

Master Track RV Polarstern ARK-IX/4

Data Processing Report

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1 Introduction

This report describes the processing of raw data acquired by position sensors on board RV Polarstern during expedition ARK-IX/4 to receive a validated master track which is used as reference of further expedition data.

2 Workflow

The different steps of processing and validation are visualized in figure 1. Unvalidated data of up to three sensors are extracted from the DAVIS SHIP data base (<https://dship.awi.de>) in a 1-second interval or 5-second interval for cruises earlier than ARK-IX/2. They are converted to ESRI point shapefiles and imported to ArcGIS. A visual screening is performed to evaluate data quality and remove outliers manually. For all resulting position tracks, a quality check is performed using a ship's speed filter, an acceleration filter and a course-change filter. Filtered positions are flagged. In addition, a manual check is performed to flag obvious outliers. Those position tracks are combined to a single master track depending on a sensor priority list (by accuracy, reliability) and availability / applied exclusion of automatically or manually flagged of data. Missing data up to a time span of 60 seconds are linearly interpolated to achieve a master track with 1-second resolution. To reduce the amount of points for overview maps the master track is generalized by using the Ramer-Douglas-Peucker algorithm. This algorithm returns only the most significant points from the track. Full master track and generalized master track are written to text files and imported to PANGAEA (<http://www.pangaea.de>) for publication.



Figure 1: Workflow of master track data processing

3 Cruise details

Vessel name	RV Polarstern
Cruise name	ARK-IX/4
Cruise start	06.08.1993 Tromsø
Cruise end	06.10.1993 Bremerhaven
Cruise duration	62 days

4 Sensor Layout

This chapter describes the position sensors mounted during this cruise.

Position sensors

Sensor name	System Position Information , short: System
Description	Position information delivered to the System

Sensor name	Navigation Automation Control System , short: NACOS
Description	Navigation system of the ship

Sensor name	Ashtech Z-12 , short: Ashtech
Description	GPS-Receiver

Position data from Parasound-surveys

Additionally to the up to three position sensors mounted, there are positions available extracted from the header-information of Parasound-surveys which are already processed and checked for quality and validity. If those data exist for this cruise, these data will be used instead of the derived master track. These data are identified as follows.

Sensor name	Corrected Parasound-Navigation , short: Parasound-NAV
Description	Already processed Position information from Parasound navigation

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Database Extraction

Data source	DSHIP database (dship.awi.de)
Exported values	5270398
First dataset	1993-08-06T00:00:01 UTC
Last dataset	1993-10-05T23:59:58 UTC

Automatic Validation

The following thresholds were applied for the automatic flagging of the position data:

Speed	Maximum 20 kn between two datapoints.
Acceleration	Maximum 1 m/s ² between two datapoints.
Change of course	Maximum 5° between two datapoints.

Manual Validation

Obvious outliers were removed manually. For details see Processing Logbook of RV Polarstern (hdl:[10013/epic.45909](#)).

Flagging result

	System		NACOS		Ashtech	
Missing	256165	4.860%	230008	4.364%	4734683	89.835%
Speed	3242	0.062%	5	0.000%	2664	0.051%
Acceleration	423415	8.034%	431568	8.189%	45328	0.860%
Course	1471325	27.917%	889895	16.885%	63949	1.213%
Manually	147827	2.805%	0	0.000%	0	0.000%

Master Track Generation

The master track is derived from the position sensors' data selected by priority.

Sensor priority used:

1. NACOS
2. Ashtech
3. System

Filters applied: manual, speed.

Distribution of position sensor data in master track:

Sensor	Data points	Percentage
Total	5270398	100.000 %
Parasound-NAV	4385779	83.215 %
System	2	0.000 %
NACOS	836625	15.874 %
Ashtech	4737	0.090 %
Interpolated	41314	0.784 %
Gaps	1941	0.037 %

Remarks

Data only available until 1993-10-05T23:59:58 UTC.

Score

For each cruise, a score is calculated ranging from 0 (no data) to 100 (only very good data). the score for the cruise ARK-IX/4 is 87.

Generalization

The master track is generalized to receive a reduced set of the most significant positions of the track using the Ramer-Douglas-Peucker algorithm and allow a maximum tolerated distance between points and generalized line of 4 arcseconds.

Results:

Number of generalized points	7145 points
Data reduction	99.8644 %

Result files

Report in XML format:

The XML contains all information of the master track generation in a machine-readable format. In addition a XSD schema file is provided.

Master track text file:

The format is a plain text (tab-delimited values) file with one data row in 1 second interval.

