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Coastal carbon transfer in the past – a box model study

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The shelf represents a relatively small fraction of global oceanic area but plays an important role in the global carbon cycle because of high production and burial of organic matter and calcium carbonate. Biological processes on the shelf can greatly alter the partial pressure of dissolved CO2, causing disequilibrium with the atmosphere and fluxes significantly larger than those in the open ocean. Also the transport of major ions from land to open ocean is mediated by shelf processes. Available models resolving the governing processes are typically designed to simulate specific regions. Global carbon cycle models typically implement all shelf processes in one simple box. Global earth system models typically impose a flux of riverine export products from land directly into the open ocean without accounting for processes in the coastal zone. However, the global role of the coastal zone in the carbon cycle on various time scales remains poorly quantified, partly due to the large variability in continental margin environments, hampering proper understanding of past, present and future global carbon cycle dynamics.

We develop a new coastal zone model that links river biogeochemistry with open ocean models, focusing on the transfer of carbon. Our first approach represents a box model in which number, size and depth of boxes can be varied. We apply global fluxes of carbon into the system and include functions describing first order organic and inorganic carbon processes in each of the boxes. With this conceptual model of the coastal zone we aim to test the effect of changes in bathymetry, temperature and light attenuation on the way carbon is transferred through the coastal interface, suitable for paleo and future applications.