Nathaniel B. Palmer AWS Data Quality Control Report

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INTRODUCTION

This report summarizes the quality of surface meteorological data collected by the research vessel *Nathaniel B. Palmer* (identifier: NBP) during one cruise completed in 1996. The data were provided to the Florida State University Data Assembly Center (DAC) in electronic format by T. Whitworth (Texas A & M) and were converted to standard DAC netCDF format. Data format and metadata support were provided by Raytheon Polar Services. 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 quality control procedures can be found in Smith et al. (1994). The data quality control report summarizes the flags for the *Nathaniel B. Palmer* meteorological data, including those added by the WOCEMET preprocessor, and the DQE.

DATA VARIABLES

The *Nathaniel B. Palmer* data include observations taken every five minutes or as provided by the NBP. 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 (Port)	(PL_WDIR)
Platform Relative Wind Speed (Port)	(PL_WSPD)
Platform Relative Wind Direction (Stbd)	(PL_WDIR2)
Platform Relative Wind Speed (Stbd)	(PL_WSPD2)
Atmospheric Pressure	(P)
Air Temperature	(T)
Humidity Air Temperature	(T2)
Relative Humidity	(RH)
Atmospheric Radiation (Shortwave)	(RAD)
Atmospheric Radiation (Longwave)	(RAD2)

1996 FLAG SUMMARY

Statistical Information:

Details of the 1996 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 278,192 values were evaluated with 39,005 flags added by both the preprocessor and the DQE resulting in 14.02% 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
S__04I/06	05/03/96 – 07/03/96	17,387	278,192	39,005	14.02

Summary:

The 1996 AWS data from the *Nathaniel B. Palmer* proves to be of poor quality with 14.02% of the reported values flagged for potential problems. The distribution of flags for each variable are detailed in Table 2.

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

Variable	B	F	G	J	K	S	Total Number of Flags	Percentage of Variable Flagged
TIME								0.00
LAT		3		74			77	0.44
LON		3		72			75	0.43
PL_HD				72			72	0.41
PL_CRS				71		2	73	0.42
PL_SPD				72		2	74	0.43
PL_WDIR				69			69	0.40
PL_WSPD				71			71	0.41
PL_WDIR2				69			69	0.40
PL_WSPD2				71			71	0.41
P			424				424	2.44
T			595		10,141	3	10,739	61.76
T2			504		10,143		10,647	61.24
RH			1		4,155	1	4,157	23.91
RAD	12,387						12,387	71.24
RAD2								0.00
Total Number of Flags	12,387	6	1,524	641	24,439	8	39,005	
Percent of All Values Flagged	4.45	0.00*	0.55	0.23	8.78	0.00*	14.02	

Percentages > 0.01

<u>B-flags</u>:

Atmospheric short-wave radiation (RAD) received 12,387 bound flags from the preprocessor. These physically unrealistic negative radiation values are likely the result of the instrument not being tuned to low radiation values.

F-flags:

Latitude (LAT) and longitude (LON) were both assessed 3 F-flags to highlight position errors. These F-flags show that the platform speed computed by the preprocessor exceeds the platform realistic speed (15 ms^{-1}). The data immediately before the F-flags, remained constant at one value for an unrealistic period of time (see *J-flags*) and then decreased(LAT)/increased(LON) rapidly. The F-flags were the direct result of the rapid decrease/increase in the LAT and LON.

G-flags:

Note: During the S__04I/06 cruise, the ship traversed south of 40 degrees South Latitude. In this region of the globe, little information is known about the climatology, as the data are sparse. Consequently, the G-flagged values may be realistic, though extreme observations.

Pressure (P) was assessed 424 G-flags by the preprocessor during the S__04I/06 cruise. The DQE felt these flagged values were realistic, as they were approximately three to six millibars (mb) higher than the climatological data value and were left in place to highlight extreme atmospheric pressure. Toward the end of the cruise, on June 27, 1996, the flagged values were approximately 20 mb higher than the climatological data value. These extreme values are rather high for this region, but not impossible and should be used with caution.

Air temperature (T) received a total of 595 G-flags at the beginning and end of the S__04I/06 cruise. These flagged values were approximately three to 10 degrees Celsius above and below the climatological value; therefore, the DQE felt these values were realistic, though extreme temperatures.

The humidity temperature (i.e., temperature in the relative humidity sensor) (T2) received 504 G-flags on the S__04I/06 cruise. The flagged values were approximately 1 to 10 degrees Celsius above and below the climatological value and were left in place to highlight extreme humidity temperatures.

Relative humidity (RH) received one G-flag on data that was 26% lower than the climatological value. The data value was not a spike, but rather a moderate decline in the data where the value was the lowest point in the downward trend.

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

J-Flags:

J-flags emphasize erroneous data and should not be used. On May 3, 1996 the S__04I/06 cruise was assessed a total of 641 J-flags on LAT, LON, PL_HD, PL_CRS, PL_SPD, PL_WDIR, PL_WSPD, PL_WDIR2, AND PL_WSPD2. These J-flags were associated with measurements holding at a constant value for an unrealistic period of time.

K-Flags:

The K-flag represents suspect data and should be used with caution. Air temperature (T), humidity temperature (T2), and relative humidity (RH) were assessed K-flags for occurrences of stair stepping. These stair steps were related to either a change in platform heading (PL_HD) and/or platform speed over ground (PL_SPD) because of the individual sensors' location. The T and RH sensors were located halfway between the bridge and the exhaust stack and were experiencing both ship heating and stack exhaust problems. It is likely that at times the sensors were experiencing both heating and exhaust problems; however, we have insufficient information to differentiate the errors. As a result, the DQE was limited to K-flagging large regions of suspect T, RH, T2 data.

Spikes:

Isolated spikes occurred in platform course (PL_CRS), platform speed over ground (PL_SPD), air temperature (T), and relative humidity (RH). 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.

FINAL DISCUSSION

Since the discovery of the temperature and relative humidity sensory problem, the *Nathaniel B. Palmer* has started to experiment with alternate sensor locations. We anticipate future improvement in these observations. All other data taken during this cruise appears to be accurate research quality data.

The public release of data for the *Nathaniel B. Palmer* did not include true winds (DIR or SPD). These winds are usually computed when possible, but insufficient metadata were available to calculate accurate values. If inquiries lead to more metadata, the true winds may be released in the future.

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.