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Measurements of halogen oxides in the Western Pacific

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Reactive halogens such as iodine, bromine and their oxides have received growing attention in the past years owing to their strong impact on tropospheric composition. In particular, reactive halogens deplete ozone and alter the HO_x and NO_x ratios, consequently changing the oxidizing capacity of the troposphere. The halogen oxides iodine monoxide (IO) and bromine monoxide (BrO), generated from the reaction of atomic I and Br with ozone, play a central role in these processes. Iodine atoms may be released by photolysis of precursor substances such as I_2 or volatile iodocarbons emitted from the marine biosphere. Inorganic release processes are also being considered, but they are so far uncertain. Bromine precursors include organic as well as inorganic sources.

Here we report on measurements of IO and BrO during and related to the SHIVA field campaign, which has been carried out in November 2011 in the Western Pacific around Borneo. Different techniques have been applied in order to detect the trace gases: cavity-enhanced differential optical absorption spectroscopy (CE-DOAS), multi axis (MAX)-DOAS, airborne multi axis (AMAX)-DOAS and laser induced fluorescence (LIF, discussed in detail in Heard et al.). While for BrO no clear signal above the detection limit was found, IO levels up to 2.5 ppt were found in the open Sulu Sea and similar levels up to 2 ppt close to seaweed farms around Semporna, Malaysia. In this area both MAX-DOAS and AMAX-DOAS observations gave indication for the presence of uplifted layers of IO. These results are discussed and interpreted by using complementary observations of the main precursor substances. In addition correlation studies taking into account meteorological and oceanic parameters have been carried out to identify possible source processes. Finally the ground-based IO observations have been compared to satellite observations and a reasonable agreement was found.