THE WATER TEMPERATURE INSTRUMENTAL METADATA PILOT PROJECT (META-T)

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1. The collection of appropriate metadata in support of instrument intercomparisons, quality evaluation studies, and instrument bias detection is important. For example, metadata such as fall rate equation coefficients, probe types, etc must be properly recorded and made available to the end users and to those conducting instrument intercomparison and evaluation studies as well as quality monitoring. Accessing the metadata is not always easy or straightforward. The META-T Pilot Project is addressing this issue from a broader perspective than the Ship Of Opportunity Programme (SOOP) but is limiting its scope to metadata related to SST and water temperature profiles.

2. The Water Temperature Metadata Pilot Project (META-T, http://marinemetadata.org/meta-t) was initiated by the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) through a workshop of its Observations Coordination Group (OCG), Reading, United Kingdom, 28-29 March 2006. It is aiming at providing an international standardization framework for collecting Sea Surface Temperature (SST) and water temperature profile instrumental metadata from a number of marine observational platforms. It is being developed under the umbrella of JCOMM.

3. The Project is considering all in situ ocean observing systems providing water temperature data in real time and/or delayed mode to the operational and research, oceanographic and meteorological communities. These include drifting and moored buoys, ship based observations, including from Voluntary Observing Ships (VOS) and Ships Of Opportunity (SOO), Argo sub-surface profiling floats, sea level stations and tide gauges, Ocean Data Acquisition Systems[1] (ODAS), deep ocean timeseries multi-disciplinary reference stations (OceanSITES[2]), etc.

4. Collected metadata are addressing a wide range of applications including Numerical Weather Prediction (NWP), SST analysis and Global Ocean Data Assimilation Experiment (GODAE) High Resolution SST Pilot Project (GHRSST), data assimilation and ocean field analysis, ocean modeling, ocean modelling validation, climate forecast, seasonal to decadal climate variability, satellite calibration and validation, operational activities (e.g. weather forecasters, disaster response), quality assurance activities serving above applications, and diagnostic by platform operators. The membership of the Pilot Project Steering Team was set up to cover expertise in most of the above fields. It is co-Chaired by Elanor Gowland, UK MetOffice, and Bill Burnett, NOAA/NDBC, USA.

5. At this point, the META-T Pilot Project has proposed three categories for the instrumental metadata from the types of platforms under consideration: 1) metadata required for real time distribution along with the observational data (push); 2) metadata required for real time use but not necessarily being transmitted along with the observational data (available via servers, i.e. pull); and 3) other metadata not required in real time (delayed mode). Possible types of instrumental metadata had been identified and cross checked with the user requirements so that an initial categorization could be drafted. Category definitions (Appendix A) and categorization (Appendix B) has then been refined by the META-T PP Steering Committee.

6. META-T has had active discussions on what information is required to travel with the data (category 1), and what is relatively static and so can be housed and referenced separately

[1] ODAS : are regarded as Ocean Data Acquisition Systems (ODAS), marine observing platforms such as lighthouses and light vessels, observing towers and platforms, oil rigs, land-based automatic stations which have been allocated international ocean data buoy identifier numbers (or national identification numbers, as is the case with Coastal-Marine Automated Network [C-MAN] reports from NDBC), ice drift buoys, and buoys mounted on ships.
[2] OceanSITES: OCEAN Sustained Interdisciplinary Timeseries Environment observation System (OceanSITES).

(category 2). The work of META-T crosses over into ODAS metadata developments, because a database of ODAS metadata (instrument characteristics) is being hosted at the National Marine Data and Information Service (NMDIS, China). META-T also links to the further development of BUFR[3] templates, since it partly is based on these templates that the metadata will be transmitted in real-time with the data. There are active email discussions between members of the JCOMM Observations and the Data Management Programme Areas, the WMO secretariat, and input from the WMO Commission for Basic Systems (CBS) Expert Team on Data Representation and Codes (ETDRC).

