Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

IODE Steering Group for Global Ocean Surface Underway Data Pilot Project (SG-GOSUD)

Second Session
Ottawa, Canada, 16-17 September 2002

UNESCO

IOC/IODE-SG-GOSUD-II
Paris, 18 September 2002
English only

Abstract
The second session of the IODE Steering Group for Global Ocean Surface Underway Data (formerly Underway Sea Surface Salinity Data) Pilot Project was held at the Marine Environmental Data Service (MEDS), Department of Fisheries and Oceans, Ottawa, Canada from 16-17 September 2002. During its Second Session the Steering Group reviewed the draft project plan. The three Working Groups - (i) Products, (ii) Transfer, processing and archiving and (iii) Data Collection - outlined their input to the project. The draft working group reports will be completed by March 2003 and presented at IODE-XVII. Two mailing lists for the project have been established to provide improved communication within the Group.

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ANNEXES

1. Introduction

The Session was opened on Monday, 16 September 20021 at 09:00 at the Marine Environmental Data Service (MEDS), Department of Fisheries and Oceans, Ottawa, Canada by Savi Narayanan, Director of MEDS. Dr Narayanan recalled the recommendation from IODE-XVI establishing the Underway Sea Surface Salinity Data Archiving Pilot Project and looked forward to the results of the integration of underway datasets to provide data and products to scientists. As host of the meeting, Bob Keeley, MEDS, welcomed the participants to the meeting.

2. Recent Developments

Bob Keeley summarized the work and progress since the last meeting. Of interest were the following points.

- He noted that there had been interest expressed by the Japanese (JODC) even though they were unable to attend this meeting. They asked that the project include them in any distribution of information or reports.
- The GODAE has keen interest in SST data to help calibrate the satellite data coming to the project. The Underway Project will be well placed to help provide the data.
- Both NASA and ESA are working on a sensor enabling salinity estimates from satellites. The data derived from this project will be extremely valuable in calibration of these data.
- The Ship Observations Team (SOT) of JCOMM held a meeting in February, 2002 at which representatives of the VOS (Volunteer Observing Ships), ASAP (Automated Shipboard Aerological Programme) and SOOP (Ship Of Opportunity Programme) attended. They agreed to work towards combining the data from these different programmes into a unified view. Since underway data are collected in these programmes, there is some overlap in the goals expressed at that meeting at what we are trying to do. It therefore is necessary to work in cooperation with these other programmes.
- Both at JCOMM-1 and the SOT meeting, interest was expressed in the Underway Project being able to deal with pCO_2 data. This was also expressed by OOPC (Ocean Observations Panel on Climate).
- The Coastal Ocean Observations Panel (COOP) is interested in the thermosalinograph (TSG) data that will be collected.

Keeley commented that in addition to the above comments, this project should design a data system that can handle any variable collected in an underway sampling (e.g. oxygen, fluorescence, etc.) and not just the short list we currently had available. He emphasized that the project needed to consider the important metadata to keep, and how to deal with the historical data. Included in the project planning had to be clear definitions of what constituted "surface" and "underway" data, setting standards for spatial and temporal scales of sampling and archiving and, data formats. Finally he recalled that the previous meeting had expressed some preferences for certain solutions for the data system. These would be discussed and refined at this meeting and would be incorporated into the draft Project Plan which would be written based on decisions taken here.

3. Review Draft Project Plan

This agenda item formed the main content of the meeting. In the preliminary discussions a few points of interest were noted.

- JCOMM has an Electronic Products Bulletin which allows users to see products from a variety of sources. The Underway Project should be sure that whatever products it produces are submitted / made available to this electronic publication.
- It was suggested that the Underway Project should have a document that can answer basic questions about the project, a Frequently Asked Questions, (FAQ) document and would be made available on the GOSUD web site. IFREMER is hosting this site at http://www.ifremer.fr/sismer/program/gosud
- Information about the project should be posted at the IODE web site.

