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Large-scale atmospheric circulation characteristics and their relations to local daily precipitation extremes in Hesse, central Germany

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The anthropogenic climate change makes society and economy particularly vulnerable with regard to extreme events. Thus, here we focus on the study of extreme precipitation on a regional scale in Hesse, central Germany.

The coarse resolution of global climate models (GCMs) cannot meet our need for high resolution daily precipitation extreme forecasts. To overcome this problem we applied a Statistical downscaling method where in its first step, statistical relations between a few large scale predictors (large-scale variables from GCMs output) and the small-scale predictands (here daily precipitation monthly maxima) are to be modeled by the Generalized Extreme Value (GEV) distribution.

We have used 45 years of data from 36 rain gauges in Hesse, ranging from 1961 to 2002. The relation between the predictors and predictand can vary depending on the region and the season. To select optimal predictors for each gauge and season, we apply the Akaike Information Criterion; additionally, we cross validate the model. After a thorough study and fitting the GEV to different set of predictors we therefore derive the best set of predictors for each gauge at each season. We then model their statistical relation to the seasonal maxima of precipitation then for each model we calculate its Akaike information criterion (AIC), to find the best seasonal model for that gauge, which has the least AIC. Then these models are evaluated by cross validation methods.

Here, we present first results for the influence of large-scale circulation patterns on local extreme precipitation. These statistical relations will enable us to predict changes in local extreme precipitation from relatively coarsely resolved circulation models. Those predictions can then be used to mitigate the effects of changes in precipitation frequency and intensity caused by climate change.