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Diversifying functional types of benthic macrofauna in an ecosystem model: food web dynamics and biogeochemical fluxes

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Benthic macrofauna significantly influences the composition of organic matter deposited to the seafloor, distribution of sedimentary solutes and their benthic-pelagic fluxes. To better explain and predict response mechanisms of marine ecosystems to macrofaunal activity, information on species' abundance and traits is necessary, as transformation of material within sediments will largely depend on dominant feeding modes, diet compositions and habitat characteristics. Benthic ecosystem models explicitly representing dynamics of functional groups of benthic fauna can be applied to explore links between community structure, benthic food web interactions and sediment biogeochemistry. Benthic modules of biogeochemical-ecosystem model ERSEM were extended to include several groups of macrofauna following WoRMS feeding types classification: active and passive suspension feeders, surface and sub-surface deposit feeders, predators and scavengers, with an aim to reproduce temporal dynamics and to investigate fluxes between benthic compartments at Station L4 of the Western Channel Observatory (WCO, http://www.westernchannelobservatory.org.uk/) during 2008-2013. Using Trait Explorer (http://www.marine-ecosystems.org.uk/Trait_Explorer), species from WCO benthic survey were assigned into subgroups according to feeding types. Model results rather accurately reproduced mean biomasses and variability of benthic faunal types. Fluxes between model compartments were further analysed, confirming the key role of suspension feeders in mediating organic matter supply to the rest of the benthic community. However, diversification of the modelled benthic feeding types revealed further details on internal community interactions, such as prominent role of scavengers in organic matter processing. We conducted series of modelling experiments analysing consequences of eliminating individual groups on biogeochemical dynamics, such as oxygen penetration depth and solute fluxes. This type of analysis contributes to understanding of disturbance impacts, e.g. bottom trawling, on structure and functioning of benthic environment.