RV "SONNE" cruise SO-182
Data Management Documentation of Sediment Echo Sounder Measurements with Atlas Parasound DS-2

1. Introduction

Aim of this work is the processing of the sediment echo sounder data of the Atlas Parasound DS-2 system gathered during the cruise SO-182 of the RV "SONNE". As described in the order, the data processing is done in several steps and the results are:

- Digital data in PS-3 data format that is readable by adequate software (i. e. readable by software SENT for special processing of PS-3 data format).
- Digital data in standard seismic format (i. e. SEG-Y).
- Meta data describing the Parasound data which are accessible by adequate interfaces (i. e. import in PANGAEA).
- Quick look visualisation images of the Parasound data, accessible by adequate interfaces (i. e. in PANGAEA).

A part of the data processing (e. g. navigation editing) was done on board during the cruise. The following text is reporting about problems and troubleshooting during the data processing. Furthermore statistics of data processing steps are presented.

2. Data Source (PS-3 Format)

Data source of the Parasound data was a CD-ROM archive (47 CD-ROMs). All data files could be copied to hard drive successfully, except of the data file 05140838.PS3, which could not be read from CD-ROM (i. e. data loss of approx. 10 minutes). Furthermore, there were duplicate files on the CD-ROMs (668 files), which were deleted.

Because of corrupt time stamps in the Parasound data, 355 data files could not be processed. These data, mostly at the beginning of the cruise and outside of seismic profiles, are visualised in Figure 1.
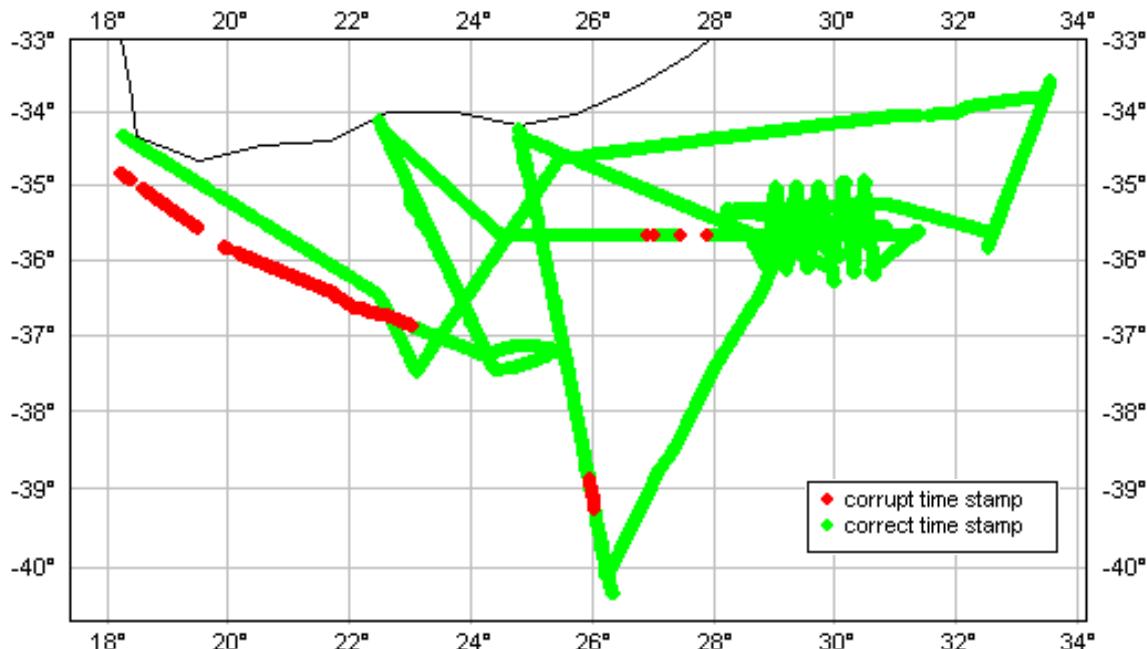
Figure 1: Parasound data with corrupt time stamps (indicated in red) could not be processed.
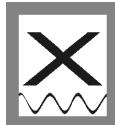
3. Data Source (Navigation)

