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Future shifts in timing of regional extreme precipitation

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Despite the high confidence in the overall intensification of the hydrological cycle in response to global warming, future changes in the spatiotemporal distribution of extreme precipitation remain uncertain. We here explore how climate change affects the seasonality and timing of extreme precipitation, which potentially alters its impact on society, economy and ecosystems substantially. Extreme precipitation events are defined as an exceedance of the all-day 98th percentile of daily precipitation.

Most of the CMIP6 models capture the historical timing of extreme precipitation compared to the REGEN observational data. With climate change, we find distinct regional shifts in extreme precipitation across models. The most pronounced signal is a distinct shift of extreme precipitation from summer into the shoulder seasons, spring and autumn, or even into winter at latitudes between about 45°N and 75°N in Eurasia and northeast America. These regions, which are climatologically characterized by extreme precipitation predominantly occurring during the summer, are projected to experience a strongly reduced fraction of extreme precipitation in summer during the second half of the 21st century.

Preliminary synoptic analysis in individual models indicates a combined effect of limited moisture supply and weaker updrafts during the core summer extreme precipitation events. Further analysis is required to disentangle the relative role of thermodynamic and dynamic contribution to impact-relevant changes in seasonality of extreme precipitation.