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Robustness of projections of European precipitation for seasonal means and seasonal extremes

Nicole Ritzhaupt[1,2] and Douglas Maraun[1]
[1]Wegener Center for Climate and Global Change, University of Graz, Graz, Austria
[2]FWF DK Climate Change, University of Graz, Graz, Austria

We analyze several sets of global and regional climate models (GCMs and RCMs) to investigate how robust climate change signals for seasonal mean and extreme precipitation are. The projections of the regional climate models ENSEMBLES and EURO-CORDEX are used along with projections of their driving global data sets of CMIP3 and CMIP5, respectively. In addition, projections of CMIP6 and the high-resolution HighResMIP global models are used. The projections are used with high emission scenarios (A1B or RCP8.5) depending on availability. To calculate the climate change signals a future period 2071-2100 and a baseline period 1971-2000 is chosen. For comparability and to reduce the uncertainty by the choice of the emission scenario, the climate change signals are normalized by the European mean surface temperature. We make statements of percentage change per degree warming. The analyses are carried out for eight European sub-regions: Alps, British Isles, Iberian Peninsula, France, Mid-Europe, Scandinavia, Mediterranean and Eastern Europe. We define extreme precipitation as the 20-year return values of each season. Regarding mean precipitation the climate change signals are robust across the different data sets. In accordance with previous studies, there is a transition zone between increasing and decreasing signals which is located in southern Europe in winter and more north in summer. This seasonal cycle can be found for all regions. For extreme precipitation, the climate change signals indicating increases in all seasons and regions. Especially in summer, in most regions the RCMs showing a higher increase compared to the GCMs up to a difference of about 5%/K for the ensemble medians. Hence, the signals for extremes are not that robust than for means.

To understand where these differences come from, we are using a precipitation scaling for extremes to investigate the thermodynamic and dynamic contributions. The thermodynamic contribution shows homogeneous increasing signals for Europe. This means the dynamic contribution is the key to understand differences between the model ensembles.

We aim to understand the discrepancy between different lines of evidence and focusing our study in the field of climate information distillation.