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Inverse estimates of natural and anthropogenic air-sea carbon fluxes

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We use inverse methods to estimate separately the natural and anthropogenic components of air-sea carbon fluxes from ocean interior observations of inorganic carbon and other tracers and information about large scale ocean circulation from Ocean General Circulation Models (OGCMs). In order to quantify the uncertainty associated with ocean transport, we have used a suite of ten OGCMs.

The inversion of the natural carbon fields leads to a robust pattern of out-gassing in the Southern Ocean between 44 S and 58 S, vigorous uptake at mid-latitudes, and out gassing in the tropics. We estimate a global anthropogenic carbon uptake of 2.2 +/- 0.25 Pg C yr^{-1} for 1995, where this error estimate is based on a skill score-weighted standard deviation of the ten OGCMs. The greatest anthropogenic carbon uptake occurs at mid- to high- latitudes, with a large anthropogenic carbon sink in the Southern Ocean.