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Oceanic contributions from tropical upwelling systems to atmospheric halogens

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Short lived halogenated substances (halocarbons) from the oceans contribute to atmospheric halogens, where they are involved in ozone depletion and aerosol formation. Oceanic regions that are characterized by high biological activity are often associated with increased halocarbon abundance of e.g. bromoform (CHBr3) and dibromomethane (CH2Br2), representing the main contributors to atmospheric organic bromine. Apart from biological production, photochemical pathways play an important role in the formation of methyl iodide (CH3I), the most abundant organoiodine in the marine atmosphere. Recently, the contribution of biogenic diiodomethane (CH2I2) and chloroiodomethane (CH2ClI) to atmospheric organic iodine has been estimated to be similarly significant as CH3I. In the tropics, rapid uplift of surface air can transport these short-lived compounds into the upper troposphere and into the stratosphere. Oceanic upwelling systems off Mauritania, Peru and in the equatorial Atlantic might therefore potentially contribute large amounts of halocarbons to the stratosphere.
Concentrations and emissions of iodo- and bromocarbons from several SOPRAN campaigns in different tropical upwelling systems, the Mauritanian and the equatorial upwelling in the Atlantic, as well as the Peruvian upwelling in the Pacific, will be presented. Processes contributing to halocarbon occurrence in the water column, as well as biological and physical factors influencing their emission into the atmosphere are investigated (Fuhlbrügge, et al. 2013; Hepach et al., 2013). We will present the relative contribution of the upwelling systems to global air–sea fluxes from different modelling studies. The data based bottom-up emissions from Ziska et al. (2013) will be compared to model simulated halocarbons. The model is a global three-dimensional ocean general circulation model with an ecosystem model and halocarbon module embedded (MPIOM/HAMOCC). It resolves CH3I and CHBr3 production, degradation, and transport in sea water, and gas-exchange with the atmosphere (Stemmler et al., 2013 a, b).

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