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Detection of BrO in the Arctic in spring 2007

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Within the ASTAR 2007 campaign ("Arctic Study of Tropospheric Aerosol, Clouds and Radiation") that took place in Svalbard (78˚N) in April 2007, limb scattered skylight measurements were performed from aboard the DLR (Deutsches Zentrum für Luft- und Raumfahrt) Falcon aircraft.

By applying the DOAS technique (Differential Optical Absorption Spectroscopy), our goal in the ASTAR 2007 campaign was the detection of vertical profiles of O_3, NO_2, BrO, OClO, IO, OIO, HONO, $C_2H_2O_2$, CH_2O, H_2O and O_4 within the arctic atmosphere from the boundary layer (BL) up to the lowermost stratosphere. Here we will focus on the detection of BrO and its vertical profile.

In order to infer the BrO mixing ratio vertical profile, the radiative transfer is modelled with Mie scattering conditions by combining in-situ data, $(O_2)_2$ measurements and a Monte Carlo Radiative Transfer Model (McArtim). The resulting BrO profile presents a maximum at around 90m over first year sea-ice with a mixing ratio of (40$\pm$10) pptv. Within the BL the BrO mixing ratio decreases with a scale height of 500m indicating (a) sufficient vertical transport, (b) recycling of bromine species by heterogeneous reactions with aerosols and/or fog particles and (c) a massive ozone destruction in the BL (e.g., Simpson et al., 2007) as shown by the in-situ ozone data measured by the DLR.

In the particular case presented, at 250m over the sea-ice, BrO reached $\sim$(30$\pm$10) pptv and the tropospheric ozone was depleted by around 93%. Chemistry studies based on halogens, ozone, NO_x, HO_x and heterogeneous reactions suggest that, depending on the amount of NO_x in the atmosphere (pollution), BrO recycles via heterogeneous reactions of $BrONO_2$ (if high NO_x) or HOBr (if low NO_x).