James Clark Ross Multimet Data Quality Control Report

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INTRODUCTION:

This report summarizes the quality of surface meteorological data collected by the research vessel *James Clark Ross* (identifier: ZDLP) during one cruise completed in 1992. The data were provided to the Florida State University Data Assembly Center (DAC) in multimet electronic format by P. Hadziabdic (BODC) and were converted to standard DAC netCDF format. The data arrived from the British Oceanographic Data Center (BODC) already quality controlled and included the BODC's own unique set of flags (e.g. G-good data, B-bad data, I-interpolated value which is assumed to be good, S-suspect data, N-null or absent value). Upon arrival, these flags were converted to WOCEMET's quality control guidelines (e.g. Z-good data, J-bad data, R-interpolated value which is assumed to be good, Q-suspect data from previous quality control, Z-null or absent value (good data)). 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 (both DAC and BODC), whereby flags were added, removed, or modified according to the judgment of the DQE and other DAC personnel. Details of the quality control procedures can be found in Smith et al. (1994). The data quality control report summarizes the flags for the *James Clark Ross* meteorological data, including those added by the BODC, the WOCEMET preprocessor, and the DQE.

DATA VARIABLES:

The *James Clark Ross* data are expected to include observations averaged once every minute on these cruises. 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	(TS)
Atmospheric Pressure	(P)
Air Temperature	(T)
Wet Bulb Temperature*	*(TW)
Downwelling Short Wave Radiation	(RAD)
Photosynthetically Available Radiation	(RAD2)

*Wet bulb temperature (TW) was not included in the public release of the data. The TW was consistently higher than the air temperature (T), which does not meet the meteorological property; T is greater than or equal to TW. After careful inspection of both variables, it was determined by WOCEMET to discard TW.

1992 FLAG SUMMARY

Statistical Information:

Details of the 1992 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 1,094,055 values were evaluated with 91,806 flags added by both the preprocessor and the DQE resulting in a total of 8.39% 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
P__19A/00	10/28/92 – 12/17/92	72,937	1,094,055	91,806	8.39

Summary:

The overall1992 multimet data from the *James Clark Ross* proves to be of fair quality with 6.73% of the reported values flagged for potential problems. *Note: R-flags are not necessarily bad data, but simply interpolated data. Therefore R-flags were not included in the overall data quality.* The distribution of flags for each variable are detailed in Table 2.

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

Variable	G	J	K	Q	R	S	Total Number of Flags	Percentage of Variable Flagged
TIME								0.00
LAT					5,821		5,821	7.98
LON					5,821		5,821	7.98
PL_HD		1,172		1,865	504	52	3,593	4.93
PL_CRS					5,446		5,446	7.47
PL_SPD					5,446	11	5,457	7.48
PL_WDIR			1,051	142		9	1,202	1.65
PL_WSPD								0.00
DIR			9,791	6,920		580	17,291	23.71
SPD			9,005	6,439		180	15,624	21.42
TS	2,518	553	934	17,369		4	21,378	29.31
P	2,402		2,063	1,664		4	6,133	8.41
T	935		1,873	7		3	2,818	3.86
RAD				892			892	1.22
RAD2		8		322			330	0.45
Total Number of Flags	5,855	1,733	24,717	35,620	23,038	843	91,806	
Percent of All Values Flagged	0.54	0.16	2.26	3.26	2.11	0.08	8.39	

G-flags:

Note: During the P__19A/00 cruise, the ship traversed south of 40-60 degrees South Latitude. In this region of the globe, little information is known about the climatology, as the data is sparse. Consequently, the G-flagged data values may be realistic, though extreme observations.

Sea temperature (TS) had 2,518 G-flags over the P__19A/00 cruise. Overall, the flagged sea temperatures were approximately one to nine degrees Celsius greater and one to five degrees Celsius lower than the climatological value; therefore, the DQE feels these are realistic, though extreme, sea temperatures.

