Knorr IMET Data Quality Control Report

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Addendum:

Member's of the WOCE Hydrographic Project Office (WHPO) and WOCEMET met at the 13th Data Products Committee (DPC) meeting in College Station, TX to discuss reconciliation of the WOCE cruise line designators. This was done in anticipation of the future release of version 3 of the WOCE global data set, and resulted in changes to several WOCE cruise line designations.

On December 21, 2000, WOCEMET changed the WOCE designator for the cruise "Unknown" to the updated form, AR_27_/02.

Introduction:

This report summarizes the quality of surface meteorological data collected by the *Knorr* (identifier: KCEJ) IMET system during one WOCE cruise made in 1997. The data were provided to the Florida State University Data Assembly Center (DAC) in electronic format by the Woods Hole Oceanographic Institute. They were then 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 preprocessor flags. Flags are then added, modified, and removed 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. (1995). 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	(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)
Ocean Relative Wind Direction	(DIR)
Ocean Relative wind Speed	(SPD)
Earth Relative Wind Direction	(DIR2)
Earth Relative Wind Speed	(SPD2)
Atmospheric Pressure	(P)
Air Temperature	(T)
Sea Temperature	(TS)
Relative Humidity	(RH)

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 1,046,503 values were evaluated with 177,789 flags added by the preprocessor and DQE for a total of 17.00% of the values being flagged.

Table 1: Statistical Cruise Information

CTC	Dates	Number of Records	Number of Values	Number of Flags	Percentage Flagged
AR_27_/02	02/02/97 - 03/17/97	61,559	1,046,503	177,789	17.00

Summary:

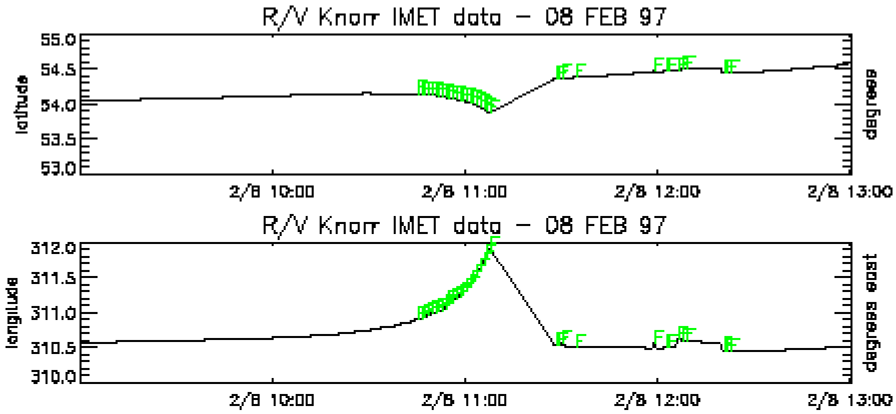
The data collected from the *Knorr* proved to be of poor quality. The distribution of flags for each variable is detailed in Table 2.

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

Variable	B	F	G	H	I	J	K	M	S	Total Number of Flags	Percentage of Variable Flagged
TIME										0	0.00
LAT		193								193	0.31
LON		193								193	0.31
PL_HD									13	13	0.02
PL_CRS									1	1	0.00*
PL_SPD	63								1	64	0.10
PL_SPD2	2,068						109	35,454	3	37,634	61.13
PL_WDIR						9,058			6	9,064	14.72
PL_WSPD						9,058			37	9,095	14.77
DIR						35,454	329		472	36,255	58.89
SPD	12		1			35,454	329		103	35,899	58.32
DIR2						3,369	10,542		858	14,769	23.99
SPD2						3,362	10,392		107	13,861	22.52
P				6			1,205		17	1,228	1.99
T	13,101					7			17	13,125	21.32
TS	5,379			4	2		888		114	6,387	10.38
RH									8	8	0.01
Total Number of Flags	20,623	386	1	10	2	95,672	23,794	35,454	1,757	177,789	
Percentage of All Variables Flagged	1.97	0.04	0.00*	0.00*	0.00*	9.15	2.27	3.39	0.17	17.00	

*Percentage<0.01

Latitude and Longitude:
Latitude and longitude received a total of 193 F-flags a piece for unrealistic platform movement. This problem occurred mainly towards the beginning of the cruise. It seemed the positioning instrument would wander at times and then be corrected.



