



Limits of sediment transport formulas in the Wadden Sea – Comparison of measured and computed transport rates

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Tidal flat areas in estuaries are affected by strong morphodynamics. Changes of sedimentation and erosion occur on very different time scales and spatial scales. These changes challenge the responsible authorities due to the high importance of a sustainable sediment management. The Hamburg University of Technology in cooperation with the Hamburg Port Authority carried out broad field measurements on a Wadden Sea area in the mouth of the Elbe estuary. The results provide a fundamental data set, which improves the knowledge about morphodynamic processes and verifies mathematical descriptions.

For four years water levels, waves, current parameters and suspended sediment concentrations were recorded continuously and in a high resolution at different positions in the Wadden Sea area. Altogether, three measurement positions were operated at any time. To observe the consequences of morphodynamic processes, the bathymetry of the investigation area was determined with a multi-beam echo sounder in frequent intervals.

The main goal of the research project was 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 were analysed as well as the influence of extreme events. The data were used to identify phases of higher morphologic activity and differences between various sections of the investigation area.

Different sediment transport formulas (e.g. van Rijn, Watanabe, Engelund & Hansen, Bailard & Inman) were evaluated in regard to their applicability in tidal flat areas. Their accuracy varies significantly depending on the tide (e.g. normal tides, tides with higher water levels) and depending on the measurement position (e.g. tidal creek, areas exposed to waves). The most adequate approaches were identified and recommendations for the use in numerical models were given.

The presentation will include a description of the investigation area and the field measurements. The results will be presented and discussed. Mathematical descriptions will be evaluated and recommendations for an according improvement will be given. Closing recommendations for further research will be given.