GLOBAL OCEANIC AND LAND CARBON SINKS FROM THE SCRIPPS ATMOSPHERIC OXYGEN FLASK SAMPLING NETWORK

R.F. Keeling[1], A.C. Manning[2], R.C. Hamme[1], W. Paplawski[1]

[1]*Scripps Institution of Oceanography, La Jolla, California, U.S.A.*
[2]*Max Planck Institute for Biogeochemistry, Jena, Germany*

ABSTRACT

Measurements of atmospheric O_2/N_2 ratio and CO_2 concentration are presented over the period 1989 to present from the Scripps Institution of Oceanography global flask sampling network. The data are used to make estimates of land and ocean sinks over various time scales. The oceanic and land biotic sinks are estimated to be 1.9±0.6 (ocean) and 1.2±0.8 Pg C/yr (land) over the period Jan. 1990-Jan. 2000 and 2.2±0.5 (ocean) and 0.5±0.7 Pg C/yr (land) over the period Jan. 1993-Jan. 2003. These estimates make allowance for oceanic O_2 and N_2 outgassing based on observed changes in ocean heat content and estimates of the relative outgassing per unit warming. The recent ocean sink is consistent, to within the uncertainties, with estimates of the accumulation of anthropogenic CO_2 in the ocean since 1800, assuming the oceanic sink varied over time as predicted by a box-diffusion model. The possibility that the ocean sink is being reduced slightly by climate feedbacks, as predicted by some models, is not ruled out, however.

On shorter time scales the data show considerable interannual variability, with changes in CO_2 strongly anti-correlated with O_2/N_2 in association with El Niño phenomenon. This correlation is consistent with the land biota being the dominant influence on atmospheric variability on this 2-5 year time scale, a conclusion which has also been supported independently by atmospheric $^{13}C/^{12}C$ data and inversion studies.