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Quantifying the ocean carbon sink for 1994-2007: Combined evidence from multiple methods

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By means of a variety of international observing and modeling efforts, the ocean carbon community has developed numerous estimates for ocean carbon uptake. In this presentation, we report on the synthesis effort we are undertaking under the auspices of an Ocean Carbon and Biogeochemistry Working Group. Our initial goal for this working group is to determine the best estimate for the net and anthropogenic carbon sink from 1994-2007 based on three approaches that independently use interior data, surface data or hindcast ocean models. Combining two approaches that use interior ocean data to estimate anthropogenic carbon, $F_{\text{ant}} = -2.40 \pm 0.21$ PgC/yr (2 sigma uncertainty). Estimates for the net, or contemporary, ocean carbon uptake come from 6 products that interpolate surface ocean $p\text{CO}_2$ data to global coverage: $F_{\text{net}} = -1.58 \pm 0.19$ PgC/yr for 1994-2007. Uncertain closure terms for naturally-outgassed river-derived carbon and non-steady state natural carbon fluxes in the open ocean are then added to derive F_{ant} from surface observation-based F_{net} . Ocean models do not include river-derived carbon, but do include non-steady state natural carbon fluxes, and thus a third estimate for F_{ant} is derived. The combined best-estimate is $F_{\text{ant}} = -2.35 \pm 0.53$ PgC/yr. We detail the uncertainties and assumptions made in deriving these estimates, and suggest paths forward to further reduce uncertainties.