- A new name is needed for the project that clearly and succinctly expresses the intent of the project.
- It is important to have the draft Project Plan written and delivered to the upcoming IODE meeting in March, 2003 in order to solicit participants and to explain what the project needed them to do to help.
- The project plan should include training material in both data management and instrument installation and maintenance.
- Participants in the Project will fund their own participation or may make whatever bilateral funding arrangements with other participants as is mutually agreeable.

3.1 Products

Yeun-Ho Chong outlined the AOML project objectives in the Caribbean Sea. They intend to use regional scale correlations between T, S and pCO_2 to formulate algorithms needed to check data quality. She also noted that some commercial cruise liners are collecting salinity and other data and that these could also be a data source for the project. She showed some sample products where cruise tracks were coloured by the value of the temperature or salinity measured. These looked to be both useful products for the project as well as being of some value in data quality control.

Catherine Maillard described products derived from TSG. These can be placed into three categories; data related products, network related products and science related products.

The requirements for data related products include:

> *A display of data quality*. Time series of SST and SSS from a TSG can be compared to similar time series derived along the ship's track from climatologies (e.g., Levitus). Dramatic departures from average conditions (the magnitude to be defined) can sound a alarm. The alarm triggers an operator's inspection of the observations to determine if the anomalies are real or instrumental.
>
> *A display of coverage and the present state of SST and SSS fields relative to a long term mean.* Monthly updated maps of TSG observations with the ship tracks colour coded for anomalies relative to climatologies.

Existing data products include:

Source	**Products: Ship track Maps**	**Coverage**
MEDS	Monthly maps	1999; Global
ICES	Decadal maps of underway data collected since the early 1900s	1900; water samples and TSG; North Atlantic
IRD/Brest/ WOCE SSS DAC	WOCE TSG ship tracks	1900; Atlantic, Indian, Pacific
IRD/NOUMEA	Yearly maps	1990,Tropical Pacific

The requirements for network related products include:

> *Spatial coverage.* The software developed by Dean Roemmich, SIO, or others that shows spatial coverage of Argo floats might be adapted to Underway data.

Existing network products include:

Source	**Product**	
IRD/Noumea	List of selected voluntary observing ships Number of measurements per month (world wide)	
IRD/Brest	Repeated lines tracks and annual number of data in the Atlantic	Starting in 1993; from ships of opportunity

The requirements for science related products include:

Time series of SST and SSS along repeated transects. When specific transects have been occupied for several years, long-term mean, monthly means, standard deviation and time-distance along line plots can be generated to document the mean situation and to indicate how SSS and SST have changed with respect to time.

Comparisons of TSG observations with similar analysis fields used to initialise climate forecast models. It is envisioned that SSS data from TSGs will be used to initialise climate forecast models. Although the data are not independent from the model fields, differences are expected because of inadequacies in the analysis procedures and/or the instrumentation. Comparisons of the two data sets are thus useful to identify and correct the sources of differences whether in the models or in the measurements.

Comparisons of TSG data with remotely sensed SST and future SSS fields. As is the case for model initialisation, it is expected that the data from TSG will be used to calibrate satellite SST and SSS measurements. Differences can be studied to identify remotely-sensed data and calibration problems.

Results from statistical analyses of TSG data. SST and SSS data along TSG lines can be analysed to determine the dominant time and space scales of variability. The resulting scales can then be used to refine sampling strategy and improve the mapping of these fields.

Identification of dramatic changes of SST and/or SSS. Large changes in SST or SSS may indicate phase changes in climatically important ocean signals. Products to identify such changes relative to historical changes should be developed.

