTS node.

As with previous years, the bulk of number of observations was from coastal fixed stations and moored buoys transmitted by NOAA NDBC in TESAC. Other platforms reporting data were moored and drifting buoys with thermistor chains, vertical profiling floats (Argo, Argo equivalent and non-Argo), ships (XBT, CTD), gliders, marine animals and aircrafts (AXBT).

A decrease in message counts, relative to previous years, was observed in the glider stream and is attributable to a switch to BUFR as a GTS format by many providers. This is problematic since there are no JCOMM approved BUFR templates for glider data yet. MEDS will report this issue to the appropriate JCOMM forum which deals with glider data management.

A comparison of BUFR and Traditional ASCII Character (TAC) code ship observation counts (XBT and CTD profiles) revealed that four GTS insertion centers (Canada, Germany, France, USA NDBC) still transmit data in TAC only. Other insertion centers (USA AOML, Japan, Australia) report both in BUFR and TAC, but seem to report less messages in BUFR than TAC, or at least, Canada is not receiving all the BUFR data transmitted. MEDS will work with AOML, JMA and CSIRO to resolve this issue. However this reveals that it is too soon to switch to decoding BUFR only for ship based profiles.

Updates are made available to NCEI three times a week on average. The same data stream is made available to US GODAE, Japan Meteorological Agency (NEAR-GOOS)

(tailored to Northeast Asian region), Australian Ocean Data Center and IFREMER (Copernicus Marine Environment Monitoring Service in situ Thematic Assembly Center).

Canada's data contributions to the GTSPP CMD were through the GTS (over 17000 Argo, glider, CTD and XBT profiles from ship) and directly to GTSPP CMD for data older than 30 days but not delayed mode quality (over 2500 CTD and XBT profiles from ships). The data providers in Canada are Fisheries and Oceans Canada (Bedford Institute of Oceanography, St. Andrews Biological Station, Maurice Lamontagne Institute, Gulf Fisheries Centre, and Northwest Atlantic Fisheries Centre), Department of National Defence (MetOc) and the Ocean Tracking Network Ocean Glider Program (HQ at Dalhousie University)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.

4.3 FRANCE

Mr Thierry Carval, on behalf of Mr Petit de la Villéon, presented the Coriolis data centre's report on GTSPP activities during 2017. It includes data aggregated in France (SHOM, IFREMER, IRD, CNRS, Institut Polaire Paul Emile Victor). It also includes European data aggregated within Copernicus Marine services.

Between January 2017 and December 2017, 37412 new profiles from 171 platforms where collected, controlled and distributed. All profiles processed during that period are available in one file on:

- http://www.ifremer.fr/co/gtspp/2017/
- Overview with GoogleEarth http://www.ifremer.fr/co/gtspp/2017/co_gtspp_2017.kmz

Format	Type	nb profiles
GL	Glider profiles	24 540
OS	CTD from vessels by way of Copernicus	6 945
RE	Fishing boats profiles	3 750
CT	CTD from vessels by way of Coriolis	1 203
XB	XBT from vessels by way of Coriolis	974
Total profiles		**37412**

Argo profiles are not mentioned in this report, as there is a direct link between GTSPP and Argo global data centers. However, the French coastal profiling floats are not part of Argo, they are included in this report.

The following tables show platform lists of 2017 observations from vessels, gliders, fishing gear sensors.

Vessel platforms

platform code	Name	nb profiles
LGWS	KRISTINE BONNEVIE	746
DBBH	METEOR	497
LDGJ	JOHAN HJORT	494

DBBT	Maria S. Merian	469
FNFP	THALASSA	385
FNCM	L'ATALANTE	322
OXYH2	NUKA ARCTICA	195
FMCY	POURQUOI PAS?	137
FNUR	ANTEA	87
FHQB	ALIS	40
FNIN	MARION DUFRESNE	32
EXMY1233	Ingoy	22
EXMY1231	Sognesjoen	13
EFCP	HESPERIDES	6
ZDLP	JAMES CLARK ROSS	3
FKJB	L'EUROPE	2
SXYY	AEGAEO	1
FZVN	LE SUROIT	1

