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Study of the Evolution of a Dredged Area Using Hydro-Acoustic Equipment

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1 INTRODUCTION AND METHODOLOGY

Recent studies (Manso et. al, 2004) have demonstrated that the combination of hydro-acoustic data from multibeam bathymetry and acoustic images (side-scan sonar mosaics and multibeam backscatter amplitude maps) reveal most of the geological and geomorphological patterns resulting from dredging activities, allowing monitoring of dredged areas.

Comparison of the data sets obtained in different surveys from the same study area allows, on one hand: generating an important input for coastal management by assessing the evolution of areas where marine aggregates are mined, since these materials are the protection of the coast against the sea; and on the other: planning of future dredging activities.

The study was performed in Tromper Wiek, a semi-enclosed bay located on the German Baltic Sea coast. This area was chosen due to the existence of two adjacent extraction sites, where different materials are mined using different techniques.

Data is available from 2 surveys, carried out in 1999 and 2003. Ground truthing was performed by sampling with an 80 kg HELCOM-standard Van Veen grab and an underwater video system.

2 RESULTS AND DISCUSSION

2.1 Acoustic Images (side-scan sonar and multibeam backscatter)

When comparing the side-scan sonar mosaics with the amplitude of the backscattered multibeam signal, different advantages and disadvantages are obtained, even though both data sets showed the same features (Manso *et. al*, 2004).

The comparison of side-scan sonar mosaics, having higher resolution than multibeam backscatter maps, allowed assessing changes of surficial seabed sediment patterns. Changes were discernible in the distribution of spilt sands (dumped on the seafloor right after the screening process). Such sands are entrained during storm events and accumulate in the pits (Klein 2003). Nevertheless this process is not enough to refill the pits within 4 years (1999-2003). Moreover, the volume of spilt sands is limited to about half the volume of the pits to be refilled (Diesing at al., 2003).

2.2 Detailed bathymetry (multibeam)

To study the vertical evolution of the features observed on the acoustic images, multi-beam depth data is essential.

The 2.5D surface generated with the multibeam data becomes even more valuable when overlaying a multibeam backscatter map, implementing essential information about seabed morphology and sediments. Although, as mentioned before, the resolution of a multibeam backscatter map is lower than a side-scan sonar mosaic, this first acoustic image is more suitable to overlay with a bathymetric surface because it is geometrically correct, while the second is not, due to assumptions done during data processing.

First comparisons on multibeam surfaces from the sand area, allowed the computation of the volume of sand extracted on the newer furrows and an approximation of the natural nourishment of the area, when focusing on old extraction sites.

1 3 CONCLUSIONS

The combination of multibeam bathymetry with multibeam backscatter generates a surface which allows, in the case of dredging activities, the management of the area in terms of impacts, evolution and location of sites for future extraction activities. In the case of Tromper Wiek, the effects of mining are easily detectable, on both sand and gravel areas.

Comparisons of both, side-scan sonar and multibeam acoustic images time series allow assessing the horizontal changes on the seabed while comparison of time series of multibeam surfaces allow the evaluation of bathymetric changes. These two different information help evaluating the evolution of dredged areas.

In the case of Tromper Wiek, slow natural regeneration rate are observed. Side-scan sonar images show very small horizontal differences while multibeam surfaces indicated a low infilling rate of the features generated on the seabed during mining.

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