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### ***Towards sustainable use of seabed resources using a combined monitoring-modelling approach, Belgian part of the North Sea***

Marine aggregates are a valuable and evermore consumed geological resource. In the Belgian part of the North Sea, their extraction has been increasing since the 1970s, raising questions about the sustainability of this activity. Here, we address these questions through the analysis of combined monitoring and modelling approaches. Since the early 1990s, high resolution depth recordings, as well as vessel monitoring datasets are available in areas with high extraction activities. For the monitoring areas in the Flemish Banks, their detailed analysis allows the estimation of depletion and regeneration rates and of the effect of the extraction activity on these. In the most heavily extracted area, a local reorganization of sediments is observed with an accretional trend in the extraction pit and an erosive pattern over the surrounding very-large dunes. This points to a general flattening of the area and suggests that the extraction activity can locally affect the seabed stability and, consequently, its recovery potential. In parallel to the analysis of monitoring data, the behaviour of the seabed is simulated. Innovatively, a 3D geological 'voxel' model of the seabed (based on cores, seismic profiles, sediment size distributions) is here coupled to a hydro- and sediment dynamics model. This provides a modelling framework at an unprecedented level of realism for the initialization and parameterization of the numerical model suite. It further allows exploring the evolution of the seabed, and morphodynamics feedback loops, under various extraction scenarios. From this, recommendations can be provided for a sustainable extraction activity within the context of the European Marine Strategy Framework Directive.

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