Glider platforms

platform code	Name	nb profiles
18951	IFM07 Slocum glider	5847
68453	Theque glider	3631
58970	Campe slocum glider	2686
6801663	Maria Glider	1931
18952	IFM09 Slocum glider	1800
6801661	Dora Glider	1574
6801634	IFM13 glider	1242
18904	IFM03 Slocum glider	1109
6801590	IFM12 glider	1076
68954	Tintin slocum glider	1054
18956	Bonpland slocum glider	777
61866	POTAME GLIDER	666
6801612	6801612	592
6801613	6801613	499
68451	Crate glider	456
6801635	IFM14 glider	317
6801631	p202 deep Slocum glider	228
6800957	unit_403 Leonardo glider	58
6801690	Uivelo slocum glider	56
4800995	sn651 Slocum glider	32
68907	SG560 Glider	18

Recopesca fishing gear sensor

platform code	name	nb profiles
EXRE0010	Recopesca sensor 5030	770
EXRE0184	Recopesca sensor 5245	363
EXRE0174	Recopesca sensor 5209	351
EXRE0014	Recopesca sensor 5046	340
EXRE0054	Recopesca sensor 5092	236
EXRE0216	Recopesca sensor 5223	200
EXRE0147	Recopesca sensor 5113	127

EXRE0092	Recopesca sensor 15096	126
EXRE0218	Recopesca sensor 15065	113
EXRE0222	Recopesca sensor 15138	92
EXRE0229	Recopesca sensor 5341	79
EXRE0036	Recopesca sensor 15033	78
EXRE0230	Recopesca sensor 5243	72
EXRE0219	Recopesca sensor 5229	69
EXRE0138	Recopesca sensor 15074	65
EXRE0221	Recopesca sensor 5192	55
EXRE0224	Recopesca sensor 15128	55
EXRE0075	Recopesca sensor 15081	54
EXRE0083	Recopesca sensor 15017	53
EXRE0220	Recopesca sensor 15061	43
EXRE0179	Recopesca sensor 5080	39
EXRE0189	Recopesca sensor 5118	38
EXRE0193	Recopesca sensor 5063	35
EXRE0182	Recopesca sensor 5186	34
EXRE0228	Recopesca sensor 35001	33
EXRE0195	Recopesca sensor 5224	29
EXRE0202	Recopesca sensor 15052	26
EXRE0231	Recopesca sensor 5334	25
EXRE0011	Recopesca sensor 5036	20
EXRE0233	Recopesca sensor 15057	19
EXRE0227	Recopesca sensor 15054	18
EXRE0223	Recopesca sensor 5225	17
EXRE0200	Recopesca sensor 5351	16
EXRE0099	Recopesca sensor 15100	15
EXRE0070	Recopesca sensor 15069	12
EXRE0066	Recopesca sensor 15094	7
EXRE0225	Recopesca sensor 25004	6
EXRE0107	Recopesca sensor 15118	6
EXRE0226	Recopesca sensor 5188	5
EXRE0188	Recopesca sensor 5350	4
EXRE0217	Recopesca sensor 15066	3
EXRE0209	Recopesca sensor 5336	2

A comparison between NCEI Ocean Climate Lab. (OCL) profiles and Coriolis profiles is underway. The profiles from Coriolis that do not exist in OCL will be provided to GTSPP.

In 2017, our German colleagues from the UDASH project released a total of 300 000 UDASH profiles. 20731 profiles were new to Coriolis data base. These new profiles were added in Coriolis database, with a specific data format code: “UD”.

A CTD data set (http://doi.org/10.17882/45461) was released by the MEOP (Marine Mammals Exploring the Oceans Pole to Pole) program (http://www.meop.net/meop-portal/) in November 2017. The data set contains delayed mode data from MEOP sea-mammals program.

The Coriolis data team is now working on the ingestion of MEOP 2017 release. All sea-mammal profiles from GTS or previous MEOP profiles will be removed and replaced by MEOP 2017 profiles.

All former IF* platform codes will be eliminated and replaced by their proper WMO code. The sea-mammal “platforms” with no WMO platform code will receive an “EXSM*” code. An action is underway with JCOMMOPS to assign WIGOS platform codes to historical sea-mammal platforms that never received a WMO platform code.

As part of Coriolis observing system, the hull ADCP from French research vessels are continuously measuring current velocity profiles. These data are public and reusable. If requested, they may contribute to GTSPP project.

