WORLD METEOROLOGICAL ORGANIZATION	INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)
JOINT WMO / IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY (JCOMM)	SOT-V/Doc. IV-1.1 (06.04.2009)
SHIP OBSERVATIONS TEAM	ITEM IV-1.1
FIFTH SESSION	
GENEVA, SWITZERLAND, 18-22 MAY 2009	Original: ENGLISH

REPORT BY THE CHAIRPERSON OF THE SOOP IMPLEMENTATION PANEL (SOOPIP)

(Submitted by Gustavo Goni, Chairperson, SOOPIP)

Summary and purpose of the document

This document includes the report by the SOOPIP Chairperson on activities undertaken during the intersessional period.

ACTION PROPOSED

The Team will review the information contained in this report, and comment and make decisions or recommendations as appropriate. See part A for the details of recommended actions.

Appendices: A. XBT data transmissions in real- and delayed-time
B. TSG observations
C. Fall Rate Equation

- A - DRAFT TEXT FOR INCLUSION IN THE FINAL REPORT

IV-1.1.1 The Panel Chairperson, Dr Gustavo Goni, opened the Eighth Session of the SOOP Implementation Panel (SOOPIP) and reported on his activities on behalf of the Panel during the last intersessional period. The Ship Of Opportunity Program (SOOP) continues being a critical player in the implementation of a sustained ocean observing system. Ships of the SOOP deploy some 25,000 XBTs per year, representing approximately 25% of the upper ocean thermal observations. There has been a continuous increase in the number of profiles transmitted in real-time: 17,586 in 2007 and 19,450 in 2008. This was accomplished due to the implementation of transmissions in real or near real-time by several countries, particularly India, Brazil and South Africa.

IV-1.1.2 Dr Goni reported on the following SOOPIP activities to which he had contributed:

(i.) SOOPIP continues to encourage and facilitate the interaction between the scientific and operational communities operating different ship based observing platforms, such as pCO2, XCTDs, TSGs, CPRs, etc. (see map in Appendix B).

(ii.) In April 2008, a Fall Rate Equation (FRE) meeting was held in Miami, FL, to review and discuss results obtained from several experiments carried out to evaluate the current FRE (see Appendix C for details).

(iii.) SOOPIP continues to support the testing of BUFR format for XBT data transmissions. The first transmission test took place in 2008.

(iv.) As part of international collaboration, a scientist from India was funded to go to the US to receive training using a real-time data acquisition system. Real-time data acquisition and transmission systems were also provided to participants in Brazil and South Africa.

(v.) A community white paper (CWP) is being prepared for the OceanObs'09 Symposium to be held in Venice 21-25 September 2009. This paper will evaluate the current XBT network and make recommendations for future work, including logistics, technology, data transmissions and storage. Members of the SOOPIP are also taking active participation in other related CWP, such as GOSUD, VOS, and pCO2.

(vi.) A science and technical presentation on the SOOP operations was made at the Global Ocean Surface Underway Data (GOSUD) Implementation panel, held in Seattle, USA from 9 to 12 June 2008.

(vii.) SOOPIP is evaluating the differences between various transmission systems in XBT transect, such as Inmarsat, Iridium and Argos.

(viii.) Scientific and technical presentation of the SOOP operations were made at the Ocean Science Meeting (Orlando, March 2008), IOC Meeting, and NOAA CPO/Climate Observations Division annual meeting (Washington, May 2008).

(ix.) Through NOAA's Climate Program Office, the XBT pool for SOOP international partners was increased to enhance their participation the XBT network. These partners currently receive approximately 1800 probes per year.

(x.) SOOPIP continues to have a strong interaction with the VOS panel, particularly on several aspects of the logistics, recruitment and operations of many of the XBT transects.

(xi.) SOOPIP supported and provided material to train scientists and technicians in the West African countries as part of a U.S. Navy and NOAA "African Partnership Station". Three training courses on XBTs, drifters and floats were already carried out, one in South Africa

(2007), Ghana (2008) and Nigeria (2009). The first course was on setting up the program, the second course on the technical aspects of the observations, and the third course on the utilization of data.

(xii.) SOOPIP continues to support the monitoring of data collected from different platforms, such as surface drifters (ZZYY), TSGs (TRACKOB-NNXX), and sea stations for CTD, Argo floats and ADCP (TESAC-KKYY/KKXX).

