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Air-sea fluxes of biogenic bromine from the tropical and North Atlantic Ocean

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Abstract. Air-sea fluxes and bulk seawater and atmospheric concentrations of bromoform ($CHBr_3$) and dibromomethane (CH_2Br_2) were measured during two research cruises in the northeast Atlantic (53–59° N, June–July 2006) and tropical eastern Atlantic Ocean including over the African coastal upwelling system (16–35° N May–June 2007). Saturations and sea-air fluxes of these compounds generally decreased in the order coastal > upwelling > shelf > open ocean, and outside of coastal regions, a broad trend of elevated surface seawater concentrations with high chlorophyll-*a* was observed. We show that upwelling regions (coastal and equatorial) represent regional hot spots of bromocarbons, but are probably not of major significance globally, contributing at most a few percent of the total global emissions of $CHBr_3$ and CH_2Br_2. From limited data from eastern Atlantic coastlines, we tentatively suggest that globally, coastal oceans (depth <180 m) together contribute ~2.5 (1.4–3.5) Gmol Br yr^{-1} of $CHBr_3$, excluding influences from anthropogenic sources such as coastal power stations. This flux estimate is close to current estimates of the total open ocean source. We also show that the concentration ratio of $CH_2Br_2/CHBr_3$ in seawater is a strong function of concentration (and location), with a lower $CH_2Br_2/CHBr_3$ ratio found in coastal regions near to macroalgal sources.

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