Data source of the ships navigation data was the ships data base. The navigation was extracted from the data base in an interval of 30 seconds and were checked for navigation errors. The resulting navigation has the following data gaps:

```
11-04-05 11:47:30 - 11-04-05 12:26:34 -> no PS-3 data
11-04-05 12:26:34 - 11-04-05 22:25:50
11-04-05 22:25:50 - 11-04-05 23:38:04 -> no PS-3 data
11-04-05 23:38:04 - 12-04-05 00:00:30
13-04-05 00:00:00 - 14-04-05 04:30:00
15-04-05 12:03:30 - 15-04-05 12:52:10
15-04-05 12:52:10 - 15-04-05 16:18:00 -> no PS-3 data
```

In time periods where no navigation data from the data base is available, the navigation from the PS-3 files was manually edited and used to correct the Parasound data. The navigation data of the following periods was extracted from Parasound data:

```
11-04-05 12:26:34 - 11-04-05 22:25:50
11-04-05 23:38:04 - 12-04-05 00:00:30
13-04-05 00:00:00 - 14-04-01 04:30:00
```

In time periods with an erroneous navigation in the Parasound data, no data processing can be done. This was the case in the following period:

```
15-04-05 12:03:30 - 15-04-05 12:52:10
```

The resulting navigation data set was used to correct the Parasound data, as well as to create the 10-minutes-interval meta data table for data access in PANGAEA.

4. Graphical Presentation in SENT

a) General and Special Parameter

The software SENT is most suitable for graphical presentation of Parasound data in PS-3 data format. For standardised visualisation of Parasound data there is an agreement with Dr. Gerhard Kuhn about the SENT parameters. These standard parameters are stored in the sample parameter file "ARKTIEF_defaults.sed", which may be received from Dr. Gerhard Kuhn (gkuhn@awi-bremerhaven.de).

There are two different versions of the software SENT, which are not quite compatible. The problems are:
- Parameter files (*.sed), created with the newer version, can be read by the older version without error messages, but not all parameters are adopted. Some parameters are set to default parameters, which is not attracting attention in that moment, but will led to problems later.
- Parameter files created with the older version, can not be read by the newer version and will produce an error message.

It is strongly recommended to use the newer version of SENT (date: 05.08.2005) exclusively. The correct import of the parameter file should be checked anyway.

b) Error in Distance Calculation and Visualisation – SENT Software update at 08/2003

With the software update from the 05.08.2003 the error in distance calculation in SENT is corrected. Dr. Hanno von Lom amended the missing cosine in the distance calculation. The updated version of SENT can be received from Dr. Hanno von Lom (l10i@uni-bremen.de) or from the company FIELAX (info@fielax.de).
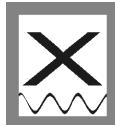
5. Meta Data

In agreement with the geology section of the Alfred-Wegener-Institute, Bremerhaven the meta data (tables for PANGAEA) contain the following columns:

	Name	Sample	Format	Comment
1	Latitude [°N]	74.99766	*f8.5*	degree of latitude
2	Longitude [°E]	2.29006	*f8.5*	degree of longitude
3	Date/Time	27.06.2001 00:00:00	*dd.mm.yyyy hh:mm:ss*	date and time
4	Speed [kn]	0.1	*f3.1*	speed in knots
5	Course [°]	254.2	*f3.1*	course in degree
6	PS-Depth [m]	3364.4	*f7.1*	depth from Atlas Parasound
7	HS-Depth [m]	3370	*i5*	depth from Atlas Hydrosweep
8	NAV-Depth [m]	3366	*i5*	depth from navigation echo sounder
9	Path (ps3)	http://hs.pangaea.de/ para/ps59/ps59_063 01307_s.ps3.tar	*char[80]*	path to data files in PS-3 format, which are stored as tape archives (tar) and can be extract by using WinZip or other adequate software
10	Path (sgy)	http://hs.pangaea.de/ para/ps59/ps59_063 01307_s.sgy	*char[80]*	path to data files in SEG-Y format
11	Path (image)	http://hs.pangaea.de/ para/ps59/ps59_063 01307_s_01.gif	*char[80]*	path to quick look images, which are separated at long profiles
12	Last file	06301438.ps3	*mmddhhmm.ps3*	last data file in the track
13	Comments	OFOS, Wait time 20	*char[80]*	special comments from measurement protocol or data processing

**Table 1:** Description of meta data

Data source of the meta data was the edited navigation, used to correct the Parasound data (see Section 3: Data Source Navigation).

