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Impact of temperature threshold selection on future changes of liquid precipitation return levels based on convection-permitting models

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In mountainous regions, temperature conditions directly affect precipitation phase (liquid or solid) and, in turn, runoff formation and the probability of flood events. The projected temperature increase due to global warming therefore directly affects the fraction of liquid precipitation during heavy storms, leading to a potential intensification of the flood regime. In this study we assess the impact of temperature threshold selection for splitting precipitation into rainfall and snowfall, on the projected changes in the liquid fraction of precipitation during extreme events in the upper Adige River catchment (Eastern Italian Alps). To this aim, we use an ensemble of convection-permitting climate models (CPM), which are well suited to the task given their ability to explicitly represent deep convection and to resolve the mountainous topography. The CPM data provided by the CORDEX-FPS Convection project at 1 hour temporal resolution and remapped to 3 km spatial resolution cover historical and far future (2090-2099) time periods under the extreme climate change scenario (RCP8.5). Future changes of rainfall extremes are obtained using the Simplified Metastatistical Extreme Value approach, which is applied to the CPM simulations for frequency analysis. This approach provides estimates of extreme return levels with reduced uncertainty with respect to traditional methods. Three different temperature thresholds are used (i.e. 1, 1.5 and 2°C) and different elevation bands are considered within the catchment. Our preliminary results indicate an increase of liquid precipitation return levels that is dependent both on temperature threshold and elevation. In particular, larger increments are obtained for lower temperature thresholds and higher elevations. Moreover, the event duration seems to have an impact on the results, with a stronger signal for long duration storms. The results highlight the importance of addressing uncertainty in the quantification of future rainfall extremes in a mountainous area, with strong implications for water resources management and adaptation strategies.