Pressure (P) received a total of 2,402 G-flags during the P__19A/00 cruise. These flagged values were approximately ½ to 32 mb greater and ½ to 13 mb lower than the climatological value. These flags were left in place to highlight extreme pressure values.

Temperature (T) was assessed 935 G-flags for values that were approximately one degree greater or lower than the climatological value.

The G-flags were left in place to emphasize values that are greater than four standard deviations from the climatological mean (da Silva et al. 1994).

J-flags:

All of the J-flags assessed to the 1992 *James Clark Ross* cruise, P__19A/00, were associated with measurements holding at a constant value (often zero) for an unrealistic period of time.

K-flags:

The K-flag represents suspect data and should be used with caution. Throughout the P__19A/00 cruise, numerous data were assessed the K-flag. The most significant use of the K-flag was to reveal signatures of ship motion in the variables. Variables such as earth relative wind direction (DIR), earth relative wind speed (SPD), atmospheric pressure (P), and temperature (T) showed stair steps in the data. These stair steps are related to a change in platform course (PL_CRS), heading (PL_HD), and/or platform speed (PL_SPD) and should not exist in earth relative data. Subsequently, the data were flagged as suspect.

The earth relative wind direction (DIR) and earth relative wind speed (SPD) had stair steps occurring throughout the data set. 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.

Stair stepping occurred with pressure (P) throughout the data set. There were some stair steps in the pressure data that were a result of a change in either forward speed or direction. These stair steps were associated with approximately a ½ 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 the ship motions. These stair steps were related to the ship relative winds and increased pressure approximately ½-1 mb when the platform wind direction was approximately 180 degrees.

Temperature received K-flags for problems other than stair stepping. The first of which was due to radiational heating of the ship. When the platform relative wind speed was low, ~5 ms^{-1} or less, significant increases in temperature were occurring during daylight hours. The second problem was flow distortion, which occurred when the platform wind direction was from around 230 degrees. This likely affected the flow of the air prior to reaching the thermometer. The thermometer is assumed to be bow-mounted, but insufficient information about the location of the thermometer was available to the DQE at the time of visual inspection. In these instances, significant increases in temperature were flagged as cautionary.

Platform relative wind direction (PL_WDIR) was assessed 1,051 K-flags to values of data severely lacking expected variability. Although PL_WDIR lacked expected variability, the actual data resembled a typical example of data values associated with PL_WDIR.

Sea temperature (TS) received K-flags during the P__19A/00 cruise for possible instrument malfunction. These erroneous data values were evaluated on many different occasions. For example, on November 11, 1992 sea temperature was near zero for many hours when abruptly, TS increased approximately six degrees Celsius in six minutes and then gradually returned back to the prior trend. The data, which was uncommon with the previous TS trend, was K-flagged as suspect.

Q-flags:

Data from the P__19A/00 that were deemed suspect by the BODC were assessed Q-flags by WOCEMET.

R-flags:

Several R-flags were assessed on the P__19A/00 cruise to variables such as, latitude (LAT), longitude (LON), platform heading (PL_HD), platform course (PL_CRS) and platform speed (PL_SPD). Interpolated values are interpolated by the data provider, BODC, and are assumed to be good data.

Spikes:

The BODC evaluated several spikes. Additional spikes were identified during visual inspection by the DQE and they were assigned the S-flag. These spikes are a relatively common occurrence with automated data, caused by various factors (e.g. electrical interference, ship movement, etc.).

FINAL DISSCUSSIONS:

Special attention should be made to variables affected by Q and R flags, as WOCEMETs' DQE did not assign these flags and therefore, did not thoroughly discuss in this document the reasons for their use.

REFERENCES:

Smith, S.R., C. Harvey, and D.M. Legler, 1994: *Handbook of Quality Control Procedures and Methods for Surface Meteorology Data*. Report No. 141/96, Report MET 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.