(xiii.) SOOPIP supported the creation of tools for new near real-time data visualization, such as using Google Earth.

(xiv.) SOOPIP improved the facilitation and metadata exchange for XBT transects to include in the Annual SOOP reports.

IV-1.1.3 Dr Goni suggested that the meeting address the following issues during the SOOPIP Session, and eventually make appropriate recommendations:

(i) Enhancing the capabilities for real-time transmissions;

(ii) Continuing the strong working relationship with other communities and communicating the value of XBT observations;

(iii) Taking an active participation in International Meetings, technical, operational and scientific;

(iv) Implementing XBT transects as recommended by the scientific and operational communities;

(v) Continue exploring the possibility of using a pool of XBT that is not dependent of one particular institution. In the meantime, supporting the continuation of NOAA contributions and evaluating if it is necessary to have a common pool of XBTs (Chairman, SOT-VI);

(vi) Support the continuation of experiments to evaluate the FRE. Implementing a new equation if/as recommended by the scientific community. Adopting a new FRE if recommended by scientific community;

(vii) Exploring the possibility of building a prototype of a self-contained XBT auto launcher;

(viii) Supporting the evaluation of the performance of different real-time data transmission platforms;

(ix) Supporting the creation of a database of all scientific and technical publications that have used XBT observations;

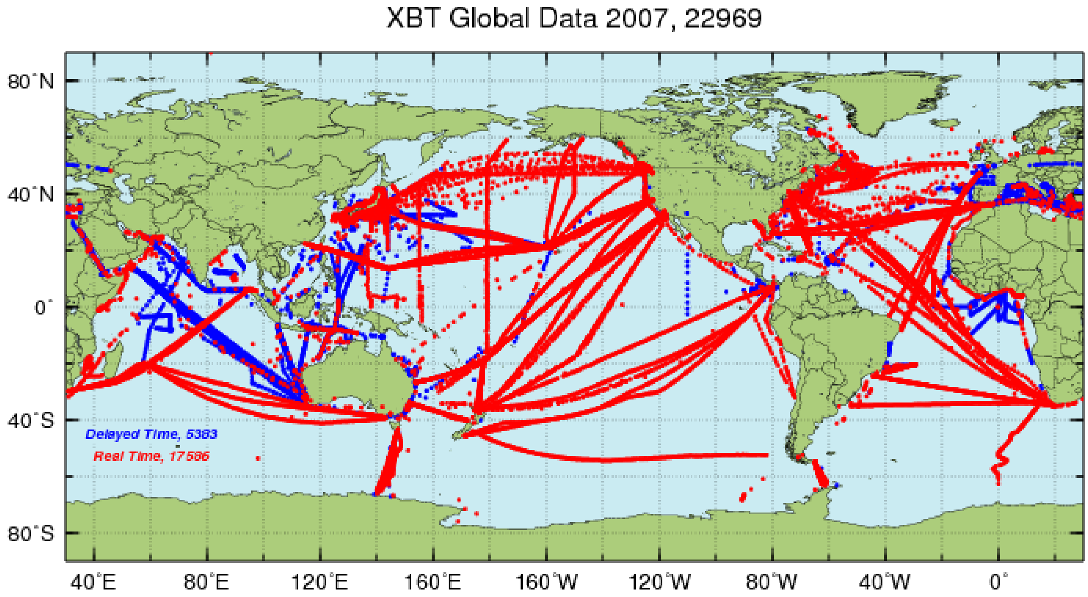
(x) Increasing international participation by supporting training of technicians and scientists in developing countries;

