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Effect of aggregate extraction on MSFD descriptor 7 (hydrographic condition) in the Hinder Banks area (Belgian Continental Shelf)

Bottom shear stress, determining sediment resuspension and erosion, deposition and bottom morphology, is proposed as an indicator for descriptor 7 (hydrographic conditions) in the Belgian MSFD implementation to evaluate human-induced changes. An impact asks consideration if the mean bottom shear stress, calculated by a validated mathematical model over a spring-neap tidal cycle, increases by more than 10%. Furthermore, it is stated that the impact should remain in a distance less than the square root of the surface occupied by this activity, taken from its external limit.

Near-bed current profiles, measured with bottom mounted Acoustic Doppler Current Profilers, have been used to calculate bottom shear stress and associated error ranges at two stations along an offshore sandbank subdued to aggregate extraction (-20 to -30m depth).

Currents were modeled using the 3D COHERENS model, waves using the WAM model. Bottom shear stress was calculated under the combined influence of currents and waves. Results of currents and waves showed good results along a linear part of the sandbank, but were less well modeled where complex bed forms occurred, implying stronger tide-topography interactions. Model results for a mean bottom shear stress of around 0.7 Pa had a bias less than -0.09 Pa and a root-mean-square error less than 0.26 Pa along the linear part, being acceptable.

To assess the impact of aggregate extraction, three different extraction scenarios were simulated. In the zone of extraction, the mean bottom shear stress, over a spring-neap tidal cycle, changed considerably, from -39% to +14%. The impact outside the zone was less than 6%. One can conclude that in these relatively deep waters, aggregate extraction does not lead to major changes in hydrographic conditions.

Keywords: bottom shear stress, aggregate extraction, Marine Strategy Framework Directive, Belgian Continental Shelf