Existing science products include:

Source	**Product**	**Coverage**
US NODC	WOA2001 Observed	Global
US NODC	Yearly and Pentadal Anomalies from WOA98 as numerical fields	Global
IRD/Brest & IFREMER/Brest	CD-ROM "WOCE Sea Surface Salinity"	Global
JODC	Monthly Statistics of salinity in 1x1 degree squares	West Pacific
IRD/Noumea	CD-ROM " Three Decades of In Situ Sea Surface Salinity Measurements	Tropical Pacific Ocean, 1969-2000
IRD/Noumea	Gridded Values (2° latitude by 10°), Means by Month and Year and Climatology	1969-95 Tropical Pacific Ocean
IRD/Brest	Monthly climatology of SSS in 1x1 degree squares	Tropical Atlantic (20°S - 35°N)
IRD/Brest	Monthly climatology of SSS in 1x1 degree squares	Indian Ocean

There was a broad ranging discussion on the topic with the following points being made.

- There are known problems with the Levitus climatology but plotting anomalies is an interesting and worthwhile activity. It may be that monthly means rather than long term means are more useful.
  We do not yet know what are the relevant space and time scales for surface, underway observations. Once we better determine the scales, these can feed back to determining the optimum sampling strategy. However, we would need to start with some recommendation and the recommendation was for 100-200 km and 10-30 days, recognizing that these scales are regionally variable.
- There is a preliminary web site for surface underway data at IFREMER.
- ICES now has web pages of all surface data (underway, CTD, etc.)

- Using data sent over the GTS in real-time is a good way to check the quality and notify ships of problems.
- Gilles Reverdin is involved with the CAVASOO project and he can help make the connection between TSG and pCO_2 data and products.
- Lesley noted that the UK has 4 ships with a variety of observations + TSG. Also research ships, and some ferry routes in planning will have installed TSGs.
- China has no TSG data yet but plan to develop.
- A discussion of products also includes the data.
- Data collected in inlets or fjords should not be mixed with the open ocean or even coastal observations when computing averages.
- The project should handle data from a variety of instruments
- The project will seek to partner with the scientific community and work with them to define the scientific products.

A summary of the conclusions reached included the following points

- It was decided that it was necessary to operate in spatial and time scales of the order of 100-200 km and 10-30 days. The appropriate accuracies for the two scales have yet to be set, but will be in cooperation with scientific partners.
- The project should clearly inform clients that they should not expect an accuracy better than 0.02 psu for sss.
- The Project must approach all who currently generate surface products from TSGs and ask if they are interested to issue a similar product at these scales and label it as part of this Project.
- The Project must encourage all participants to issue products as they are able, to label as part of this Project and to get a real mix for evaluation later.
- The Project must ask that some statement accompany products to define what data contributed (i.e. definition of what is surface, accuracy, etc.)
- An objective of the Project is to integrate all surface data from both this project archives and other archives with surface values.
- The Project must connect to other projects i.e. it would be desirable to approach those with other variables to become part of project. Cooperation with other projects may be through inviting representatives to sit on the Steering Group of this project.
- The Project must have a product that shows the high resolution available as a complement to the broad scale sampling of projects such as Argo.
- The Project must write a Project Plan with the list of products that we feel are missing. For example, we need a product that can help identify observations that are in error in order to notify ships so that data problems can be corrected as soon as possible.
- The Project must have a list of publications that discuss the analysis of the data.
- The Project web site will have the Project Plan, list of participants, links to products, data, documentation generated, Project logo, etc. Coriolis volunteered to host the site.
- The Project will strive to have a suite of products to be represented at the meeting discussing the future of the JCOMM Electronic Products Bulletin.

3.2 Transfer, processing and archiving

Loic Petit de la Villeon reported on IFREMER/IRD data contributions in 2002. TSG data collected from French research vessels are disseminated on the GTS after real time quality control. A quality control tool has been developed and needs to be improved for web dissemination and for delayed mode purposes. No data are disseminated via the internet in delayed mode. IFREMER has five research vessels equipped with TSG. Data processing consists of merging the T and S data. No averaging is made and new data are calibrated every six months.

Harry Dooley reported on recent work on TSG data in support of the Steering Group, which included a large TSG dataset acquired from two research vessels, Scotia and Clupea of the Marine Laboratory, Aberdeen, UK.

