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Hydrological scenarios for two selected Alpine catchments for the 21st century using a stochastic weather generator and enhanced process understanding for modelling of seasonal snow and glacier melt for improved water resources management

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The overall objective of HydroGeM^3 is to quantify and assess both water demand and water supply in two coupled human-environment mountain systems, i.e. Lütschine in Switzerland and Ötztaler Ache in Austria. Special emphasis is laid on the analysis of possible future seasonal water scarcity. The hydrological response of high Alpine catchments is characterised by a strong seasonal variability with low runoff in winter and high runoff in spring and summer. Climate change is expected to cause a seasonal shift of the runoff regime and thus it has significant impact on both amount and timing of the release of the available water resources, and thereof, possible future water conflicts.
In order to identify and quantify the contribution of snow and ice melt as well as rain to runoff, streamflow composition will be analysed with natural tracers. The results of the field investigations will help to improve the snow and ice melt and runoff modules of two selected hydrological models (i.e. AMUNDSEN and WaSiM) which are used to investigate the seasonal water availability under current and future climate conditions. Together, they comprise improved descriptions of boundary layer and surface melt processes (AMUNDSEN), and of streamflow runoff generation (WaSiM).
Future meteorological forcing for the modelling until the end of the century will be provided by both a stochastic multi-site weather generator, and downscaled climate model output. Both approches will use EUROCORDEX data as input. The water demand in the selected study areas is quantified for the relevant societal sectors, e.g. agriculture, hydropower generation and (winter) tourism.
The comparison of water availability and water demand under current and future climate conditions will allow the identification of possible seasonal bottlenecks of future water supply and resulting conflicts. Thus these investigations can provide a quantitative basis for the development of strategies for sustainable water management in mountain environments.