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1 On the use of SF_6 for estimation of anthropogenic CO_2 in the upper ocean

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Anthropogenic carbon (C_{ant}) is concentrated within the upper layers of the world ocean. However, carbon-based approaches to C_{ant} estimation face major challenge in the upper ocean due to the strong temperature- and biology-related seasonality of inorganic carbon and related properties in these waters. Tracer-based approaches to C_{ant} estimation are less-strongly affected by seasonality, and tend to reflect physical processes of ventilation. Chlorofluorocarbons (CFCs) are commonly used for these calculations, but the reversal of the atmospheric transient after the mid-1990's makes the transfer between tracer and C_{ant} ambiguous for waters since that time. SF_6 atmospheric and surface ocean concentrations continue to increase. We will compare the results of C_{ant} estimates for a data set collected in the mid-latitude North Atlantic in 2004, and using the transit time distribution (TTD) approach calibrated with both CFC-12 and SF_6. We will show that the SF_6 based estimates have significantly lower uncertainty (by up to 6 μmol kg^{-1}) for recently ventilated waters (i.e. where pCFC-12$>\sim$450 ppt). On the other hand, CFC-based estimates remain the more reliable in older water.