CORA (Coriolis Ocean Dataset for Reanalysis), the Coriolis delayed mode reanalysis on temperature and salinity, is released once a year (*http://doi.org/10.17882/46219*.) All vertical profiles from 1950 to now are analyzed with ISAS (In-Situ Analysis System; http://www.umr-lops.fr/en/SNO-Argo/Products/ISAS-T-S-fields) V6 objective analysis. Alert on profiles generated by ISAS and by the MIN-MAX comparison are visually checked in Coriolis database. The visual inspection is performed by a scientist who may decide to flag suspicious data as bad.

The MIN-MAX quality control is regularly improved by Coriolis-science team.The ISAS objective analysis is also regularly improved by Ifremer-CNRS physical oceanography laboratory team (LOPS).

MEDS ASCII format issues were pointed out by Norman Hall on the last Ifremer data delivery: the history section of some profiles was exceeding the MEDS ASCII format limit. These were fixed in December 2017. An action is underway to upload in GTSPP CMD database the MEDS ASCII files provided by Ifremer.

4.4 JAPAN

Dr Sun, on behalf of Ms Ayako Takeuchi, reported the activities of the GTSPP data product center (GDPC) for the North Pacific Ocean operated by the Japan Meteorological Agency (JMA). GDPC started the monitoring of BATHY/ TESAC messages on GTS, in March 2011 and issuing the monthly report in April 2012.

The GDPC website (http://ds.data.jma.go.jp/gmd/gtspp/data/index.html) provides near real time access to BATHY/ TESAC messages, on a call-sign basis or on a Pacific SOOP line basis. The messages can be found together with the temperature profiles, position maps, and the comparison results with JMA ocean data assimilation system. From September 2016 to January 2018, GDPC recognized 56 cruises by 16 ships going on GTS as “Frequently Repeated” or “High Density” or “JMA Research Vessel” SOOP line observations in the Pacific. The table below shows the numbers of observations for each ship.

Call-Sign	Name	Times	Call-Sign	Name	Times
9V2401	TACOMA TRADER	3	NMMJ	USCGC SHERMAN	4
9V3581	MAERSK JAUN	3	OWKF2	JOSEPHINE MAERSK	2
9V9713	SHENGKING	2	V2DV4	CAP PASADO	10
9V9832	SIANGTAN	3	V7GQ8	MAERSK LOME	2
D5ES8	E.R.FRANCE	3	V7LH7	CAPE FRANKLIN	1
JGQH	RYOFU MARU III	2	VNVZ	NORTHEWEST SANDERLII	11
JPBN	KEIFU MARU	2	VROX6	SAFMARINE MULANJE	1
KRGB	HORIZON ENTERPRISE	6	WFLG	HORIZON SPIRIT	1

GDPC started issuing the Monthly Report in April 2012. Monthly Report is targeted at SOOP line observations and provides the summary of JMA AQC results together with some

figures showing the comparison results with JMA assimilation system. Monthly Report reflects GTSPP best copy data, if available JMA issues a Monthly Report two (2) months after observations. It includes the JMA automatic quality check results.

4.5 USA-CMD

Dr Norman Hall reported that NCEI continued to provide services for maintaining the GTSPP Continuously Managed Database (CMD), known as the GTSPP archive, during the GTSPP inter-sessional period 2017 – 2018.

All valid real-time (RT), SEAS Real-Time Archive (RTA), and Delayed-Mode (DM) GTSPP data received at NCEI through March 2018 have been archived and loaded into the Continuously Managed Database. Matching by (Source + Date-Time + Position) and by CRC have been performed. Information in the match table has been used to generate a report on CRC matching to supplement the report from the last meeting (November 2016). SEAS RTA data from AOML was found to match by CRC for 95% of the 14650 total RTA stations received since October 2016, with 5% of RTA stations remaining unmatched. One new (since Oct. 2016) delayed-mode accession (from CSIRO) was found to have stations with CRC values, but matched by CRC for only 1% of those stations. All of the stations with unmatched CRC's in that accession were nevertheless matched by Time and Position.

Although three DM accessions in 2007-2009 had CRC values that matched, No IFREMER delayed-mode data has been loaded to the database recently, as the files made available have format problems (MEDS-ASCII frame-shift errors) which may require correction by the originator. A full description and examples have been sent to Loic Petit De La Villeon.

