

The Inorganic Carbon Cycle in a Simple Box Model

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The inorganic carbon cycle is represented in a simple 4-box ocean model. The model contains two surface boxes, a high and low latitude box, an intermediate box, and a deep box. Each ocean box contains a reservoir of total carbon, which is transported between the boxes via advection and water mass exchange; the system can optionally be spun up to a steady-state preindustrial equilibrium. Net air-sea fluxes within the surface boxes are calculated explicitly from the delta $p\text{CO}_2$ between the ocean and atmosphere. The $p\text{CO}_2$ of each surface ocean box is calculated as a function of dissolved inorganic carbon, alkalinity, and equilibrium constants dependent on temperature and salinity. Simple box-models like this can reproduce many of the observations and larger-scale GCM outputs of global trends in atmospheric CO_2 and temperature when coupled with a simple land and atmosphere model. By explicitly calculating the carbon parameters (dissolved inorganic carbon, alkalinity, pH, and $p\text{CO}_2$) in the surface boxes, we can begin to decipher changes to the carbon system under differing climate scenarios. This study will show some preliminary results of this 4-box ocean model and the simple global model of which it is a part of.