Geophysical Research Abstracts
Vol. 18, EGU2016-15687-2, 2016
EGU General Assembly 2016

Modelling benthic biophysical drivers of ecosystem structure and biogeochemical response

Nicholas Stephens, Jorn Bruggeman, Gennadi Lessin, and Icarus Allen
Plymouth Marine Laboratory, Plymouth, United Kingdom (nste@pml.ac.uk)

The fate of carbon deposited at the sea floor is ultimately decided by biophysical drivers that control the efficiency of remineralisation and timescale of carbon burial in sediments. Specifically, these drivers include bioturbation through ingestion and movement, burrow-flushing and sediment reworking, which enhance vertical particulate transport and solute diffusion. Unfortunately, these processes are rarely satisfactorily resolved in models. To address this, a benthic model that explicitly describes the vertical position of biology (e.g., habitats) and biogeochemical processes is presented that includes biological functionality and biogeochemical response capturing changes in ecosystem structure, benthic-pelagic fluxes and biodiversity on inter-annual timescales. This is demonstrated by the model's ability to reproduce temporal variability in benthic infauna, vertical pore water nutrients and pelagic-benthic solute fluxes compared to in-situ data. A key advance is the replacement of bulk parameterisation of bioturbation by explicit description of the bio-physical processes responsible. This permits direct comparison with observations and determination of key parameters in experiments. Crucially, the model resolves the two-way interaction between sediment biogeochemistry and ecology, allowing exploration of the benthic response to changing environmental conditions, the importance of infaunal functional traits in shaping benthic ecological structure and the feedback the resulting bio-physical processes exert on pore water nutrient profiles. The model is actively being used to understand shelf sea carbon cycling, the response of the benthos to climatic change, food provision and other societal benefits.