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Statistical-dynamical downscaling of climate projections for climate change adaptations of transport infrastructure

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To provide useful climate change information for decision makers, climate scenarios are a key tool. Even if climate change is a global phenomenon, it is also an issue at smaller scales where adaption strategies can be more easily applied when national decision making is predominantly responsible. So, climate change information has to be made available on different scales, ranging from global to local. The dynamical downscaling technique is an appropriate tool for getting small-scale simulation information from coarse-gridded model data. However, it is very costly in terms of CPU-time requirements. Alternatively, using statistical downscaling techniques like cluster analysis, specific weather types on a coarse scale can be grouped together and linked to fields of variables on local scales. However, these methods have to deal with certain limitations due to assumptions like stationary relationship over time between predictor and predictand.
For the adaption of transport infrastructure to climate change in Germany, simulations are performed with the non-hydrostatic regional climate model COSMO-CLM at 2.8 km resolution for the RCP 8.5 scenario in the framework of the project “Network of Experts” of the German Federal Ministry of Transport and Digital Infrastructure. Beside the historical and evaluation runs from 1971 to 2000, a near-future (2030-2060) and a far-future (2060-2100) run will be performed. The high resolution is hoped to give increased certainty of frequencies of extreme events, especially for heavy rainfall and storm events. Climate projection results are then distributed to project partners for subsequent simulations, e.g. of river runoff in Germany.
In a second step, a statistical downscaling method will be applied to establish an ensemble of high resolution climate projections for Germany which in turn will be used for quantifying uncertainty. In the present study, two different cluster analysis methods, the k-means algorithms and the self-organizing maps scheme, are going to be used to group weather types for Europe. The linked local variable fields will be compared to results of dynamical downscaling.