Geophysical Research Abstracts,
Vol. 10, EGU2008-A-04005, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-04005
EGU General Assembly 2008

Dynamic of Suspended Particulate Matter on tidal flats. Modelling study for the German Wadden Sea

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A three-dimensional Suspended Particulate Matter (SPM) transport model with horizontal and vertical resolution of 100 m and 0.5 m, correspondingly, is developed and implemented for one part of the North Frisian Wadden Sea characterised by extremely shallow depths. Hydrodynamics is provided by a modelling system including TRIM 3-D model for circulation and K-model for wind waves. These two models are coupled interactively. The model includes two fractions of fine SPM with grain size less than 20 micrometers and one with coarser grain size less than 63 micrometers. Below the water column a bottom slab subject to erosion is also included. In this 20 cm slab, which is discretized by four layers with variable thickness, diffusion and bioturbation are accounted for. Vertical redistribution of SPM is controlled locally in the model by sinking and mixing, the latter is due to turbulence created by current shear and wind waves. The processes of sedimentation, resuspension and erosion of bottom deposits results from the local shear stress velocity, derived in time and space under consideration of local currents and waves. The major focus in this research is put on some specific effects appearing in extremely shallow water. Among them, wave breaking on sand banks, rapid water exchange caused by ebb and flood currents, as well as turbulence driven by transport and waves provide a fundamental control to SPM dynamics. We demonstrate that the performance of model is well supported by independent observations and general concepts.