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Observations of RHS concentrations and processes at the Dead Sea Valley

Stefan Schmitt (1), Robert Holla (2,1), Katharina Kamilli (3), Jutta Zingler (4), Udo Frieß (1), Andreas Held (3), Ulrich Corsmeier (5), and Ulrich Platt (1)

(1) Institute of Environmental Physics, University Heidelberg, Germany, (2) Deutscher Wetterdienst, Germany, (3) Bayreuth Center of Ecology and Environmental Research, University Bayreuth, Germany, (4) Fortbildungszentrum für Technik und Umwelt, University Karlsruhe, Germany, (5) Institut für Meteorologie und Klima, University Karlsruhe, Germany

The gas phase halogen chemistry in the lower troposphere is known to play an important role in the chemistry of the Earth's atmosphere. Due to their high reactivity, halogens, even in small mixing ratios in the parts per trillion (ppt) range, can have a strong impact on the chemical and physical composition of the enclosing air masses, e.g. fast ozone depletion or particle formation. Due to the high reactivity the measurements are difficult, but can reliable be made with Long Path Differential Optical Absorption Spectroscopy (LP-DOAS).

The Dead Sea Valley (DSV), located at the border of Israel and Jordan, is a unique place with high activity of reactive halogen species (RHS). Former DOAS measurements revealed high abundances of bromine monoxide (BrO) as well as iodine monoxide (IO) but the processes and sources are still not understood. Therefore we performed intensive LP-DOAS measurements in May 2012. The measurement path of about 10 km was positioned entirely over the water surface of an evaporation pond in the southern basin of the Dead Sea. We observed simultaneous diurnal cycles of anthropogenic emitted trace gases like NO_2, CH_2O and SO_2, and also RHS like BrO, IO and I_2. We observed mixing ratios of up to 90 ppt, 5ppt and 60 ppt for BrO, IO and I_2 respectively. NO_2 mixing ratios dropped from about ppb to below the detection limit of 0,5 ppb during sunrise on every day while significant BrO and IO concentrations were only detected at low NO_2 mixing ratios. This supports the assumption that NO_2 is consumed by the formation of $BrONO_2$ and $IONO_2$ from released RHS. The data shows several interesting chemical features which are presented.

Further, condensation particle counter (CPC) measurements of particles with sizes of 9-800 nm indicate that significant mixing ratios of IO were observed only at low particle loads while BrO seems to prefer high particle concentrations. This indicates a possible impact of aerosols on the halogen chemistry at the DSV.