Geophysical Research Abstracts
Vol. 13, EGU2011-600, 2011
EGU General Assembly 2011

Photolysis of Nitrate in Greenland Snow

Carl Meusinger (1), Joël Savarino (2), and Matthew Johnson (1)

(1) CCAR, University of Copenhagen, Denmark (came@kiku.dk), (2) LGGE/CNRS-UJF, St Martin d'Hères, France (jsavarino@lgge.obs.ujf-grenoble.fr)

Nitrate concentrations undergo drastic changes in the first tens of centimeters in the snow layer at both Arctic and Antarctic low accumulation sites [1]. Those changes go along with elevated gaseous NO_x levels above the snow pack. A thorough description of these post-depositional effects is still not at hand, so that nitrate and NO_x data from field campaigns can't serve quantitatively to interpret the oxidation state of the (past) atmosphere.

At the moment, the most promising candidates for explaining this behavior of nitrogen compounds are the photolysis of nitrate in the snow and its re-evaporation [5]. While several attempts have been made to quantify the photolysis [2-4], obtained results could not explain field data fully [6]. Laboratory experiments were criticized due to their use of specific lamps, synthetic snow and non-flow conditions leading to accumulation of NO_x above the snow layer [6]. A new experiment is set up that studies the photochemistry of real snow collected on field campaigns in our newly designed freezer-photoreactor at CCAR.

Inside a commercial freezer that operates down to -25ºC, UVA and UVC lamps are installed to induce photolysis. The snow is kept in 2-port-teflon bags that allow maintaining a constant flow of air over the sample in order to avoid the accumulation of NO_2. Before it enters the freezer, this air passes through a chilled water tank, which is kept at the same temperature as the freezer. This gives the flowing air a constant water vapor pressure to ensure steady atmospheric conditions inside the bag (so the snow doesn't freeze more or melts). After the freezer, the released NO_x is sampled in a cold trap, while the photolyzed snow will be analyzed in Joël Savarino's group (Grenoble) using Nitrogen mass spectrometry.

We will present the characterization of the setup along with initial results; implications are discussed.

1. Röthlisberger, R., et al. **2000**, *J. Geophys. Res., AGU*, Vol. 105.

2. Blunier, T., et al. **2005**, *Geophys. Res. Let.*, Vol. 32.

3. Jacobi, H.-W., et al. **2006**, *J. Photochemistry and Photobiology*, Vol. 179.

4. Honrath, R. E., et al. **2000**, *Geophys. Res. Let.*, Vol. 27.

5. Frey, M. M., et al. **2009**, *Atmos. Chem. Phys.*, Vol. 9.