



Towards a better understanding of Swiss mountain hydrology: a regional analysis using PREVAH

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Mountain hydrology provides unique challenges to runoff modellers. Not only are physical basin characteristics highly variable, but the runoff regime itself is very complex, being governed by glacial melt, snowmelt, rainfall, and the temporal superposition of snow and rain. Mountain climates are also highly variable, both temporally and spatially. This variability is not easily captured, due to the limited number of climate stations at high altitudes, and due to the sparseness of climatic stations in mountainous areas in general.

PREVAH (Precipitation-Runoff-Evapotranspiration-Hydrotope) was developed to improve the understanding of hydrological processes in catchments with complex topography. Detailed snow and glacier routines are included in the model, and detailed distributed catchment data are required as model inputs. PREVAH has been tested on numerous Swiss catchments and has successfully met the challenge of reproducing mountainous runoff regimes. This study focuses on a particular region in southeastern Switzerland: the Engadin. A number of catchments of varying sizes, up to 100 km², are evaluated. Basin elevations range from 1600 m to 4000 m, with average basin elevations of approximately 2500 m. The analysis uses twenty years of hourly streamflow and hourly meteorological data, with a calibration period of 5 years. In the regional analysis of calibrated parameters sets, special attention is given to physical basin characteristics, as well as the effects of basin characteristics on snow accumulation and snowmelt processes. An analysis of observed meteorological data is also conducted, with a focus on the effects of elevation changes on actual areal-distributed values of precipitation (snow or rain) and temperature. This study provides insight into the many challenges of hydrological modelling in mountainous areas.