6. Data Correction

```
Amount of data: 25.25 GB

Total number of files checked             : 6026
Total number of headers checked           : 1256478
Total number of files with invalid date/time : 28 ( 0.46 percent )
Total number of invalid date/time headers   : 168 ( 0.01 percent )
Total number of files with wrong lat/longs  : 274 ( 4.55 percent )
Total number of wrong lat/long headers      : 2409 ( 0.19 percent )
```

The correction of the header navigation is visualised in the following figures. Figure 2 displays the navigation of the complete data set, which shows, that the position of 0° E / 0° N is the most significant error. The navigation before correction is indicated in red, the navigation after the correction is indicated in green.
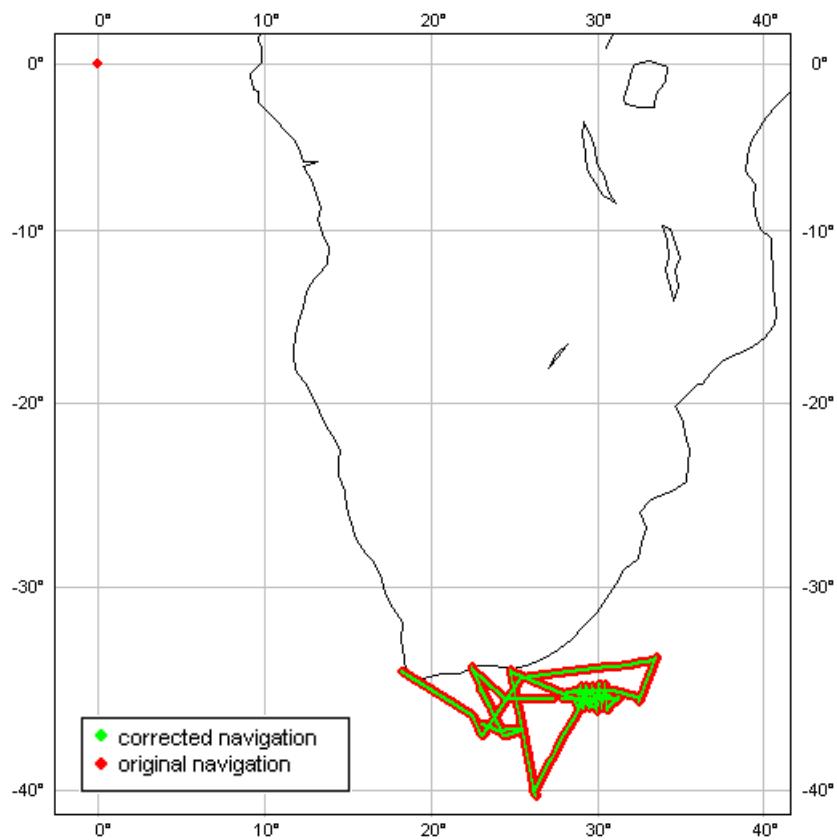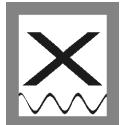
Figure 2: Visualisation of the Navigation of the Parasound data of the cruise SO-182 of RV "SONNE". The navigation before the correction is indicated in red dots, the navigation after the correction is indicated in green dots.
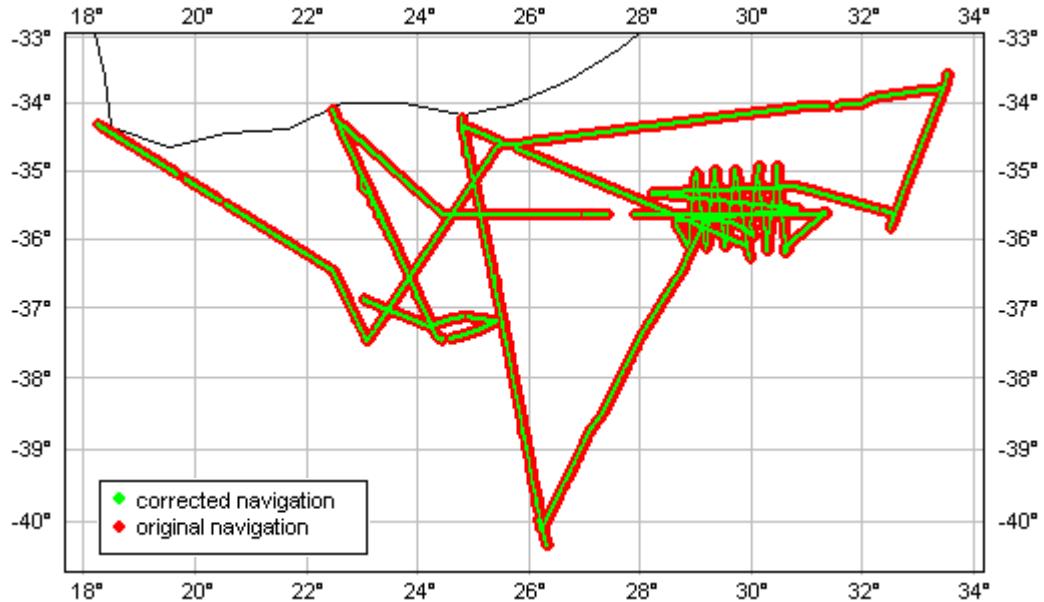

