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HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

FIELAX
Gesellschaft für wissenschaftliche Datenverarbeitung mbH

Master Track RV Heincke HE411

Data Processing Report

Contents

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1 Introduction

This report describes the processing of raw data acquired by position sensors on board RV Heincke during expedition HE411 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 fig. 1. Unvalidated data of up to three sensors and ship-motion data are extracted from the DAVIS SHIP data base (dship.awi.de) in 1-second interval. They are converted to ESRI point shapefiles and imported to a GIS. 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 roll, pitch, 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. Those position tracks are combined to a single master track depending on a sensor priority list (by accuracy, reliability) and availability / filter flag 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 CSV files and imported to PANGAEA (www.pangaea.de) for publication.

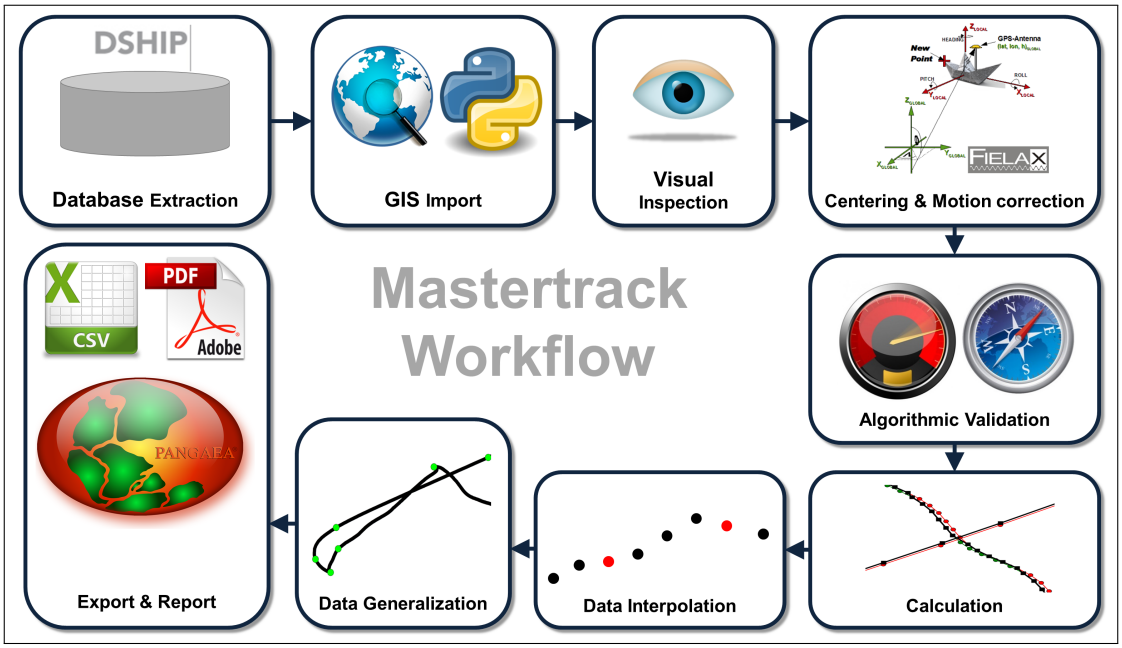

Figure 1: Workflow of master track data processing

3 Sensor Layout

This chapter describes the position sensors mounted during this cruise.

Cruise details

Vessel name:	RV Heincke
Cruise name:	HE411
Cruise start:	17.10.2013 in Bremerhaven
Cruise end:	26.10.2013 in Bremerhaven
Cruise duration:	10 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 track reference point to sensor installation point X Positive to bow 0.000 m Y Positive to starboard 0.000 m Z Positive upwards 0.000 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: ± 0.25 m + 1 ppm Vertical: ± 0.50 m + 1 ppm
Installation point:	Starboard railing above bridge deck
Installation offset:	Offset from master track reference point to sensor installation point X Positive to bow 5.044 m Y Positive to starboard 6.788 m Z Positive upwards 11.489 m

Sensor name:	**DEBEG/Leica MX400**, short: DEBEG
Description:	GPS-Receiver for navigation purposes
Accuracy:	± 7-15 m
Installation point:	Mast
Installation offset:	Offset from master track reference point to sensor installation point X Positive to bow 12.986 m Y Positive to starboard 2.958 m Z Positive upwards 11.328 m

Motion sensor

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

4 Processing Report

This section describes each processing step with its parameters and results.

Database Extraction

Data source:	DSHIP database (dship.awi.de)
Number of exported values:	863941
First dataset:	17.10.2013, 00:00 UTC
Last dataset:	26.10.2013, 24:00 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.

Algorithmic Validation

Input parameters:

Maximum speed for data filter:	20 kn
Maximum acceleration offset for data filter:	1 m/s

Results:

PHINS	0	Speed > 20 kn
	78227	Acceleration difference between points > 1 m/s
Trimble	4	Speed > 20 kn
	137	Acceleration difference between points > 1 m/s
DEBEG	34	Speed > 20 kn
	14686	Acceleration difference between points > 1 m/s

Master Track Generation

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

Sensor priority used:
1. Trimble
2. PHINS
3. DEBEG

Distribution of position sensor data in master track:

Sensor	Data points	Percentage
Trimble	863773	100.0 %
PHINS	119	0.0 %
DEBEG	18	0.0 %
Interpolated	31	0.0 %
Gaps	0	0.0 %

Bounding coordinates of the master track:

	Lat	Lon
NW	54.9786768	7.6382124
NE	54.9786768	8.5804262
SE	53.5230817	8.5804262
SW	53.5230817	7.6382124

Remarks
No additional remarks

Generalization

The master track is additionally generalized to receive a reduced set of the most significant positions of the track.