7. Specific data streams have now been considered (e.g. drifting buoys, ships, floats, etc.) and the categorization of related metadata types initiated. Good progress was made regarding the VOS data stream and the list of category 1 metadata for the VOS template is completed and was presented to the third Session of the JCOMM Data Management Coordination Group. The current version is provided in Appendix C. Results from the initial study regarding the SOOP data stream in given in Appendix D.

8. META-T now appears to be in a position to make recommendations to the SOT Task Team on Codes as well as to the JCOMM Data Management Coordination Group (DMCG) Task Team on Table Driven Codes in order to take the META-T requirements for category 1 metadata into account when defining requirements for the BUFR templates for VOS data. Metadata from the International List of Selected, Supplementary and Auxiliary Ships (WMO Publication No. 47), form a key component of the VOS metadata and will also be part of the system as category 2 metadata.

9. META-T now needs to select another type of platform (i.e. another data stream, e.g. buoys, floats, OceanSITES, tide gauges, or other types of ODAS) for which to develop a similar list of metadata.

10. Informal META-T discussions are planned in conjunction with third workshop on advances in marine climatology (CLIMAR-III), Gdynia, Poland, 6-9 May 2008, and an oral presentation will be made about the project at the workshop, which should stimulate some useful feedback from the climate research and wider data management communities. Results and recommendations based on the META-T work will also be presented to the third Session of JCOMM in late 2009.

11. META-T has proposed a mechanisms to make the SST and/or temperature profile metadata (category 1) available in real time. The NOAA National Data Buoy Centre (NDBC), USA, and NMDIS, China, have offered to develop and run mirrored metadata servers for category 2 metadata. Work remains to set up the META-T servers at both the NMDIS and NDBC and agree on the communication between the two centres for mirroring the metadata servers (category 1 and 2 metadata). NMDIS and NDBC are now planning to discuss the real-time receiving and updating mechanism for META-T metadata. The NMDIS proposed to receive and update metadata on a daily basis in text or XML format through FTP on the Internet, so as to ensure the consistency of the data that reside on both the NMDIS and NDBC servers.

12. Once the META-T system will be in place, the ship operators deploying XBTs under the SOOP will be requested to comply with the requirements of the META-T metadata collection systems, and make sure that metadata are made available in real-time through the mechanisms proposed by the META-T.

13. The XBT fall rate equation workshop is invited to make recommendations to the META-T in terms of metadata categorization for those related to the XBT data, i.e. what specific XBT related metadata to make available in real-time along with the observations distributed on the GTS (category 1), and what metadata to make available to the metadata servers (category 2).

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[3] BUFR : A table driven binary code used for the operational exchange of time critical meteorological, physical oceanographical, and hydrological information amongst National Meteorological and Hydrological Services (NMHS) over the Global Telecommunication Systems (GTS) of the WMO.

APPENDIX A

META-T PILOT PROJECT
CATEGORIZATION OF METADATA AND REQUIREMENTS

(version 2.00, 2006-11-06)

Categories of metadata

The following categories of metadata are being considered:

Category 1: Metadata required by operational users for real-time distribution within observational reports. Observational reports therefore include identification, observation date/time, location, sensor values, and category 1 metadata. Observational reports include GTS reports such as BUFR, BUOY, BATHY, TESAC, or SHIP, as well as reports distributed in real-time through other means, e.g. netCDF reports.

Under category 1, the following sub-categories can be proposed based on delivery techniques being used:

> Category 1.a: Metadata transmitted directly by the ocean platform (e.g. from the deck of the ship for a VOS) along with its observations and added to the real-time observational reports (BUFR, netCDF, SHIP, etc.).
>
> Category 1.b: Metadata not transmitted directly by the platform but known by the platform operator and added on-shore to the real-time observational reports after appropriate data processing (e.g. added in real-time to SHIP or BUFR reports before actual GTS insertion).