Figure 3: Visualisation of the Navigation of the Parasound data of the working area of the cruise SO-182 of RV "SONNE". The navigation before the correction is indicated in red dots, the navigation after the correction is indicated in green dots.
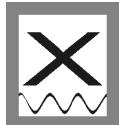
Figure 3 displays a clipping from Figure 2 for a closer look to the working area of the cruise SO-182. One of the steps in the processing of the Parasound data is to associate the traces to the correct navigation, depending on the time the sound signal hits the bottom (cps: common depth point). Especially in pulse train mode there is a significant enhancement, because with the correction all single soundings of one pulse train are not associated with one position anymore, but with individual positions for each sounding. As you can see in Figure 4 the positions of the traces are shifted, depending on the time of the bottom contact and there are now individual positions for each sounding.
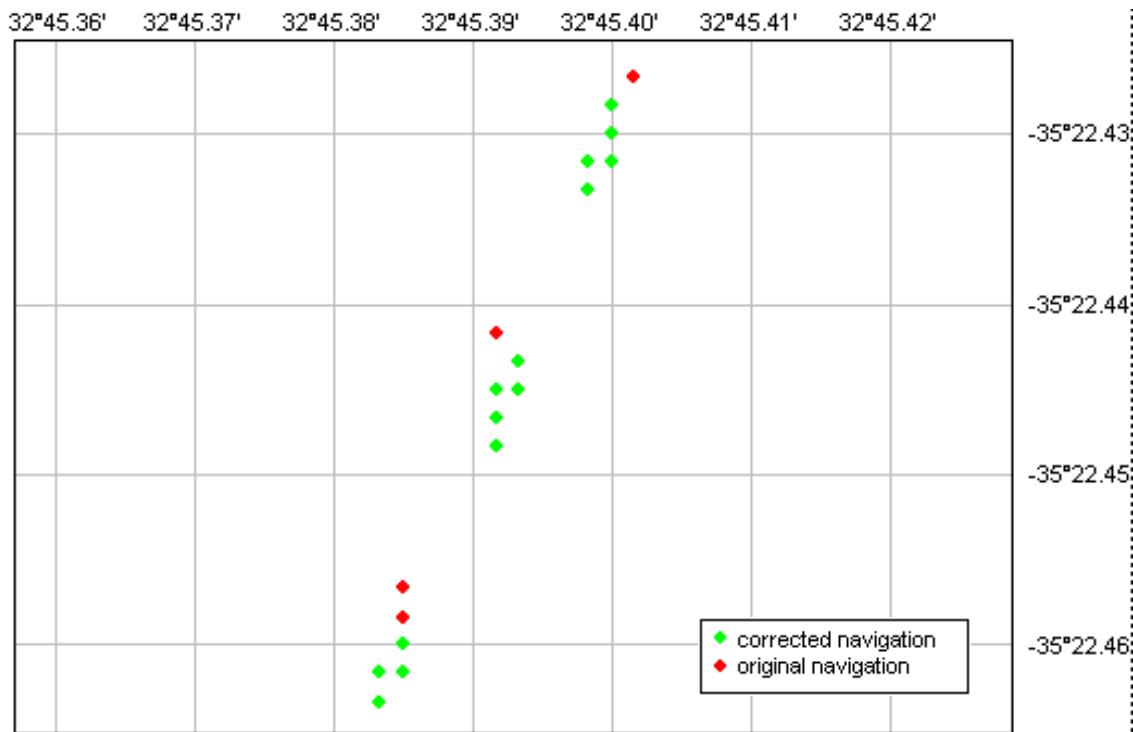
Figure 4: Corrected positions of the Parasound soundings for the true bottom contact place. The navigation before the correction is indicated in red dots, the navigation after the correction is indicated in green dots.