Input parameters:

Algorithm:	Ramer-Douglas-Peucker
Maximum tolerated distance between points and generalized line:	4 arcseconds

Results:

Number of generalized points:	652 points
Data reduction:	99.92 %

Result files

Master track CSV file:

The format is a plain text CSV (comma separated values) file with one data row in 1 second interval.

Column separator:	Comma ","
Column 1:	Date in format YYYY/MM/DD
Column 2:	Time (UTC) in format HH:MM:SS
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	DEBEG
3	Trimble
INTERP	Interpolated point
GAP	Missing data

CSV file of the generalized master track:

The format is a plain text CSV (comma separated values) file.

Column separator:	Comma ","
Column 1:	Date in format YYYY/MM/DD
Column 2:	Time (UTC) in format HH:MM:SS
Column 3:	Latitude in decimal format, unit degree
Column 4:	Longitude in decimal format, unit degree

Master track data 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.

Cruise map

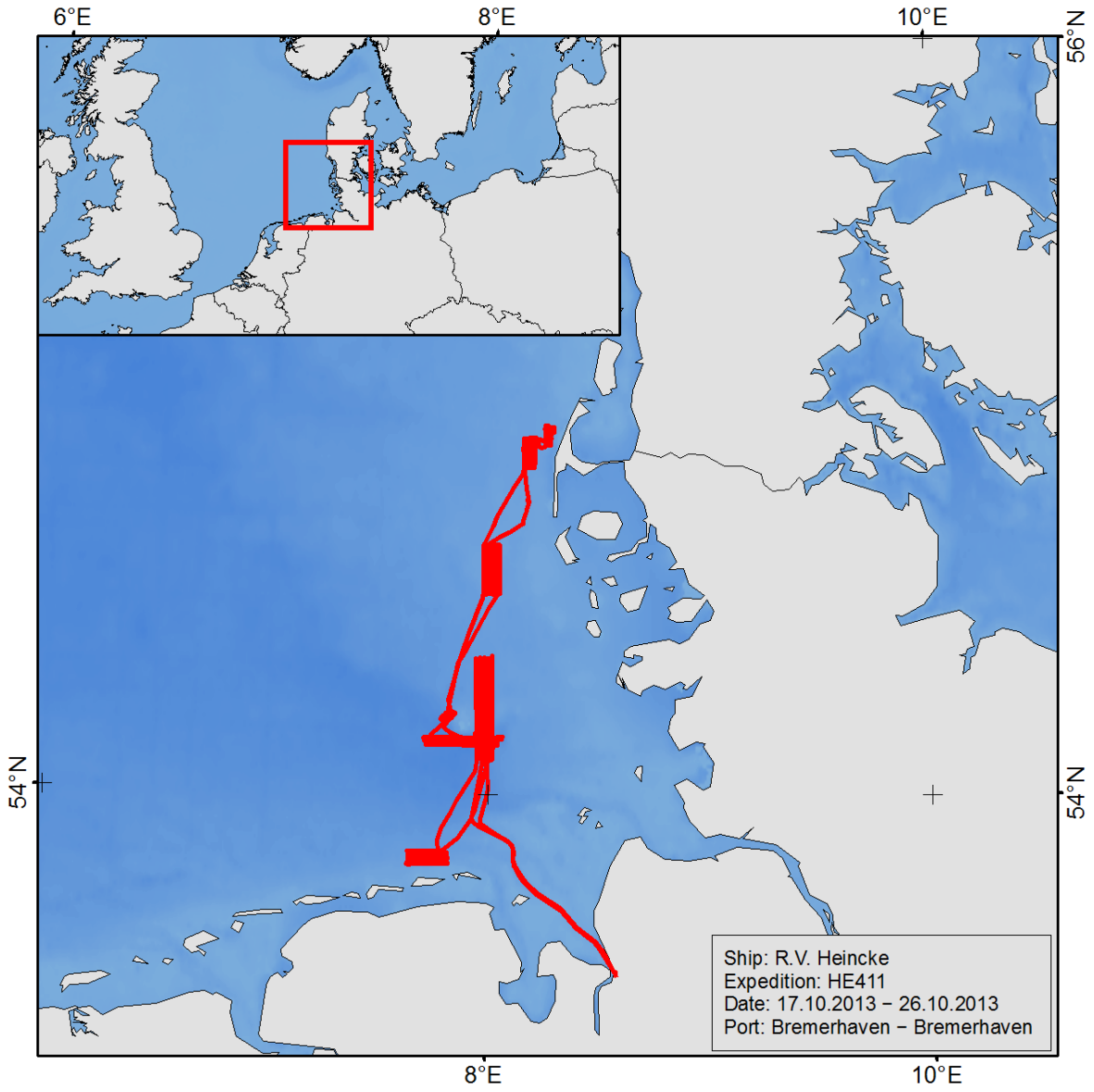

Figure 2: Map of the master track