Preservation of nitrate in the snowpack across the East Antarctic Ice Sheet: Results from snowpit observations

G. SHI[1]*, M. G. HASTINGS[2] AND Y. LI[1]

[1]Polar Research Institute of China, Shanghai 200136 P.R. China (*correspondence: shiguitao@pric.org.cn)
[2]Department of Earth, Environmental and Planetary Sciences and Institute at Brown for Environment and Society, Brown University, Providence, RI, 02912, USA (meredith_hastings@brown.edu)

In total, 22 snowpits/firn cores were sampled to depths of 100 to 300cm on the traverse from coastal East Antarctica to the summit of the ice sheet, Dome A, with varied sampling resolution of 1.0-5.0cm. Nitrate concentrations were determined for all samples, and for seven pits the isotopic composition of nitrate was also measured. The results show that nitrate concentration in individual coastal snowpits (with distance of ~450km to coast, 6 pits included) varied considerably, possibly indicating a seasonal pattern. Together with the isotopic composition profiles of nitrate, it is suggested that the post-depositional loss of nitrate on the coast is minor, and the atmospheric signal appears to be largely preserved. The linear relationship between snow accumulation rate and concentration or flux of nitrate in coastal snow suggests a major nitrate flux of wet deposition, while the dry deposition flux was found to be spatially homogeneous on the coast, accounting for <44% of total inputs of nitrate. In comparison with coastal sites, the inland snowpits (from ~450km to Dome A) show a considerable decrease in nitrate concentration from surface snow to deeper layers, accompanied by coincident increases in $\delta^{15}N$ and decreases in $\delta^{18}O$ of nitrate. These trends suggest a dominant role of photolysis in the post-depositional processing of nitrate [1]. At inland sites, a weak relationship was found between 'preserved' nitrate concentration and snow accumulation, indicating more variable conditions in ambient concentrations and dry deposition flux of nitrate. However, the nitrate flux in inland snow was found to be highly dependent on the 'preserved' concentration, with snow accumulation less influential. The varied patterns of snow nitrate in coastal and inland Antarctica suggest distinct preservation mechanisms of nitrate in the two regions.

This research was financially supported by NSFC (No. 41206188). The CHINARE inland members are appreciated for sampling assistance.

[1] Shi *et al.* (2014) *Atmos Chem Phys Discuss* **14**, 31943-31986.