



Time series study of the air-sea CO₂ flux in frontal regions of the Southern Ocean from in situ data

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A time-series of CO₂ fugacity, $f\text{CO}_2$, has been obtained from twelve CARIOCA drifters deployed in the Southern Ocean between 2001 and 2007, and which record more than 70 months of measurements. Hydrological fronts detected from altimetry data between 1993 and 2005 allow us to situate the buoys with respect to the polar, subantarctic and subtropical fronts (PF, SAF and STF). In most regions $f\text{CO}_2$ is undersaturated with respect to the atmospheric value. The air-sea CO₂ fluxes along the trajectories are primarily driven by $f\text{CO}_2$ spatial variability with the largest sinks occurring close to the STF. When extrapolated zonally over the whole regions, the yearly fluxes computed from the CARIOCA drifters amount to -0.8 PgC/yr in the Subantarctic Zone, SAZ, and to -0.1 PgC/yr in the Polar Zone with very small seasonal variation. Additional cruise data are used in order to refine air-sea CO₂ flux estimates in the SAZ and increase data coverage, particularly in the eastern Pacific Ocean. The observed variability is analyzed in relation with the mixed layer depth detected from ARGO profiles.