

The Nivolet Critical Zone Observatory: relation between carbon fluxes and geology.

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In extreme environments, the Critical Zone is especially important as it represents the thin and potentially fragile layer at the borders of life. In particular, high mountains are hotspots of climate change, where temperatures are often rising faster in comparison to the global mean.

In 2017 we established a new Critical Zone and Ecosystem Observatory in the high-altitude environment of Pian del Nivolet in the Gran Paradiso National Park, northwestern Italy, a highly-protected, closed hydrological basin between about 2500 and 2700 meters amsl. This area, usually covered with snow from November to June, is characterized by a complex environment of alpine pastures. The Pian del Nivolet area shows typical glacial and geomorphic landforms and deposits and is drained by the meandering Dora del Nivolet. The outcropping geological formations mainly consist of orto- and para-gneisses, calcschists, metabasites, marbles and dolostones. Four study plots have been selected on the basis of main geological and geomorphological features of the area.

The study currently focuses on how CO₂ fluxes are modulated by soils (considering temperature, humidity and TOC) and their underlying bedrock. CO₂ fluxes at the soil-atmosphere interface (respiration and net ecosystem CO₂ exchange) are measured by a portable accumulation chamber. Measurements have been performed during the day in light and dark conditions, in order to estimate CO₂ absorption due to photosynthesis processes and CO₂ emissions due to soil activity and root respiration. A total of 5 surveys, from July to October, have been carried out and 36 measurements for each plot (covering about 250 m²) have been performed during each survey. Univariate and bivariate statistical analysis have been performed in order to evaluate statistical distribution, mean and variance in each sampling plot. For each dataset, statistical tests have been performed to estimate the significance of the observed variability across the plots.