Surface T/S Data RV "Heincke"

HE538
Data Processing Report

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Contact:
Gerd Rohardt
Alfred-Wegener-Institute
Am Handelshafen 12, D-27570 Bremerhaven, GERMANY
Mail: info@awi.de

Processing Agency:
FIELAX
Schleusenstr. 14, D-27568 Bremerhaven, GERMANY
Mail: info@fielax.de

Ref.: HE538_TSG.pdf  Vers.: 1.1  Date: 2020/01/16  Status: final
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<th>Version No.</th>
<th>Author</th>
<th>Date</th>
<th>Comments or Changes</th>
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<td>11.04.2016</td>
<td>first edition</td>
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<td>Flow Rate Filter added; minor text changes</td>
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1 Introduction

This report describes the processing of raw data acquired by the thermosalinograph on board RV "Heincke" during expedition HE538 to receive cleaned up and drift corrected salinity data.

2 Workflow

The different steps of processing are visualized in Figure 1. Unvalidated data of conductivity sensor, internal and external temperature are extracted from the DAVIS SHIP data base (https://dship.awi.de) in a 1-second interval. The salinity was calculated using conductivity and internal temperature by applying the Practical Salinity Scale 1978 (PSS-78).

As a first step, a basic cleanup was performed to remove missing or flagged data. Then, too low flow rates are taken as indicator for an improper usage of the thermosalinograph. Since the salinity measurements in coastal areas (e.g. rivers and ports) are less reliable, measurements in a buffer of 2 nautical miles (NM) along the coast are filtered. In the Norwegian area (fjords) the buffer is set to 200 meters (0.108 NM). After the exclusion of data outside the speed interval of 0.5 kn to 15 kn, the salinity is drift corrected with lab calibration data. In the next processing step, data with differences between external and internal temperature sensor > 5 K are removed. After despiking, a visual screening is performed to enhance the data quality. Then, the temporal resolution is reduced to 5-minutes-means. In the last step, the 5-minute-means of salinity and external temperature are exported.

Figure 1: Workflow of TSG data processing
3 Cruise details

Vessel name  RV "Heincke"
Cruise name   HE538
Cruise start  29.07.2019 Bremerhaven
Cruise end    09.08.2019 Bremerhaven
Cruise duration  12 days

4 Sensor

Thermosalinograph:  Seabird SEACAT SBE21 (SN: 3334)
External Temperature:  SBE38

Figure 2: Cruisemap of HE538.
5 Processing Report

Database Extraction

<table>
<thead>
<tr>
<th>Data source</th>
<th>DSHIP database (dship.awi.de)</th>
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<tbody>
<tr>
<td>Exported values</td>
<td>1551689</td>
</tr>
<tr>
<td>First dataset</td>
<td>2019-07-26T07:23:27 UTC</td>
</tr>
<tr>
<td>Last dataset</td>
<td>2019-08-13T06:24:55 UTC</td>
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</table>

Automatic Validation

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

- **Min. flow rate**: Minimum 2.5
- **Min. speed**: Minimum 0.5 kn between two datapoints.
- **Max. speed**: Maximum 40 kn between two datapoints.
- **GeoBuffer**: 0.1080 NM around Norway, 2 NM anywhere else
- **Temperature**: Maximum T-difference of 5 K.

Flagging result

<table>
<thead>
<tr>
<th>Filter</th>
<th>Data left (abs.)</th>
<th>Data left (rel.)</th>
<th>Data removed (abs.)</th>
<th>Data removed (rel.)</th>
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<tr>
<td>Raw data</td>
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<td>100 %</td>
<td>—</td>
<td>—</td>
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<tr>
<td>Basic</td>
<td>278059</td>
<td>17.92 %</td>
<td>1273630</td>
<td>82.08 %</td>
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<tr>
<td>Flow rate</td>
<td>237022</td>
<td>15.28 %</td>
<td>1314667</td>
<td>84.72 %</td>
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<tr>
<td>Geo</td>
<td>237022</td>
<td>15.28 %</td>
<td>1314667</td>
<td>84.72 %</td>
</tr>
<tr>
<td>Speed</td>
<td>161240</td>
<td>10.39 %</td>
<td>1390449</td>
<td>89.61 %</td>
</tr>
<tr>
<td>Temperature</td>
<td>161220</td>
<td>10.39 %</td>
<td>1390469</td>
<td>89.61 %</td>
</tr>
<tr>
<td>Despike</td>
<td>161220</td>
<td>10.39 %</td>
<td>1390469</td>
<td>89.61 %</td>
</tr>
<tr>
<td>Manual</td>
<td>161022</td>
<td>10.38 %</td>
<td>1390667</td>
<td>89.62 %</td>
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<tr>
<td>5-min-Mean</td>
<td>2732</td>
<td>0.18 %</td>
<td>1548957</td>
<td>99.82 %</td>
</tr>
</tbody>
</table>

Sensor drift

- **Last calibration**: 16.05.2019
- **Current calibration**: 17.12.2019
- **Start of deployment**: 12.06.2019
- **End of deployment**: 03.12.2019
- **Scaled drift**: -1.7206e-003 [PSU/month]
- **Minimal offset**: 2.5064e-003 [PSU]
- **Maximal offset**: 3.5223e-003 [PSU]

Comments

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Process evolution

Figure 3: Raw salinity data.

Figure 4: Salinity after basic filter.

Figure 5: Salinity after flow rate filter.
Figure 6: Salinity after geofilter.

Figure 7: Salinity after speed filter.

Figure 8: Salinity after temperature filter.
Figure 9: Salinity after despike.

Figure 10: Salinity after manual filter.

Figure 11: Salinity in 5-min-mean values.
Result file

Text File (HE538_surf_oce.tab):

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

<table>
<thead>
<tr>
<th>Column separator</th>
<th>Date and time expressed according to ISO 8601</th>
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<tbody>
<tr>
<td>Column 2</td>
<td>Latitude in decimal format, unit degree</td>
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<tr>
<td>Column 3</td>
<td>Longitude in decimal format, unit degree</td>
</tr>
<tr>
<td>Column 4</td>
<td>Depth below water surface, unit meter</td>
</tr>
<tr>
<td>Column 5</td>
<td>Temperature, unit degree</td>
</tr>
<tr>
<td>Column 6</td>
<td>Salinity, unit PSU</td>
</tr>
</tbody>
</table>

Processing Report (HE538_TSG.pdf):

This PDF document.