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Building a 4D Voxel-Based Decision Support System for a Sustainable Management of Marine Geological Resources

For sustainable management of marine geological resources, a geological knowledge base is being built for the Belgian and southern Netherlands part of the North Sea. Voxel models of the subsurface are used for predictions on sand and gravel quantities and qualities, to ensure long-term resource use. The voxels are filled with geological data from boreholes and seismic lines, but other information can be added also. The geology provides boundary conditions needed to run environmental impact models that calculate resource depletion and regeneration under various scenarios of aggregate extraction. Such analyses are important in monitoring progress towards good environmental status, as outlined in the Marine Strategy Framework Directive. By including uncertainty, data products can be generated with confidence limits, which is critical for assessing the significance of changes in the habitat or in any other resource-relevant parameter. All of the information is integrated into a cross-domain, multi-criteria decision support system optimised for user-friendliness and online visualisation.

Keywords: Aggregates, Sand, Gravel, Habitat, Seafloor Integrity, Marine Strategy Framework Directive, Uncertainty, Resource Suitability, 3D Voxel Modelling; 4D Impact Assessment, North Sea, Belgium, Netherlands