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Decadal increases of anthropogenic CO_2 in the South Atlantic subtropical ocean along 30S

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Using high-quality data for dissolved inorganic carbon and related properties obtained about 10 years apart (from 1992/1993 to 2003), we examined decadal increases of anthropogenic CO_2 (ΔnC_T^{CAL}) along 30˚S (WHP A10 section) in the subtropical ocean of the South Atlantic. Significant ΔnC_T^{CAL} was detected from the bottom of the mixed layer down to an isopycnal surface of sigma theta = 27.3 kg m^{-3} ($\sim$1000 m water depth). In Sub-Antarctic Mode Water (SAMW; 26.6 – 27.0 sigma theta, 350 – 700 m), ΔnC_T^{CAL} was higher by $\sim$7 μmol kg^{-1} west of 15˚W than east of it, while ΔnC_T^{CAL} in Antarctic Intermediate Water (AAIW; 27.1 – 27.4 sigma theta, 700 – 1200 m) did not show such a distinct east-west difference. Averaged ΔnC_T^{CAL} in SAMW and AAIW was 6.8 $\pm$ 1.6 and 5.1 $\pm$ 0.6 μmol kg^{-1}, respectively. For deep waters, significant ΔnC_T^{CAL} was detected in Antarctic Bottom Water at depths greater than 4500 m in the Cape Basin (longitude 2 – 10˚E). No significant ΔnC_T^{CAL} could be detected for North Atlantic Deep Water. Regional differences of ΔnC_T^{CAL} along the A10 section were well accounted for by water mass flows, implying that anthropogenic CO_2 is re-distributed in the ocean's interior by oceanic circulation. From a water column inventory, uptake rate of anthropogenic CO_2 over the decade from 1992/1993 to 2003 was estimated to be 0.6 $\pm$ 0.2 mol m^{-2} yr^{-1}, which is half of the rate in the South Pacific (1.0 $\pm$ 0.4 mol m^{-2} yr^{-1}).