COST-VALUE Workshop on GCM Bias Correction

Notes from the discussions

Andreas Fischer, Friday 17/10/2014, Hamburg

This discussion follows from two input-talks by M. Widmann (on correcting / downscaling GCM-simulated precipitation) and R. Chandler (on interpreting simulator ensembles).

- Proposal to make an inter-comparison of standard bias-correction methods: where do they work and where not? (S. Hagemann).
- General agreement that this is a good pragmatic way forward. It should be investigated if the relevant processes are correctly simulated (Douglas) and whether a specific impact application is at all affected by GCM errors, e.g. the displacement of the storm track in the GCM (Richard).
- In particular, the question whether and how the large-scale bias is related to the local scale precipitation ('emerging constraints') should be answered (T. Sheperd). He gives an example of a relation between local precipitation and the NAO.
- How to inter-compare different bias-correction methods? One could for instance investigate the spatial correlation structure of the corrected/downscaled precipitation fields (S. Hagemann). The methodological details would have to be discussed. Validation of the spatial structure is on-going discussion in VALUE. There is a Skype-meeting on 23/10 related to this (Martin)
- Proposal by T. Sheperd to test the bias corrections in a model-world reality. It is mentioned that this is already part of the VALUE framework experiments. Results from the pseudo-reality experiments could indeed give answers to see under which circumstances bias correction works.
- Can Richard's method correct for a displacement of the storm track? His (Bayesian) method would have to be adjusted by choosing additional predictors and/or by mimicking location and intensity of the storm-track (Richard)

Discussion on flow-dependent bias correction (proposed by Wetterhall et al.)

- Idea: condition bias on weather types
- Concerns are raised that weather-type classifications are too arbitrary (Martin). There is no unique classification and we run into the problem that the sample size per class is very much reduced which introduces uncertainties (Radan)
- Another problem with conditional bias correction: the resulting time-series is not continuous anymore, but discretized
- Nevertheless, from a conceptual point of view, it would be interesting to see whether it improves GCM error correction (Douglas) and this is even worth investigating if storms are at right place (e.g. ERA-driven RCMs) [Martin].
- How flow-dependent are local precipitation –biases at all? Research is needed to answer this question (T. Jung)

General Discussion on future work

- General agreement that common bias correction methods will have large difficulties in case that storm track is at wrong position. There is no simple solution to the problem.
- There should be a statement from VALUE that we won't be able to deliver useful local-scale projections, as long as key features of the extratropical circulation are not well simulated in terms of location (Martin).
- There is general agreement that the fundamental problems in providing reliable local-scale projection data lie in the GCMs and not in the RCMs. Further GCM development is key for downscaling-community.
- T. Jung: to prioritize future developments, it is very helpful to know from VALUE-community what their key requirements in terms of GCM-simulations are (e.g. blockings over Atlantic sector).
- T. Jung: The model-development community needs arguments to invest for better simulations. Ideally, these arguments/needs come from outside their community. For instance, it is conceivable, that higher model resolution might alleviate the location problem of storm tracks.
- T. Jung: how to invest resources? Tradeoff between the number of ensemble initializations and the resolution size.
- S. Hagemann: can we do something about orography? Several studies have shown a large influence of orography. Maybe compromise? EC-EARTH is running dynamics on high-resolution but things they don't understand so well (e.g. radiation) at a coarse resolution.
- Idea from T. Sheperd: "bias correction of the climate change signal" of just one model that features a small systematic bias; this could for instance be a model with a rather high resolution that is more reliable than others. The rationale behind is that the climate change signal is only a small perturbation compared to systematic biases.
- This proposal goes into the direction of a pattern-scaling approach: use the change of a multi-model ensemble as a correction factor for unexplored territories (Douglas).
- Weakness of this approach is that the explicit uncertainty information is lost again; and how do we know what a good model is? (Richard)

Overall wrap-up

Large-scale circulation errors in GCMs are the big challenges to correct for. There is no simple way of correcting for these errors. A substantial breakthrough on the GCM-development side is needed. It is to be determined by the practitioner, whether the jet stream mis-location is of 1st oder or 2nd order importance for their application. In any case, it is recommended to use multi-model ensembles for the provision of local future projection data.

A publication on the topic of GCM bias correction is foreseen (around 10 people willing to contribute). The key questions should be framed and supported with schematic illustrations. One of the outcomes should be to identify in which regions do bias correction methods work well and in which regions they are not suitable.