Documentation of the operational procedures for maintaining the database, and of the schema structure and the functions of the data processing software are currently being prepared, in anticipation of handing operations over to a new manager upon Norman Hall's retirement. Additionally, before his expected retirement at the end of calendar year 2018, Norm will be working with Tim Boyer to facilitate more direct integration of the GTSPP CMD PostgreSQL operations with those of the World Ocean Database.

4.6 USA-SEAS

Dr Trinanes, on behalf of Dr Goni, reported the activities of the XBT Network operations in the US. The XBT Network in the US is maintained by the Ship Of Opportunity Program (SOOP), which is an international program mainly involved in the implementation, maintenance, enhancement, and data management of upper ocean measurements from Ships Of Opportunity (SOO). Operations include the deployment of XBTs, as well as the installation and operations of ThermoSalinoGraphs (TSGs), CPRs, and pCO2 systems (part of SOOPIP since SOT-9). Additionally SOOP supports other observational platforms such as drifters and profiling floats.

SOOP supports scientific and operational efforts to help improve our knowledge of the ocean environment, through data analysis and contribution to modeling efforts. The data obtained from the XMB network are used for Meridional Heat Transport (MHT) and Meridional Overturning Circulation (MOC) studies and assessments, and for studies and monitoring of surface and subsurface currents, fronts and eddies. The data obtained also contribute to upper ocean heat content studies and to initialize and validate modeling efforts.

Global XBT operations are carried out mostly as part of international partnerships and collaborations between institutions from several countries including Argentina, Australia, Brazil,

Canada, China, Cyprus, France, Germany, India, Italy, Japan, South Africa, United States, United Kingdom, and Taiwan.

During the last two years, XBT operations in the US had several accomplishments regarding the network implementation, engineering developments and science applications, including:

- Continue maintaining a complex XBT network, through strong international partnerships
- Facilitated interaction with other communities (pCO2, TSG, Argo, Drifters, CPR, VOS, GHRSST, SAMOS, OceanScope, IQUOD etc.)
- Improved Auto Launcher (AL) for multiple types of probes
- New antennas for RT data transmissions through Iridium
- Contributed with the design, development, and first tests of improved XBT probe in partnership with Sippican.
- Development of the first prototype of a low cost XBT recorder.
- New SEAS improvements
-
- US XBT data fully compliant with BUFR format since 2012
- Transmissions in RT into the GTS of all XBT transect data
- Recommended biases/offsets correction (Lijing et al, 2015)
- New antennas for RT data transmissions through Iridium
- Contributed with the design, development, and first tests of improved XBT probe in partnership with Sippican.
- Strong use of XBT observations for scientific studies: variability of western boundary currents, undercurrents, eddy fields, frontal variability, heat transport, heat content, (~85 XBT publications per year)
- Use of XBT data for validation and initialization of numerical models for weather and climate forecasts

During the period October 2016-Septeber 2017 NOAA/AOML and partners completed 6824 XBT deployments along 11 transects in the Atlantic and Indian Ocean and Scripps Institution of Oceanography (SIO) completed 4678 deployments along 9 transects in the Pacific, South Atlantic and Indian Ocean.

Additionally, for the same period the US-SOOP provided data distribution through the GTS using the SEAS system for approximately 500,000 marine weather observations obtained from 800 ships of the US Voluntary Observing Ship (VOS). The US-SOOP also supports the deployment of Drifter and Agro float. For example since 2000 a total of 861 drifter and 719 Argo floats have been deployed along 5 transects in the Atlantic Ocean (AX07, AX08, AX10, AX18, and AX25) during high density XBT cruises. All XBT data collected in the US is submitted in real-time and delayed mode to GTSPP.

The US XBT Network Status:

- Continue having strong scientific justification
- Continue supporting proper implementation and partnerships
- Continue supporting timely data distribution and quality control
- Continue supporting strong science and operational uses
- Continue acknowledging critical contribution of engineers, science and technical support personnel, program managers and funding agencies, ship riders, PMOs, shipping companies, etc.
- Continue partnerships with Argo, Global Drifter Program, closer partnership with pCO2 community (Super SOOP)

- Initiate partnership with GRHSST community
- Enhance sampling planning in collaboration with the shipping industry

4.7 UK-BODC

Dr Sun reported that Ms BEJA of UK-BODC was unable to give the report in person or via teleconference. Instead, she provided a few slides descripting the "Oceanids" project that includes development of a new 1500m depth-rated Autosub Long Range (ALR1500), and a 2000m depth-rated vehicle capable of carrying high-power sensors and venturing under ice (Autosub2000-UI). The objects of Oceanids are (1) to unify and consistent infrastructure to control multiple unmanned long-range vehicles operated by the National Oceanography Centre (NOC), (2) support the automated transfer and archiving of near real-time science data collected by the vehicles into BODC, (3) be expanded in the future to the UK community, and (4) Implement for gliders, expand for other data streams (including ship's underway and CTDs).

