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Predicted changes in intermediate and deep water carbonate chemistry in response to the invasion of anthropogenic CO2.

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This study addresses the change in carbonate chemistry of intermediate and deep water masses in response to the invasion of anthropogenic CO2 computed with the global biogeochemical model PISCES interactively coupled to a global sediment model. The model reproduces observed distributions of core top CaCO3 content and bottom water carbonate chemistry. A sensitivity study according to the standard CMIP scenario of atmospheric pCO2 increasing at a rate of 1% per year from 286 to 1144 ppm suggests a strong decrease in bottom water carbonate ion concentration reaching -100 microM in areas of deep water formation in the North Atlantic and mode and intermediate water formation in the Southern hemisphere. The concomitant decrease in calcite saturation state of bottom waters drives the dissolution of CaCO3. The absolute CaCO3 content averaged over the top first cm decreases by up to 6%, while the change in advection calculated at the base of the bioturbated layer (10 cm) is indicative of net erosion. The amplitude of changes in bottom water chemistry are consistent with results obtained with the same biogeochemical model, but atmospheric CO2 levels following the IPCC SRESA2 scenario. These results highlight the potential rapid spread of anthropogenic CO2 across the water column in areas of intermediate and deep water formation.