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Survey of Morphological Changes on Tidal Flats in Estuaries

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Tidal flat areas in estuaries are affected by strong morphodynamics. Changes of sedimentation and erosion occur on very different time and spatial scales. These changes challenge the responsible authorities due to the high importance of sufficient navigation channel depths and the ecological importance of those unique zones. The Hamburg University of Technology in cooperation with the Hamburg Port Authority runs broad field measurements on different tidal flat areas in the Elbe estuary. The results provide a fundamental data set, which improves the knowledge about morphodynamic processes and verifies mathematical descriptions.
The field measurements focus on two investigation areas: One area is located in the mouth of the estuary and represents a marine tidal flat. The other one is located near the city of Hamburg and typifies a limnic tidal flat area. For more than 3 years water levels, waves, current parameters and suspended sediment concentrations are being recorded continuously and in a high resolution at different positions. Altogether, three measuring positions are operated at any time. To observe the consequences of the morphodynamic processes, the bathymetry of the investigation areas is determined with a multi-beam echo sounder (MBES) in frequent intervals.
The main goal of the research project is to improve the knowledge about morphodynamic processes on tidal flats. Derived from the field data certain patterns of erosion, sediment transport and sedimentation could be observed depending on tidal currents, waves and large scale weather conditions. Seasonal effects are analysed as well as the influence of extreme events. A comparison of the processes observed on marine and limnic areas is done, whereas the latter additionally is affected by upstream water discharge.
For example, on the marine tidal flats the sediment transport capacity was analysed: Extreme events cause a short peak, which does not result in significant bathymetric changes. Larger morphological changes occur during and after phases with high transport capacities due to longer-lasting high wind velocities from western directions.
The presentation will include a description of the investigation area and the field measurements. Then the results will be discussed and the creation of a numerical model will be described. The results of the model will be evaluated and conclusions will be drawn on the basis of both, the field measurements and the model. Closing recommendations for further research will be given.