

## **Significance and robustness of climate change signals over Germany in a convection permitting regional climate model ensemble**

Useful and user-oriented climate information is key to adapt our society to present and expected future climate change. Within the project NUKLEUS such an information basis is being built for Germany based on dynamical downscaling of 3 general circulation models using 3 regional climate models with a convection permitting spatial resolution (~ 3km), that allows to explicitly resolve deep convection. The resulting 3x3 ensemble will be the first of its kind over Germany and is expected to offer new insight into projected climatic changes, especially of extreme temperatures and precipitation, which can be quantified by a set of climate indices (e.g., ETCCDI-indices). The projected changes will be derived for entire Germany and specific subregions.

Yet, due to the relatively small size of the ensemble, the emergence of projected climate change signals from internal variability (significance) and the agreement of projected changes (robustness) may be limited. Thus, two key questions arise:

- Q1) Which climate change signals of ETCCDI-indices derived from the NUKLEUS ensemble can be classified as significant and robust?**
- Q2) Can we derive estimates of the required ensemble size to provide satisfactory significance and robustness of specific climate change signals?**

Answering Q1) is a relevant contribution to NUKLEUS itself, while the answer to Q2) is relevant for the future extension of the convection permitting ensemble, e.g. in the project UDAG.

Specific major steps of the Master thesis will be

- Identification of suitable methods to quantify significance and robustness of climate change signals in convection permitting regional climate model ensembles
- Implementation and application of the above methods to the NUKLEUS-ensemble
- Identification and application of methods to estimate the required ensemble size based on specific climate indices

The Master thesis will offer you the option to

- learn in detail about projected climatic changes in Germany,
- contribute to the development of an information basis for climate adaptation measures in Germany,
- and develop your skills in statistics, handling big amounts of data with python, as well as working with gitlab.

Optional contents of the Master thesis are to locally extend the NUKLEUS-ensemble with available simulations from other projects. Furthermore, the analyses conducted during the Master thesis could be additionally performed for the Baden-Württemberg and Karlsruhe region or other specific regions of interest within Germany.

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The thesis will be supervised by Christoph Braun and Joaquim Pinto.