Category 2: Metadata of category 1 plus metadata required by users in real-time but obtained separately from the observations. Such metadata will not appear in the GTS or netCDF reports but platform operators should make them available as soon as possible after platform deployment to the servers for real-time access from there.

Category 3: Metadata of categories 1 and 2 plus metadata not required by the operational users. These typically include metadata useful for scientific purposes.
All categories of metadata should eventually reach the dedicated metadata server(s). Distribution mode is detailed below.

- Category 1 metadata require encoding in appropriate observational reports. BUFR and NetCDF formats are recommended format. Category 1 metadata should be collected by dedicated metadata server(s) from the GTS and from dedicated data systems (e.g. Argo, OceanSITES, GOSUD) for distribution.

- Category 2 metadata should be made available to the servers by platform operators as soon as possible after operational deployment of observing platforms. Formats in which to make the metadata available still needs to be defined by the META-T Pilot Project after careful consideration of existing standards (e.g. XML, MarineXML, ISO 19115).

- Category 3 metadata can be made available to the servers after the start of the platform operational life-time. Formats in which to submit the metadata will be defined by the META-T Pilot Project.

However, category 1b and 2 could be combined depending on the method of delivery of the information (i.e. if 1b is not via the GTS but pulled from a centralised server by the user).

The following user requirements are being considered by META-T: (i) data assimilation and ocean field analysis; (ii) ocean modelling; (iii) ocean modelling validation; (iv) climate forecasting; (v) seasonal to decadal climate variability; (vi) numerical weather prediction; (vii) satellite calibration; (viii) satellite validation; (ix) SST analysis; (x) operational activities (e.g. weather forecasters, disaster response)' (xi) quality assurance activities serving above applications, and (xii) diagnostics for platform operators.

Categorization

From the user requirements matrix, the categorisation of metadata types has been proposed, where the fields appear in the earliest section they are mentioned, so the information is provided in time for all users:

Category 1:

- Operational state of platform (e.g. state of ship)
- Platform type (e.g. moored buoy, drifter, VOS ship, SOOP ship, Research Vessel, profiling float, ODAS)
- Instrument type (e.g. manufacturer)
- Instrument height or depth (e.g. relative to agreed standard)
- Quality information
- Data QC'ed indicator (y/n)
- Data modified indicator (y/n)
- Sampling intervals and schemes
- Averaging schemes
- Unique tag (e.g. CRC)
- Instrument behaviour (e.g. fall rate equation)
- Housekeeping parameter (e.g. battery voltage)

Category 2:

- Platform characteristics (e.g. size, dimensions, manufacturer)
- Assumed instrument performance/resolution/precision Instrument calibration status
- Instrument location information
- Period of validity of metadata
- Information regarding data centre processing the data
- Location of further information (e.g. photos, drawings)
- Data management information (e.g. creation date, update date)
- Data telecommunication system (e.g. Argos, Iridium, Code 41)
- Type of algorithm used to convert the data

Category 3:

- Operator of platform or instrument
- Global programme in which platform is participating (e.g. Argo, VOS)
- Date of last useful transmission
- Post-Calibration information

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APPENDIX B

CATEGORIZATION OF METADATA AND REQUIREMENTS MATRIX

(version 2, 2006-11-06)

Requirements matrix

From the matrix, it can be deduced in what category every type of metadata should eventually be placed.

