



Shipborne MAX-DOAS Measurements of Reactive Halogen Species over the Western Pacific and the Eastern North Atlantic

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Reactive halogen species (RHS) exert various influences on the photochemistry of the marine boundary layer. They are formed in the marine atmosphere for example from precursors released from sea salt aerosols, through the degradation of organo-halogens emitted by certain algae, or from inorganic aqueous reactions. The halogen radicals (BrO and IO) can destroy ozone catalytically, oxidize dimethyl sulfide (DMS) or cause the formation of new aerosol particles. However, there are still open questions concerning the abundance and significance of RHS in the marine boundary layer over the open ocean.

Therefore, measurements of BrO and IO abundances were carried out during two ship cruises in two different parts of the ocean, i.e. the Western Pacific and the Eastern Tropical North Atlantic.

The measurements were performed with Multi-Axis Differential Optical Absorption Spectroscopy (MAX-DOAS). From the spectral analysis of spectra of scattered sunlight recorded at different elevation angles, information about the vertical distribution and the concentration of trace gases can be derived.

During the “TransBrom-Sonne” cruise on the German research vessel “Sonne” in the Western Pacific from Tomakomai, Japan (42°N/ 141°E) to Townsville, Australia (19°S/ 146°E) during October 2009, BrO could be detected in very small amounts in the marine boundary layer (MBL) close to Micronesia and Papua New Guinea, with maximum BrO mixing ratios around 2 ppt and a detection limit of 0.8 ppt.

During the whole cruise, tropospheric IO clearly exceeded the detection limit of 0.6 ppt. The bulk of the IO was located in the lower troposphere up to 1 km. In the tropics, the IO concentration reached maximum values between 1 and 2.5 ppt. IO was measured in the Western Pacific for the first time and was used as input for model calculations of tropospheric chemistry.

Further measurements of BrO and IO were carried out during a campaign on the German research vessel “Poseidon” in June 2010 in the Eastern North Atlantic from Las Palmas, Gran Canaria via the Cape Verde Islands and back along the West African Coast to Vigo, Spain.

Close to the Mauritanian Coast tropospheric BrO could be detected at a maximum mixing ratio of approximately 10 ppt at an assumed layer height of 1 km, whereas IO was present only in very small amounts close to the detection limit during the whole cruise.

The measurements indicate that reactive halogens, in particular iodine, are likely to have a significant impact on the photochemistry of the marine boundary layer, at least in oceanic regions of upwelling waters or of large biological activity.