

Lessons learned MBES and SSS data analysis by Timo Gaida

During the Hollandse Kust Zuid (HKZ), Borssele, Luchterduinen and Ten Noorden van de Waddeneilanden (TNW) project (carried out by De Rijke Noordzee and TU Delft), several obstacles occurred and lessons learned were defined:

I. Regular measurements of sound velocity and sound absorption in the water column

Insufficient water column sampling leads to artefacts in the bathymetry and backscatter data. In particular, the bathymetry can be deteriorated since the sound velocity is required for the calculation of the water depth from the travel time of the acoustic signal. With sophisticated software, the artefacts can be reduced to some extent (see Figure 7).



Figure 1 Influence of insufficient sound velocity sampling results in along-track stripes between adjacent MBES track lines. Postprocessing can correct for it just to a certain extent.

II. Consistent MBES settings

In order to use acoustic backscatter for sediment and habitat classification, the MBES settings need to be consistent during the survey campaign. Only then, the data is representative of the current seabed state and allows a comparison between the acquired data. For example, the pulse length was changed during the acquisition in the Ten Noorden van de Waddeneilanden, which resulted in incomparable backscatter data.

III. Simultaneous (temporal and spatial) acquisition of acoustic (MBES and SSS) and ground truth data

Since the seabed is a dynamic environment and the composition of the seabed might change over time, simultaneous acquisition of acoustic and ground truth data is highly important. Depending on the local dynamics, the time difference between the acquisition of both datasets can vary between hours, days and weeks, but should never be more. For example, a tidal inlet requires a better timing than the open sea. The smaller the time lag between datasets the better the results.

IV. Selecting ground truth location already on the vessel during MBES data acquisition

Ideally, the acoustic data will already be preliminary analysed on the vessel and based on the observed acoustic pattern a location for the ground truthing will be chosen. The ground truthing could be done from the same vessel as the acoustic acquisition. MBES backscatter mosaics, created on the vessel, should be used to select ground truth locations

V. *Combination of physical samples and video footage*

In-situ measurements with a Box Corer or Van Veen sampler provide detailed information about the seabed properties, such as grain size or biogenic content. However, the information are refined to a single and very small location on the seabed. In addition, a Van Veen samples only represents the disturbed seabed. By combining the physical samples with video footage the detailed information can be extended to a larger area and thereby further improving the verification of the acoustic data. In particular, for reef detection video footage can be crucial, as box cores and Van Veen grabs are likely to miss the actual reef.

VI. *Representative sample size for coarse grains and a good documentation*

Coarse grains, such as gravel or shell fragments, require a larger sample size (e.g., 200 g) in order to receive a reliable grain size analysis in the lab. In addition, a good documentation on the vessel, including a Photo (see Figure 8), improves the acoustic analysis significantly without additional effort.



Figure 2 Example of a photo taken on the vessel from a seabed sample acquired with a Box Corer

VII. *SSS survey lines orthogonal to the orientations of the megaripples*

As seen in Figure 9, the orientation of the SSS track lines can alter the visualisation of the seabed. Therefore, it is recommended to define the orientation of the SSS lines based on the project goal and geological information. It might even be necessary to adjust the track line on the vessel after the first check of the data quality. Still, it is recommend to do several lines orthogonal to each other to cover different perspectives.

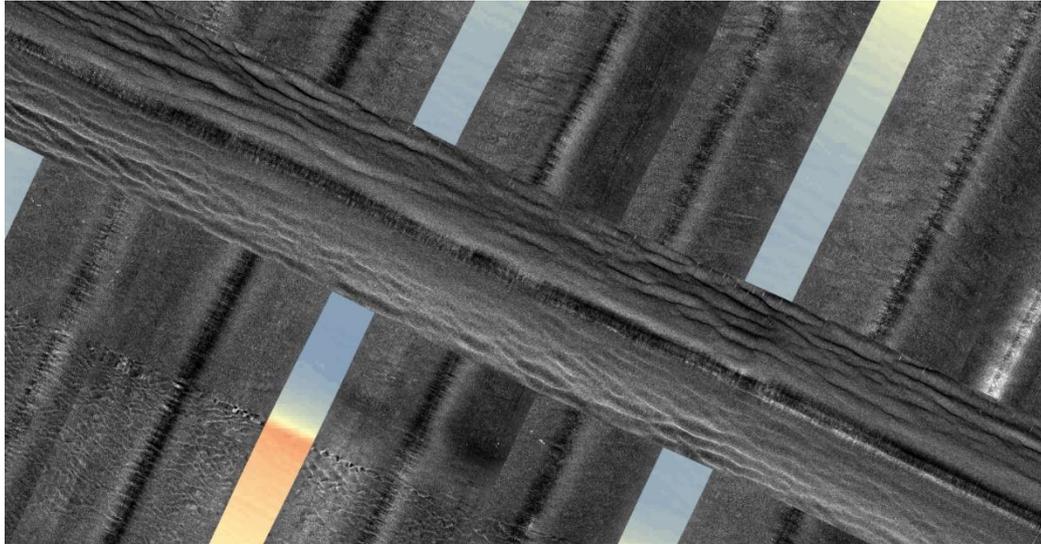


Figure 3 SSS track lines with different orientations. The direction of the track line with respect to the bedforms can highly alter the acoustic picture. In the background the bathymetry is shown. The black apparent stripes along the survey direction represents an artifact caused by the sonar configuration and the sound propagation. Grid cell size 20 cm.

VIII. Seasonality of biogenic reefs

A potential seasonality of biogenic reefs should be considered during the survey planning. Ideally, several surveys during the season should be carried out to evaluate the effect of the season on reefs growth. Alternatively, a literature study can be carried out and depending on the outcome the time of the survey should be planned.

IX. Storage of MBES backscatter

Highly important is the storage of the MBES backscatter data during the acquisition. Without the MBES backscatter no sediment classification can be carried out. Usually, the surveyor has to enable the storage, otherwise the backscatter will not be stored in the MBES files. This happened during the MBES acquisition in the Luchterduinen area. The data was lost and cannot be restored or reprocessed afterwards.

X. Scanning the data quality on the vessel

A quick check of the MBES backscatter and bathymetry on the vessel for data quality is highly recommended. Appropriate software for checking the MBES data is for example *QPS FMGT* (MBES backscatter) and *QPS Qimera* (MBES bathymetry).

- MBES backscatter should be checked for across-track and along track stripes.
 - Low Intensity across-track stripes are often caused by water bubbles in the water column due to bad weather or high sailing speed. Reducing the sailing speed or waiting for calmer weather is recommended
 - Along-track stripes can be caused due to a change in sonar-settings, change of water column properties (wrong sound absorption), high sediment turbidity or change of seabed composition over time
- MBES bathymetry should be checked for artifacts in regions with overlapping MBES data. Artifacts can be caused by:
 - Insufficient CTD sampling (see item I)
 - A wrong input of MBES and sensor installation parameters