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Monitoring the runoff response of an ephemeral rocky basin: a case study in the Dolomites (North-Eastern Italy)

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In high elevation alpine catchments, first-order streams are often constituted by steep and narrow channels bound by cliffs. These channels frequently have a structural control imposed by fractures and faults in bedrock and typically constitute temporary streams where snowmelt processes strongly influence runoff. Rocky headwater basins show a different hydrological response with respect to soil-mantled basins and their hydrology is poorly known due to the lack of widespread monitoring sites. Herein we present the preliminary results achieved through an experimental hydro-meteorological monitoring network setup in a 0.1 km^2 rocky headwater basin located on the southern flank of the Sella Group in the Dolomites (North-Eastern Italy). Elevation ranges between 2700 m, at the outlet, and 3174 m, with an average value of 2950 m. Geology is constituted mainly by the Norian "Dolomia Principale" (Dolomite) featuring a complex structural setting. The monitoring network, active since 2009, is designed with three rain gauges with a time rate of 5 minutes. Two are located at 2609 and 2597 m (close to the outlet), and the third is located on the divide in the central part of the basin (2911 m). Runoff at the outlet is monitored by a pressure transducer. The time interval was set at 5 minutes in the summer months in order to capture the stream response due to intense and spatially-concentrated rainfall events. In winter the pressure transducer is maintained active with a time rate of 30 minutes so as to be ready to register in spring the stream response due to snowmelt. In the summer 2011, some precipitation, runoff, snow and spring water samples for isotopic analysis (δ^{18}O and δ^{2}H) were collected aiming to better characterize the origin of subsurface water and the main sources to runoff. Preliminary results show ephemeral presence of runoff, mostly occurring during snowmelt (from May to early July) and after intense summer rainstorms. The lag-time from precipitation centroid to runoff peak (on the order of about 1 hour) is rather long for a very small and steep basin. This is likely due to the presence of fractured bedrock that creates a shallow, subsurface reservoir and increases the catchment response time. Isotopic data of water samples well reflect the precipitation signal indicating reduced evaporation processes during the transfer of the water input to the outlet. Moreover, the isotopic composition of streamflow is close to that of the sampled springs but less depleted than snowmelt samples, revealing a possible contribution to runoff of snowmelt water mixed with subsurface water previously stored in the system.