Yeun-ho Chong from AOML reported that her group was developing QC software and learning how to use climatologies effectively.

A report was provided on historical sea surface salinity data in RIHMI-WDC-B. A total of 221 cruises were identified, most of them have been submitted in manuscript form to the RIHMI-WDC by foreign countries in the framework of international data exchange. Former Soviet Union vessels collected data from 23 cruises. All data refer to underway bucket measurements only. A total of 54,282 sea surface salinity observations were made from 1908 to 1988, most of which were made in the 1960s. The spatial distribution of stations is concentrated in the North Sea, in the northeastern Atlantic, around Nova Scotia, and to the east of Australia. The Russian observations are mainly situated in the Barents, Black, Azov and Caspian Seas.

Thierry Delcroix described the IRD-Noumea procedures for delayed mode QC. They consist of 7 test procedures involving visual inspection with nearby data, comparison with climatology (monthly mean and standard deviation), consideration of simultaneous bottle samples and/or ctd measurements, and utilization of pre/post calibration coefficients provided by the manufacturer. He also recommended using a local climatology rather than, or together with, that from Levitus.

Archive. There is a requirement to define a common data format for exchange within the project. The following possible items were identified for the Project format.

For each dataset:

- dataset ID : unique tag attributed when the data set enters SSS network
- platform ID (WMO code)
- organization
- contact person : person in charge of the line if VOS / PI in the case of research vessel
- data centre : centre which processed the data
- date of last update of the data set
- positioning system
- positioning accuracy
- list of available parameters (GF3/IOC code)
- list of collected parameters (GF3/IOC code)
- parameter dictionary used
- measurements description, including the units
- technical parameters:
    - positioning system
    - positioning accuracy

For each parameter:

- sampling method description
- data processing level
- list of instruments and sensors
- calibration equation
- technical parameter values
    - time lag
    - depth of water intake

For each measurement:

- date and time (UTC) YYYYMMDDHHMMSS
- latitude (as decimal degrees)
- longitude (as decimal degrees)
- position QC flag?
- measurement : best value
- raw value
- QC

Calibration samples:

- all samples from the platform used for calibration

A summary of conclusions for the Project included the following points.

- The Project should use an existing exchange format rather than invent a new one. The format should be expandable to other types of data. A Working Group consisting of Lesley Rickards, Harry Dooley, Joe Linguanti, Bob Keeley, and Thierry Carval (leader) was formed. They will review available formats and metadata standards to propose a format for the exchange of data within the project and perhaps another for delivery of data to clients. The first choice is to use an existing format, second is to use a modified version of an existing one and last choice is to create a new one.
- The Project should not enforce a format on a data collector.
- The Project should not separate other parameters from T and S in sending data to an archive.
- The Project needs a document of QC procedures, and perhaps a "handbook" as exists for Argo. It is expected that the QC process will be distributed and carried out by data contributors. A working Group was formed to deal with this issue. It consisted of Mathieu Ouelette, Yeun-ho Chong, Anh Tran, Loic Petit de la Villeon, Joe Linguanti, and Thierry Delcroix (leader). This group will review the QC procedures applied by various groups and come to an agreement on what are the standards for this project. This will deal with version control, data state indicators, QC flags. The result will be a manual or project standards.
- The Project needs to specify where data be sent for processing and archiving, and Coriolis looks like a potential candidate
- The Project should have an inventory of what is available to include other data.
- The Project must talk to the US NODC/WDC-A to determine their interest to participate.
- The Project will encourage data be put on GTS but will not retrieve from there. Instead it will make direct contact with collectors and request they post data to a data server for the real-time (similar to the operations of Argo).
- The Project should poll clients (e.g. Reynolds) to see who uses the data now.
- The Project needs to consider how to collaborate with other groups to provide the integrated data to clients.
- The Project should send copy of the draft Project Plan to WDCs for their interest in participation.
- The Project start year is 1990, and will use WOCE and CLIVAR data as the first to be served. Pre-1990 data will be treated as a 2nd priority but are still of interest to the Project and contributors are encouraged to acquire these data as the opportunity arises.
- The Project should approach both IODE and JCOMM to help.
- The Project needs a process to notify ships when problems are found in the data. This will be the responsibility of contributors since they are the ones doing QC.
- MEDS offered to continue to monitor TRACKOB to see what is being missed coming directly to the server.
- The Project will ask JCOMM and JCOMMOPS TC to help track underway data collected and resolve problems.
- The Project will have an Argo-like model where contributors are the maintainers of their data residing on the global servers.
- The Project will have a centralized server since it removes the requirement that all contributors need sustain a node in a truly distributed system.
- Data merging, and version control will be the responsibility of contributors. The Project must set out the rules of this interaction. Contributors will be permitted only to manipulate their own data. Rules will be set on when data are deleted, how to document changes, etc. These rules will need to be enforced by the global server.

