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Frequency changes of atmospheric circulation types and the use of linear regression as a synoptic downscaling method for precipitation extremes

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The statistical evaluation between the relationship of atmospheric circulation types and large-scale precipitation events takes place in the context of an international project, called WETRAX (Weather patterns, storm tracks and related precipitation extremes). The aim of the project is to estimate the regional flooding potential in Central Europe under enhanced climate change.

For Southern Germany and Austria with surrounding areas, a gridded, daily precipitation set with 6km horizontal resolution has been generated for the period 1951-2006 within the WETRAX-project. To determine regions with similar precipitation variability, a S-mode principal component analysis (PCA) is applied. Extreme precipitation events are defined by the 95th percentile, based on regional arithmetic means of daily precipitation. Large-scale atmospheric circulation types are derived by different statistical methods and variables by using the COST733 classification software and gridded daily NCEP1 reanalysis data.

To evaluate the performance of a particular circulation type classification with respect to regional precipitation extremes, a multiple regression is applied on the number of monthly rainfall threshold exceedances with the circulation type frequencies as predictor variables.

To estimate the regional flooding potential in Central Europe under enhanced climate change, multiple regression models are applied to different projected GCM model data, and changes in circulation type occurrence frequencies, rainfall exceedances and specific circulation patterns are determined.