Is the Global Oceanic Carbon Sink Shrinking?

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An analysis of over a decade's worth of atmospheric CO_2 and $\delta^{13}C$ measurements from the NOAA/CMDL sampling network indicates that the global oceanic carbon sink has been shrinking (Figure 1). This is in stark contrast to the results of oceanic general circulation models (OGCMs) that indicate the sink is increasing, or is at least steady. In addition, the interannual variability of the ocean sink predicted by these models is much smaller than that inferred from the atmospheric data. An alternative interpretation of the atmospheric data is that the ocean sink is constant, but that the residence time of carbon in the biosphere and/or oceans is undergoing dramatic interannual variations with a strong upward trend (not shown). With either interpretation, the atmospheric $\delta^{13}C$ data point to unexpected and hard-to-explain behavior of the global carbon cycle.

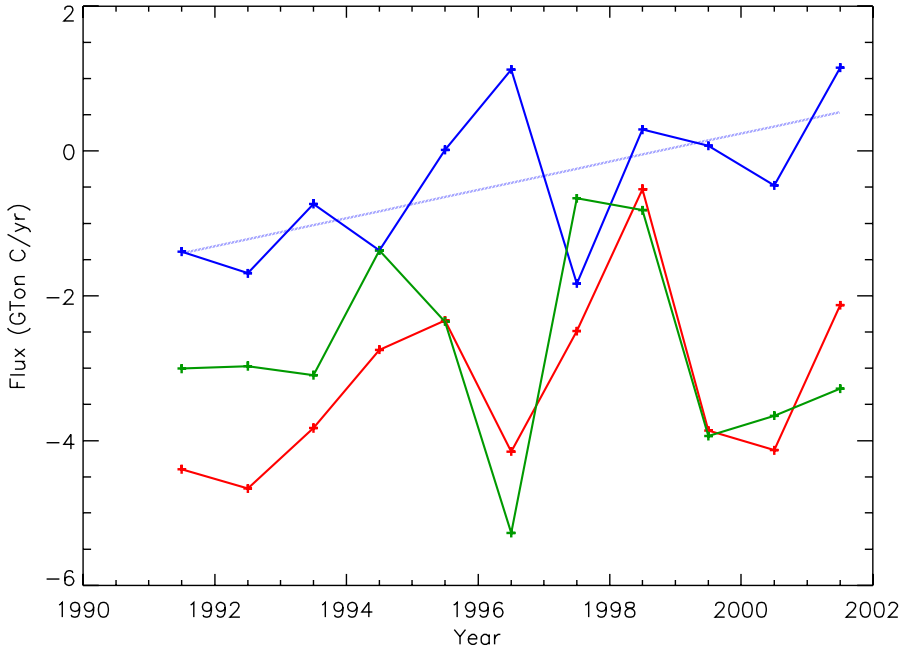

Figure 1. Global land/sea partitioning: The annual average separation of oceanic (blue) and terrestrial (green) components of the global carbon sink (red) is shown from 1991 through 2001. The partitioning is based on atmospheric measurements of CO_2 and $\delta^{13}C$ and estimates of fossil-fuel-derived CO_2 emissions, isotopic fractionation by plants, and the residence time of carbon in the oceans and biosphere. The oceanic flux shows an increase of 0.2 ± 0.1 billion tons (Gton) per year over our data record, as indicated by the linear fit.