



Master Track RV Heincke HE363

Data Processing Report

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Contact: Dr. Rainer Knust Alfred Wegener Institute Columbusstrasse, D-27568 Bremerhaven, GERMANY Tel: +49(471)4831-1709 Fax: +49(471)4831-1918 Mail: Heincke-Coordination@awi.de

Processing Agency: FIELAX Gesellschaft für wissenschaftliche Datenverarbeitung mbH Schleusenstr. 14, D-27568 Bremerhaven, GERMANY Tel: +49 (0) 471 30015 0 Fax: +49 (0) 471 30015 22 Mail: info@fielax.de

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1 Introduction

This report describes the processing of raw data acquired by position sensors on board RV Heincke during expedition HE363 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 and ship-motion data are extracted from the DAVIS SHIP data base (https://dship.awi.de) in a 1-second interval. They are converted to ESRI point shapefiles and imported to ArcGIS. A visual screening is performed to evaluate data quality and remove outliers manually. The position data from each position sensor are centered to the destined master track origin by applying ship-motion data (angles of roll, pitch and heading) and lever arms. For all three resulting position tracks, a quality check is performed using a ship's speed filter and an acceleration 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 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.

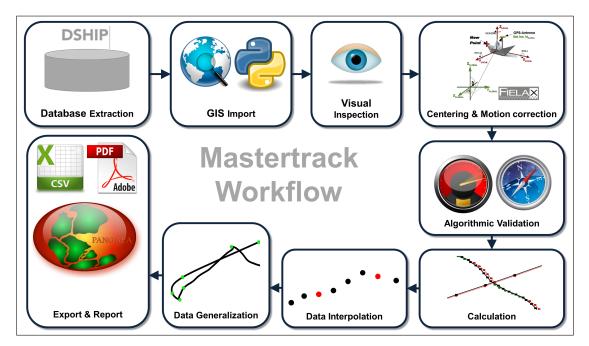


Figure 1: Workflow of master track data processing



3 Sensor Layout

This chapter describes the position sensors mounted during this cruise.

Cruise details

Vessel name	RV Heincke
Cruise name	HE363
Cruise start	16.08.2011 Helgoland
Cruise end	26.08.2011 Helgoland
Cruise duration	11 days
Master track reference point:	Resulting master track is referenced to PHINS installation point.

Position sensors

Sensor name	IXSEA PHINS III, short: PHINS			
Description	Inertial navigation system with reference positions from Trimble DGPS			
Accuracy	± 0.5-3.0 m			
Installation point	Electrician's workshop, close to COG			
Installation offset	Offset from master trackreference point to sensor installation pointXPositive to bow0.000 mYPositive to starboard0.000 mZPositive upwards0.000 m			

Sensor name	Trimble Marine SPS461, short: Trimble				
Description	DGPS-Receiver, correction type DGPS RTCM 2.x, correction source				
	DGPS Base via radio				
Accuracy	Horizontal: \pm 0.25 m + 1 ppm & Vertical: \pm 0.50 m + 1 ppm				
Installation point	Masttop				
Installation offset	Offset from master trackreference point to sensor installation pointXPositive to bow5.298 mYPositive to starboard-0.034 mZPositive upwards22.297 m				

Sensor name	DEBEG/Leica MX400, short: DEBEG				
Description	GPS-Receiver for navigation purposes				
Accuracy	± 7-15 m				
Installation point	Observational Deck, fore rail				
Installation offset	Offset from master track reference point to sensor installation pointXPositive to bow12.985 mYPositive to starboardZPositive upwards11.328 m				



Motion sensor

Sensor name	IXSEA PHINS III, short: PHINS		
Description Inertial navigation system with reference positions from Trimble DGPS			
Accuracy	\pm 0.01 roll, \pm 0.01 pitch, \pm 0.05 heading (deg)		
Installation point	Electrician's workshop, close to COG		

4 Processing Report

Database Extraction

Data source DSHIP database (dship.awi.de)	
Exported values 1036741	
First dataset	2011-08-15T00:00:00 UTC
Last dataset	2011-08-26T23:59:00 UTC

Centering & Motion Compensation

Each position track has been centered to the *PHINS installation point* by applying the correspondent motion angles for heading, roll and pitch as well as the installation offsets from chapter 2. The motion data were acquired by IXSEA PHINS III.

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 "Heincke" (hdl:10013/epic.45841).

Flagging result

	PHINS		Trimble		DEBEG	
Missing	1	0.000%	23556	2.272%	130	0.013%
Speed	59	0.006%	49873	4.811%	2137	0.206%
Acceleration	91764	8.851%	57871	5.582%	13198	1.273%
Course	250992	24.210%	558437	53.865%	472067	45.534%
Manually	11	0.001%	3071	0.296%	14	0.001%



Master Track Generation

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

Sensor priority used:

- 1. PHINS
- 2. DEBEG
- 3. Trimble

Filters applied: manual, speed.

Distribution of position sensor data in master track:

Sensor	Data points	Percentage
Total	1036741	100.000 %
PHINS	1036671	99.993%
Trimble	4	0.000%
DEBEG	61	0.006%
Interpolated	5	0.000%
Gaps	0	0.000%

Remarks

Cruise starts on 2011-08-16T06:01:08 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 HE363 is 95.

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	535 points
Data reduction	99.9484 %



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	
	1	PHINS
	2	Trimble
	3	DEBEG
	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

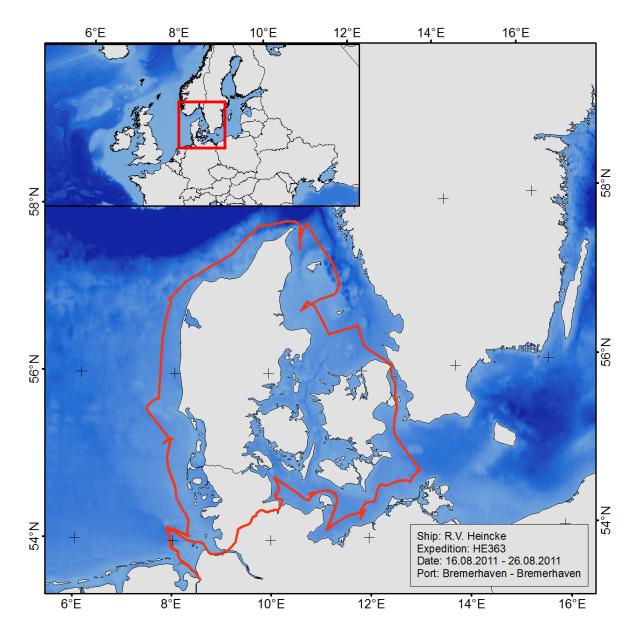


Figure 2: Map of the generalized master track