



## **GAINING INSIGHT INTO THE INTERANNUAL VARIABILITY OF AIR-SEA CO<sub>2</sub> FLUXES USING SATELLITE OBSERVATIONS**

**C. Le Quéré** (1) and N. Gruber (2)

(1) Max-Planck-Institute for Biogeochemistry, Jena, Germany (lequere@bgc-jena.mpg.de, fax: +49 3641 577200), (2) IGPP Dept. of Atmospheric Sciences, UCLA, Los Angeles, USA (ngruber@igpp.ucla.edu, fax: (310) 206 3051)

While estimates of interannual air-sea CO<sub>2</sub> flux variability in the tropics tend to converge, the role of the mid and high-latitude oceans is poorly understood. Most of the interannual variability in air-sea CO<sub>2</sub> flux at these latitudes is caused by variations in surface ocean mixing and associated entrainment, in biological export production, in warming or cooling of surface waters, and in gas exchange velocity. Each of these processes leaves a signature that has been observed by satellite for at least five years. Here we present a first attempt to quantify these processes and their contribution to air-sea CO<sub>2</sub> flux variability in the extra-tropics. We use sea surface height (SSH) from Topex/Poseidon to estimate the impact of interannual variations in the depth of the surface mixed layer and associated entrainment. We assume that all interannual variations in SSH are caused by variations in the heat content of the water column. Based on model results, this assumption is valid for large areas outside the equatorial region. We use chlorophyll a retrievals from SeaWiFS to compute primary production. To estimate export production, we combine these primary production estimates with estimates of the e-ratio inferred from primary production and temperature. We use sea surface temperature from various satellites to estimate the effect of warming and cooling on the solubility of CO<sub>2</sub>. Finally we use wind speed observations from ERS to estimate variations in the gas exchange coefficient. The reconstructed interannual variations in air-sea CO<sub>2</sub> flux are of the order of +/-0.5 PgC/yr when integrated over an entire basin. These estimates are larger than those deduced from ocean model simulations, but the satellite inferred estimates are also associated with large uncertainties. Although our estimates are highly dependent on the selected data and algorithms, they

present the advantage of being based on observations and not on ocean models, which are known to vary too little at high latitudes, or on atmospheric inversions, which have difficulty to separate the land from the ocean.