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Using a high-resolution regional climate model large ensemble to simulate the impact of extreme precipitation on flooding over small to medium-size catchments

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Recent studies show that the frequency and intensity of extreme precipitation will increase under a warmer climate. It is expected that extreme convective precipitation will scale at a larger than Clausius–Clapeyron rate and especially so for short-duration rainfall. This has implication on flooding risk, and especially so on small catchments (<500 km^2) which have a quick response time and are therefore particularly vulnerable to short duration rainfall. The impact of the amplification of extreme precipitation as a function of catchment scale has not been widely studied because most of the climate change impact studies have been conducted at the daily time step or higher. This is because until recently the vast majority of climate model outputs have only been available at the daily time step.

This study has looked at the amplification of sub-daily, daily, and multiday extreme precipitation and flooding and its dependency on catchment scale. This work uses outputs from the Climex large-ensemble to study the amplification of extreme streamflow with return period from 2 to 300 years and durations from 1 to 24 hours over 133 North-American catchments. Using a large ensemble allows for the accurate empirical computation of extreme events with very large return periods. Results indicate that future extreme streamflow relative increases are largest for smaller catchments, longer return period, and shorter rainfall durations. Small catchments are therefore more vulnerable to future extreme rainfall than their larger counterparts.