



Wave energies and wave-induced longshore currents in an unstructured-grid model – circulation in front of barrier islands

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An unstructured-grid model (FVCOM) coupled to a wave model (FVCOM-SWAVE) is used to investigate the hydrodynamic and wave energy conditions during a moderate and a storm situation in the southern North Sea. Two different setups are presented. One setup covers the whole North Sea with moderately increased grid resolution at the coast, whereas the other comprises a very high resolution East Frisian Wadden Sea setup, one-way coupled to the coarser North Sea model.

The results of both model setups are validated, compared to each other and analysed with a focus on longshore currents and wave energy. The results show that during storm conditions strong wave-induced longshore currents occur in front of the barrier islands of the East Frisian Wadden Sea, resulting in total current speeds up to 2 m/s. This effect is especially pronounced in the high-resolution setup.

The wave-current interaction also influences the sea surface elevation by raising the water level in the tidal basins. Calculated wave energies show large differences between moderate wind and storm conditions with time-averaged values up to 200 kW/m.

The numerical results indicate that wave-current coupling, albeit numerically expensive, cannot be ignored because it plays an important role in almost all near coastal transport phenomena (sediments, contaminants, bacteria, etc.).