

## **Abstract**

Mountain areas are important sources of streamflow and fresh water and have several important societal impacts, such as exploitation for drinking water, irrigation, hydropower production. The hydrological mechanisms that regulate movements and availability of water in these environments are often highly variable over time and in space, and make the behaviour of mountain catchments particularly complex. Therefore, advancements in unravelling this complexity and conceptualizing the hydrological functioning of mountain catchments are critical for scientific and management reasons, including flood forecasting, water supply and the protection of stream habitat. Useful tools for this purpose are environmental tracers that can help to identify water sources, to estimate their contributions to runoff, and to investigate water transmission at the catchment scale with the aim to better understand runoff generation processes.

In this talk I will give an overview of recent experimental studies in mountain catchments in Northern Italy where tracers, such as stable isotopes of water and electrical conductivity, have been used to investigate fundamental hydrological processes. Particularly, I will present results about the identification of geographical sources of streamflow and the assessment of their spatio-temporal variability, the quantification of rainfall, snowmelt and glacier melt contributions to streamflow and groundwater recharge at different time scales, the analysis of the controls on hillslope-stream connectivity and the development of surface and subsurface flow pathways.