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Isotopes as a tool to disentangle post deposition processes of nitrate in the firn

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At low accumulation sites like Dome C the nitrate concentration of recent precipitation decreases by orders of magnitude in the first meter of the firn. Photodissociation and/or evaporation of nitrate have been proposed to explain this net loss. The amount of nitrate finally preserved in the ice depends among other on the accumulation rate [Röthlisberger et al., 2000].
First isotopic measurements suggest a correlation between the annual mean precipitation and the isotopic composition of nitrogen of the preserved nitrate [Freyer et al., 1996]. Thus the isotopic composition of the preserved nitrate may offer a way to reconstruct the atmospheric nitrate concentration signal.
A first step in this direction is to understand the loss process in the firn from an isotopic point of view. We measured the isotopic composition of nitrogen in the top 14 cm at the EPICA Dome C site (Summer 2003). We find a massive fractionation of up to 200L' with increasing depth. A laboratory experiment suggest that this heavy isotope effect can not be explained by photolytic decomposition of nitrate alone.