	Category 1 (real time with obs)	Category 2 (real-time via server)	Category 3 (delayed, e.g. for research)
NWP	(SST related only) • Platform type • Instrument type • Instrument height/depth • Quality information • Data QC'ed indicator (y/n) • Data modified indicator (y/n) • Sampling intervals and schemes • Averaging schemes • Unique tag	Any metadata useful for programme management • Operational state of platform • Assumed instrument performance/resolution/precision • Platform characteristics • Instrument calibration status • Instrument location information • Instrument behaviour • Type of algorithm used to convert the data • Period of validity of metadata • Information regarding data centre processing the data • Location of further information • Data management information • Housekeeping parameter • Data telecommunication system	• Operator of platform or instrument • Global programme
SST analysis GHRSST	• Platform type • Instrument type • Instrument height/depth • Quality information • Data QC'ed indicator (y/n) • Data modified indicator (y/n) • Sampling intervals and schemes • Averaging schemes • Unique tag	Any metadata useful for programme management • Operational state of platform • Assumed instrument performance/resolution/precision • Platform characteristics • Instrument calibration status • Instrument location information • Instrument behaviour • Type of algorithm used to convert the data • Period of validity of metadata • Information regarding data centre processing the data • Location of further information • Data management information • Housekeeping parameter • Data telecommunication system	• Operator of platform or instrument • Global programme
Data assimilation	• Platform type	Any metadata useful for programme management	• Operator of platform or instrument

and ocean field analysis	• Instrument type • Instrument height/depth • Quality information • Data QC'ed indicator (y/n) • Data modified indicator (y/n) • Sampling intervals and schemes • Averaging schemes • Unique tag	• Operational state of platform • Assumed instrument performance/resolution/precision • Platform characteristics • Any metadata useful for programme management • Instrument calibration status • Instrument location information • Instrument behaviour • Type of algorithm used to convert the data • Period of validity of metadata • Information regarding data centre processing the data • Location of further information • Data management information • Housekeeping parameter • Data telecommunication system	• Global programme
Ocean modelling	• Platform type • Instrument type • Instrument height/depth • Quality information • Data QC'ed indicator (y/n) • Data modified indicator (y/n) • Sampling intervals and schemes • Averaging schemes • Unique tag	Any metadata useful for programme management • Operational state of platform • Assumed instrument performance/resolution/precision • Platform characteristics • Instrument calibration status • Instrument location information • Instrument behaviour • Type of algorithm used to convert the data • Period of validity of metadata • Information regarding data centre processing the data • Location of further information • Data management information • Housekeeping parameter • Data telecommunication system	• Operator of platform or instrument • Global programme
Ocean modelling validation	• Platform type • Instrument type • Instrument height/depth • Quality information • Data QC'ed indicator (y/n) • Data modified indicator (y/n) • Sampling intervals and schemes • Averaging schemes • Unique tag	Any metadata useful for programme management • Operational state of platform • Assumed instrument performance/resolution/precision • Platform characteristics • Instrument calibration status • Instrument location information • Instrument behaviour • Type of algorithm used to convert the data • Period of validity of metadata • Information regarding data centre processing the data • Location of further information • Data management information • Housekeeping parameter • Data telecommunication system	• Operator of platform or instrument • Global programme • Post-calibration information
Climate			

forecast	• Platform type • Instrument type • Instrument height/depth • Quality information • Data QC'ed indicator (y/n) • Data modified indicator (y/n) • Sampling intervals and schemes • Averaging schemes • Unique tag	Any metadata useful for programme management • Operational state of platform • Assumed instrument performance/resolution/precision • Platform characteristics • Instrument calibration status • Instrument location information • Instrument behaviour • Type of algorithm used to convert the data • Period of validity of metadata • Information regarding data centre processing the data • Location of further information • Data management information • Housekeeping parameter • Data telecommunication system	• Operator of platform or instrument • Global programme • Post-calibration information
Seasonal to decadal climate variability	All metadata types from that category moved to category 2 (Keeley & Charpentier, 29/06/2006)	A practical way to access the data. Platform type and Instrument type as an indication of where the data can be accessed. Any metadata useful for programme management. • Operational state of platform • Platform type • Platform characteristics • Instrument type • Instrument height/depth • Quality information • Data QC'ed indicator (y/n) • Data modified indicator (y/n) • Sampling intervals and schemes • Averaging schemes • Instrument behaviour • Type of algorithm used to convert the data • Unique tag • Assumed instrument performance/resolution/precision • Instrument calibration status • Instrument location information • Data telecommunication system • Period of validity of metadata • Information regarding data centre processing the data • Location of further information • Data management information • Housekeeping parameter	• Operator of platform or instrument • Global programme • Post-calibration information
Satellite calibration	• Platform type • Instrument type • Instrument depth/height • Quality information • Data modified indicator (y/n)	• Operational state of platform • Platform characteristics • Instrument calibration status • Instrument location information • Assumed instrument performance/resolution/precision	• Operator of platform or instrument • Global programme • Location of further information • Post-calibration information