5. REVIEW OF THE GOVERNANCE OF GTSPP

Dr Sun reminded the SG-GTSPP that the revised Terms of Reference (ToR) and General membership of GTSPP were adopted by the 22nd session of the IOC Committee on International Oceanographic Data and Information Exchange (IODE). He continued to remind 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 step aside from the chair position but remained in the steering group. He suggested that a new chair should be selected as soon as possible.

Dr Sun 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. NCEI, (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.

6. EXTERNAL CONNECTIONS

6.1 IQUOD CONNECTION

The International Quality Controlled Oceanographic Database (IQuOD) is a global effort to provide a standardized set of quality controlled subsurface ocean temperature data for oceanographic and climate research. The effort consists of testing to provide an agreed-upon best set of automated quality control checks, a system for expert quality control whereby automated flags will be verified, uncertainty values for each measurement, intelligent metadata to enable the uniform application of needed adjustment, and dissemination through multiple sources. GTSPP plays a leading role in many of these activities by 1) supplying automated quality checks for testing and possible inclusion in the final standardized set, 2) adaptation of expected set of automated tests to near-real time needs, 3) expertise in data management, intelligent metadata, and specific instrumentation, 4) being a major data source for IQuOD.

6.2 GTSPP-WOD INTEGRATION

The World Ocean Database (WOD) and GTSPP have long had an overlapping connection. GTSPP is one of the main sources of near-real time data to the WOD historic ocean profile database. GTSPP supplies nearly all of the near-real time XBT, CTD, instrumented pinniped, and glider data found in the WOD. There is personnel overlap between the two efforts, both at NCEI and internationally through delayed-mode data exchange. It has

long been a goal to integrate the two data sets. Integration between the two is being pursued at two levels at NCEI. On the database level, Norm Hall is working on allowing the full processing and dissemination of the WOD through the postgres database schema which currently supports GTSPP. Norm has fit the WOD into the structure and the next step is testing to be sure the necessary speed of processing and scientific calculation necessary to the WOD work flow are possible in the postgres environment. On the dissemination level, GTSPP and WOD are part of a project at NCEI to allow for conjoined access to any data set through a subsetting service. This project, in the testing stage, will allow a user to access GTSPP, WOD, the NCEI thermosalinograph database, the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) meteorological and underway data, Argo, and the Global Ocean Currents Database (GOCD) concurrently.

6.3 JCOMM MCDS CONNECTION

The JCOMM Marine Climate Data System (MCDS) is an international system to facilitate data flow, maximizing the volume of data available, minimizing data latency and effort by data providers and data users. The MCDS is expected to have 6-10 data areas, each with a Center for Marine Meteorology and Oceanographic Climate Data (CMOC) to aggregate all data within the data area, be a dissemination point, and create products. The CMOCs will be fed by a series of Global Data Assembly Centers (and National Data Centers) which in turn will be fed each by a select set of Data Assembly Centers (institutional, project based, etc.). For ocean profile data, the WOD is ratified as a CMOC by JCOMM and WMO, awaiting IOC ratification, potentially at the next IODE meeting. GTSPP is slated to be a GDAC, specifically for near-real time data pulled off the Global Telecommunications System (GTS). None of the paperwork for installing GTSPP as a GDAC has yet been completed. It is recommended that this be done by the upcoming IODE meeting. It is expected that GTSPP already meets all requirements to be a GDAC in the MCDS as defined by JCOMM.

