ABSTRACT

TOPIC: Does Ocean Color Data Assimilation Improve Estimates of Global Ocean Inorganic Carbon?

Author: Dr. Watson Gregg, NASA, Goddard Space Flight Center
Global Modeling and Assimilation Office, (GMAO) 610.1
Greenbelt, Md. 20771

Ocean color data assimilation has been shown to dramatically improve chlorophyll abundances and distributions globally and regionally in the oceans. Chlorophyll is a proxy for phytoplankton biomass (which is explicitly defined in a model), and is related to the inorganic carbon cycle through the interactions of the organic carbon (particulate and dissolved) and through primary production where inorganic carbon is directly taken out of the system. Does ocean color data assimilation, whose effects on estimates of chlorophyll are demonstrable, trickle through the simulated ocean carbon system to produce improved estimates of inorganic carbon? Our emphasis here is dissolved inorganic carbon, pCO2, and the air-sea flux. We use a sequential data assimilation method that assimilates chlorophyll directly and indirectly changes nutrient concentrations in a multi-variate approach.

The results are decidedly mixed. Dissolved organic carbon estimates from the assimilation model are not meaningfully different from free-run, or unassimilated results, and comparisons with in situ data are similar. pCO2 estimates are generally worse after data assimilation, with global estimates diverging 6.4% from in situ data, while free-run estimates are only 4.7% higher. Basin correlations are, however, slightly improved: r increase from 0.78 to 0.79, and slope closer to unity at 0.94 compared to 0.86. In contrast, air-sea flux of CO2 is noticeably improved after data assimilation. Global differences decline from -0.635 mol/m2/y (stronger model sink from the atmosphere) to -0.202 mol/m2/y. Basin correlations are slightly improved from r=0.77 to r=0.78, with slope closer to unity (from 0.93 to 0.99). The Equatorial Atlantic appears as a slight sink in the free-run, but is correctly represented as a moderate source in the assimilation model. However, the assimilation model shows the Antarctic to be a source, rather than a modest sink and the North Indian basin is represented incorrectly as a sink rather than the source indicated by the free-run model and data estimates.