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Could one monitor the effects of ocean acidification through radionuclides?

C. Heinze (1), M. Gehlen (2), and C. Land (3)

(1) University of Bergen, Geophysical Institute and Bjerknes Centre for Climate Research, (2) Laboratoire des Sciences du Climat et de l'Environnement / IPSL, (3) meteoterra GmbH (Contact Email christoph.heinze@gfi.uib.no, Fax +47 55589883)

Large-scale changes in marine calcium carbonate production and the particle rain ratio BSi:POC:$CaCO_3$ are possible due to natural or human induced ocean pH changes (BSi=biogenic silica, POC=particulate organic carbon, $CaCO_3$=calcium carbonate). An assessment to which degree open ocean export production rates change as a function of ocean acidification is difficult to carry out, because e.g. an accurate number for global $CaCO_3$ export production is not even available for the modern or pristine oceans before the industrial revolution. The particle reactive radionuclides ^{230}Th, ^{231}Pa, and ^{10}Be provide a potential option for monitoring rain ratio changes. These radionuclides have a different particle reactivity and are scavenged out of the water column at different timescales. Their delivery functions to the ocean are different and reasonably well known. The ability of these radionuclides to record rain ratio changes depends on their preferential carrier phase. We employ the HAMOCC (HAMburg Ocean Carbon Cycle) biogeochemical ocean general circulation model to test the potential ability of those radionuclides for the case of preferential scavenging to alternative combinations of particle species as suggested from the literature. The global model has a horizontal resolution of 3.5 by 3.5 degrees and includes parameterisations of biogenic particle production, particle flux through the water column, and sedimentation. Though the method seems to have potential, the question to which degree the radionuclides are reactive to organic material next to inorganic shell material needs to be solved, before drawing final conclusions. In the case that the method would work, it would be a tool to help quantifying the effect of ocean pH changes for paleoclimatic applications and the future. Funding: EU FP6 Integrated Project CARBOOCEAN (contract no. 511176).