Thompson IMET Data Quality Control Report

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Introduction:

This report summarizes the quality of surface meteorological data collected by the research vessel *Thompson* (identifier: WSRY) IMET system during two WOCE cruises beginning 29 October 1995 and ending 28 December 1995. The data were provided to the Florida State University Data Assembly Center (DAC) in electronic format by Bill Martin 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 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 summarizes the flags for the *Thompson* IMET surface meteorological data, including those added by both the preprocessor and the DQE.

Statistical Information:

The *Thompson* IMET data are expected to include observations taken every minute on these WOCE cruises. Values for the following variables were collected:

Time	(TIME)
Latitude	(LAT)
Longitude	(LON)
Platform Heading (Gyrocompass)	(PL_HD)
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)
Atmospheric Pressure	(P)
Air Temperature	(T)
Sea Temperature	(TS)
Relative Humidity	(RH)
Atmospheric Radiation	(RAD)
Rain Rate (mm/min)	(RRATE)
Rain Rate 2 (mm/hr)	(RRATE2)
Precipitation	(PRECIP)

Details of the cruises 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 1,446,246 values were evaluated with 21,360 flags added by both the preprocessor and the DQE resulting in a total of 1.48% of the values being flagged.

Table 1: Statistical Cruise Information

CTC	Dates	Number of Records	Number of Values	Number of Flags	Percent Flagged
ISS02_/12	10/29/95 – 11/25/95	39,598	712,764	6,502	0.91
ISS02_/13	11/29/95 – 12/28/95	40,749	733,482	14,858	2.03

Summary:

The IMET data from the *Thompson* proves to be of excellent quality with a total of 1.48% of the reported values being flagged for potential problems. The rain rate (mm/min) were found to be of extremely poor quality and subsequently not included in the public release. 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**	**G**	**J**	**K**	**S**	**Total Number of Flags**	**Percentage of Variable Flagged**
TIME						0	0.00
LAT						0	0.00
LON						0	0.00
PL_HD					2	2	0.00*
PL_CRS					830	830	1.03
PL_SPD						0	0.00
PL_SPD2			280		16	296	0.37
PL_WDIR						0	0.00
PL_WSPD						0	0.00
DIR				2,532	70	2,602	3.24
SPD				10,122	1	10,123	12.60
P				3,593	1	3,594	4.47
T				3,640	1	3,641	4.53
TS					130	130	0.16
RH		1				1	0.00*
RAD	1			140		141	0.18
RRATE2						0	0.00
PRECIP						0	0.00
Total Number of Flags	1	1	280	20,027	1,051	21,360	
Percent Of All Values Flagged	0.00*	0.00*	0.02	1.38	0.07	1.48	

*Percentage<0.01

Bounds Flag:

There was 1 B-flag assessed to a value of atmospheric radiation of -0.2 $W \cdot m^{-2}$ by the preprocessor representing a radiation value of less than 0 $W \cdot m^{-2}$. This physically unrealistic negative radiation value is likely the result of the instrument not being tuned to low radiation values.

G-Flag:

Only 1G-flag was assessed to relative humidity by the preprocessor. The DQE felt this value was realistic as it was only 3% lower than the given data trend. The 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).

J-Flag:

Platform speed over ground was assigned 280 J flags on the first day of the second cruise, which contains approximately five hours of data. The data were flat lined at 0 m/sec, so the ship was most likely stationary in port. On the following day the data resumed normal operation.

K-Flags:

Nearly all of the 20,027 suspect data flags (K) assigned to atmospheric pressure (P), earth relative wind direction (DIR), earth relative wind speed (SPD), temperature (T), and atmospheric radiation (RAD) were due to signatures of ship motion in the variables. These discontinuous stair steps in the data, related to a change in platform course, heading, and/or speed should not exist in earth relative data and were subsequently flagged as suspect.

Pressure remained fairly consistent with stair stepping occurring throughout the data sets. There were some stair steps in the pressure data that were a result of either a change in forward speed or direction. These stair steps were associated with approximately a 1/2 millibar (mb) decrease in pressure relative to both the forward speed and direction change of the ship. However, there were some stair steps in the pressure data that were not a result of ship motions. These stair steps were related to the ship relative winds and found to increase pressure approximately 1/2 mb when the platform wind direction was from around 0 degrees and were subsequently flagged with the K-flag.

The earth relative wind direction and earth relative wind speed had stair stepping occurring throughout the data sets. The cause was likely due to flow distortion. Flow distortion is the disturbance of airflow from other objects or instruments upstream from the anemometer. The significance of the stair stepping varied throughout the data set; therefore, the earth relative winds should be used with caution.

Temperature had more specific problems. The first of which was 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 was ventilation, which occurred when the platform wind direction was from around 180 degrees. This likely affected the flow of the air prior to reaching the bow-mounted thermometer. In these instances, significant increases in temperature were flagged as cautionary.

Deleted Data:

It was determined by the DQE that the rain rate (mm/min) data not be reported in the public release of the data. The rain rate (mm/min) data were inconsistent with the precipitation amounts, so they were deleted.

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.