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# Modelling spatial and temporal variability of methyl iodide concentrations and air-sea gas-exchange in the open ocean

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Methyl iodide ($CH_3I$) is a volatile organic halogen compound that contributes significantly to the transport of iodine from the ocean to the atmosphere, where it plays an important role in tropospheric chemistry. $CH_3I$ is naturally produced and occurs in the global ocean. The processes involved in the formation of $CH_3I$, however, are not fully understood. In fact, there is an ongoing debate whether production by phytoplankton or photochemical degradation of organic matter is the main source term. Recent findings further indicate that $CH_3I$ production is influenced by the cell physiological state of phytoplankton.

Here, both the biological and photochemical production mechanisms are considered in a biogeochemical module that is coupled to a one-dimensional water column model for the Eastern Tropical Atlantic and a global three-dimensional ocean general circulation model. In a series of sensitivity studies different production rates are tested towards the models ability to represent observed concentrations. In both model applications the simulated $CH_3I$ concentrations agree well with observed values. The results further indicate that the dominating source process cannot be clearly identified. Published production rates for the biological $CH_3I$ source that were derived from laboratory studies are shown to be inappropriate for explaining $CH_3I$ concentrations in the Eastern Tropical Atlantic. Overall, the global annual $CH_3I$ fluxes range between 70 and 260 $\mathrm{Gg\ yr^{-1}}$, i.e. the ocean is a net source of methyl iodide for the atmosphere, though in some regions in boreal winter fluxes are of opposite sign (from the atmosphere to the ocean).