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Tidal asymmetry in the Sylt-Rømø Bight, south-eastern North Sea

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The study is dedicated to the tidal dynamics in the Sylt-Rømø Bight with a focus on the non-linear processes. The FESOM-C model was used as the numerical tool, which works with triangular, rectangular or mixed grids and is equipped with a wetting/drying option. As the model's success at resolving currents largely depends on the quality of the bathymetric data, we have created a new bathymetric map for an area based on recent studies of Lister Deep, Lister Ley, and the Højer and Rømø Deep areas. This new bathymetric product made it feasible to work with high resolution grids (up to 2 m in the wetting/drying zone). As a result, we were able to study the tidal energy transformation and the role of higher harmonics in the domain in detail. The tidal ellipses, maximum tidally-induced velocities, energy fluxes and residual circulation maps were constructed and analysed for the entire bight. Additionally, tidal asymmetry maps were introduced and constructed. The full analysis was performed on two grids with different structures and showed a convergence of the results as well as fulfillment of the energy balance. The tidal residual circulation and asymmetric tidal cycles largely define the circulation pattern, transport and accumulation of sediment and the distribution of bedforms in the bight, therefore the results are necessary and useful benchmarks for further studies in the area, including baroclinic and sediment dynamics investigations.

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