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Direct nutritional link between 600-m deep cold-water corals and surface productivity

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Cold-water corals (CWC) form deep-sea reefs that are found in all of the world's oceans, with an areal extent at par with that of tropical coral reefs, and are recognised hotspots of biodiversity and metabolic activity. Yet, it remains largely enigmatic how these rich CWC reefs can thrive in a cold and dark environment that is considered to be strongly food-limited. Here, we use a novel benthic-pelagic modeling approach, which involves coupling models of hydrodynamics, biogeochemistry and habitat suitability, to unravel organic matter delivery to reef mounds at a water depth of 600 m that are capped with a thriving CWC reef community at Rockall Bank (NE Atlantic).
Model simulations show that the interaction between 300-m high reef mounds and spring tidal currents induces episodic downwelling events that establish a vertical coupling between 600-m deep CWC with surface productivity. We therefore conclude that there is a positive feedback between CWC mound growth and organic matter supply. This episodic downwelling strongly enhances carbon sequestration to the deep ocean and the ubiquitous occurrence of topographic rises along the ocean margins suggests that a topographically-induced benthic-pelagic carbon pump could be of global importance.