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## Investigation of weather conditions and tropospheric BrO transport during Bromine Explosion Events in the Arctic and ozone depletion in Ny-Ålesund observed by satellite and ground-based remote sensing

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Bromine Explosion Events (BEEs) have been observed since the late 1990s in the Arctic and Antarctic during polar spring and play an important role in tropospheric chemistry. In a heterogeneous, autocatalytic, chemical chain reaction cycle, inorganic bromine is released from the cryosphere into the troposphere and depletes ozone often to below detection limit. Ozone is a source of the most important tropospheric oxidizing agent OH and the oxidizing capacity and radiative forcing of the troposphere are thus being impacted. Bromine also reacts with gaseous mercury, thereby facilitating the deposition of toxic mercury, which has adverse environmental impacts. Cold saline surfaces, such as young sea ice, frost flowers, and snow are likely bromine sources during BEEs. Different meteorological conditions seem to favor the development of these events: on the one hand, low wind speeds and a stable boundary layer, where bromine can accumulate and deplete ozone, and on the other hand, high wind speeds above approximately 10 m/s with blowing snow and a higher unstable boundary layer. In high wind speed conditions – occurring for example along fronts of polar cyclones – recycling of bromine on snow and aerosol surfaces may take place aloft.

To improve the understanding of weather conditions and bromine sources leading to the development of BEEs, case studies using high resolution S5P TROPOMI retrievals of tropospheric BrO together with meteorological simulations by the WRF model and Lagrangian transport simulations of BrO by FLEXPART-WRF are carried out. WRF simulations show, that high tropospheric BrO columns observed by TROPOMI often coincide with areas of high wind speeds. This probably points to release of bromine from blowing snow with cold temperatures favoring the bromine explosion reactions. However, some BrO plumes are observed over areas with very low wind speed and a stable low boundary layer.

In addition, BEEs over Ny-Ålesund and the prevailing weather conditions are examined. To monitor the amount of ozone depleted during BEEs, ozone sonde measurements from Ny-Ålesund were used. First evaluations show a drastic decrease in ozone, partly below the detection limit, while measuring enhanced BrO values at the same time. In order to analyze the origin of the

BrO plumes observed in Ny-Ålesund, and to investigate transportation routes, FLEXPART-WRF runs are executed for the times of observed ozone depletion.

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