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Tripwires between climatological and hydrological research

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Climate change as such, particularly when expressed only as mean values, has only limited impacts on people's lives. Of much more interest and concern are climate extremes and climate induced impacts on hydrological properties and subsequent impacts on agricultural production and other sectors determining human living conditions. Thus, the role of climate modeling is to provide the necessary input to those impact research communities. However, climate simulation results are not suited to be taken at face value but require some thorough interpretation, handling and partly post-processing.

In the climate modeling community there is a general consensus on the use of model projections, their reliability (or uncertainty), and the limits of their interpretation. Since all climate models are by their very nature imperfect representations of reality all models show systematic differences from observed data. Some of these are common to all models (e.g. problems of resolution) while some are distributed more randomly between models. Thus, previous studies have repeatedly led to the conclusion that there is no "one best model for all purposes". So, ensembles of simulations, not only their averages but also the range they display, should be taken into account.

Particularly for hydrological modeling, the use of lots of climate projections as input is often not feasible. Furthermore, the known biases or weaknesses of climate models provide additional handicaps for using the data directly. So, lots of projects end up either using only results of those climate models that seem most suited for providing input to their respective impact models or doing (more or less fancy) bias corrections of the climate model results. While the first approach ignores the recommendations for using ensembles, the second approach has its own tripwires. In principal, bias correction can alter all model outputs to a seemingly optimal fit with observations (at least for the specific question; there is no correction method for all biases in one go). This can easily lead to over-correction, allowing overconfidence into the model results.

Thus, to improve the reliability of hydrological simulation results, a much closer communication between climate modelers and hydrological modelers is called for. This communication should not only identify differences in the approaches between the two communities, but mainly aim at developing methods that integrate the recommendations of climate modelers for use of climate model outputs and the inherent requirements of the impact models.

The presentation will discuss the problems and present first ideas at solutions from ongoing research projects in the German federal state of Hesse.