	• Data QC'ed indicator (y/n) • Unique tag	• Sampling intervals and schemes • Averaging schemes • Instrument behaviour • Type of algorithm used to convert the data • Period of validity of metadata • Information regarding data centre processing the data • Data management information • Housekeeping parameter • Data telecommunication system	
Satellite validation	• Platform type • Instrument type • Instrument depth/height • Quality information • Data modified indicator (y/n) • Data QC'ed indicator (y/n) • Unique tag	• Operational state of platform • Platform characteristics • Instrument calibration status • Instrument location information • Assumed instrument performance/resolution/precision • Sampling intervals and schemes • Averaging schemes • Instrument behaviour • Type of algorithm used to convert the data • Period of validity of metadata • Information regarding data centre processing the data • Data management information • Housekeeping parameter • Data telecommunication system	• Operator of platform or instrument • Global programme • Location of further information • Post-calibration information
operational activities (e.g. weather forecasters, disaster response)	• Platform type • Instrument type • Operational state of platform • Instrument height/depth • Quality information • Instrument behaviour • Sampling intervals and schemes • Averaging schemes	• Platform characteristics • Assumed instrument performance/resolution/precision • Instrument location information • Type of algorithm used to convert the data • Period of validity of metadata • Information regarding data centre processing the data • Data modified indicator (y/n) • Data QC'ed indicator (y/n)	• N/A
Quality assurance activities serving above applications	• Platform type • Instrument type • Operational state of platform • Instrument height/depth • Quality information • Data modified indicator (y/n) • Data QC'ed indicator (y/n) • Instrument behavior • Unique tag • Housekeeping parameter • Sampling intervals and schemes • Averaging schemes	• Platform characteristics • Assumed instrument performance/resolution/precision • Instrument calibration status • Instrument location information • Type of algorithm used to convert the data • Period of validity of metadata • Information regarding data centre processing the data • Location of further information • Data management information • Data telecommunication system	• Operator of platform or instrument • Global programme in which platform is participating • Date of last useful transmission • Post-calibration information
diagnostic by			

platform operators	• Platform type • Instrument type • Operational state of platform • Instrument height/depth • Quality information • Data QC'ed indicator (y/n) • Data modified indicator (y/n) • Unique tag • Instrument behavior • Housekeeping parameter	• Platform characteristics • Instrument calibration status • Instrument location information • Assumed instrument performance/resolution/precision • Sampling intervals and schemes • Averaging schemes • Type of algorithm used to convert the data • Period of validity of metadata • Information regarding data centre processing the data • Location of further information • Data management information • Data telecommunication system	• Operator of platform or instrument • Global programme in which platform is participating • Date of last useful transmission • Post-calibration information

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APPENDIX C

DRAFT REQUIREMENTS FOR REAL-TIME SST METADATA THAT RELATE TO VOS

Notes:

