Session: C44 Poster: Th201B

Estimating global ocean carbon trends using in-situ pCO2 observations

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Ocean carbon uptake significantly modulates the atmospheric CO2 levels, slowing the rate of anthropogenic change. Is the global oceanic CO2 sink in decline (Le Quere et al. 2009; Knorr 2009)? Recent studies of the North Atlantic carbon cycle suggest conflicting flux trends: data-based extrapolations report a declining sink (Schuster et al 2009), while models have suggested an increasing flux (Ullman et al. 2009). Likewise, significant debate is ongoing regarding the Southern Ocean sink (Le Quere et al. 2009; Boning et al. 2008; Ho et al. 2010). Using the vast, newly updated, in-situ pCO2 dataset (Takahashi et al. 2009), analysis of ocean pCO2 trends and carbon fluxes in the global ocean over recent decades can be considered. We use multiple global biogeochemical models (Doney et al. 2009; Dunne et al. 2005) to evaluate methodologies for determining trends constrained by limited spatial and temporal coverage. Using a robust methodology, we infer changes in carbon uptake over large biogeochemically-consistent regions from sparse oceanographic data, diagnosing pCO2 trends over varying timescales along with their dominant mechanisms of change.