Geophysical Research Abstracts
Vol. 16, EGU2014-7431, 2014
EGU General Assembly 2014

Retrieval of vertical aerosol- and trace gas profiles in the Antarctic troposphere using helicopter-borne MAX-DOAS measurements

Jan-Marcus Nasse (1), Johannes Zielcke (1), Joelle Buxmann (2), Udo Frieß (1), and Ulrich Platt (1)

(1) Institute of Environmental Physics, University of Heidelberg, Heidelberg, Germany , (2) Met Office, Exeter, United Kingdom

During springtime in polar regions when the sunlight returns, bromine monoxide (BrO) is released from sea ice into the atmosphere from saline surfaces due to an autocatalytic reaction mechanism. BrO affects the oxidative properties of the troposphere and can lead to a virtually complete depletion of surface ozone within a few days or even hours. Furthermore, the oxidation of gaseous elemental mercury by BrO renders this toxic compound soluble and leads to a deposition and thus entry of mercury into the vulnerable biosphere.
However, the exact nature of the bromine radical sources in polar regions, as well as the details of the mechanisms leading to bromine explosions and also the interactions between dynamics and chemistry are not yet completely understood. For a better understanding of these processes, an accurate determination of the spatio-temporal distribution of BrO is crucial.

We present first measurements of BrO and aerosols performed onboard a helicopter using a compact Multi AXial Differential Absorption Spectroscopy (MAX-DOAS) instrument during a cruise of the German research vessel Polarstern in the Antarctic Weddell Sea between August and October 2013. Numerous flights were performed in the boundary layer as well as in the free troposphere up to 2300m.
Due to its versatility, allowing measurements at multiple altitudes with small elevation angles and thus high air mass factors, a helicopter as a platform for MAX-DOAS measurements offers a considerably improved information content throughout the lower troposphere compared to MAX-DOAS measurements from the ground.
Using our HEIPRO (HEIdelberg Profile) retrieval algorithm based on optimal estimation, vertical profiles of aerosols and trace gases can be retrieved with an unprecedented vertical resolution and a better sensitivity for higher altitudes. Furthermore, these measurements allow for a thorough characterization of the dynamical and chemical processes bromine radicals are involved in.

We will present BrO and aerosol vertical profiles obtained from the helicopter-borne observations, discuss the vertical resolution, error budget and information content of the measurements, and compare the data with profiles from our co-located ship-borne MAX-DOAS instrument.