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Differences in the regional pattern of projected future changes in extreme precipitation over Europe are driven by the dynamic contribution

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Heavy precipitation is a major natural hazard that can have severe impacts. In response to global warming, the character of heavy precipitation is expected to change. Projections of the future hydrologic cycle, especially of heavy precipitation, are uncertain. Especially at the regional scale, different data sources, such as different ensembles of global and regional climate models (GCMs and RCMs), provide sometimes conflicting conclusions. Therefore, it is even more important to investigate where differences between ensembles lie and to which processes they can be attributed.

A precipitation scaling (introduced by Paul O'Gorman) is used to disentangle thermodynamic and dynamic contributions in extreme precipitation. In this work, we compare the results of CMIP5 and CMIP6 and focus on climate change signals between the periods 1971-2000 and 2071-2100 over Europe. The thermodynamic component provides homogeneous signals across Europe with a rise in extreme precipitation of about 7 %/K. In contrast, the dynamic component shows no spatial homogeneous results where the dynamic contribution can even modify the thermodynamic signal. The spread between the models within one ensemble is much larger. However, based on initial analyses, the spread in the CMIP6 models appears to have become smaller compared to CMIP5. This means, understanding the dynamic changes is the key to understanding the differences between the ensembles.

As a next step, to analyze the discrepancy between CMIP5 and CMIP6 in terms of atmospheric circulation changes, we look into three atmospheric drivers: tropical and polar amplification of global warming and changes in stratospheric vortex strength.