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Nitrogen dynamic in a high-elevation catchment in the Italian Alps

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Since 1994, a number of investigations have been performed in the Val Masino catchment, in the Central Italian Alps, in order to understand interactions between the atmospheric fluxes and the biological compartment. In front of a N atmospheric input of 15 kg ha-1 yr-1, several observations, notably the strong soil N retention, seem to indicate N-limitation in the forested portion. Other observations, such as the monthly nitrate (N-NO3-) variations of river Masino, point in the opposite direction, suggesting a surplus of N bioavailability in the terrestrial ecosystem. With the purpose of obtaining a further insight on nitrogen dynamics in this remote ecosystem, a sampling campaign of running waters was conducted, from 2007 to 2008, in the high-elevation portion of the catchment (1900 - 2600m ASL). Eighteen sampling sites, including rock glacier outflows, kryal reaches and main channel areas, were sampled monthly from June to October. A snow survey was conducted in May 2008, for the chemical and physical characterization of the snow cover. Topsoil samples were collected in October 2008 and analyzed according to reference methods (Italian Soil Science Society). Ammonium (N-NH4+), nitrate (N-NO3-) and dissolved organic nitrogen (DON) were determined by the diffusion technique. Median N-NO3- concentrations were 16 μeq/L in running waters, compared to 4 μeq/L in snow and 24 μeq/L in rain. Nitrate concentration in running waters generally increased with time and showed the maximum concentration of 45 μeq/L in October, recorded for rock glacier outflows. Dissolved organic carbon (DOC) was present in all samples with a median concentration of 0.91 mg/l, the half of that measured (1.9 mg/L) at the closing section of the river Masino.

A PCA analysis was performed on the chemical species concentration of the running water sites to interpret major trends of variation in the study system. The first three PCA axes explained together the 73% of the variability. The first component (i.e. axis 1), was related to basic cations and alkalinity and seems associated to the weathering processes. The second axis summarized N-NO3- and DOC information and can be related to the processes controlling the N export. As far as general environmental factors are concerned, these axes of variation were correlated to altitude, flow and substrate type, and to some soil properties such as N-NO3-, N-NH4+, bulk density, humidity and soil skeleton.