# Response of a subalpine watershed to atmospheric $NO_3^-$ deposits using $\Delta^{17}O$

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Atmospheric deposition of reactive nitrogen (N) species has considerably increased over the last century, and is predicted to double by 2050[1]. Pristine alpine and subalpine watersheds are increasingly affected by atmospheric deposition. Atmospheric nitrate ($NO_3^-$) deposition in particular increases soil N availability for plant uptake. This will eventually lead to a shift in plant diversity and alter the joined ecosystem services (soil erosion, freshwater quality, patrimonial value, etc.) delivered by these nutrient-poor ecosystems[2]. Furthermore, eutrophication of streams and lakes are, among others, known consequences of ecosystems fertilization by atmospheric deposition.

To evaluate and quantify the impact of atmospheric deposition of $NO_3^-$ in high-altitude watersheds is complicated due to limiting access, logistical issues, harsh climatic conditions and topography. In this context, the use of coupled concentrations and isotopes of air, streams, soils and plants $NO_3^-$ dynamics is a good proxy to understand, at the watershed scale, the respective seasonal contribution of the potential N sources. $\Delta^{17}O$-$NO_3^-$, for instance, acts as a conservative tracer of atmospheric deposition, and enables non-destructive tracing and quantification of atmospheric $NO_3^-$ input in the watershed.

Here, we present the results of a 2-yrs survey in a subalpine watershed at the Col du Lautaret (2 100-m a.s.l.) in the central French Alps. Three small tributaries, a medium-size stream and a lake in the Romanche Valley were sampled once a week. Aerosols, snow, wet and dry deposition were collected to characterize the isotopic signature of entering atmospheric $NO_3^-$. Soils and plants samples were also collected bi-monthly from three locally representative meadows. All samples were analyzed for $\Delta^{17}O$, $\delta^{15}N$, $\delta^{18}O$ of $NO_3^-$ as well as $[NO_3^-]$.

Extrapolation of these results at the catchment scale enabled a synopsis of the watershed response to atmospheric nitrate fertilization, and could help policy makers in mitigation efforts.

[1]The Nitrogen cascade, Galloway et al (2003), *BioScience* 53, 341-356
[2]Human alteration of the global nitrogen cycle: sources and consequences, Vitousek et al (1997), *Ecological Applications* 7, 737-750