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Concentration and isotopic compositions of atmospheric nitrate collected on the traverse from coast to the summit of Antarctic ice sheet

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Atmospheric nitrate, i.e., both particulate and gaseous nitrate, was collected on the Chinese Antarctic inland expedition traverse from coast to the ice sheet summit (Dome A), East Antarctica, during austral summer. The samples were collected on glass fiber filters (8 ins × 10 ins) using a high volume air sampler, with a flow rate of about 1.0 m^3 min^{-1}. In total, a set of 31 samples were collected, and the concentration and isotopic compositions ($\delta^{15}N$, $\delta^{18}O$ and $\Delta^{17}O$) of nitrate were determined. The results show that both concentration and $\delta^{15}N$ of atmospheric nitrate generally increase from the coast towards the plateau, while $\delta^{18}O$ shows an opposite trend and no remarkable trend was found for $\Delta^{17}O$. The negative $\delta^{15}N$ values (mean=-8‰) and relativley low oxygen isotopic ratios ($\delta^{18}O$ mean=65‰, $\Delta^{17}O$ mean=27‰) of nitrate were found on the plateau. Together with the elevated atmospheric nitrate concentrations, it is suggestive of an intense cycling of nitrate on the plateau, i.e., NO_x emissions from nitrate photolysis in the snowpack and subsequent oxidation of NO_x to produce nitrate in the atmosphere. A close relationship was found between concentration and $\delta^{15}N$ or $\delta^{18}O$ of nitrate, with respective *r* values of 0.72 and -0.66 ($p<0.01$). The very negative $\delta^{15}N$ values (e.g., about -40‰) observed near the coast suggest transport of snow sourced NO_x from the Antarctic inland. The significant correlation between $\delta^{18}O$ and $\Delta^{17}O$ of nitrate is suggestive of the mixing of different oxidants that react with NO_x to produce atmospheric nitrate. The high end-member is more likely associated with ozone, while the lower end-member likely results from oxygen atoms from OH radical and/or H_2O(vapor).

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