Karlsruher Institut für Technologie

IMKASF

Ozone Depletion in the Arctic Spring-time

The lifecycle of bromine

Global Modelling Group

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Tropospheric ozone is after carbon dioxide and methane the most important greenhouse gas and affects air quality with implications for health and ecosystems. During spring-time in the polar regions of both hemispheres tropospheric **ozone depletion events (ODEs)** with near complete removal of boundary layer ozone are frequently observed. These ODEs are caused by so-called **bromine explosion events (BEEs)**, that can be observed from satellites as **strongly enhanced tropospheric bromine monoxide (BrO) column densities**. There is still no generally accepted comprehensive mechanism of BEEs and consequently most chemistry climate models (CCMs) do not include mechanisms of polar tropospheric bromine chemistry.

The **TROPOMI instrument** on board the **Copernicus Sentinel 5-P satellite** data products include **vertical column densities (VCDs)** and vertical profiles of important **greenhouse gases** such as carbon monoxide, methane, and ozone at **high spatial resolution**. Retrieved **tropospheric BrO VCD** indicates an **enhancement** in close proximity to **open leads** in sea ice, while other studies did not find a strict causality. The **quality of the retrieval** algorithm depends on the used **Air Mass Factor (AFM)**, including an **assumed stratospheric BrO distribution**. **Stratospheric dynamics** and the position and state of the jet stream cause **higher variability than** represented by **climatologies**. For a **fair model comparison with observation** this variability has to be taken into consideration.

Research question

Contribution of BEEs to stratospheric BrO burden & spatio-temporal variability for improved satellite retrievals

Good to know

- ✔ Data analysis with python (xarray, pandas, numpy)
- ✔ Atmospheric dynamics
- ✔ Atmospheric chemistry in cold environments

Data & tools

- ■ Analyze CCM experiments (ECHAM/MESSy)
- ■ Evaluate and improve TROPOMI tropospheric VCD retrieval
- ■ Study spatio-temporal correlations