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Investigating the seasonal response of precipitation extremes to global warming using observations and large-ensembles of coupled climate models

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Changes in extreme precipitation are amongst the most impactful consequences of global warming, with potential effects ranging from increased flood risk and landslides to crop failures and impacts on ecosystems. Thus, understanding historical and future changes in extreme precipitation is not only important from a scientific perspective, but also has direct societal relevance.

However, while most current research has focused on annual precipitation extremes and their response to warming, it has recently been noted that climate model projections show a distinct seasonality to future changes in extreme precipitation. In particular, CMIP5 models suggest that over Northern Hemisphere (NH) land the summer response is weaker than the winter response in terms of percentage changes.

Here we investigate changes in seasonal precipitation extremes using observations and simulations with coupled climate models. First, we analyse observed trends from the Hadley Centre's global climate extremes dataset (HadEX2) to investigate to what extent there is already a difference between summer and winter trends over NH land. Second, we use 40 ensemble members from the CESM Large Ensemble to characterize the role played by internal variability in trends over the historical period. Lastly, we use CMIP5 simulations to explore the possibility of a link between the seasonality of changes in precipitation extremes and decreases in surface relative humidity over land.