Charles Darwin Multimet AWS Data Quality Control Report

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Introduction:

This report summarizes the quality of surface meteorological data collected by the Charles Darwin (identifier: GDLS) multimet system during two WOCE cruises in 1991. The quality controlled data were provided to the Florida State University Data Assembly Center (DAC) in electronic format by J. Gould at the BODC. The data were converted to standard DAC netCDF format and the existing BODC cautionary flags were changed to "Q" flags designating questionable values. 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 reviews the data and current flags. Flags are added, modified, and 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 Charles Darwin multimet data and explains reasons for the flags assigned.

Statistical Information:

The Charles Darwin multimet data are expected to include observations taken every minute on each of the WOCE cruises. Values for the following variables were collected:

Time	(TIME)
Latitude	(LAT)
Longitude	(LON)
Earth Relative Wind Direction	(DIR)
Earth Relative Wind Speed	(SPD)
Sea Temperature	(TS)
Air Temperature	(T)
Wet-bulb Temperature	(TW)
Long Wave Radiation	(RAD)
Short Wave Radiation	(RAD2)
Atmospheric Pressure	(P)*

* Collected only on cruise AR_12_/03.

Details of each cruise including cruise dates, number of records, number of values, number of flags, and percentage flagged are listed in Table 1. A total of 773,210 values are evaluated with

76,098 flags added by the preprocessor and Data Quality Evaluator for a total of 9.84 percent of the values being flagged.

Table 1: Statistical Cruise Information

CTC	Dates	Number of Records	Number of Values	Number of Flags	Percentage Flagged
AR_07E/03	8/01/91 - 9/03/91	47,225	472,250	48,804	10.33
AR_12_/03	9/08/91 - 9/26/91	27,360	300,960	27,294	9.07

Summary:

The quality of the Charles Darwin multimet data is very good for most of the variables. Short wave radiation values, however, were suspiciously low and were flagged completely with the "K" flag. Earth relative wind direction and speed had numerous spikes, resulting in 1 to 2 percent of these variables receiving flags. The other variables are of excellent quality and exhibited only

Table 2: Number of Flags and Percentage Flagged by Variable

Variable	D	G	J	K	Q	S	Total Number of Flags	Percentage of Variable Flagged
DIR			822	81	105	307	1315	1.76
SPD		1	822	86	64	85	1058	1.42
TS					4	3	7	0.01
T	509		54		133	2	698	0.94
TW	509		54		9	7	579	0.78
RAD			216		11	5	232	0.31
RAD2			6	71746			71752	96.20
P			452			5	457	1.67
Total number of Flags	1018	1	2426	71913	326	414	76098	9.84
Percentage of All Values Flagged	0.13	0.00	0.31	9.30	0.04	0.05	9.84	

minor problems. Table 2 details the distribution of flags among the variables and a discussion of the problems receiving flags immediately follows.

RAD2

All short wave radiation values appear to be suspiciously low. The radiation profiles were examined on relatively clear days and compared to a climatology (da Silva et al. 1994) . The measured values in all cases were nearly 50 percent lower than climatology. No malfunction of the recording instrument was apparent, as the profiles were the correct shape and showed the proper response to cloud cover. Only the relative magnitudes are in question; thus, RAD2 values were flagged with a "K" and should be used with caution. The only values left marked as good data are missing values accounting for 3.8 percent of the data.

DIR and SPD

Earth relative wind direction and speed both showed spikes in their time series plots, nearly always occurring when the research vessel made a sudden change in speed or direction. This problem is not unusual for calculated true winds and is examined in more detail in Smith et al. (1997). The data provider (BODC) was aware of this problem and flagged these values as cautionary, the "Q" flag under DAC convention. The DAC analyst changed these flags to the "S" when the values were clearly in error and the use of these data values should be avoided. Other values flagged with the "Q" were not discernable from the noise in the plots and the flags were left unaltered. These values are suspect and should be used with caution.

On 9/03/91 the ship's movements were clearly visible in the plots of DIR and SPD, indicating that these variables were calculated incorrectly. This was the last day of cruise AR_07E/03 and one of the parameters used to calculate the true winds may not have been measured. All values of DIR and SPD were flagged with a "J" on this day and should not be used.

On 8/18/91 values of SPD suddenly dropped from 15 to 5 m/s and DIR became highly erratic. The variables returned to reasonable values after around 90 minutes. No trends could be found in the temperature or radiation profiles to confirm this behavior as realistic, so DIR and SPD were flagged with the "K" during this period.

T and TW

The preprocessor performs a multivariate check to determine if the reported wet-bulb temperature is greater than the reported air temperature, a physical impossibility. When TW is greater than T, a "D" flag is assigned to both the T and TW values. The variables failed this test 509 times and were flagged appropriately. These flags were found in large, discrete clusters and may have been caused by drying of the packing around the wet-bulb thermometer. The air temperature values are likely correct while use of the wet-bulb values should be avoided.

On 9/14/91 both T and TW were recorded at a constant value of over 80 degrees C for two periods totaling 54 records. The variables received the "J" flag for these values. On and around 9/18/91 the air temperature had short periods where the values rose and fell rapidly plus or minus one degree C from the local mean. These values had been flagged with the "Q" by the BODC and should be used with caution.

RAD

Plots of the long wave radiation data had short periods where the values would rise over 50 W/m^2 in one time step and return to normal just as quickly. The problem is probably electronic in nature and had been previously flagged with the "Q" flag. Nearly all of these flags were changed to "J" or "S" flags and the values should not be used.

P

Atmospheric pressure data had small blocks of erroneous values (i.e., -1500 mb). All such values

were assigned the "J" flag.

Miscellaneous Flags

Isolated "S" and "Q" flags were assigned to individual points throughout the data. Also, SPD received one "G" flag for a value greater than four standard deviations from a climatology.

Final Comments:

Most of the Charles Darwin multimet data is of excellent quality and, aside from short wave radiation measurements, should be very reliable for the user. This data has been quality controlled by both the provider and the DAC and unflagged values can be used with a high level of confidence. Use of the short wave radiation data should avoided unless an explanation can be found for the suspiciously low values.

References:

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. In preparation.

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 32301

Smith, S. R., M. A. Bourassa, and R. J. Sharp, 1997: *Establishing more truth in true winds.* J. Atmos. Ocean. Technol., Submitted.