

Changing role in ocean and land carbon balances: Global ocean carbon uptake

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As part of the Regional Carbon Cycle Assessment project (RECCAP) the global sea-air CO₂ flux and the trends over the past two decades are estimated from observations. The net carbon dioxide uptake by the global ocean is estimated at -1.19 Pg C yr⁻¹ from a climatology of water-air partial pressure of CO₂ difference ($\Delta p\text{CO}_2$), based on extensive observations of surface water pCO₂ levels, and a parameterization of gas transfer with wind. The slightly lower estimate than that provided in the climatology of Takahashi et al. (2009) of -1.38 Pg C yr⁻¹ is due to using a different, satellite observation based, wind speed product. Using empirical relationships of pCO₂ with SST anomalies (Park et al. 2010), the inter-annual variability is estimated to be 0.13 Pg C yr⁻¹ from 1990 through 2009 mostly driven by large-scale climate re-organizations. The trend shows a decrease in uptake of 0.1 Pg C decade⁻¹ which is opposite from the increase determined from models and global mass balance estimates. This is attributed to the fact that the empirical method does not implicitly include rising atmospheric CO₂ levels. The decadal trends differ regionally with increasing uptake at high latitude caused in equal measure by increasing $\Delta p\text{CO}_2$ and wind, and increased outgassing in mid- to low-latitudes.