Project: **1336**
Project title: **AL CAPONE**
Principal investigator: **Patrick Pieper**
Project member: **Donghe Zhu**
Allocation period: **2024-01-01 to 2024-12-31**

For the first project year, we have been focused on two work packages. The first one is to quantify the projected changes in future extreme precipitation and separate different sources of uncertainties. To characterize the uncertainties in forced heavy precipitation response, fractional changes in annual 1-day rainfall maximum (RX1DAY) with global mean surface temperature are computed for each ensemble members. The following uncertainty analysis also proved that by comparing the variance across the ensemble mean of individual CMIP6 models with the spread of variances across each model ensembles under a given emissions scenario, inter-model uncertainty rather than internal variability is found to be mainly responsible for the regional uncertainties in the future heavy precipitation changes, e.g., Mediterranean and Asian monsoon regions. To characterize the inter-model uncertainty, process-based assessment is applied conditional on clusters of different model responses to climate change. Dominant regional dynamics, e.g., atmospheric circulation, are evaluated to develop physical storylines of future changes in extreme precipitation. Specifically, a tendency of anticyclonic circulation is found to be responsible for model projections indicating a higher reduction in Mediterranean future extremes.

The second work package is to apply a full scaling analysis to the CMIP6 model ensembles. The spatial patterns of changes in full scaling, (thermos-)dynamic contribution and changes in vertically averaged vertical velocity are quite similar to what is showed in Pfahl et al. (2017) for CMIP5. The scaling analysis forms the foundation of our project, with which we can further attribute contribution into one or several synoptic factors.

**Reference**

Pfahl, S., O'Gorman, P. A., & Fischer, E. M. (2017). Understanding the regional pattern of projected future changes in extreme precipitation. Nature Climate Change, 7(6), 423-427.