Ronald H. Brown IMET Data Quality Control Report

Jesse Enloe and Shawn R. Smith

World Ocean Circulation Experiment

Surface Meteorological Data Assembly Center

Center for Ocean Atmospheric Prediction Studies

Florida State University

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Introduction:

This report summarizes the quality of surface meteorological data collected by the research vessel *Ronald H. Brown* (identifier: WTEC) IMET system during one WOCE cruise beginning 8 January 1998 and ending 24 February 1998. The data were provided to the Florida State University Data Assembly Center (DAC) in electronic format by J. Shannahoff 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, whereby flags are added, removed, or modified according to the judgement 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 summaries the flags for the *Ronald H. Brown* IMET surface meteorological data, including those added by both the preprocessor and the DQE.

Statistical Information:

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

Time	(TIME)
Latitude	(LAT)
Longitude	(LON)
Platform Heading (Gyrocompass)	(PL_HD)
Platform Heading 2 (Robertson Gyrocompass)	(PL_HD2)
Platform Course	(PL_CRS)
Platform Speed Over Ground	(PL_SPD)
Platform Speed Over Water	(PL_SPD2)
Platform Relative Wind Direction (IMET)	(PL_WDIR)
Platform Relative Wind Speed (IMET)	(PL_WSPD)
Earth Relative Wind Direction (IMET)	(DIR)
Earth Relative Wind Speed (IMET)	(SPD)
Platform Relative Wind Direction	(PL_WDIR2)
Platform Relative Wind Speed	(PL_WSPD2)
Earth Relative Wind Direction	(DIR2)
Earth Relative Wind Speed	(SPD2)
Atmospheric Pressure	(P)
Air Temperature	(T)
Sea Temperature	(TS)
Relative Humidity	(RH)
Atmospheric Radiation	(RAD)

Details of the cruise are listed in Table 1 and include cruise dates, number of records, number of values, number of flags, and total percentage of data flagged. A total of 1,342,551 values are evaluated with 89,205 flags added by both the preprocessor and the DQE resulting in a total of 6.64% of the values being flagged.

Table 1: Statistical Cruise Information

CTC	Dates	Number of Records	Number of Values	Number of Flags	Number Flagged
AR_01_/02	01/08/98 – 02/24/98	63,931	1,342,551	89,205	6.64

Summary:

The IMET data from the *Ronald H. Brown* proves to be of fair quality with 6.64% of the reported values being flagged for potential problems. The precipitation data were found to be of extremely poor quality and subsequently not included in the public release. 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	E	G	K	S	Total Number of Flags	Percentage of Variable Flagged
TIME						0	0.00
LAT					3	3	0.00*
LON						0	0.00
PL_HD					2	2	0.00*
PL_HD2						0	0.00
PL_CRS					2	2	0.00*
PL_SPD					1	1	0.00*
PL_SPD2	9,276				462	9,738	15.23
PL_WDIR						0	0.00
PL_WSPD					1	1	0.00*
DIR		392		8,068	17	8,477	13.26
SPD		31		8,832	41	8,904	13.93
PL_WDIR2						0	0.00
PL_WSPD2					1	1	0.00*
DIR2				7,542	22	7,564	11.83
SPD2				10,444	26	10,470	16.38
P			361	9,766	18	10,145	15.87
T					5	5	0.01
TS					30	30	0.05
RH						0	0.00
RAD	33,860				2	33,862	52.97
Total Number of Flags	43,136	423	361	44,652	633	89,205	
Percentage of All Values Flagged	3.21	0.03	0.03	3.26	0.05	6.64	

*Percentage<0.01

Bounds Flag:

Platform speed over water (PL_SPD2) received 9,276 B-flags from the preprocessor for recorded negative values. At very low platform speeds, it is possible to have negative ship speeds, relative to the water, caused by winds, waves, and currents. Negative values also occur when the vessel is in reverse. Values of PL_SPD2, flagged B due to negative recorded values, could conceivably be good data. The user may want to disregard the boundary flags in this case.

There were also 33,860 B-flags assessed to atmospheric radiation by the preprocessor representing radiation values less than 0 $W \cdot m^{-2}$. These physically unrealistic negative radiation values are likely the result of the instrument not being tuned to low radiation values.

E-Flag:

Earth relative wind direction (DIR) and earth relative wind speed (SPD) were assessed E-flags for wind data that failed the resultant wind recomputation check. When the data set includes all variables required, a program recomputes the earth relative wind speed and direction and compares the computed values to the reported earth relative wind speed and direction. A failed test occurs when the wind direction difference is > 20º or the wind speed difference is > 2.5 m/s.

G-Flag:

A total of 361 G-flags were assessed to pressure by the preprocessor. The DQE felt these values were realistic and the flags were left in place to highlight values that are greater than four standard deviations from the climatological mean (da Silva et al. 1994).

K-Flags:

Nearly all of the 44,652 suspect data flags (K) assigned to atmospheric pressure (P), earth relative wind directions (DIR, DIR2), and earth relative wind speeds (SPD, SPD2) were due to signatures of ship motion in the variables. These signatures, often an increase/decrease in the data in relation to a change in platform course, heading, and/or speed, are referred to as stair-stepping and should not exist in earth relative data.

Both sets of earth relative winds began the cruise as good data. However, as the cruise went on, the quality of the data declined. The stair-stepping gradually became more frequent to the point where, at the end of the cruise, entire days of the data were flagged as suspect. The stair-stepping tended to be subtle, yet noticeable.

Pressure remained fairly constant with consistent stair-stepping occurring throughout the data set. However, there were some stair-steps in the pressure data flagged with the K-flag that were not a result of ship motion. For example, on 10 January, pressure demonstrated a ~4 mb increase in ~45 minutes, followed by a ~6 mb decrease in ~1 hour. There were no supporting meteorological data for such an occurrence, nor any change in platform course, heading, and/or speed.

Deleted Data:

It was determined by the DQE that the precipitation data not be reported in the public release of the data. The precipitation gauge was an R.M. Young self-siphon rain gauge. This particular instrument records precipitation measurements up to 50 mm. The instrument is then designed to rapidly drain over approximately a one-minute period. The recorded data demonstrated not only high variability in its measurements, but a potential leak in the instrument as well, as the water level would gradually decrease over the course of the day.

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.

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.