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Global ocean carbon estimates in a model forced by MERRA

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MERRA reanalysis products were used to force an established ocean biogeochemical model to estimate carbon inventories and fluxes in the global oceans. The results were compared to public archives of in situ carbon data. The model exhibited considerable skill for ocean carbon inventories, i.e., dissolved inorganic carbon (DIC), and partial pressure of ocean CO2 (pCO2). For DIC, the model produced a global mean difference of 0.3% (approximately 7.0 μM) and basin-scale distributions were significantly correlated with observations ($r=0.97$, $P<0.05$). The model produced a global mean difference in pCO2 of 2.6% (about 9.5 μatm) with positive correlation across oceanographic basins ($r=0.76$, $P<0.05$). Model estimates of carbon flux (FCO2) were within 12.4% of data, and again there was a statistically positive correlation across ocean basins ($r=0.74$, $P<0.05$). All ocean basins corresponded with in situ data whether they were a source or sink (the tropical basins were sources, the rest were sinks on an annual mean basis). However, there were substantial discrepancies regarding the amount of source or sink. The two largest discrepancies occurred in the South Atlantic and Pacific, where the model overestimated the sink by factors of 16 and 3, respectively. Here, and in other basins, most of the discrepancy was attributed to issues resulting from data scaling (using point observations to construct large scale representations), and inconsistencies between data sets of DIC and those of pCO2 and carbon flux. The results also suggested that MERRA is a viable source of forcing information for global ocean biogeochemical models with respect to carbon estimates.