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Changes in bottom shear stress, due to aggregate extraction, in the area of the Hinder Banks (Belgian Continental Shelf)

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ABSTRACT

The bottom shear stress, which determines sediment resuspension and erosion, deposition and bottom morphology, is used as an indicator in the Belgian implementation of the European Marine Strategy Framework Directive, to evaluate changes linked to human activities. It is stated that human impact asks consideration when the bottom shear stress, calculated by a validated mathematical model over a spring-neap tidal cycle, increases by more than 10 %. The near-bed current profiles, measured with bottom mounted Acoustic Doppler Current Profilers (ADCP), have been used to calculate bottom shear stress, and their associated error ranges. Data at two stations, along the eastern and southern part of the Oosthinder sand bank, were available. The modelling of bottom shear stress was done based on different models. Currents were modelled using the three-dimensional COHERENS model, waves were calculated using the WAM model. Results of the validation showed, for a mean bottom shear stress of around 0.7 Pa, a bias less than -0.09 Pa and a root-mean-square error less than 0.26 Pa at the eastern part of the Oosthinder. The results on the southern part were less good, mainly due to strong tide-topography interactions. To assess the impact of aggregate extraction, three different scenarios of extraction were simulated. Results show that in the relatively deep waters of the Hinder Banks, the impact on the bottom shear stress remains restricted to the areas of the extraction, while the impact outside the impact areas remained limited to less than 6 %.

Keywords: bottom shear stress, Marine Strategy Framework Directive, modelling, sustainable extraction

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