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Role of sediment in the marine C cycle—insights from a coupled ocean-sediment model

Christoph Völker et al.

Fluxes of particles and solutes between deep ocean and marine sediment are essential in the biogeochemical cycles of carbon and nutrients, such as nitrogen, silicon and iron. On a millennial time scale, sediment accumulation connects the ocean with the surface lithosphere which impacts the climate through weathering. Despite the importance of sediments in the climate system, fluxes between ocean and sediment are poorly constrained and most of the ocean models use very simplified parameterisation based on some measurements on shelves.

Here we like to present the coupling of the marine biogeochemical model REcoM2 (Regional Ecosystem Model, version2) coupled with the sediment model MEDUSA (Model of Early Diagenesis in the Upper Sediment with Adaptable complexity) for a better understanding of the role of sediments in the marine carbon cycle. MEDUSA resolves chemical reactions and physical processes within the marine sediments. As REcoM allows deviations from the Redfield C:N ratio both in phytoplankton production and remineralisation, the molar ratio of carbon and nitrogen in sinking fluxes vary with time and depth. Our MEDUSA set-up is made to be able to deal with flexible stoichiometry in sinking fluxes by resolving two classes of organic matter with different C:N ratios and degradation rates. We performed model-data comparisons of calcite, opal and particulate organic matter in sediment for present-day to constrain the biological productivity and sinking behaviour of particles in water column, and studied the role of the marine carbon cycle for glacial carbon storage and the drawdown of atmospheric CO2 in simulations under glacial climate conditions.

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