3.3 Data Collection

The data collection sub-group have identified a number of known data sources including:

- The ICES (http://www.ices.dk/ocean) data archive dates from 1892. These are obtained from bucket measurements and continue through the 1960s. There was a drop in data input from the

mid 1980s. The spatial coverage is the Atlantic Ocean, most of the data being collected north of 40°N. All data are transferred to WDC.

- In Greece, TSGs are being installed on Research Vessels and arrangements underway to have data transferred to data centres. Calibration is carried out with CTD values only. Most of their data are from the eastern Mediterranean.
- UK/BODC (http://www.bodc.ac.uk). Pump and TSG data are available from project databases. The pump data are made available to ICES. Datasets are fully documented and published on CD-ROM. Surface salinity measurements are also collected along ferry routes from 1960s to 1980s. They have experience in documenting characteristics of the data collection systems on ships. Only some of the data have been sent to WDCs.
- Japan/JAMSTEC (http://www.jamstec.go.jp/). Underway SSS data are collected from the R/V Mirai servicing the TRITON moorings array in the tropical Pacific. The TSG data are calibrated with the help of bottle sampling (1-2 per day). The data are stored at JAMSTEC and available via their web site; note that they are available as well from the SSS database at IRD/ Nouméa (see France: IRD).
- France: IFREMER research vessels routinely collect real time surface salinity. They consider the most appropriate sampling granularity to be 1-5 minutes, with a preference for 2 minutes. The delayed mode processing software and archive of TSG data is not developed but some work is underway. CTDs are used for calibration purposes. Generally, the data have not been sent to the WDCs
- France: IRD maintains a network of SOOPs through the 3 oceans, with a TSG sampling rate of 15 sec (a median value over 5 min is then stored). Additional support from CNRS is provided in the North Atlantic. Several ships send hourly real-time data through the GTS. Delayed-mode data are processed in Nouméa and in Brest, including regular sensor calibrations and comparisons with their own bucket data climatology (the reference period is different for the Atlantic and Pacific). In addition, 2 IRD-owned research vessels collect SSS data. Data from the IRD operated network are freely available on the internet. A large part of these data has been sent to international data centres like ICES and NODC. The IRD tropical Pacific network data, including data from vessels servicing the TAO/TRITON moorings array, are available on the web and published on a CD-ROM which is updated about every year (see http://www.ird.nc/ECOP).
- France / Australia. Underway SSS data are collected about 6 months per year (during austral summer) since 1992 in between Tasmania and Antarctica, from the French R/V Astrolabe servicing Terre Adélie. TSG data are validated with concurrent water samples and/or CTD and XCTD, and stored at LEGOS in Toulouse, France.
- Russia. Underway datasets are collected with various sensor types. Some data are on the GTS but they do not use TRACKOB. They plan to acquire TRACKOB next year. Various Russian institutes make underway measurements.
- USA: AOML. They had started to develop a real-time program a few years ago, but this was not properly funded and so ceased operation. The emphasis was on developing an operational activity for salinity data. Real time QC was done against Levitus climatology and reported back to the ship if any problems were noticed. An unfinished goal was to automate the procedures. Delayed mode calibration checks were also done. It is the intention to re-apply for funding to carry out this work, and join the programme if funding is secured.
- USA/PMEL (http://www.pmel.noaa.gov). Underway SSS data are collected from the R/V Ka'imimoana servicing the TAO/TRITON moorings array in the tropical Pacific. The TSG data are calibrated with the help of concurrent CTD. Data are stored at PMEL; note that they are available as well from the SSS database at IRD/Noumea (See France: IRD).
- SeeKeepers (http://www.seakeepers.org). The International SeaKeepers Society is a non-profit organization that "actively protects the oceans by equipping luxury yachts, other vessels, and

