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Halogen measurements during Arctic Spring 2008 in the Amundsen Bay with ground based LP-DOAS and comparison with Satellite (GOME-2) data

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Reactive halogens are known to play an important role in the chemistry of the springtime polar troposphere. Their release by halogen activation process leads to the almost complete destruction of near-surface ozone during ozone depletion events (ODE), which may cover areas of up to several thousand square kilometres. In the past polar lower tropospheric BrO was regarded as indicator for halogen activation.
The mechanisms leading to halogen activation from saline surfaces, such as frost flowers and brine, are not well understood yet and may occur on much smaller spatial scales than resolved by satellite measurements. Also, during recent years no active DOAS measurements of BrO, which could give valuable insight into bromine activation processes, were performed in the arctic.

Within the OASIS project in the framework of the International Polar Year (IPY) Long Path – Differential Optical Absorption Spectroscopy (LP-DOAS) and Multi Axis –DOAS measurements were simultaneously carried out over the ice covered Amundsen Bay (close to Beaufort See) on board the research vessel Amundsen in March and April 2008. For the first time such measurements were performed offshore and close to the frozen sea. The LP-DOAS data show repeated diurnal cycles of BrO with peak concentrations of 44ppt during the breaking ice period in the Amundsen Bay. Strongest ODEs correlate with highest BrO levels, but also during periods with normal O3 levels or weak ODEs BrO frequently exceeded the detection limit of 1 -3 ppt. The other halogen oxides IO and ClO could not be detected. Surprisingly, HCHO could be measured at noontime levels up to 1ppb.

We compare the ground-based LP-DOAS measurements of BrO with diurnal profiles of BrO vertical column densities (VCDs) measured by the GOME-2 instrument on board the MetOp satellite. Both measurements clearly show high BrO levels in the air above the sea ice surface during daylight and during periods of low ozone mixing ratios.