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Interannual variations of the oceanic and the land biospheric CO2 uptake estimated based on atmospheric O2/N2 ratio

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To investigate interannual variations of the oceanic and the terrestrial biospheric CO2 uptake within 10 years based on the observation of Atmospheric Potential Oxygen (APO = O2 + 1.1 x CO2), the APO observed at Ny-Alesund, the Arctic and Syowa, Antarctica for the period 2001-2009 are analyzed. The interannual variations of air-sea O2 flux due to a change of the ocean heat content is simulated using an atmospheric transport model with a global fields of the upper ocean heat content and a coefficient of air-sea O2 flux / heat flux. The observed and the simulated increase rates of APO are in phase, and the interannual variation of the estimated oceanic CO2 uptake using the corrected increase rate of APO for the variation of air-sea O2 flux is lower than +-0.6 GtC yr-1. This variation is comparable to those reported by previous studies using an atmospheric inversion or ocean biogeochemical model. It is also suggested that the land biosphere emits CO2 to the atmosphere around El Nino event in 2002-2003, as well as the oceanic CO2 uptake is relatively smaller around La Nina event than that around El Nino event. The average oceanic CO2 uptake is estimated to be 2.9+-0.8 GtC yr-1 for the period 2001-2009, and the terrestrial biospheric CO2 uptake for the period 2004-2009, i.e. excluding its drop-off around 2002-2003, is estimated to be 1.7+-0.9 GtC yr-1.

Keywords: Atmospheric O2/N2 ratio, Atmospheric Potential Oxygen, Interannual variation of anthropogenic CO2 budget, Ocean heat content, Air-sea O2 flux