Future projections of wave induced bed shear-stress in shallow waters

Jens Murawski¹, Mikhail Dobrynin², Shuting Yang¹

¹Danish Meteorological Institute, ²Institute of Oceanography, University of Hamburg

Wave induced sea bed shear stress is one of the main parameter that controls the erosion, suspension and deposition of mud's and sands as well as the sedimentation and re-suspension of fine sediments in the shallow near-coastal waters. It is also related to coastal erosion, which is widely believed to increase in the future as a consequence of raising water levels and changing wind regimes. Focusing on the latter, shear-stress impacts under changing climate conditions, as predicted by the Earth system model (DMI EC-Earth) in the CMIP5 - Coupled Model Intercomparison Project have been studied globally in the climate adaptation project BALTADAPT. Waves and wave induced shear stress have been found to exhibit long-term trends that are not just following the trends of the developing wind fields, but are also corresponding to climate changes in swell generation and swell related energy exchange between ocean basins. Two methods have been implemented into WAMcycle4.5 to calculate the sea bed shear-stress as a function of the orbital velocity. It is either calculated from spectral integrated quantities: significant wave height and mean wave period; a method that was tested and validated for the North Sea, or is calculated by spectral integration of the shear-stress contribution of individual modes. Latter shows a tendency for producing stronger values for high wind events in shallow water. Model runs for future scenarios RCP4.5, RCP8.5 and historical periods have been conducted, inter-compared and analyzed to identify mean trends and anomalies. Critical erosion limits have been applied to the wave induced shear stress value, to study coastal erosion pattern and trends in number of erosion events. The analysis shows where erosion problems may arise. or where they are likely to intensify.