Project: **1336**
Project title: **AL CAPONE**
Principal investigator: **Patrick Pieper**
Allocation period: **2024-11-01 to 2025-10-31**

For the past project year, we have computed scaling analyses for the CMIP6 model ensembles. The spatial patterns of changes in the full scaling, its (thermo-)dynamic contribution and changes in vertically averaged vertical velocity are quite similar to what is shown in Pfahl et al. (2017) for CMIP5. The scaling analysis forms the foundation of our project, with which we can further attribute (thermo-)dynamic contributions to one or several synoptic factors.

Using these scaling analyses, we investigated how climate change influences the seasonal timing of extreme precipitation events. Using the daily precipitation data from the DKRZ CMIP6 archive, we focused on the historical period (1950-1999) and the future period (2050-2099) under scenario SSP5-8.5. For each model, extreme precipitation events were identified as days exceeding the 98^{th} percentile of daily precipitation during the historical period. We then analyzed the Day of Year (DoY) to assess the timing of these extremes. Our findings reveal a significant reduction in the summer fraction of extremes, with shifts towards colder seasons (spring and autumn) in Eurasia and North America. This shift in the timing of extreme precipitation could have substantial impacts on agriculture, ecosystems, and society. Our analysis shows that reduced moisture supply during strong updraft events is a key driver of these changes, with a strong correlation between the reduced summer occurrence of extremes and lower relative humidity during these events across models.

These insights may guide future model improvements. Moreover, we aspire to use these insights to find observational constraints for the CMIP6 ensemble to reasonably narrow the range of reliable projections. The readily computed scaling analyses will guide our exploration of observational constraints.

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.