Todo list

NUMERICAL AND IN-SITU INVESTIGATIONS OF FEASABILITY STUDIES OF REINSTATEMENT WORK FOR THE PORT OF DAGEBÜLL

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Abstract

The Port of Dagebüll at the north Friesian coast, Germany, exemplifies the field of conflicting interests in which a multitude of small German North Sea harbors reside. Initially designed for ro-ro ferry traffic to the nearby Islands Föhr and Amrum and the turnover of fishery products, the ports utilization profile changed. The current design hosts three ro-ro ferry bridges for cars, a heavy duty jetty as well as a ro-ro railway bridge. Lately the harbor adapts to the rise of off-shore wind energy and receives components from Bremen (2).
The port is subjected to the continuous influence of tides and wind-waves. Sediment transport regularly causes siltation of the harbor basin. Frequenting ferries and other nautical vessels induce eddies and propeller-induced turbulence, causing remobilization and redistribution of alluvial sediments in the harbor basin. Therefore the harbor basin requires regular annual dredging operations to maintain navigability.
The steel pile foundation of the south jetty, shows signs of corrosion and will need reinstatement within the near future. Three different design studies oriented at previous findings (3, 6, 4) regarding the reinstatement of the jetty foundation are investigated regarding possible impacts upon the hydro- and morphodynamic situation.
Bathymetric soundings of the harbor basin from multiple years and adjacent wadden-sea area are assimilated into the simulation data base. A supplemental water-born field campaign is conducted acquiring 3D-current velocities as well as 2D-depth profiles of water quality parameters by CTD spanning a tidal cycle (see Figure 1).
Furthermore, water and soil samples have been extracted yielding a comprehensive picture of the situation for developing and calibrating a numerical model utilizing the open source software suite Delft3D (5, 1). Application of the calibrated numerical model with varied geometry of the south pier (blocked/flow-through) makes prediction of morphological changes an option to optimize repair design prior to construction begin, meeting the new utilization profile.

Keywords: numerical model, reinstatement design study, morphodynamics, utilization profile, field of conflicting interests

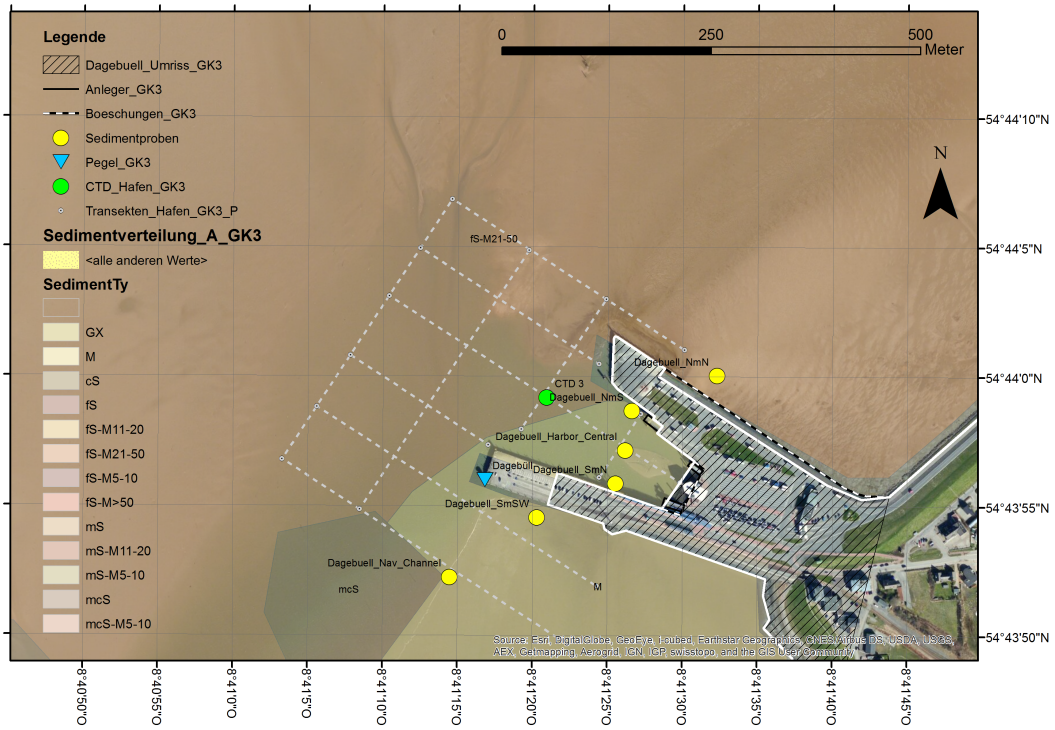

Figure 1: Measurement plan for the Port of Dagebüll including ADCP-transects, CTD-profile locations, soil sample positions and occurring sediment types

References

[1] Deltares, editor. *Delft3D-FLOW User Manual; Hydro-Morphodynamics: Simulation of multi-dimensional hydrodynamic flows and transport phenomena, including sediments: User Manual, Version: 3.15.34158*. Deltares, 2629 HV Delft, 2014. 1

[2] Hafengesellschaft Dagebüll mbH. Dagebüll: Techncal figures dagebüll, 2016. 1

[3] John R. Headland, Robert Kirby, Han Winterwerp, Horst Nasner, Jacob Vested, Marc Sas, Koen Lamers, Yasuyuki Nakagawa, Javier Enriquez, Franz Westermeier, and Jaques Paul. Minimizing harbor siltation (mhs). In ASCE, editor, *Ports 2007: 30 Years of Sharing Ideas 1977-2007;*, page 28. 2007. 1

[4] Robert Kirby. Minimising harbour siltation-findings of pianc working group 43. *Ocean Dynamics*, 61(2-3):233–244, 2011. 1

[5] J. A. Roelvink and G. K Van Banning. Design and development of delft3d and application to coastal morphodynamics. *Hydroinformatics '94. Proc. 1st international conference, Delft, 1994. Vol.1*, pages 451–456, 1994. 1

[6] Dirk Sebastiaan van Maren, Johan C. Winterwerp, Marc Sas, and Joris Vanlede. The effect of dock length on harbour siltation. *Continental Shelf Research*, 29(11-12):1410–1425, 2009. 1