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Simultaneous satellite observations of IO and BrO over the Antarctic

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Reactive halogen species (i.e., iodine, bromine, chlorine and their oxides) impact on atmospheric composition, especially in marine and Polar Regions. In the troposphere, iodine and bromine atoms deplete ozone (O_3), thereby producing iodine monoxide (IO) and bromine monoxide (BrO). In addition, sufficient amounts of IO form condensable iodine vapours and generate fine particles which may influence the atmospheric radiation balance. Bromine may cause the oxidation of mercury, which has not been discovered for iodine yet, but might be also possible. Sources of bromine and iodine species and their precursors are in part, but not fully known, and some potential release processes are not completely understood. While mostly an inorganic release mechanism is assumed for bromine, iodine concentrations in sea water seem too small to support a similar process.

IO and BrO are measured by the Differential Optical Absorption Spectroscopy (DOAS) method from satellite. The present study concentrates on the observation of IO from space which became possible only a few years ago. Nadir observations from the SCIAMACHY satellite instrument are used to retrieve column amounts of IO with a focus on the South Polar Region. Enhanced IO amounts are found around and on the Antarctic continent, in shelf ice regions and over sea ice covered areas. The analysis of the spatial and temporal variability of IO columns yields information on the underlying processes and sources. Multi-year averages of short time periods are utilized for a comparison with BrO amounts over Antarctica. Although some general similarities exist, the details on the spatial and temporal distributions are considerably different between the two species. While BrO is present mainly on the sea ice from polar sunrise throughout spring time, for example, IO is observed in that specific area only later in spring for a shorter period of time. The comparison of these simultaneous measurements gives strong indications for different release pathways and processes for the two compounds. In addition, several arguments support a prevailing biological release for the case of iodine species.