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First steps towards simulating biogeochemical cycles in the Bern3D dynamical ocean model

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The biogeochemical cycling of phosphate, carbon, opal, calcite, oxygen and alkalinity has been implemented in the seasonal, cost-efficient Bern3D dynamical ocean model (Müller et al., JC, 2005). We will discuss model setup and implementation schemes and compare simulated fields with available observations. In particular model results are compared with the GLODAP and WOA01 data bases and quality-assesed by using Taylor diagrams to display quantitative metrics. The model's carbon cycle is first spun-up in a diagnostic mode by nudging simulated euphotic zone concentrations of phosphate, alkalinity and silicate towards observations. Next, rate coefficients (potential production fields) are calculated from the diagnosed export productions. Then, the model is switched to a prognostic mode for transient simulations. In first applications, the model is used to simulate the oceanic uptake of anthropogenic carbon over the industrial period and the future. Results are compared with model runs using a perturbation approach to simulate anthropogenic carbon. The impact of restoring the carbonate ion concentrations to fixed values at the calcite and aragonite saturation horizon on the airborne anthropogenic CO_2 is investigated.

S. A. Müller, F. Joos, N. R. Edwards, and T. F. Stocker. Water mass distribution and ventilation time scales in a cost-efficient, 3-dimensional ocean model. J. Climate, submitted, 2005.