ISOSCAPES OF ATMOSPHERIC NITRATE: WHAT DO THEY TELL US?

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What drives the high degree of spatial and temporal variability in the amount and isotopic composition of atmospheric nitrate? Deposition of atmospheric nitrate can range from over 50 to less than 1 kg/ha yr and seasonally vary by an order of magnitude. These variations are largely a function of proximity to sources of nitrogen oxides (NO_x) such as power plants, cities, and agricultural centers. Does the isotopic composition of nitrate primarily reflect these different sources or is it mainly controlled by the kinetic and equilibrium isotope effects that occur during NO_x oxidation into nitrate? We have begun using archived samples from the National Atmospheric Deposition Program and US- EPA's aerosol monitoring program to analysis $\delta^{15}N$, $\Delta^{18}O$, and $\Delta^{17}O$ composition of atmospheric nitrate. We observe seasonal trends in all three isotope ratios, with high $\Delta^{18}O$ and $\Delta^{17}O$ values in the winter and lower values in the summer months. A similar trend is observed in the $\delta^{15}N$ values but with considerably more scatter in the data. Interpreting the observed spatial and temporal trends in atmospheric nitrate's isotopic composition requires incorporating isotopes into sophisticated computer models, which can work on local, regional, and global scales. New modeling approaches will be discussed including what roles aerosols, trace gas concentrations and atmospheric water play in the isotope composition of atmospheric nitrate. Preliminary results suggest isotopes can be used to understand how NOx is converted to nitrate under different chemical conditions and the role aerosols play in heterogeneous reactions of NOx. Current limitations and future directions will also be discussed.