



## Digital twin based on very high-resolution data assimilation to track harmful algae blooms

We have developed and validated a biogeochemical component of a very-high resolution (1.5 km) data assimilation system for the North-West European Shelf. The predictions generated by the pre-operational 1.5 km model were combined with multi-platform observations (by the satellites and in situ measurements from ship and gliders) and stochastic path-planning model into a complex digital twin (DT). The DT was designed to track and observe harmful algae blooms (HABs) of a particular species of phytoplankton (*Karenia Mikimoto*) and its environmental consequences, like oxygen depletion. The digital twin was based on a fleet of fully autonomous gliders navigated by stochastic forecasts informed both by the 1.5 km pre-operational model forecast and observations. Gliders were calibrated in real time by other observational facilities run under Western Channel Observatory present in the area.

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