Franklin AWS Data Quality Control Report

Jennifer Lovell and Shawn R. Smith

World Ocean Circulation Experiment

WOCE Surface Meteorological Data Analysis 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 *Franklin* (identifier: VJJF) during five WOCE cruises completed in 1994, 1995 and 1996. The data were provided to the Florida State University Data Assembly Center (DAC) in electronic format by Terry Byrne (CSIRO, Australia) 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 judgment 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 *Franklin* meteorological data, including those added by both the preprocessor and the DQE.

DATA VARIABLES:

The *Franklin* data are expected to include observations averaged every five minutes on these WOCE cruises. Values for the following variables were collected:

Time	(T)
Latitude	(LAT)
Longitude	(LON)
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)
Relative Humidity	(RH)

* Platform course (PL_CRS) and platform speed (PL_SPD) contained only missing data for the 1996 cruises, ISS03_/02 and ISS03_/03.

1994 FLAG SUMMARY

Statistical Information:

Details of the 1994 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 78,572 values were evaluated with 5 flags added by both the preprocessor and the DQE resulting in a total of 0.01% 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
IR_04_/03	08/23/94 – 09/13/94	6,044	78,572	5	0.01

***Summary*:**

The 1994 automated weather system (AWS) data from the *Franklin* proves to be of excellent quality with 0.01% 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	S	Total Number of Flags	Percentage of Variable Flagged
TIME			0.00
LAT			0.00
LON			0.00
PL_CRS			0.00
PL_SPD			0.00
PL_WDIR			0.00
PL_WSPD			0.00
DIR			0.00
SPD			0.00
TS			0.00
P			0.00
T	5	5	0.08
RH			0.00
Total Number of Flags	5	5	
Percent of All Values Flagged	0.01	0.01	

<u>Spikes</u>:

Isolated spikes occurred in air temperature (T). 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.

<u>1995 FLAG SUMMARY</u>

***Statistical Information*:**

Details of the 1995 cruise are listed in Table 3 and include the cruise dates, number of records, number of values, number of flags, and total percentage of data flagged. A total of 197,743 values were evaluated with 19,226 flags added by both the preprocessor and the DQE resulting in a total of 9.72% of the values being flagged.

Table 3: Statistical Cruise Information

Cruise Identifier	Cruise Dates	Number of Records	Number of Values	Number of Flags	Percent Flagged
IR_06_/05	04/01/95 – 04/23/95	6,423	83,499	939	1.12
IR_06_/04	09/13/95 – 10/13/95	8,788	114,244	18,287	16.01

Summary:

The 1995 AWS data from the IR_06_/05 cruise proves to be of excellent quality with 1.12% of the reported values flagged for potential problems. However, the IR_06_/04 data proves to be of poor quality with 16.01% of the reported values flagged for potential problems. *User discretion advised: The number of flags and percent flagged for the IR_06_/04 cruise is large because air temperature (T) and relative humidity (RH) were K-flagged for the entire cruise. These flags are discussed in the K-flag discussion below.* The distribution of flags for each variable are detailed in Table 4.

Table 4: Number of Flags and Percentage Flagged for Each Variable

Variable	G	K	S	Total Number of Flags	Percentage of Variable Flagged
TIME				0	0.00
LAT				0	0.00
LON				0	0.00
PL_CRS			3	3	0.02
PL_SPD				0	0.00
PL_WDIR				0	0.00
PL_WSPD				0	0.00
DIR		534		534	3.51
SPD		1,009		1,009	6.63
TS				0	0.00
P	95			95	0.62
T		8,788	9	8,797	57.83
RH		8,788		8,788	57.77
Total Number of Flags	95	19,119	12	19,226	
Percent of All Values Flagged	0.05	9.67	0.01	9.72	

G-Flags:

Pressure (P) received 95 G-flags during the IR_06_/05 cruise. These flagged values were approximately 15 millibars (mb) lower than the climatological value. These flags were left in place to highlight extreme pressure values. All 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).

K-Flags:

The K-flag represents suspect data and should be used with caution. Throughout the 1995 cruises, 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), air temperature (T), and relative humidity (RH) showed stair steps in the data. These stair steps were related to a change in platform course (PL_CRS) 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 IR_06_/05 cruise had a total 835 K-flags and the IR_06_/04 cruise was assessed 708 K-flags. These suspect data were likely due to a flow distortion problem. 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 flagged earth relative winds should be used with caution.

Temperature (T) and relative humidity (RH) showed periodic steps in the data, similar to flow distortion and ventilation signals that have been identified on previous WOCE research vessels. An insufficiently ventilated thermometer can experience steep temperature increases in a relatively short amount of time when the platform relative wind speeds are low, or when wind flow over the instrument is blocked. These data sets were inconsistent, as on occasion the platform relative wind speeds were high and the temperature would increase rapidly. The DQE could not determine which part of the time series was correct, nor could a definite conclusion for these problems be determined from the given data. Thus, during the IR_06_/04 cruise, the entire T and RH data set were flagged as suspect.

Spikes:

Isolated spikes occurred in platform course (PL_CRS) and air temperature (T). 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.

1996 FLAG SUMMARY

Statistical Information:

Details of the 1996 cruise are listed in Table 6 and include the cruise dates, number of records, number of values, number of flags, and total percentage of data flagged. A total of 124,345 values were evaluated with 3 flags added by both the preprocessor and the DQE resulting in less than 0.01% of the values being flagged.

Table 6: Statistical Cruise Information

Cruise Identifier	Cruise Dates	Number of Records	Number of Values	Number of Flags	Percent Flagged
ISS03_/02	05/07/96 – 05/31/96	6,742	87,646	3	0.00*
ISS03_/03	06/01/96 – 06/10/96	2,823	36,699	0	0.00

Summary:

The 1996 AWS data from the *Franklin* proves to be of excellent quality with less than 0.01% of the reported values flagged for potential problems. The distribution of flags for each variable are detailed in Table 7.

Table 7: Number of Flags and Percentage Flagged for Each Variable

Variable	S	Total Number of Flags	Percentage of Variable Flagged
TIME			0.00
LAT			0.00
LON			0.00
PL_CRS			0.00
PL_SPD			0.00
PL_WDIR			0.00
PL_WSPD			0.00
DIR			0.00
SPD	3	3	0.03
TS			0.00
P			0.00
T			0.00
RH			0.00
Total Number of Flags	3	3	
Percent of All Values Flagged	0.00*	0.00*	

*Percentages < 0.01

Spikes:

Isolated spikes occurred in earth relative wind speed (SPD). 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 DISSCUSSIONS

The overall quality of the *Franklin* automated weather system proves to be of excellent quality. A total of 30,820 values were evaluated with 19,234 flags added by both the preprocessor and the DQE resulting in 4.80% of the values being flagged for potential problems.

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.