- Cells in grey are not appropriate for particular field
- A yes only indicates presence of field, not consistency of content, precision, units etc.
- A “no” indicates that the field is not available for FM-13/IMMT/IMMA/Pub. 47.
- All coded values need to be defined. Many will be adequately defined by FM-13/IMMT/IMMA but some will need updating, consolidating or need to be developed from scratch. Of particular interest to META-T might be:
    - original units of SST measurement
    - precision of SST measurement
    - method of SST measurement
- The QC fields required are presently undefined.
- This is intended to be a maximal set of requirements.
- "att" indicates field available in optional IMMA attachment
- In the META-T category:
    - Category 1 – Metadata required for real-time distribution along with observational data
    - Category 1* - Metadata required for real-time distribution along with observational data which does not require transmission from platform but which requires ancillary metadata information which is not currently available (Pub. 47 = no) or if available (Pub. 47 = yes) requires up-to-date information from Publication No. 47 to be available electronically
    - Category 2 – Metadata required for real-time applications but made available separately from the observations via a national server (note: for VOS this requires up-to-date information from Publication No. 47 is available electronically which is not currently the case)
    - Category 3 – Non-real time metadata available via a national server

						Available in Format?				
#	**Description**	**Comments**	**Units**	**Precision**	**Range**	**META-T cat.**	**FM-13**	**IMMT**	**IMMA**	**Pub. 47**
1	Unique tag	Unique identifier for report, to e.g. associate abbreviated real-time report and more complete delayed-mode report	code			1	No	No	No	
2	Ship identifier	ITU callsign	text/ code	10 char		1	Yes	Yes	Yes	Yes
3	Ship identifier	IMO number	text/ code	10 digit		2	No	No	No	Yes
4	Ship identifier	masked/encrypted	text/ code	10 char		3	No	No	No	No
5	Platform type identifier	VOS, platform, buoy, etc. - required when combining reports from multiple platforms	code			2	Yes	No (VOS only, some platforms)	att	No (VOS only, some platforms)
6	Country	Of recruitment or operator	code			2	No	Yes	Yes	Yes
7	Type of ship	e.g. research vessel, trawler, container ship	code			2	No	No	att	Yes
8	Type of observing system	e.g. manual, AWS, hybrid	code			2	No	No	No	No
9	Type of logging	e.g. manual, TurboWin Ver. x, SEAS, BATOS	text/ code			2	No	No	No	Yes
10	Original format of transmitted report	e.g. FM-13, type of national AWS transmission format	text/ code			2	n/a	Yes	No	No
11	Format version	Version of this storage/transmission format	text/ code			2	No	Yes (FM-13 version only)	No	
12	Collecting centre	For archive, which GTS collecting centre was used	code			2	No	No	Yes	
13	GTS Bulletin ID		code			2	No	No	Yes	
14	Originator	For GTS, which centre inserted data only to GTS	code			2	Yes	No	Yes	
15	Year	YYYY required if to be used for historical data	years	whole years	0000: 9999	1	No	Yes	Yes	Yes
16	Month		months	whole months	1:12	1	No	Yes	Yes	quarter
17	Day		day of month or day of year	whole days	1:31 1:366	1	Yes	Yes	Yes	No

						Available in Format?				
#	**Description**	**Comments**	**Units**	**Precision**	**Range**	**META-T cat.**	**FM-13**	**IMMT**	**IMMA**	**Pub. 47**
18	Hour	integer or fractional to include minutes?	hour of day (GMT)	whole hours or fractional hours to 0.01	0:23 0:23.99	1	Yes	Yes	Yes	
19	Minutes	integer fractional to include seconds?	minute of hour (GMT)	whole minutes or fractional minutes to 0.01	0:59 0:59.99	1	No	No	Yes	
20	Time indicator flag	gives resolution/precision of original time information	code			1*	No	No	Yes	No
21	Latitude		degrees	0.01˚ required for e.g. GHRSST	-90:90	1	Yes	Yes	Yes	
22	Longitude		degrees	0.01˚ required for e.g. GHRSST	various e.g. 0:359.99? -179.99: 180.00	1	Yes	Yes	Yes	
23	Position indicator flag	gives resolution/precision of original time information or indicates if obtained by interpolation	code			1*	No	No	Yes	No
24	Position method flag	e.g. GPS, dead reckoning, GPS with selective availability	code			1*	No	No	No	
25	Ship speed over ground	"instantaneous value" over similar period as observations, e.g. 10 minutes as opposed to speed made good over previous 3 hours	Knots	1	0.99	1	No	No	att	
26	Ship speed indicator flag	method of ship speed data	code			1*	No	No	No	No
27	Ship direction	"instantaneous value"	mixed degrees and code	1	1-360 (0 calm and 361, 362 codes)	1	Yes	Yes	Yes	
28	Ship direction indicator flag	method of ship direction data	code			1*	No	No	No	No
29	Ship heading	"instantaneous value"	mixed degrees and code	1	1-360 (0 calm and 361, 362 codes)	1	No	No	att	
30	Ship heading flag	method of ship heading data				1*	No	No	No	No

