

SEDIMENT DYNAMICAL AND MORPHOLOGICAL STUDY OF A MARINE SHOAL: THE PAARDENMARKT, BELGIAN CONTINENTAL SHELF. CONTRIBUTION OF GRAIN-SIZE ANALYSIS, ACOUSTIC INSTRUMENTS, CURRENT MODELISATION

Charlet François and Vera Van Lancker

Ghent University, Renard Centre of Marine Geology, Krijgslaan 281 S8, B-9000 Gent, Belgium
E-mail: Francois.Charlet@rug.ac.be

The Paardenmarkt is a marine shoal, located two kilometers east of the Zeebrugge harbour (51°20'N-03°16'E), in water depths varying between 3-7m. This site is characterized by the presence of shallow biogenic gas. Moreover, this site forms a dangerous area for shipping and fishing because it was used as a dumpsite for WWI bombs. For this reason, the understanding of the sedimentary transport is important to estimate the future evolution of this site.

This study combines acoustic data (side-scan sonar, single- and multibeam, acoustic doppler current profiler), current modeling and grain-size analysis of surficial sediment samples to evaluate the relative contribution of the hydrodynamic and morphological effects on the sedimentary transport in the area.

The hydrodynamic results show a dominance of the flood tidal current for the entire study area. However, locally near the Scheldt Estuary, the ebb current dominates as an effect of the Scheldt outflow.

Based on the grain-size analysis, a sediment map is made in combination with the seabed morphology and permits a classification of 5 sediment types.

The residual sediment transport, based on the grain-size data, is estimated by a numerical model (Gao and Collins, 1991) and is related to seabed features observed on the acoustic data (side-scan sonar and multibeam). Four different sedimentary transport zones are distinguished with this method:

- ↳ in the western part of the study area, the flood currents dominate and influence the sedimentary transport;
- ↳ in the southern part, the gyre created behind the Zeebrugge harbour influences the sedimentary transport;
- ↳ in the central part, no significant residual transport is observed;
- ↳ to the east, near the Scheldt Estuary, the sedimentary transport is influenced by the amplification of the ebb currents. This amplification is due to a minimal addition of freshwater and the contrasted morphology of the estuary, which canalizes and accelerates the ebb current.

This case study was carried out in the framework of an evaluation study of the anthropogenic influence of the harbour construction between 1954-2000. Due to the construction of the harbour, a gyre is generated resulting in a sedimentary accretion south and erosion north of the Paardenmarkt site.