

Observing System Data Access

XBT Networks

G. J. Goni, NOAA/AOML

Version 24 March 2008

1. Program Definition

The global eXpendable BathyThermograph (XBT) network provide temperature profiles that are used (1) to generate ocean analyses of upper ocean temperature characteristics; (2) to initialize seasonal-to-interannual climate forecast models; (3) in research directed at improving understanding of upper ocean dynamics and thermodynamics; and (4) ocean model validation. Three types of line sampling (the spatial and temporal sampling along each transect) have evolved with changing scientific requirements. High density (HD) sampling is eddy resolving in space and typically done four times a year with a distance of 25 to 50km between consecutive XBT drops. The eddy resolving HD sampling is directed primarily at providing data to estimate oceanic fluxes of mass and heat. On frequently repeated (FR) transects, 6 probes are launched per day and up to 18 occupations of a line per year are desired. The FR lines are primarily meridional transects done in the tropics and directed at obtaining estimates of the annual cycle of currents and heat content changes. Low density (LD) sampling includes 4 probes per day on a monthly time scale. LD was designed to map upper layer temperature characteristics. However, with the implementation of the global Argo program combined with satellite altimetry, it is envisioned that LD sampling will be phased out as the Argo array reaches its 3000 float design. Approximately 26,000 XBTs are deployed in the three deployment modes and transmitted into the GTS every year.

The design of the XBT network is derived from the Oceanobs99 report and by recommendations provided to SOOPIP by the individual CLIVAR regional panels. However, individual countries may maintain transects according to their their regional priorities that may differ from the recommendations of these panels

2. Data Flow and Quality Control

Historically data flow issues for XBT data have been addressed by the Ship of Opportunity Implementation Panel (SOOPIP) and quality issues by the Global Temperature Salinity Profile Project (GTSP). The IOC/WMO Publication "Guide to Operational Procedures for the collection and exchange of Oceanographic Data- Revised Edition", 1984 required operation data (now typically called real-time data) to be distributed on the GTS within 30 days of collection. Non-operational data (now typically called delayed mode data), which is older than 30 days should not be exchanged on the GTS. In this publication, there was no time limit or indication of the data flow pathway for non-operational data.

Since the operational centers that use the XBT data perform their own quality control on the profiles, historically, no real-time quality control has been performed on the profile data prior to submission to the GTS. Presently, in the U.S. real-time data are quality controlled using

automatic tests (i.e., no operator involvement) and visual quality control procedures before insertion on the GTS. The data submitted through MEDS, Canada undergo manual quality control before being sent to the GTS. The status of real-time quality control in other countries is unknown to the author. One objective of the pre-GTS quality control step is to identify and remedy problems quickly. This step may be improved if the operational centers communicate to data collectors the profiles that did not pass their quality control tests for identification and correction of problems.

The GTSP operation is not currently working in its original form due to lack of funding. Historically, AOML, SIO and CSIRO were in charge of the delayed-mode XBT data quality control in the Atlantic, Pacific and Indian oceans basins, respectively. At this moment, there are conversations between these three laboratories and NODC to implement a continuation of GTSP.

3. Timeliness of Distribution

Based on timeliness criteria developed for Argo, U.S. real-time XBT data undergo automatic quality control and submission of those profiles that passed these tests to the GTS within 24 hours. A similar time constraint is not put on the international community by SOOPI except for the 30-day requirement discussed above. Between 90 and 95% of the U.S. data are submitted to the GTS within 24 hours. U.S. data that fail the automatic quality control tests are reviewed by an operator, but not within a 24/7 schedule. If the operator determines that the profile is good, it is then put on the GTS (typically within 2 to 3 days). AOML provides the U.S. real-time data on <http://www.aoml.noaa.gov>. Globally, about 75% of XBT data have been distributed on the GTS, passed QC at MEDS, and are available within 3 days from time of collection. With the introduction of the BUFR format, now being tested at NOAA/AOML, metadata and flags will begin to be inserted in the XBT profiles. However, fully operational implementation of BUFR will not take place for at least three or four years.