						Available in Format?				
#	**Description**	**Comments**	**Units**	**Precision**	**Range**	**META-T cat.**	**FM-13**	**IMMT**	**IMMA**	**Pub. 47**
31	Relative wind speed	"instantaneous value"	Knots	0.1	0:99.9	1	No	No	att	
32	Relative wind speed indicator flag		code			1*	No	No	No	No
33	Relative wind direction	"instantaneous value"	mixed degrees and code	1	1-360 (0 calm and 361, 362 codes)	1	No	No	att	
34	Relative wind direction indicator flag		code			1*	No	No	No	No
35	SST	note 0.01 precision is required if units of K are mandated, this higher precision might also be desirable for high quality observations (e.g. high time resolution TSG from RV)	˚C	0.1	-99.9: 99.9? -99.99: 99.99?	1	Yes	Yes	Yes	
36	Method of SST measurement	note: all the code formats have different categories/codes	code			1*	Yes	Yes	Yes	Yes
37	Depth of SST sampling	below maximum summer load line (height for radiometers)	m	1	0:99? 0:99.9"	1*	No	No	att	Yes
38	Difference of MSLL from MWL	as for VOSClim, gives change in draft	M	1	-99:99? - 99.9:99.9"	1	No	No	att	
39	Original units of SST measurement		code			1	No	No	Yes	No
40	Precision of SST measurement		code			1*	No	No	Yes	No
41	Sampling interval and scheme for SST measurement	e.g. instantaneous value, 10 minute average, 10 minute median	code			1*	No	No	No	No
42	QC indicator(s)		code			3	No	Yes	Yes	
43	VOSClim indicator	Indicates participation in VOSClim program	code			2	No	No	No	Yes

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APPENDIX D

SOOP DATA STREAM

1. What information is currently recorded?

- Observations are T, sometimes S (if collected using CTDs) as a function of time of fall (for XBTs) or pressure (for CTDs) for profiles. Metadata:
- Line number
- cruise ID
- transect number
- operator
- name of telecommunication system
- recorder type
- instrument type
- fall rate equation coefficients
- software version
- drop number
- unique tag
- date of probe batch
- Argos ID (if any)
- quality of profile
- ship name
- ending points
- national programme name
- total depth
- Details at http://www.jcommops.org/doc/metadata/submission_format.html
- Additional metadata can be available for those SOOP ships which are also VOS (WMO Pub 47).
- Surface T & S (sometimes fluorescence, nutrients, other variables) are available from pumped systems on SOOP, VOS or other platforms. Metadata: check with national programme. Additional metadata can be available for those SOOP ships which are also VOS.
- Additional information: This varies depending on how the data are received. It can include PI, platform, type of sensor, QC flags, processing history, additional meteorological or surface observations, calibrations, references to seawater samples.

2. How is it transmitted (real-time, delayed-mode, codes used, etc)?

- Real-time: profiles sent as BATHYs (XBTs) or TESACs(CTDs) with about 70% or more being distributed within 3 days of the measurement.