Column separator	Tabulator "\t"	
Column 1	Date and time expressed according to ISO 8601	
Column 3	Latitude in decimal format, unit degree	
Column 4	Longitude in decimal format, unit degree	
Column 5	Flag for data source	
	0	Parasound-NAV
	1	System
	2	NACOS
	3	Ashtech
	INTERP	Interpolated point
	GAP	Missing data

Text file of the generalized master track:

The format is a plain text (tab-delimited values) file.

Column separator	Tabulator "\t"
Column 1	Date and time expressed according to ISO 8601
Column 2	Latitude in decimal format, unit degree
Column 3	Longitude in decimal format, unit degree

Processing Report:

This PDF document.

Cruise map

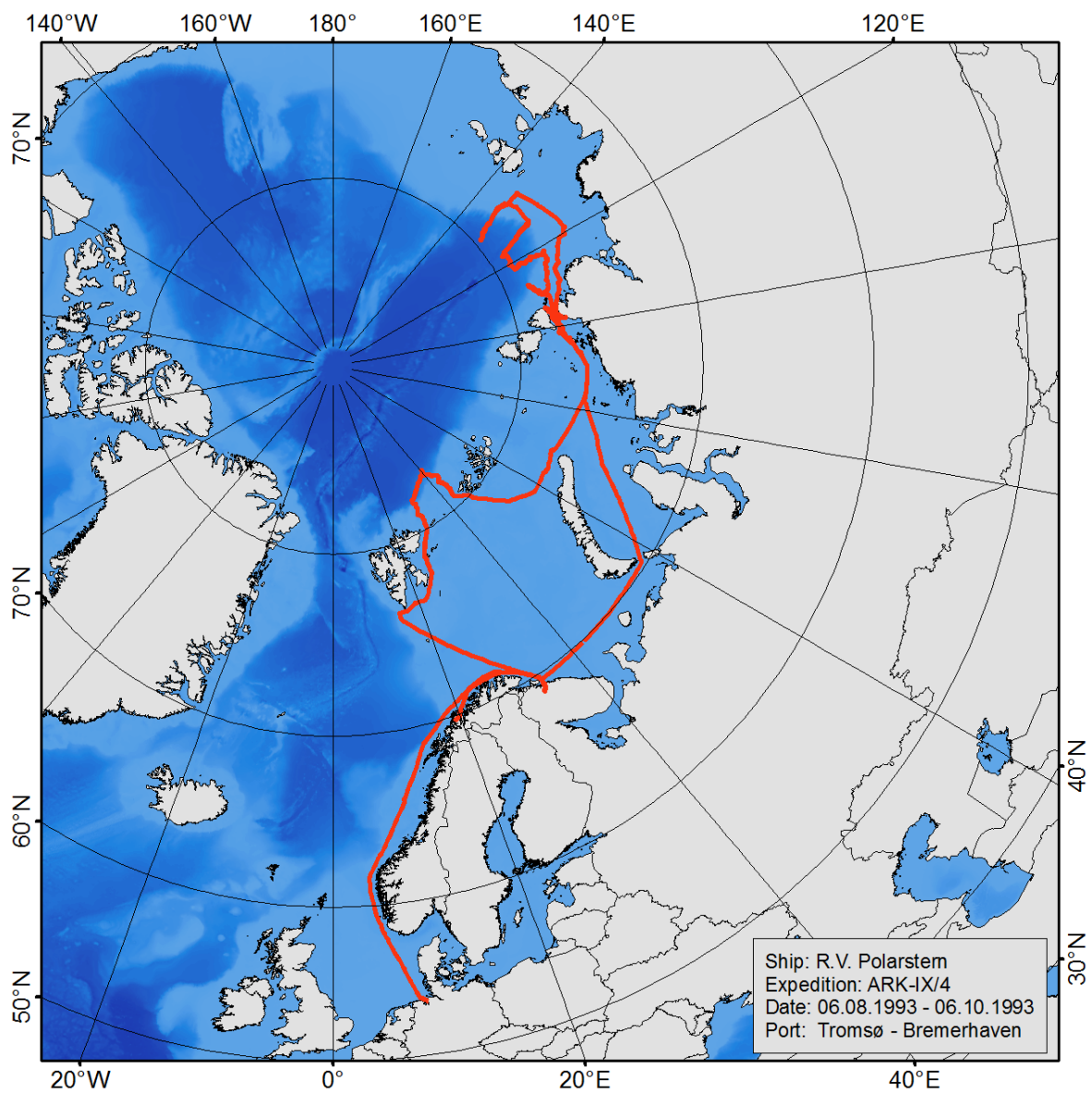


Figure 2: Map of the generalized master track