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Uptake of anthropogenic CO_2 in the Bern3D ocean model: Results from an Ensemble Kalman filtering approach

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The air-sea fluxes of anthropogenic carbon are investigated using an inverse, Ensemble Kalman filtering method with the Bern3D model. The Bern3D model (Müller et al., Journal of Climate, 2006) is a computationally-efficient, 3-dimensional coarse resolution ocean model tuned to CFCs and radiocarbon. Atmospheric CO2 concentrations are prescribed from ice core measurements and direct atmospheric observations throughout the runs (Müller et al., Journal of Climate,2006).
In a first step, uptake of anthropogenic CO2 is modeled in a forward simulation following the perturbation approach by Sarmiento et al. (Journal of Geophysical Research,1992) and assuming steady state conditions for ocean circulation and ocean biogeochemistry. Next, air-sea fluxes for different regions are estimated with the Ensemble Kalman filtering method (Evenson, Ocean Dynamics, 2003). The fluxes are computed by optimising model results towards the data-based distribution of anthropogenic carbon in the ocean (GLODAP; Key et al., GBC, 2004). Flux patterns within individual regions are derived from different climatologies (e.g. Takahashi et al. 2002). Again, steady state conditions for oceanic circulation and biogeochemistry are assumed. The Kalman Filter estimates for air-sea fluxes and the oceanic distribution of anthropogenic carbon are compared with results from a published ocean inversion study (Mikaloff Fletcher et al., GBC, 2006) and the forward simulation. Generally, good agreement is found.
We will investigate the robustness of results by varying Bern3D model settings and by applying different observation-based DIC_{anth} fields as obtained from different reconstructoin mehtods.