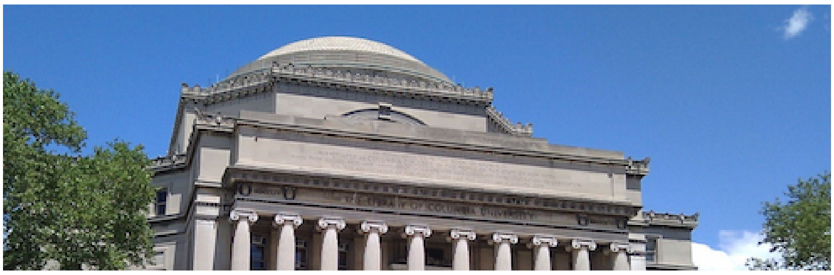

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Overview of the NITEDC (NItrate Evolution in Dome C snow) program and presentation of its preliminary results

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The interpretation of nitrate profiles recorded in deep ice cores is hindered by surface post depositional processes. Deciphering the atmospheric information embedded in these profiles should greatly enhance our understanding of the chemical state of paleo-atmospheres as nitrate potentially contains information about the NOx chemistry. Furthermore, there is now consensus that photo-dissociation of nitrate in snow drives emissions of NOx from snow surfaces and thereby significantly impacts the NOx, and HOx budgets over ice-sheets during the summer season, altering the oxidative capacity of the polar boundary layer.
Concordia station at Dome C (Antarctica) is the third year-round research base (after South Pole and Vostok) located in the interior of the Antarctic continent (75°06'S, 123°20'E, alt. 3306m asl). Contrary to the other inland stations, Concordia is at the summit of a dome and consequently experiences more stratified air with very shallow boundary layers associated with strong temperature inversion and low average wind speeds. Furthermore, its position at 75°S produces strong diurnal variations of radiation and temperature during the summer season capable of revealing the relative action of photochemistry and boundary dynamic in this environment. Another positive point is that the permanent presence of technicians and scientific at the station allows year-round study of change of the physical and chemical characteristic of snow and air.
The NITEDC program was dedicated to study the evolution of atmospheric and snow nitrate/nitric acid in this harsh environment. It is the first East Antarctic Plateau study outside of South Pole investigating the cycling of reactive nitrogen between atmosphere and snow. Both physical and chemical aspects were studied.
The specific surface area of snow (SSA = Surface of snow/Mass of snow) which governs the surface available for air-snow exchange was measured in different snow pits and along the Dome C-Dumont d'Urville (the coastal French station). Strong vertical and horizontal gradients were observed. Higher SSA were observed at the surface (˜38 m2 kg-1), decreasing monotonically to ˜14 m2 kg-1 at 15 cm depth. Closer to DDU, the SSA of the top 5 cm was 23 m2 kg-1, decreasing to 19 m2 kg-1 at 50 cm depth.
UV/Vis light penetration was measured directly at different snow depths with a multiprobe spectrometer. Depth characteristic of light penetration is a function of the type of snow encountered at DC with e-folding ranging from 10 cm for windpack layers and ˜20 for depth hoar layers at 400 nm wavelength.
Nitrogen dioxide (NO/NO2) concentrations were followed during the 09-10 summer season, showing a repeatable, strong diurnal cycle, with a minimum at noon and a maximum in the early evening. Further analysis shows that the diurnal variability results from a combination of the strength of the snowpack source (i.e. radiation) and the mixing properties of the atmospheric boundary layer.
Finally and for the first time, snow and atmospheric nitrate were simultaneously analyzed for both concentration and N and O isotope compositions. The comparison between surface snow and atmosphere reveals the intense recycling between these two nitrogen pools. Intense negative nitrogen but positive oxygen fractionations found in snow pits strongly suggest that photodissociation (moderated by the interplay of accumulation rate and actinic flux) is the driving force that controls the nitrate concentration in snow (and not HNO3 desorption). However, laboratory experiments demonstrate that liquid phase photodecomposition of nitrate is unable to explain the observation isotopic fractionations and that photodissociation of nitrate/nitric acid in solid or adsorption phase should be considered firstly. Tests are currently underway in our laboratory to find the location of nitrate in Antarctic snow as well as incorporating of these findings in a semi empirical

photochemical model.

Please list some keywords

reactive nitrogen; atmosphere-snow exchange; snow photochemistry; stable nitrate isotopes;Antarctica

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