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How to best simulate production and dissolution of calcium carbonate in an shelf sea ecosystem model?

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Recently, the joint project, 'Biological Impacts of Ocean Acidification', briefly BIOACID, started in Germany. Part of this large and challenging project is our ecosystem modeling group's subproject 'Impact of alkalinity fluxes from the Wadden Sea on the carbon cycle and the primary production of the North Sea'. To investigate this problem, it is necessary to reliably calculate the total alkalinity as function of physical, chemical and biological processes in the water column and at the sediment – what we circumvented in previous 3D studies by prescribing climatological fields of alkalinity. As part of the project, a more realistic representation of the biogenic production of calcium carbonate, mostly calcite, and its dissolution within the water column and at the sediment has to be implemented.

We will give a brief overview of the different model approaches recently used to describe these processes (Aumont and Bopp, 2006; Gehlen et al., 2007). A critical assessment of applying these parameterizations, primarily developed for global applications, within the shelf sea ecosystem model ECOHAM4 will be given. The critical point is the description of carbonate dissolution in a shallow sea. Preliminary simulations with a 1-D version of ECOHAM4 demonstrate the effect of different parameterizations of pelagic and dissolution on the near-surface pCO_2 and, consequently, on the air-sea flux of CO_2.

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Gehlen, M., Gangstø, R., Schneider, B., Bopp, L., Aumont, O., Ethe, C., 2007, Biogeosciences 4, 505-519