Observation and analysis of tropospheric BrO in the Arctic region

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Bromine Explosion Events (BEEs) have been observed since the late 1980s in the polar regions during spring, often in combination with Ozone Depletion Events (ODEs). In a heterogeneous, autocatalytic, chemical chain reaction cycle, inorganic bromine is released from the cryosphere into the troposphere and depletes ozone sometimes to below detection limit. Besides cold temperatures favoring the bromine explosion reactions, two different meteorological conditions are mainly observed during these events. We evaluated two long-term ozone data sets from Ny-Ålesund and the Zeppelin mountain between 2010 and 2021 to detect ODEs and analyzed the prevailing weather conditions and the amount of BrO during these events.

Since BrO appears mainly in the stratosphere, tropospheric BrO is difficult to retrieve from satellite observations. Several methods have already been published to separate the tropospheric from the stratospheric part. In our analysis, we applied three stratospheric separation methods on the TROPOMI BrO dataset and validated them using airborne BrO data from the 2022 CHACHA campaign in Alaska.