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A what-if scenario for the European Digital Twin Ocean**

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The impact of increased shellfish cultivation in the North Sea on the carbon cycle: a what-if scenario for the European Digital Twin Ocean.

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For the European Commission, the EDITO consortium is creating the European Digital Twin Ocean, a platform that integrates coastal and oceanic modelling tools with ocean observation databases and computing infrastructure. Building on EMODnet and CMEMS, EDITO Model Lab will contribute by making the next generation of ocean models more accessible.

This work demonstrates one of the capabilities of the Digital Twin Ocean, **focussing on human exploitation impacts on carbon fluxes**. More specifically this what-if scenario is about the impact of upscaling the cultivation of shellfish in the North Sea on the carbon cycle. Upscaling the cultivation of shellfish is part of the envisioned “blue economy” and a promising option for multi-use of offshore wind parks. As shellfish are respiring organisms, they are a carbon source. At the same time shells are a carbon storage as they are built through biocalcification, a process that turns dissolved carbon and calcium into calcium carbonate.

The research aims to quantify the effects of upscaling shellfish cultivation in the North Sea on the carbon cycle. This is done by implementing a biocalcification module (Stechele & Lavaud, manuscript submitted for publication in 2024), in the Dynamic Energy Budget (DEB) module integrated in Delft3D-FM’s water quality process library (Troost et al., 2010; Deltares, 2023). Our work includes assumptions about how harvesting accounts for calcium carbonate leaving the sea and is therefore sequestered.