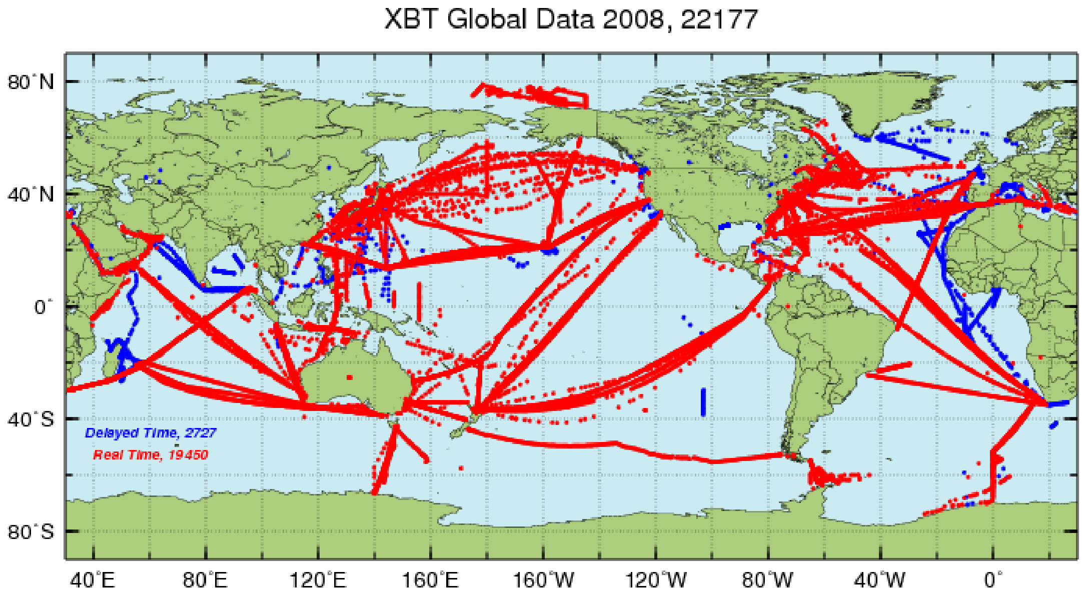
(xi) Support the maintenance of the Global Temperature Salinity Profile Program (GTSPP).