While latitude and longitude were recording inaccurate position values, platform speed over the ground (PL_SPD) received B-flags for speeds that were unrealistically high. Recorded speeds were greater than 15m/s, and even as high as 150 m/s. Ocean relative wind speed also received B-flags for recorded wind speeds of greater than 40 m/s, up to as high as 150 m/s during these episodes.

Stair-stepping:
Using the platform wind and navigation data collected from the *Knorr*, the earth relative 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), it was obvious that the calculated true winds echoed the movement of the ship. Correct true winds show no signal of the ship's movement in the absence of flow distortion. The winds from the beginning of the cruise were somewhat noisy - worse in some parts than others. A filter may be necessary in use for some for the data. There was a lot of noise caused by ship movement resulting in spike flags (S) and suspect data flags (K).

Pressure overall was generally noisy. This could however be an account of the harsh weather the vessel experienced during the cruise in the Labrador Sea. However pressure also experienced some stair-stepping in response to ship movement. Pressure gauges will generally have a port to the outside air. Distorted pressure reading could occur if the wind happened to flow directly into the port, causing a slightly higher pressure reading. The DQE flagged these stair-steps as suspect with the K-flag.

Sea Temperature also demonstrated segments in its data that echoed ship movement and thusly received the K-flag. Reasons for this are not apparent.

Winds:
On 4 March 1997, the anemometer on the ship, due to the extremely harsh weather the vessel traversed, had frozen up for a period of approximately seven days. For this period, all calculated winds were flagged with the J-flag. Upon the instrument's restoration, the

true winds were anomalously noisy and demonstrating stair-stepping with ship movement. Not being able to decipher which data were accurate, the earth relative winds were K-flagged from restoration of the instrument to the end of the cruise.

Platform Speed:
The Woods Hole Oceanographic Institute informed the DAC of an instrument malfunction for the platform speed over water, beginning 21 February 1997 until the end of the cruise. These data were flagged with the M-flag. Without platform speed over water, the ocean relative winds could not have been calculated correctly and therefore were assessed the J-flag for this period.

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. 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 in this case.

PL_SPD2 also received 109 K-flags for a period where the data demonstrated a very steady increase of ~2 m/s in ship speed over ~2 hours, with little to no variability.

Sea Temperature:
During this cruise, the vessel traversed into the extremely cold waters of the Labrador Sea. Because of the high salinity of the ocean in this region, due to brine rejection, it is possible for the sea temperature to actually fall a few degrees below freezing without solidifying. These negative sea temperature values, though realistic at only a degree or so below freezing, received the B-flag.

On 27 February 1997, the ship crossed into the Labrador Current. This is evident as the sea temperature drops ~4ºC inside of 10 minutes. This episode is bounded on either side with an interesting feature flag (I).

On 24 February 1997, sea temperature experienced a ~0.5ºC discontinuity. The next several hours were anomalously nosier than the recorded data subsequently assessed the K-flag.

Temperature:
Recorded temperatures below -10ºC received the B-flag. Due to the severe weather experienced by the ship, these temperatures are conceivably realistic.

Spikes:
Isolated spikes occurred in most of the variables throughout the data. Spikes are a relatively common occurrence with automated data, caused by various factors (i.e.

electrical interference and ship accelerations). These individual points were assigned the S-flag.

Final Comments:
Several of the variables' data are particularly noisy in parts. Granted, this may be in response to the harsh weather experienced by the vessel, but a filter may be necessary in use of the data. Specifically noted are pressure, most non-flagged wind data, and the position data, mainly at the beginning of the cruise.

References:

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 32306-2840

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