# Accurate quantification of atmospheric nitrate in stream water eluted from a small forested watershed using triple oxygen isotopic composition

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Excess loading of nitrogen often leads to "nitrogen saturation" (Aber et al., 1989) in forest ecosystems from which significant quantify of nitrogen is eluted as nitrate. Enrichment of nitrate often caused environmental problems so that we should clarify the origin and behavior of nitrate in stream water, especially for the mixing ratio of unprocessed atmospheric nitrate within total nitrate. The natural stable isotopic compositions of nitrate ($\delta^{15}N$ and $\delta^{18}O$) have been widely used to determine the origin and behavior of nitrate in stream water (Durka et al., 1994). Besides to these isotopes, the triple oxygen isotopic compositions of nitrate have been available as an additional, more robust tracer for the unprocessed atmospheric nitrate (e.g. Michalski et al., 2004) in recent years, due to the stability during biological processings on nitrate. In this study, we measured temporal variation in the stable isotopic compositions of nitrate in a stream eluted from the Kajikawa experimental forest in Niigata Prefecture, together with those in soil solutions, from December 2013 to December 2014. Although the triple oxygen isotopic compositions of nitrate in soil solutions showed significant seasonal variation from +0‰ to +6‰, these in stream water samples showed small variation. On the other hand, the concentration-weighted mean of the soil solutions (+0.8‰) was consistent with that of stream water samples (+1.3‰). We concluded that the major source of the stream water was groundwater in the forest, in which the observed significant seasonal variation in soil solutions had been smoothed.