7. Data Quality

The data quality is affected by outer influences and problems of the Parasound system itself. Outer influences are for instance the morphology: On steep slopes the reflected transmission signal will not return to the receiver. which is sometimes some case in the working area of this cruise. Another problem are hydroacoustic disturbances, caused by sound emissions of the ships engine and other echo sounder. The sediment records are covered by the noise, as shown in an example in Figure 5.
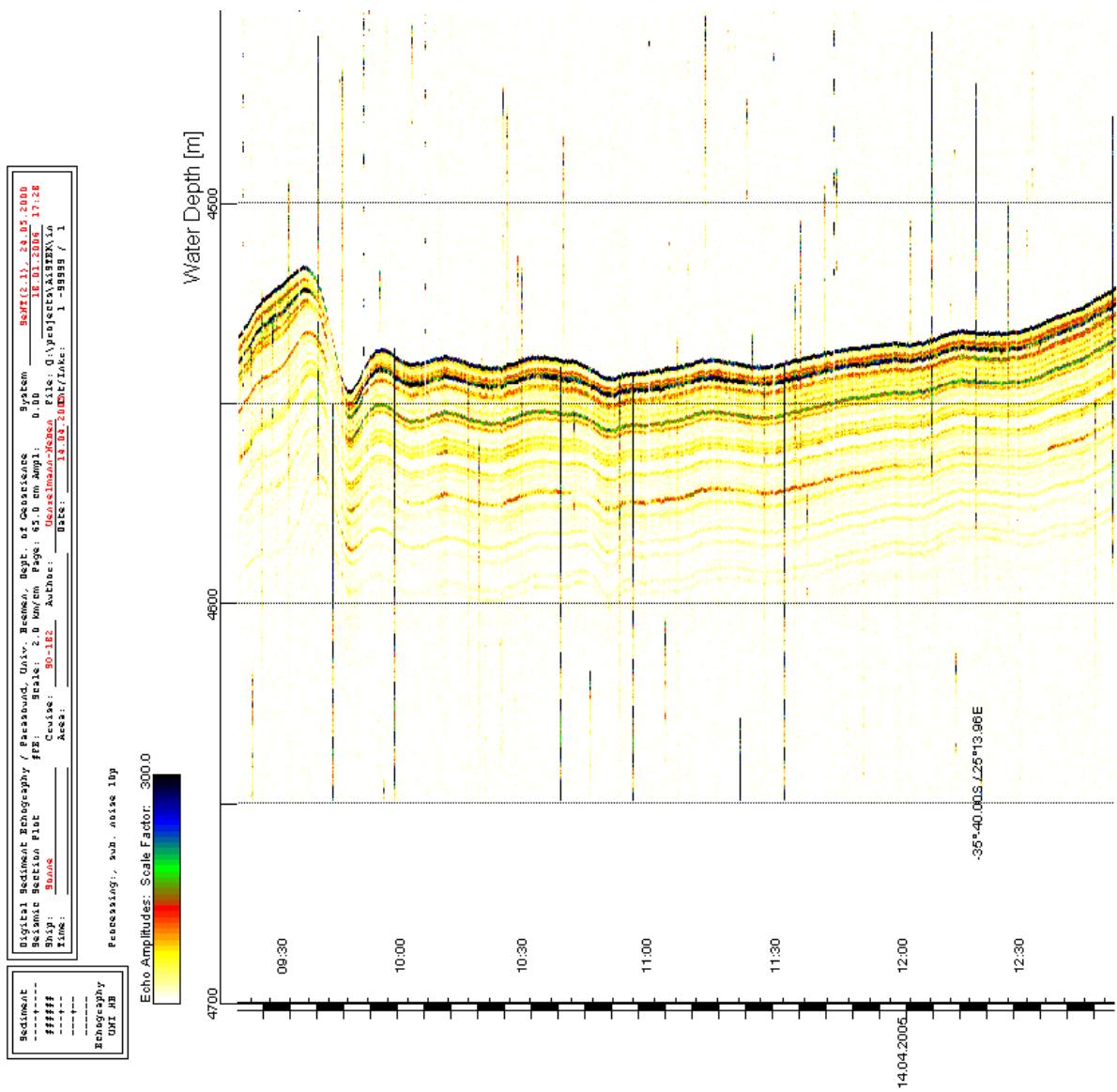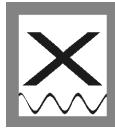
Figure 5: Sediment records are covered by hydroacoustic disturbances, caused by sound emissions of the ships engine and other echo sounders.
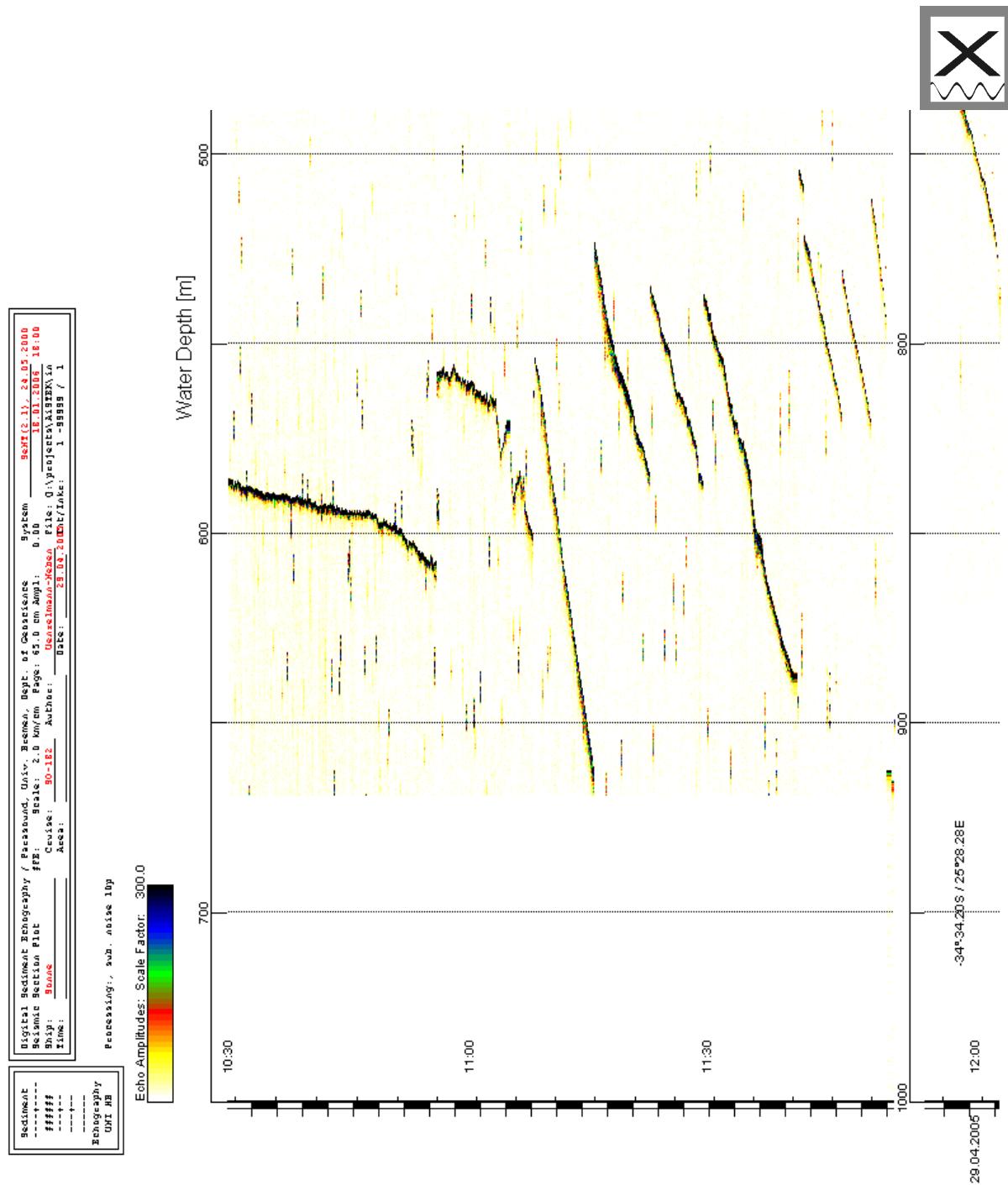
Figure 6: Example for a wrong window depth delay.

An example for erroneous data records, caused by the Parasound system itself, is given in Figure 6. The depth window was shifted by the operator, but the shifting was not recorded in the data, resulting in a wrong window depth delay.

8. Data Accessibility

All data files are stored on the mass storage system at the Alfred-Wegener-Institute at http://hs.pangaea.de/para/so182/. The data are accessible with the aid of meta data search at http://www.pangaea.de. The Parasound data files in the data formats PS-3 and SEG-Y as well as the quick look images are linked to the entries in the 10-minute-interval table. In case of restricted access to the data please contact Dr. Hannes Grobe (hgrobe@awi-bremerhaven.de).