platforms around the world with sophisticated ocean and atmospheric monitoring sensors". TSG measurements have been made since 2000, mainly in the warm oceans.

The sub-group identified the need to address the issue of protocols for measurements, including sampling, averaging, in-situ calibrations, characterization of the errors, etc. The ICES Working Group on Marine Data Management have produced and made available guidelines for Underway type data (http://www.ices.dk/committe/occ/mdm/guidelines/). IRD has produced a guide to the installation and maintenance of TSGs. (http://www.ifremer.fr/ird/soopip/).

A summary of the discussions produced the following points.

- The Project web site and Project Plan will point to TSG installation guide and ICES guidelines.
- The Project will make recommendations about how often water samples should be taken for comparisons with TSG and how the samples should be taken. The Project Plan should extract the main points from the existing manuals and point readers to the manuals for more details.
- The Project standards should be based on scientific arguments not instrumentation capability. The Project must ask its scientific partners to provide guidance.
- The Project must write guidelines with as precise statements of what it would like in sampling protocols, recognizing not all of the requirements are settled. T. Delcroix will help with this, including citing publications that address this problem.

4. Next Steps

The Project Plan will be prepared by Bob Keeley, Thierry Delcroix and Catherine Maillard. It was agreed that the Group should seek input from the scientific community as there are some open questions which needs their advice.

The Group discussed the current name of the pilot project - Underway Sea Surface Salinity Data Pilot Project – and it was decided, after some discussion, the project should be renamed to Global Ocean Surface Underway Data (GOSUD) Pilot Project.
The following action plan was agreed.

- Draft WG reports should be completed by IODE-XVII in March, 2003.
- The Project Plan will be done by March, 2003. A rough outline will be circulated by the end of October, 2002 by Bob Keeley.
- The chairs of the Steering Group will make a recommendation to IODE to get IODE members to begin participation.
- The chairs will request IODE to allow for a key lecture of why these data are important at IODE. Catherine Maillard to coordinate.
- The Project will be renamed to the Global Ocean Surface Underway Data Project, GOSUD.
- The group preparing the Project Plan will also generate a 1-2 page summary of the project about the same time as the plan.
- Two mailing lists for the project have been established:
  - gosud@ifremer.fr for general information
  - gosud-format@ifremer.fr for people involved in the data management and formats

5. Closure

Bob Keeley thanked all participants for their contribution to the second session of the Steering Group. It was agreed that the next session of the Steering Group should be held in conjunction with the ARGO Data Management Team meeting. It was also agreed that Bob Keeley and Thierry Delcroix, would continue in the role of the Steering Group co-chairs. The meeting closed at 1630 on 17 September.

ANNEXE I

AGENDA

1. Introduction
   1.1 Welcome
   1.2 Local Arrangements
2. Recent Developments
3. Review Draft Project Plan
   3.1 Products
   3.2 Transfer, Processing and Archiving (including QC procedures, and format)
   3.3 Data Collection
4. Next Steps
5. Time and place of next meeting
6. Closure

ANNEXE II

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