

Polarstern Quality Control Report

Melissa Griffin and Shawn R. Smith

World Ocean Circulation Experiment

WOCE Surface Meteorology Data Center

Center for Ocean Atmospheric Prediction Studies

Florida State University

November 16, 2000

Report WOCEMET 00-09

Version 1.0

Introduction:

This report summarizes the quality of surface meteorological data collected by the research vessel *Polarstern* (identifier: DBLK) during one WOCE cruise beginning 21 March 1997 and ending 25 April 1997. The data were provided to the Florida State University Data Assembly Center (DAC) in electronic format by G.Koenig-Longlo and were converted to standard DAC netCDF format. The data were then processed using an automated screening program, which added quality control flags to the data, highlighting potential problems. Finally, the Data Quality Evaluator (DQE) reviewed the data and current flags, whereby flags were added, removed, or modified according to the judgment of the DQE and other DAC personnel. Details of the WOCE quality control procedures can be found in Smith et al. (1996). The data quality control report summarizes the flags for the *Polarstern* meteorological data, including those added by both the preprocessor and the DQE.

Data Variables:

The *Polarstern* data are expected to include observations taken once every minute on this WOCE cruise. Values for the following variables were collected:

Time	(TIME)
Latitude	(LAT)
Longitude	(LON)
Platform Heading	(PL_HD)
Platform Course	(PL_CRS)
Platform Speed	(PL_SPD)
Platform Relative Wind Direction	(PL_WDIR)
Platform Relative Wind Speed	(PL_WSPD)
Earth Relative Wind Direction	(DIR)
Earth Relative Wind Speed	(SPD)
Sea Temperature (bow)	(TS)
Sea Temperature (keel)	(TS2)
Atmospheric Pressure	(P)
Air Temperature	(T)
Dewpoint Temperature	(TD)
Relative Humidity	(RH)
Rain Rate	(RRATE)
Atmospheric Radiation	(RAD)

Statistical Information:

Details of the cruise are listed in Table 1 and include the cruise dates, number of records, number of values, number of flags, and total percentage of data flagged. A total of 907,110 values were evaluated with 26,737 flags added by both the preprocessor and the DQE resulting in a total of 2.95% of the values being flagged.

Table 1: Statistical Cruise Information

Cruise Identifier	Cruise Dates	Number of Records	Number of Values	Number of Flags	Percent Flagged
AR_09_/01	03/21/97– 04/25/97	50,395	907,110	26,737	2.95

Summary:

The 1997 AWI data from the *Polarstern* proves to be of good quality with 2.95% of the reported values being flagged for potential problems. The distribution of flags for the remaining variables is detailed in Table 2.

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

Variable	B	D	G	H	K	S	Total Number of Flags	Percentage of Variable Flagged
LAT								
LON								
PL_HD						2	2	0.00*
PL_CRG						16	16	0.03
PL_SPD						18	18	0.04
PL_WDIR						53	53	0.11
PL_WSPD						1	1	0.00*
DIR				10	75	103	188	0.37
SPD			1				1	0.00*
TS								
TS2								
P					221		221	0.44
T		6			3,033	1	3,040	6.03
TD		6					6	0.01
RH					1,103		1,103	2.19
RRATE								
RAD	22,075				13		22,088	43.83
Total Number Of Flags	22,075	12	1	10	4,495	194	26,737	
Percent Of All Values Flagged	2.43	0.00*	0.00*	0.00*	0.49	0.02	2.95	

*Percentages < 0.01

B-Flag:

There were 22,075 B-flags assessed to Atmospheric Radiation (RAD) by the preprocessor representing radiation values less than 0 Watts per meter squared. These physically unrealistic negative radiation values are likely the result of the instrument not being tuned to low radiation values.

D-Flags:

Temperature (T) and Dewpoint Temperature (TD) were given a total of 12 D-flags by the preprocessor. The DQE felt that the flags should be left in place as they represent data that failed to be $T > T_d$.

G-Flag:

Earth Relative Wind Speed (SPD) was assessed one G-flag by the preprocessor. The DQE felt this value were realistic, as it was approximately 1.2 m/s greater than the given data trend. The G-flag was left in place to highlight a value that is greater than four standard deviations from the climatological mean (da Silva et al. 1994).

H-flags:

Earth Relative Wind Direction (DIR) was given 10 H-flags by the DQE. These discontinuities occurred with changes in the Platform Heading (PL_HD) and are likely the result of the ship's acceleration or flow distortion. Detailed investigation of the heading and ship-relative wind angles associated with the H-flags was not completed; therefore, this type of discontinuity may exist elsewhere in the time series.

K-flags:

K-flags were used to reveal signatures of ship motion in certain variables. Variables such as atmospheric pressure (P), and temperature (T) showed stair steps in the data. These stair steps were related to a change in platform course (PL_CRSS), heading (PL_HD), and/or platform speed (PL_SPD) and should not exist in earth relative data. Subsequently, the data was flagged as suspect.

Atmospheric Radiation (RAD) was given several K-flags due to a shadowing effect on March 31. As the ship altered its course/heading, the DQE suspects a shadow falls over the instrument causing a drop in the radiation level. Once the shadow passes, the radiation returned to prior levels. Shadowing may be a problem on other days; however due to the high variability in radiation values, the DQE was unable to locate other shadow signatures.

Temperature (T) was assessed several K-flags due to radiational heating of the ship. When the platform relative wind speed was low, ~ 3 m/sec or less, significant increases in temperature were occurring during daylight hours. The second problem in the temperature (T) data was a ventilation problem, which occurred when the platform wind direction was from around 180 degrees. In these instances, significant increases in temperature were flagged as cautionary.

Relative Humidity (RH) was assessed several K-flags due to unrealistic data. The current instrument used, a Pernix hair hygrometer, has an accuracy of 5 to 10%, meaning that when the RH flat-lines between 100% and 90% humid, foggy and misty conditions are likely present.

Values of relative humidity that flat-lined for two or more hours at values below 90% were flagged as cautionary. *Note:* The resolution of the data is low (whole percentage units), causing the data to contain a "block-like" pattern.

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 (e.g. electrical interference, ship movement, etc.). These individual points were assigned the S-flag.

Missing Data:

On the first day of the cruise, many of the variables had missing data. Platform Course (PL_CRIS), Platform Heading (PL_HD), and Sea Temperature (TS) were variables that reported some missing data throughout the data set. Data for Rain Rate (RRATE) primarily contained missing data, unless a rainfall event occurred.

Final Comments:

On April 1, 1997, only the first minute (0:00) of the day reported any data. Missing Data was continually reported until the second minute (0:01) on April 2, 1997. The cause of this gap in the time series is unknown.

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

da Silva, A.M., C.C. Young and S. Levitus, 1994: *Atlas of Surface Marine Data 1994, Volume 1: Algorithms and Procedures*. NOAA Atlas Series.