6.4 JCOMM SOT/SOOP

Dr Bringas reported that the Ship Of Opportunity Program (SOOP) is an international program mainly involved in the implementation, maintenance, enhancement, and data management of upper ocean measurements from ships of opportunity (SOO), including:

- Expendable BathyThermographs (XBTs) but not limited to SOO
- ThermoSalinoGraphs (TSGs)
- pCO2 systems

Additionally, SOOP supports other observational platforms, including the deployment of drifters and profiling floats. The following is a summary of the current status and activities in the SOOP:

- Incorporation of CO2 network into SOOP
- Reducing uncertainty in air-sea flux in CO2 and quantification of temporal and spatial variability
- Review of metadata requirements for platforms and observations continues
- Submission of platform registration at JCOMMOPS
- Scientific research focus on boundary currents and trans-basin meridional heat transports
- Operational focus on validation of products obtained from numerical modelling and data assimilation
- Around 90 yearly scientific publications using XBT data
- There are ~70 active XBT ships

- There are ~ 50 automated underway CO2 systems
- The XBT Network is implemented with the participation of 12 institutions globally
- Data distribution in real time via GTS
- Supports VOS and GOSUD data acquisition, and Argo deployments.
- 36 XBT lines: 32 active lines, 2 inactive lines (ship issues), 2 lines with limited data-sharing;
- Approximately 15,000 XBTs are deployed per year on repeat transects and 2,000 elsewhere
- Several transects have provided repeat data for more than 20, 30 years

Future plans and activities include:

- Improve submission rates of XBT metadata to JCOMMOPS
- Implement robust, sustained efforts to maintaining and tracking the network
- Maintain existing transects; recruit ships on inactive priority lines
- Harmonize with other panels in need of volunteer ships
- Migrate to unique ID scheme.

6.5 NOAA OSMC AND IODE ODIS

Mr Ouellet reported that he kept monitoring the data on the OSMC ERDDAP server to check for instruments reporting on the GTS which may be missing from the GTSPP stream and contacted Kevin M. O'Brien when appropriate.

Mr. Ouellet presented the results of the "First Session of the Intersessional working group to develop Concept Paper for an Ocean Data and Information System" (IWG-ODIS) which took place on March 23-24 2018 and developments since.

He recalled the timeline of events leading to the establishment of the "Ocean Data and Information System" (our "Sources") since the IOC External Audit in 2016, those events are summarized in the IOC/IODE-ODIS-IWG-1/3 report (http://www.ioc-unesco.org/index.php?option=com_oe&task=viewDocumentRecord&docID=21425). The outlook of ODIS was also further articulated in an abstract to be presented by the Task Team on ODIS at OceanObs'19.

The recommended solution for ODIS will initially be a repository of known marine data and information sources. A web inventory of international and national sources, consisting of a description and URL for each source, was established by IODE in late 2017. ODIS would include such existing data sources but further describe how they can be used, by organising them in a structured and searchable repository with proper discovery and technical metadata. An example of such a repository is re3data.org, endorsed by DataCite. Over time, the interoperability between systems will be improved and data providers having limited capacity will have easier connection to established repositories.

Both GTSPP and WOD are present in the IODE inventory of global systems. Mr. Ouellet noted that GTSPP did not have a presence in re3data.org, but the World Ocean Database (WOD) did. The GTSPP data-sets have many web resources (FTP, THREDDS, ERDDAP) that can be described using the Metadata Schema for the Description of Research Data Repositories.

6.6 OCEAN DOCS AND OCEAN BEST PRACTICES

Dr Sun reported that “OceanDocs” (http://www.oceandocs.org/) is one of the IODE projects aimed to collect, preserve and facilitate discovery and access to all research output from members of the ocean research and observation community and specifically their Ocean Data and Information Networks (ODINS). He continued to report that “OceanBestPractices” (https://www.oceanbestpractices.net/) is another IODE project aimed to provide a discovery point for research groups to search and find community accepted existing ocean best practices. He briefed the meeting participants on the “OceanDocs” and “OceanBestPractices” Web pages and suggested the following four should be submitted to “OceanDocs” for publications:

- GTSPP Data User’s Manual, Second Edition, 2018
- GTSPP Continuously-managed Database Manual
- The Use of the Cyclic Redundancy Check Algorithm to Generate Unique Data Tags for Ocean Profile Data (https://www.nodc.noaa.gov/GTSPP/document/IOC_MG_CRC_final.pdf)
- GTSPP Real-Time Quality Control Manual , Revised Edition, 2010 (https://www.nodc.noaa.gov/GTSPP/document/qcmans/MG22rev1.pdf).

