Spatio-temporal characterization of chemical signatures of water resources in two Alpine catchments

Ole Rössler (1,2), Jan Schmieder (3), Moritz Bigalke (1), Markus Aeschlimann (1), Gabriel Peier (1), Marc Wyss (1), Ulrich Strasser (3), Rolf Weingartner (1,2)

(1) Insitute of Geography, University of Bern, Bern, Switzerland, (2) Oeschger Centre of Climate Change Research, University of Bern, Bern, Switzerland, (3) Insitute of Geography, University of Innsbruck, Innsbruck, Austria

The spatio-temporal characterization of the chemical signatures of rain, snow, ice, groundwater and integrating river runoff is a crucial prerequisite to evaluate the potential for tracer-based attribution studies. A major challenge of using element signatures originates from their non-conservativeness when water passes through bedrock, soil, vegetation, or human structures like hydropower units. This behavior makes it unclear whether chemical signatures are only usable as tracers on smaller scales, or if they are suitable at all scales. In the frame of the HydroGeM3 project, extensive sampling and measurements in two Alpine catchments located in a relatively dry inner-alpine region in Austria and a wet alpine region in Switzerland are conducted to find characteristic elements or element combinations that might serve as tracers for further hydrologic studies. Samples of snow, glaciers, rainfall and groundwater as well as water samples from different tributary rivers are investigated within each of the two catchments. Each chemical signature of a sample is determined by measuring the concentration of 39 elements using an inductively coupled plasma mass spectrometer (ICP-MS). The spatio-temporal patterns of characteristic elements and element combinations are presented on different scales (intra- and inter-catchment comparison), and their suitability to serve as a tracer for hydrologic studies is discussed.