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Coupling a glacier evolution model and a hydrological model to simulate future runoff scenarios in the Oetztal Alps, Austria

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Fluctuations of glacier and snow runoff play a key role in water management of alpine catchments. Consequently, the catchment water balance is strongly influenced by the variability of the seasonal snow cover and the glacier melt. The huge water storages enable a shift of the hydrological response of glaciers across time scales, leading to response times in the range of decades.
In the future, an initial increase of water availability connected to higher temperatures and respective melt rates is expected to turn into a decrease as the glaciers dwindle. One key question is to predict the “moment of peak discharge” when water availability will start to decrease as a consequence of the reduction of glacierized areas.
To assess the influence of a warming climate on runoff regimes of glaciated catchments, we couple a simple glacier evolution model (GEM), based on a statistical approach, with a semi-distributed hydrological model (HQsim). Climate scenarios are taken from downscaled EURO-CORDEX data for the scenarios RCP2.6, RCP4.5, and RCP8.5, respectively.
The results indicate that the impact of the glaciers on runoff regimes will very likely change towards the second half of the 21st century. Given the scenarios in which most glaciers will attain their minimum extent and sustain only at high elevation levels, the resulting runoff regime is dominated by precipitation and seasonal snow cover, since the “moment of peak discharge” is assumed to occur in the first half of the 21st century.