Knorr IMET Data Quality Control Report

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May 20, 1999

Report WOCEMET 99-06

Version 1.0

Introduction:

This report summarizes the quality of surface meteorological data collected by the *Knorr* (identifier: KCEJ) IMET system during one WOCE cruise made in 1995. The data were provided to the Florida State University Data Assembly Center (DAC) in electronic format by the Woods Hole Oceanographic Institute. They were converted to standard DAC netCDF format and then processed using an automated data screening program which adds quality control flags to the data, highlighting potential problems. Finally, the Data Quality Evaluator (DQE) reviews all the data and the processor flags. Flags are then added, modified, and deleted according to the judgement of the DQE 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 *Knorr* IMET data and explains the reasons why these flags were assigned.

Statistical Information:

The *Knorr* data were expected to include observations taken every minute. Values for the following variables were collected on the cruise:

Time	(TIME)
Latitude	(LAT)
Longitude	(LON)
Platform Heading	(PL_HD)
Platform Course Over Ground	(PL_CRS)
Platform Speed Over Ground	(PL_SPD)
Platform Speed Over Water	(PL_SPD2)
Platform Relative Wind Direction	(PL_WDIR)
Platform Relative Wind Speed	(PL_WSPD)
Earth Relative Wind Direction	(DIR)
Earth Relative Wind Speed	(SPD)
Atmospheric Pressure	(P)
Air Temperature	(T)
Sea Temperature	(TS)
Relative Humidity	(RH)
Precipitation	(PRECIP)
Atmospheric Radiation	(RAD)

Details for the cruise 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 577,738 values were evaluated with 15,589 flags added by the preprocessor and DQE for a total of 2.70% of the values being flagged. Note that three parameters (DIR, SPD, and PRECIP) were found to be of poor quality and are not included in the statistical results. These values will not be released with the data for this cruise (see discussion below).

Table 1: Statistical Cruise Information

CTC	Dates	Number of Records	Number of Values	Number of Flags	Percentage Flagged
I__02E/00	11/30/95 – 12/31/95	41267	577,738	15,589	2.70

Summary:

The overall quality of the data collected from the *Knorr* proved to be good except for the variables DIR, SPD, and PRECIP. After evaluation of the three variables it was determined that they should not be included in the public release. Table 2 details the distribution of flags among the remaining 14 variables. Discussions of the flagged and removed variables follow.

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

Variable	B	G	K	S	Total Number of Flags	Percentage of Variable Flagged
TIME					0	0.00
LAT					0	0.00
LON					0	0.00
PL_HD					0	0.00
PL_CRS			2,655		2,655	6.43
PL-SPD					0	0.00
PL_SPD2	3,134				3,134	7.59
PL_WDIR					0	0.00
PL_WSPD					0	0.00
P		16			16	0.04
T			211	81	292	0.71
TS			355	69	424	1.03
Total Number of Flags	12,202	16	3,221	150	15,559	
Percentage of All Values Flagged	2.11	0.00*	0.56	0.03	2.70	

*Percentage < 0.01

<u>Deleted Data</u>:

True Winds:
Using the platform wind and navigation data collected from the *Knorr*, the true winds were calculated by the DAC employing a tested code. A detailed description of the true wind calculation procedures can be found in Smith et al. (1999). Viewing a time chart of the true winds using the Visual Data Assessment Tool (VIDAT) determined that the calculated true winds echoed the movement of the ship. Correct true winds show no signal of the ship's movement. Not being able to pinpoint the source of the error (possibly an error in the heading or the reference of the zero degree line on the anemometer to the ship), both the earth relative wind direction and speed were expunged.

Precipitation:
The precipitation instrument used by the *Knorr* was the R.M. Young Self-Siphoning Rain Gauge; a gauge designed to collect water until it is full (50mm) and then self-siphon in a relatively short amount of time. There was an obvious leakage problem with this rain gauge, therefore preventing any accurate measurement of precipitation. The precipitation data were extracted as well.

<u>Other Problems</u>:

Platform course received 2,655 cautionary (K) flags over a period of approximately two days. In this same 48-hour period the ship's platform speed over ground was less than 1 m/s and the data from the speed over water were missing altogether. The ship's course showed very little or no variability in this time, which is highly uncharacteristic given the low speed of the ship. Consequently, the DQE assessed these data as questionable.

The air temperature and sea temperature both experienced numerous spikes. It appears that these data experienced more electronic noise as the cruise progressed. Isolated spikes were appropriately flagged an S, while groups of data that showed high variability (spikes too numerous to be flagged individually) were all flagged as suspect with the K flag.

Relative humidity received 127 B flags from the preprocessor for values over 100 percent. These values are probably due to instrument calibration error rather than actual supersaturation.

Negative values of radiation were recorded at night and were assigned the B flag by the preprocessor. Being that radiation is a measurement of incoming solar radiation, these negative values would be physically meaningless and are likely to result of a calibration problem at low values.

The G flags assessed to pressure by the preprocessor were left in place to highlight values that are greater than four standard deviations from the climatological means (da Silva et al. 1994).

At very low platform speeds it is possible to have negative values for PL_SPD2, which are consequently assessed B flags by the preprocessor. The user should note that the EDO speedlog uses Doppler technology to measure the speed of the ship relative to the water. When the ship's speed is low, wind waves, and currents can cause realistic negative values. Negative values also occur when the vessel is in reverse.

Final Comments:

The quality of the *Knorr* IMET data ranges from very good to poor. The use of the data is left up to the discretion of the user. The problem experienced by PL_CRS was isolated to a few days in a month's worth of data. The rest of its data is of excellent quality. Values of PL_SPD2 flagged B due to negative recorded values could conceivably be good data. The user may want to disregard the boundary flags.

References:

Smith, S.R., C. Harvey, and Legler, D.M., 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

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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.