3.136 Determination of δ18O, Δ17O, and δ15N in atmospheric nitrates: First steps towards a deeper understanding of the nitrogen cycle over the Tibetan Plateau.

Early Career Scientist

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Abstract:

Over the past century, the budget of nitrate, a major component in the terrestrial nitrogen cycle, is greatly modified as a result of increased anthropogenic contributions. However, its interactions with the atmosphere and ecosystems remain poorly understood because of the complex physical and chemical transformation of nitrate within the atmosphere, cryosphere, hydrosphere, and biosphere. The atmospherically produced oxygen isotopic anomalies (quantified as $\Delta^{17}O=\delta^{17}O-0.52*\delta^{18}O$) in nitrates provide valuable information that cannot be obtained from other techniques including the conventional isotopic measurements ($\delta^{15}N$ and $\delta^{18}O$). This unique isotopic signature has been utilized in understanding photochemistry of nitrogen (in the atmosphere, snow/ice, and their interface), tracing nitrogen sources for varying ecosystems, and reconstructing the atmospheric composition and climate in the past.

Tibetan Plateau, the world’s highest and greatest plateau, strongly influences the regional circulation patterns, freshwater availability, and ecosystems. In addition, because of the unique location of the plateau (at mid-latitude and high-altitude), cryospheric records preserved in this region provide valuable paleo-climate information that cannot be obtained from polar regions. In this study, we measured $\delta^{18}O$, $\Delta^{17}O$, and $\delta^{15}N$ in size-segregated aerosols collected in the central Tibetan Plateau (Nam Co, 30.77°N, 90.98°E, 4730 m above sea level) for the first time to provide fundamental information of atmospheric nitrate isotopic composition and chemistry in this unique and climatically important region. Our study not only yields new insight into the present-day atmospheric nitrogen cycle over the Tibetan Plateau, but also allows for extended studies to define the role of nitrate in the atmosphere-cryosphere-hydrosphere-biosphere interaction in the modern- and paleo-environments using this novel and high-dimensional

isotopic technique.