Metadata within BATHY:

- Indicator for digitization (k1, code table 2262)
- Instrument type for XBT with fall rate equation coefficients (IxIxIx, code table 1770)
- Recorder types (XrXr, code table 4770)
- Indicator for the method of current measurements (k5, code table 2266)

Metadata within TESAC:

- Indicator for digitization (k1, code table 2262)
- Indicator for salinity (k2, code table 2263)
- Duration and time of current measurement (k3, code table 2264)
- Period of current measurement (k4, code table 2265)
- Method for removing ship's velocity and motion from current measurement (k6, code table 2267).

Metadata with BUFR template for XBT/XCTD:

Descriptor	Name
001011	Ship call sign
001019	Ship name
001080	Ship line number according to SOOP
005036	Ship transect number according to SOOP
001036	Agency in charge of operating the observing platform
007030	Height of station above MSL
002040	Method of removing platform direction and speed from current
022067	Instrument type for water temperature profile measurement
022068	Water temperature profile recorder type
033050	Global GTSPP quality class For global water pressure profile as qualified above
033050	Global GTSPP quality class For global water temperature profile as qualified above
033050	Global GTSPP quality class For global water salinity profile as qualified above
033050	Global GTSPP quality class For global water conductivity profile as qualified above
025100	XBT/XCTD fall rate equation coefficient a
025101	XBT/XCTD fall rate equation coefficient b

Real-time: surface measurements are sent in TRACKOB code form. Metadata:

Averaging period for sea temperature. (mT, Code table 2604),
Averaging period for salinity. (mS, Code table 2604),
Averaging period for surface current direction and speed (mc, Code table 2604).

Delayed mode: arrives in a variety of formats and usually in national data centres. Receipt can be anywhere from a few days to years. Receipt at GDAC usually by exchange with national centres. SOOP Metadata for XBTs are provided on a Semestrial basis by the SOOP operators to the Technical Coordinator of the SOT. For SOOP ships which are also VOS they are provided by VOS National Focal Points on a quarterly basis to WMO for inclusion in WMO Publication No. 47.

3. Where is the data currently stored?

a. Ocean profiles are captured in both real-time and delayed mode by the Global Temperature and Salinity Profile Project (GTSPP)

- Real-time observations are captured by ISDM (formerly MEDS) in Canada
- Delayed mode observations by SISMER in France and NODC in US (operates as GDAC). Metadata are stored in JCOMMOPS database.

b. Surface measurements are captured by the Global Ocean Surface Underway Data Project (GOSUD)

- Real-time observations are captured by ISDM in Canada
- Delayed mode observations by SISMER in France (operates as GDAC)

c. Individual countries also maintain data from their own platforms

d. Data end up in WDCs - Oceanography

4. How can it be accessed?

- Both GDACs have on-line query and download capabilities.
- JCOMMOPSA metadata are made available online on a semestrial basis via its web site (query form) but a better system could be developed to provide the metadata in some standard format.
- Individual countries may provide query and download features.

5. Where are the gaps? What data is missing in real-time? What requirements are not met?

- TESAC, TRACKOB code forms do not permit sending data quality flags, variables other than T, S, currents and limited information about methods of collection. WMO traditional Character codes are frozen so BATHY/TESAC/TRACKOB cannot include more metadata than they presently contain.
- Security concerns are encouraging call sign masking in real-time. This complicates QC and long term archiving especially matching real-time to delayed mode data.
- Matching real-time to delayed mode data receipts is complicated.
- BUFR distribution needs to be initiated for BATHY, TESAC, TRACKOB.

6. How we can address the issues?

Conversion to BUFR will improve the information content of the real-time data stream, and may simplify call sign masking problems. Some metadata need to be included in BUFR reports. Hence BUFR templates need to be revised in order to comply with the requirements for real-time metadata (as eventually expressed by META-T). BUFR templates do exist but some rationalization is needed between all ship based BUFR templates. National programmes need to make appropriate software developments in order to encode data in BUFR.

b. BUFR may encourage a unification in reporting measurements (i.e. not use 3 different codes forms to report a near surface measurement collected in 3 different modes).

c. A unique identification scheme would assist in matching real-time to delayed mode.

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