Geophysical Research Abstracts
Vol. 19, EGU2017-12685, 2017
EGU General Assembly 2017

Temperature dependence of bromine activation due to reaction of bromide with ozone in a proxy for organic aerosols and its importance for chemistry in surface snow.

Jacinta Edebeli (1), Markus Ammann (1), Anina Gilgen (1), Jürg Trachsel (2), Sven Avak (1), Anja Eichler (1), Martin Schneebeli (2), and Thorsten Bartels-Rausch (1)

(1) Paul Scherrer Institut (PSI), Villigen PSI, Switzerland, (2) WSL-Institute for Snow and Avalanche Research SLF, Davos Dorf, Switzerland

Tropospheric ozone depletion events (ODEs) via halogen activation are observed in both cold and warm climates [1-3]. Very recently, it was suggested that this multiphase halogen activation chemistry dominates in the tropical and subtropical upper troposphere [4]. These occurrences beg the question of temperature dependence of halogen activation in sea-salt aerosol, which are often mixtures of sea-salt and organic molecules [3, 5]. With the application of flow-tubes, the aim of this study is to investigate the temperature dependence of bromine activation via ozone interaction in a bromide containing film as a proxy for mixed organic – sea-salt aersol. Citric acid is used in this study as a hygroscopically characterized matrix and a proxy for oxidized organics, which is of relevance to atmospheric chemistry.
Here, we present reactive ozone uptake measured between 258 and 289 K. The data show high reproducibility. With available knowledge, we have reproduced the measured uptake with modelled bulk uptake while accounting for temperature dependence of the substrate's properties as diffusivity, viscosity, and gas solubility.

This work is part of a cross-disciplinary project with the aim to investigate the impact of metamorphism on impurity location in aging snow and its consequences for chemical reactivity. Metamorphism drastically shapes the structure and physical properties of snow, which has impacts on heat transfer, albedo, and avalanche formation. Such changes can be driven by water vapour fluxes in dry metamorphism with a mass turnover of as much as 60% per day - much greater than previously thought [6]. The consequences for atmospheric science are a current question of research [7]. Here, we show first results of a joint experiment to probe the re-distribution of impurities during snow metamorphism in artificial snow combined with an investigation of the samples structural changes. Future work is planned with the goal to investigate to which extend the observed re-distribution of impurities can explain the varying reactivity of the natural snow cover.

1. Barrie, L.A., et al., Nature, 1988. 334: p. 138 - 141.
2. Hebestreit, K., et al., Science, 1999. 283: p. 55-57.
3. Simpson, W.R., et al., Atmospheric Chemistry and Physics, 2007. 7: p. 4375 - 4418.
4. Schmidt, J. A., et al., Journal of Geophysical Research, 2016 121: 11,819–11,835.
5. O'Dowd, C.D., et al., Nature, 2004. 431(7009): p. 672-6.
6. B. Pinzer et al., The Cryosphere, 6, 1141-1155, (2012).
7. T. Bartels-Rausch et al., Atmos. Chem. Phys., 14, 1587-1633 (2014)..

https://www.psi.ch/luc/miso