Characterisation of bromine explosion events and their impact on tropospheric ozone depletion in Ny-Alesund

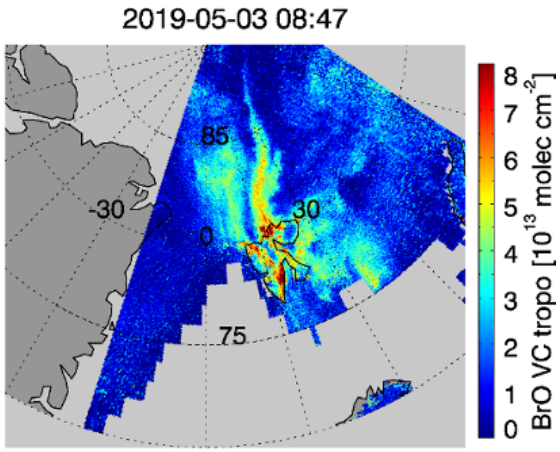
Every polar spring, the so called 'bromine explosion', a chemical chain reaction rapidly releasing bromine into the atmosphere takes place. Bromine explosion events are linked to depletion of tropospheric ozone, thereby impacting on the oxidizing capacity and composition of the polar troposphere. The initial source releasing bromine is still in debate. Young sea ice and blowing snow are amongst the possible sources. Specific weather situations seem to favor bromine explosions. For example, blowing snow is produced by high wind speeds while low temperatures favor the bromine explosion reactions.

Satellite observations regularly show plumes of tropospheric bromine monoxide (BrO, produced by reaction of bromine with ozone) around or in vicinity of Ny-Alesund (Spitsbergen). The advantage of the satellite observations is their large spatial coverage but only few observations of tropospheric columns of BrO are available during one day. Although BrO observations by a ground based remote sensing MAX-DOAS instrument and ozone sonde measurements have been carried out since a long time in Ny-Alesund, both data records have not been compared to each other yet. This Master thesis will therefore characterize bromine explosion events using the measurements from Ny-Alesund and quantify the impact on ozone both by investigating averages of the trace gases over a limited time period and by trying to understand the formation of the events from a few case studies. Satellite observations will aid in specifying the origin of the events. Furthermore, the weather conditions present during bromine explosion events will be investigated and their role for the formation will be discussed.

This Master thesis will contribute to the DFG (Deutsche Forschungsgemeinschaft) funded Transregio on Artic Amplifications (AC)³ (http://ac3-tr.de/), which investigates the impact of climate change in the Arctic. Bromine explosion events observed during the MOSAIC (Multidisciplinary drifting Observatory for the Study of Arctic Climate, https://mosaic-expedition.org/) field campaign between autumn 2019 and 2020 will be of specific interest.

If you would like to work on this Master thesis, you should be generally interested in atmopheric physics, atmospheric chemistry and remote sensing techniques. As the study is taken out by analysing trace gas data sets, some experience in programming would be highly useful.

Please contact by email: *Dr. Anne Blechschmidt (anne.blechschmidt@iup.physik.uni-bremen.de)*



High-resolution (3.5x5.5km²) satellite observation from the TROPOMI instrument onboard Sentinel-5P showing a plume of tropospheric Vertical Column density (VCD) of BrO over Spitsbergen (Figure by S. Seo, IUP-Bremen)

Photograph of the MAX-DOAS instrument in Ny-ALesund