Assessing the impact of climate change on flood types in the Austrian and French Alps using the stochastic weather generator TripleM and rainfall-runoff modeling

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We developed a new methodology for classifying flood types, which appears to be particularly suitable for climate change impact studies. Climate change is not only expected to change the magnitude and frequency of Alpine floods but also the types of floods. The distribution of existing flood types may change and new flood types may develop. A shift away from solely focusing on the magnitude and frequency of floods in flood hazard assessment and disaster risk management towards the causal types of floods is required as the types and therefore also timing and characteristics of floods will have implications on both the local social and ecological systems. The flood types are classified using k-means clustering of temperature and precipitation indicators, capturing differences in rainfall amounts, antecedent rainfall, snow-cover, and the day of the year. In a first step, we used the open-source multi-site weather generator TripleM coupled with the fast conceptual rainfall-runoff model HBV to extrapolate the observed discharge time series and generate a large inventory of different types of observed flood events and flood types. The weather generator was then parameterized based on projections of rainfall and temperature to simulate future flood types and events. We selected four climate projections (mild dry, mild wet, warm dry and warm wet conditions) from a set of 15, which originated from the EURO-CORDEX dataset. We worked in two catchments in the Austrian and French Alps that have been affected by floods in the past: the medium-sized Salzach catchment in Austria, which is dominated by rainfall driven flooding during the summer and autumn period, and the small Ubaye catchment in the Southern French Alps, which is dominated by rain-on-snow floods in the spring period. The analysis of the simulated future flood types shows clear changes in the distribution and characteristics of flood types in both study areas under the different climate projections examined.