



Contribution ID: 18

Type: **not specified**

Atmospheric nitrogen oxides (NO and NO₂) at Dome C: first observations & implications for reactive nitrogen cycling above the East Antarctic Ice Sheet

Tuesday, 7 June 2011 09:00 (20 minutes)

The nitrogen oxides NO and NO₂ (NO_x) play a key role in determining the oxidizing capacity of the boundary layer in high latitudes. Previous Arctic and Antarctic field campaigns have demonstrated that the polar snow pack can release significant amounts of NO_x and that one of the major driving mechanisms is UV-photolysis of snow nitrate (NO₃⁻). Unusually high levels of NO observed at South Pole and on an airborne campaign suggested that the East Antarctic Ice Sheet (EAIS) can be perceived as a gigantic chemical reactor, processing many chemical trace species at the surface and thereby modifying their concentration eventually preserved in ice cores. However, the database for a quantitative understanding of reactive nitrogen recycling across Antarctica is still weak.

First measurements of atmospheric NO_x mixing ratios at Dome C (DC), East Antarctica (75.1°S 123.3°E, 3233 m) during austral summer 2009/2010 yield new insights: NO_x mixing ratios were large, ranging between 3 pptv and >1000 pptv, but unlike at South Pole showed a strong diurnal variability. Concentration maxima in ambient air at 0.01, 1.0 and 4.0m above the snow occurred in the evening hours. They coincided with the strongest concentration gradients between the snow surface and 4.0 m, highlighting the importance of the interplay between snow pack source strength and the evolution of the boundary layer diffusivity profile. Conversely, near-surface firn air levels of NO_x varied in phase with solar radiation, consistent with a photolytic source in the near-surface snow.

Steady-state analysis shows strong increases in the Leighton ratio around solar noon, confirming the importance of oxidants other than ozone, i.e. hydroxyl radicals. Comparison of observations with a potential NO₂ flux based on a radiation transfer model (TUV-snow) allows to improve the parameterization of NO_x emissions in a quantitative model of reactive nitrogen recycling above Antarctica.

Please list some keywords

NO_x snow emissions, nitrate photolysis, Antarctica, oxidation capacity

Primary author: Dr FREY, Markus (British Antarctic Survey)

Co-authors: Dr JONES, Anna (British Antarctic Survey); Prof. WOLFF, Eric (British Antarctic Survey); Dr FRANCE, James (Royal Holloway University of London); Dr SAVARINO, Joel (Université Joseph Fourier –Grenoble 1 / CNRS-INSU, Laboratoire de Glaciologie et Géophysique de l'Environnement,); Dr KING, Martin (Royal Holloway University of London); Dr BROUGH, Neil (British Antarctic Survey); Dr ANDERSON, Phil (British Antarctic Survey)

Presenter: Dr FREY, Markus (British Antarctic Survey)