# WOCE Subduction Buoy Data Quality Control Report

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*Introduction:*

This report summarizes the quality of surface meteorological data collected from the WOCE Subduction Experiment - an array of five surface moorings straddling the eastern flank of the Bermuda/Azores High located at 18ºN 34ºW (identifier: SUBUOYNW), 18ºN 22ºW (identifier: SUBUOYNE), 25.5ºN 29ºW (identifier: SUBUOYC), 33ºN 22ºW (identifier: SUBUOYSE) and 33ºN 34ºW (identifier: SUBUOYSW) - beginning June 1991 and ending June 1993 (Brink et al. 1995). The data were provided to the Florida State University Data Assembly Center (DAC) in electronic format by the Woods Hole Oceanographic Institution and were converted to standard DAC netCDF format. The data were then processed using an automated screening program, which adds quality control flags to the data, highlighting potential problems. Finally, the Data Quality Evaluator (DQE) reviews the data and current flags. Flags are then added, modified, or deleted according to the judgement of the Data Quality Evaluator and other DAC personnel. An in depth description of the WOCE quality control procedures can be found in Smith et al. 1996. The data quality control report summarizes all flags for the five WOCE Subduction Experiment buoys and explains reasons why these flags were assigned.

*Statistical Information:*

The WOCE Subduction Experiment buoy data are a collection of 15 minute averaged data produced by WHOI from higher temporal resolution observations. Values for the following variables were measured; however, some parameters are missing on some buoys.

| | |
|---|---|
| Time | (TIME) |
| Latitude | (LAT) |
| Longitude | (LON) |
| Earth Relative Wind Direction | (DIR) |
| Earth Relative Wind Speed | (SPD) |
| Sea Temperature | (TS) |
| Atmospheric Pressure | (P) |
| Air Temperature | (T) |
| Relative Humidity | (RH) |
| Rain Rate | (RRATE) |
| Shortwave Radiation | (RAD) |
| Longwave Radiation | (RAD2) |

Details for the buoy data are listed in Table 1 and include dates, number of records, number of values, number of flags, and total percentage of data flagged. A total of 3,434,544 values are evaluated with 67,806 flags added by the preprocessor and the DQE resulting in a total of 1.97% of the values being flagged.

**Table 1:** Statistical Information

| Buoy | Dates | Number of Records | Number of Values | Number of Flags | Number Flagged |
|---|---|---|---|---|---|
| SUBUOYC | 06/23/91 - 06/16/93 | 69,574 | 834,888 | 7,607 | 0.91 |
| SUBUOYNE | 06/18/91 - 06/14/93 | 69,778 | 837,336 | 23,835 | 2.85 |
| SUBUOYNW* | 07/03/91 - 03/13/93 | 41,218 | 494,616 | 11,614 | 2.35 |
| SUBUOYSE* | 06/29/91 - 06/19/93 | 57,704 | 692,448 | 16,924 | 2.44 |
| SUBUOYSW* | 06/25/91 - 05/24/93 | 47,938 | 575,256 | 7,857 | 1.37 |

*Note: substantial gaps in data coverage exist, see Brink et al. 1995.

*Summary:*

The buoy data proved to be of excellent quality. The distribution of flags for each variable is detailed in Table 2.

**Table 2:** Number of Flags and Percentage Flagged for Each Variable

| **Variable** | **B** | **I** | **K** | **S** | **Total Number of Flags** | **Percentage of Variable Flagged** |
|---|---|---|---|---|---|---|
| **TIME** | | | | | 0 | 0.00 |
| **LAT** | | | | | 0 | 0.00 |
| **LON** | | | | | 0 | 0.00 |
| **DIR** | | 5 | | 7 | 12 | 0.00* |
| **SPD** | | 3 | | 19 | 22 | 0.01 |
| **TS** | | | | 8 | 8 | 0.00* |
| **P** | | 1 | 45 | 13 | 59 | 0.02 |
| **T** | | 2 | 459 | 125 | 586 | 0.20 |
| **RH** | | 1 | | 21 | 22 | 0.01 |
| **RRATE** | | | | | 0 | 0.00 |
| **RAD** | 66,683 | | | 3 | 66,686 | 23.30 |
| **RAD2** | | 2 | 406 | 3 | 411 | 0.14 |
| **Total Number of Flags** | 66,683 | 14 | 910 | 199 | 67,806 | |
| **Percentage of All Values Flagged** | 1.94 | 0.00* | 0.03 | 0.01 | 1.97 | |

*Heating Problem:*

There was a noticeable radiational heating problem with the temperature sensor on all five buoys. When the earth relative wind speed was less than 2 m/s the temperature was flagged as questionable (K) or with a spike (S) during daylight hours if there was more than a 2ºC difference between the previous night's low temperature and the temperature during the day. The K-flag was used with groups of values that demonstrated this problem and the S-flag was used for more isolated values displaying the problem. Special consideration was taken into account when nighttime weather events occurred that could potentially cause the nighttime low to be anomalously lower (i.e. precipitation event).

*Negative Radiation Values:*
There were numerous B-flags assessed to shortwave radiation (RAD) by the preprocessor throughout the data sets of all five buoys, representing negative radiation values. These values are physically impossible and are likely the result of the sensor not being calibrated to resolve low shortwave radiation values.

*I-Flags:*
On the evening hours of 22 September 1992, just before midnight, Tropical Storm Charley passed right over SUBUOYNW. An I-flag (for interesting features) was used to flag the minimum pressure - a drop of close to 15 millibars in 6 hours. An I-flag was used also to indicate a minimum wind speed for when what is assumed to be the storm's center passed over the buoy - a wind speed change of approximately 15 m/s to 2 m/s in 1 hour. A sudden wind shift of about 80º inside of 15 minutes (at the time which the assumed storm center's wall passed) also earned an I-flag. Two more I-flags were used on longwave radiation for this event to indicate the beginning and end of the passing storm, representing the elevated longwave radiation values.

The I-flag was also used on two other events that were believed to be intense squall lines. An I-flag was used on the minimum value for temperature, the highest values for wind speed and relative humidity, and at the beginning and end of the passing storms' wind shifts.

*Spikes:*
Isolated spikes occurred in most of the variables throughout the data. Spikes are a relatively common occurrence with automated data, caused by various factors (i.e. electrical interference). These individual points were assigned the S-flag.

*Other Problems:*
There were no wind data recorded on SUBUOYNW from 3 July 1991 until 24 February 1992. Therefore, the DQE recommends caution be taken with daylight temperatures, given the aforementioned heating problem.

Both pressure (SUBUOYC) and longwave radiation (SUBUOYC, SUBUOYSW) displayed flat lines - data values that remained unchanged for a noticeable period. These "flat lines" were flagged as suspect with the K-flag.

*References*:

Smith, S.R., C. Harvey, and D.M. Legler, 1996: *Handbook of Quality Control Procedures and Methods for Surface Meteorology Data*. WOCE Report No. 141/96, Report WOCEMET 96-1, Center for Ocean-Atmospheric Prediction Studies Florida State University, Tallahassee FL 32306-2840

Brink, N., K. Moyer, R. Trask, R. Weller, 1995*: The Subduction Experiment Mooring Field Program and Data Summary*. UOP Technical Report 95-2, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543-1541