7. GTSPP FUTURE PLAN

Dr Sun led the discussion on GTSPP future plan. He reminded the participants that GTSPP (initially, Global Temperature and Salinity Pilot Project) was formulated in about 1988 and went into operation in 1990. The project established by IODE Recommendation IODE-XV.4. It was initiated jointly by IODE and IGOSS in 1990 as a pilot project (through Recommendation IODE-XIII.4 and transformed in 1996 into a permanent operational programme under the co-sponsorship of IODE and IGOSS (IODE Recommendation IODE-XV.4. In 2001 JCOMM-I defined GTSPP as a programme jointly sponsored by JCOMM and IODE.

Dr Sun mentioned that there have been important developments in international ocean data management since the start of GTSPP and these other projects have commonalities with GTSPP operations. It is obvious that there are the overlaps in GTSPP operations with the programs.

Dr Sun reported that the underlying principle of the GTSPP is to operate a “continuously managed database” of global ocean temperature and salinity data. The concept of a continuously managed database, combining real-time and delayed mode data and the associated processing demands was unique at the beginning of GTSPP. GTSPP shall continue to operate under its underline principle of continuously managing global ocean temperature and salinity profile data and providing the most recent, highest quality data available at the time of a request.

He suggested to revisit requirements of the GTSPP, analyze the full capacity and capabilities of GTSPP and to lay out options and recommendations for the future of GTSPP in time for the 25th session of the IODE committee in Tokyo, Japan, between 19 and 22 February 2019.

8. ADAPTION OF THE WORKPLAN FOR THE NEXT PERIOD (2019 – 2020)

Dr Sun noted that the GTSPP future work plan shall cover 2020 in order to be in line with the IODE-XXV work plan. He anticipated that the GTSPP will conduct the action items 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) Provide data services by the U.S. NCEI and the MEDS in Canada,
d) Publish the results of comparison between temperature observations circulated on the GTS and model-simulated temperature data by JMA,
e) Continue to integrate the GTSPP CMD and WOD, and,
f) Publish the GTSPP Continuously Managed Database (CMD) system document in July 2018.

9. CLOSING OF THE MEETING

The meeting was closed at Noon on 13 April 2018. The next meeting is expected to be held in June 2020.

ANNEX I

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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-CMD
5.6 USA-SEAS
5.7 UK-BODC PLAN

6. EXTERNAL CONNECTIONS
6.1 IquOD (International Quality-Controlled Ocean Database) connection
6.2 GTSPP-WOD Integration
6.3 JCOMM Marine climate data system (MCDS) connection
6.4 IODE OceanTeacher Global Academy connection
6.5 Integrating interoperability at NOAA/AOML
6.6 XBT Data Flow and QC at NOAA/AOML

7. FUTURE COORDINATIONS
7.1 Copernicus Marine Environmental Monitoring Service (CMEMS) connection
7.2 NOAA Observing System Monitoring Center (OSMC) connection
7.3 Inter-operability: Ocean Data Interoperability Platform (ODIP), IODE-ODP, ERDDAP

8. GTSPP FUTURE PLAN

9. ADOPTION OF THE WORKPLAN FOR THE NEXT PERIOD (2019 – 2020)

10. CLOSING OF THE MEETING

ANNEX III

ACTION LIST

No.	Action	Who	Target Date
1	Report on corrected CRC calculation.	CSIRO	Next meeting
2	Update QC documentation (as required) and provide copy to GTSPP Long-Term Archive for preservation.	AOML, CSIRO,	Next meeting
3	Complete the second revision of the GTSPP Real-Time QC manual (draft)	MEDS	03/2019
4	Review the second revision of the GTSPP Real-Time QC manual (draft)	Chair (lead) GTSPP-SG	Next meeting
5	MEDS 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 will provide MEOP2017 database in MEDS ASCII files to be ingested into GTSPP database. It will cancel and replace an important amount of GTSPP sea-mammal profiles.	MEDS (lead), IFREMER	Next meeting
6	Develop a GTSPP exchange format in netCDF-4 that solves the problems of netCDF-3 (resulting from one unlimited dimension)	AOML (lead) NCEI	Next meeting
7	NCEI to implement creation of GTSPP with a DOI (include GTSPP as part of the DOI)	NCEI	Next meeting
8	Transition to next GTSPP chair	Charles	Next meeting
9	Complete CMD system document	NCEI	07/2018
10	Invite member states of the IODE and JCOMM and representatives of oceanographic projects those are important to GTSPP operations to attend the GTSPP SG meetings	Chair	Next Meeting