Appendices: 3

APPENDIX A

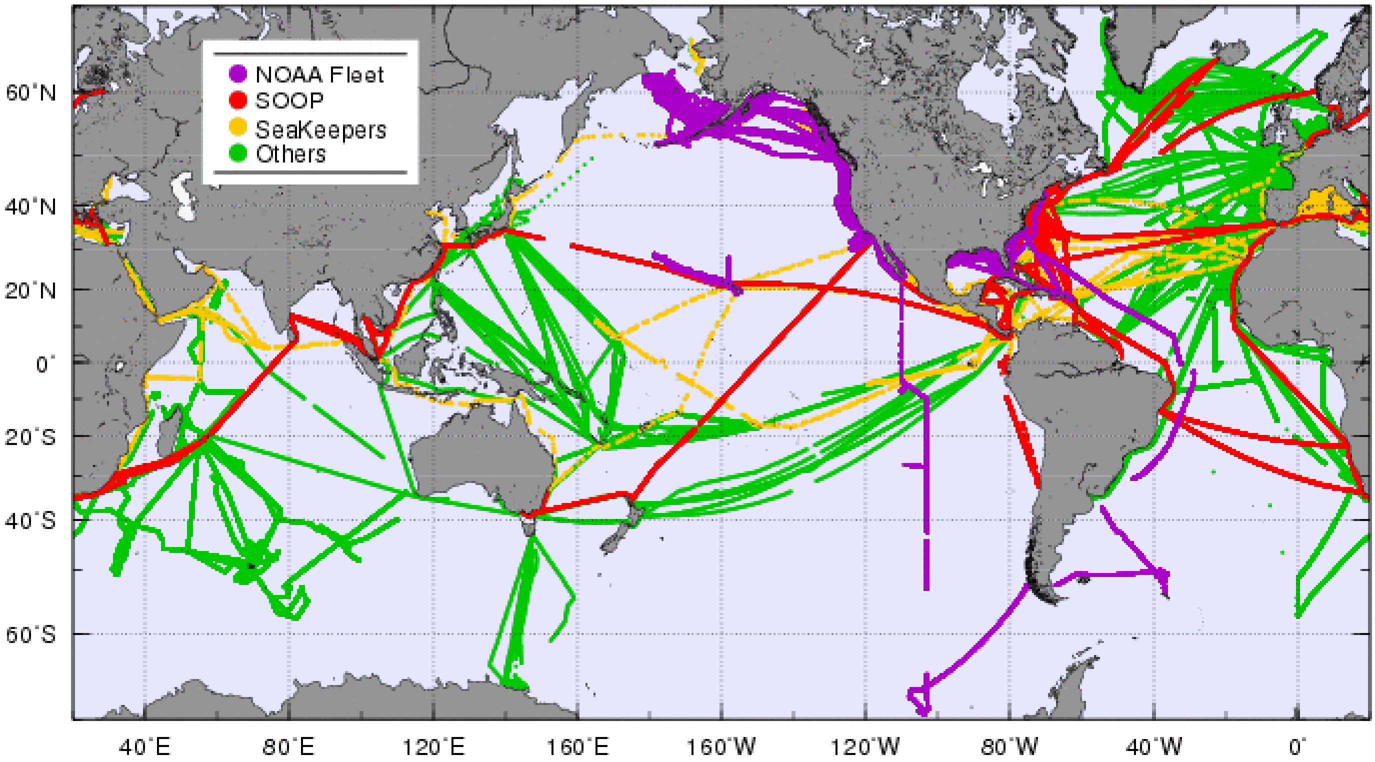
XBT DATA TRANSMISSIONS IN REAL AND DELAYED TIME





APPENDIX B

TSG OBSERVATIONS 2007-2009



____

APPENDIX C

FALL RATE EQUATION

An XBT fall rate equation (FRE) workshop was held in Miami, March 10-12, 2008. The participants reviewed the status of investigation of FRE and made several recommendations. The determination of the XBT depth is the most important source of error in XBT temperature profiles [McDowell 1977] although other sources of error exist (e.g. temperature offsets, recording errors, etc). Unlike Argo observations, XBTs determine the depth of the temperature observations indirectly from a time trace converted into depth using an FRE. This FRE results from a simple dynamical model where the net buoyant force is balanced by hydrodynamic drag proportional to the square of the probe speed [Green, 1984; Hallock and Teague, 1992]. The fall speed is virtually equal to the terminal velocity, a reasonable assumption for depths larger than 10 m. The bulk of XBT temperature profiles are collected using probes manufactured by Sippican Incorporated (now Lockheed Martin Sippican). Systematic errors in the computed XBT depths have been identified since the mid 1970s: Early comparison studies between simultaneous XBTs and Conductivity Temperature Depth (CTD) casts found a small positive bias above the thermocline, while a much larger negative bias for depths below [Fedorov, 1978; Flierl and Robinson, 1977; McDowell, 1977; Seaver and Kuleshov, 1982] demonstrating the limitations of the original FREs. Evidence of surface offset associated with initial transients has also been found [Singer, 1990]. Nonetheless, XBT temperature profiles have been shown, to be accurate enough to characterize mesoscale phenomena [Seaver and Kuleshov, 1982, Flierl and Robinson, 1977]. It was not until the 1990s when the impact of time-dependant systematic errors on climate applications was recognized. Sippican adopted a steady state correction factor after a comprehensive analysis of research-quality CTD and XBT data by Hanawa *et al.* (1995). This study showed that the manufacturer coefficients in the FRE resulted in depths that were too shallow, producing a cold temperature bias in most of the water column. As a result a stretching factor of 1.0336 was applied to the manufacturer original FRE. Recent studies suggest time-varying biases between XBT and CTD observations [Gouretski and Koltermann, 2007, Wijffels *et al.*, 2008]. The implied changes in the FRE exceed the 2% error specified by the manufacturer (Sippican) and are likely to be responsible for spurious decadal signals in global mean heat storage time series [Wijffels *et al.*, 2008]. Starting in 2000, the rapidly expanding Argo array [Gould *et al.*, 2004] provides global and highly quality controlled ocean temperature and salinity data with CTD accuracy. Nonetheless, XBT profiles currently make up to 25% of the current global temperature profile observations. Therefore, assessing and correcting this bias is critical to monitoring changes of global ocean heat content. Moreover, systematic biases between observing systems with disparate quality capabilities, such as Argo and XBTs, can also introduce spurious climatic signals in heat storage as the ratio of the number of observations collected with each platform changes [e.g. Willis 2008]. The participants recommended that more comparison studies be done using concurrent observations from XBTs, and CTDs, which may include other platforms, such as satellite altimetry, to provide help in determining if the corrections introduced by Hanawa et al (1995) would need to be revised. More studies will also need to be done to investigate if the FRE is time varying.

More information on this workshop can be found at http://www.aoml.noaa.gov/phod/goos/meetings/2008/XBT/index.php

---