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Multivariate BIAS adjustment and statistical downscaling of climate variables

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Operating traffic and transport infrastructure sustainably requires enhanced resilience to climate change impacts. Adaptation measures have to be determined and implemented in order to increase the resilience of roads, railways and waterways. Specific threats to the infrastructure are posed for instance by very cold and very hot temperatures, freeze-thaw repetitions and heavy precipitation.

In Germany the adaptation to the impacts of climate change is investigated by the Network of Experts that has been established in 2016 by the German Federal Ministry of Transport and Digital Infrastructure (BMVI). In the research topic „Adapting transport and infrastructure to climate change and extreme weather events“ the BMVI Network of Experts conducts an integrated climate impact assessment for the German federal transport infrastructure. Deutscher Wetterdienst (DWD) provides climate data (observations and climate projections) appropriate for impact modelling and related studies. Statistical downscaling combined with multivariate bias adjustment is applied to an ensemble of regional climate projections generated within the projects of EURO-CORDEX and ReKliEs–De.

Multivariate bias adjustment merges quantile based bias adjustment with rectification of inter-variable dependence structure. This is of particular importance for water balance related impact modelling and with regard to statistically robust conclusions about climate indices using fixed threshold definitions. Statistical downscaling is done by linking high-resolution (5 km) gridded observational data with regional climate model simulations at 12 km grid spacing. Principle component analysis (PCA) is used to derive high-resolution climate information required for the regression based statistical downscaling procedure. Application of the methodology to climate projections for six variables (mean, minimum and maximum temperature, relative humidity, precipitation and global radiation) and evaluation results will be detailed.