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The significance of coastal bathymetry representation for the simulation of tidal dynamics in the German Bight with sea level rise

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Due to climate change an accelerated sea level rise is expected. One key question for the development of adaptation measures is how sea level rise affects tidal dynamics in marginal seas such as the North Sea.
Studies investigating the impact of sea level rise on tidal dynamics in the North Sea reveal different and in some cases oppositional results even for the same sea level rise scenarios. These studies show that the implementation of the landward boundary has an influence on the change of the M2 amplitude. The results differ depending on whether new elements at the landward side of the model boundary are allowed to flood with sea level rise or if the model boundary is fixed.
Our study shows that different results of the M2 amplitude with sea level rise originate not only from the implementation of the landward boundary, but also from the representation of the coastal bathymetry in the model. Using a high-resolution 3D hydrodynamic model of the German Bight we investigate the changes in M2 amplitude. A coarse and a high resolution bathymetry is interpolated on the numerical grid of the high resolution model. The result is a different dissipative behaviour in the intertidal zone that leads to oppositional changes of the M2 amplitude.
In an additional test case we investigate the impact of excluding estuaries from the model do-main, which is a common resolution-dependant simplification in shelf models. In the high resolution model the estuaries are removed to investigate the influence of the missing oscillation space. The results show that this can have locally a high impact in the mouth of the estuaries.
Our results confirm that depending on the research question and the region of interest, it is important to select the model setup in such a way that all relevant processes are included, especially in the shallower parts and the intertidal zone.