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Modeled air-sea gas exchange fluxes and regional inventories of bomb-produced radiocarbon

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The relationship between air-sea gas transfer rates and regional bomb-produced oceanic radiocarbon inventories is studied. The compatibility of gas exchange formulations commonly used in the modelling of air-sea interactions of biogeochemical cycles (e. g. the formulation used within the OCMIP) with data-based estimates of bomb-produced radiocarbon inventories is investigated. Two computationally efficient models of different complexity, the Bern3D and Bern2.5D models, are applied to simulate the air-sea exchange of radiocarbon. Inventory estimates based on sensitivity studies with varying parameters controlling circulation and gas exchange are presented. The comparison of these results with data-based estimates on a basin-scale reveals a disagreement, which can be brought into agreement with a rescaling of the gas exchange rate. The results for the Pacific, Indian and Southern Ocean suggest, that the gas-exchange formulation used within the OCMIP must be scaled down by about 25% to find agreement with the most recent data-based estimates of bomb-produced radiocarbon. However, in the North Atlantic the simulation significantly underestimates the data-based inventories. The disagreement between the modeled and the data-based inventories is almost a factor of two with the reduced gas exchange rate.