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Hydrology and Earth System Sciences Discussions

Interactive comment on "Use of regional climate model simulations as input for hydrological models for the Hindukush–Karakorum–Himalaya region" *by* M. Akhtar et al.

Anonymous Referee #2

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General comments:

This is a concise and well written paper about hydrological modelling in a data scarce region with a high socio-economic importance. I fully agree that this is an important scientific question that need proper attention and I am convinced that the paper can be a useful contribution to this. However, I have some major remarks that I would urge the authors to consider:

In its current form, I am not entirely convinced by the scientific value of the presented results and their interpretation. I think the main culprit is some confusion about the actual aims of the paper. The abstract states: "The objective is to investigate the effect

of precipitation and temperature simulated with the PRECIS RCM nested in these two data sets on discharge simulated with the HBV model for three river basins in the Hindukush-Karakorum-Himalaya (HKH) region." As the two datasets are the coarse resolution ERA-40 reanalysis data and the HadAM3P GCM, I would expect that the aim is to investigate whether downscaling those coarse resolution datasets using a dynamic method, in casu the PRECIS model, would improve the simulations of the HBV hydrological model. However, this would imply that the model is run with the original ERA-40 and HadAM3P output data, to use them as a benchmark to evaluate the improvements made by the downscaling.

This was not done in the paper, and that makes it very difficult to interprete the quality and usefulness of the PRECIS data. I do not agree with the conclusions drawn by the authors: "Analysis of present day simulations shows that PRECIS possesses strong capacity to simulate spatial patterns of present climate characteristics". I don't think the paper actually proves this. One could even question whether the use of a hydrological model is the best way to investigate such a claim. Surely it would be more straightforward to validate the PRECIS present day simulations directly with observed meteorological data? However, what would be useful from a hydrological viewpoint is to investigate whether the PRECIS data have added value for the hydrological modelling. If indeed PRECIS has a capacity to represent the spatial patterns of the current climate, one would expect that this improves the hydrological model input and as such also the hydrological predictions (at least if the model structure is able to take advantage of the spatial distribution, which is likely to be the case with a semi-distributed model). However, again, this would need a benchmark.

I am also unsure about the analysis of the "robustness" of the parameter sets. The authors state: "However, using input data series from sources different from the data used in the model calibration shows that HBV models driven by the PRECIS outputs are more robust compared to HBV-Met." Interchanging optimised parameter sets as a way to investigate how models react to errors in input data is possible, but here the

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comparison seems unfair. Both PRECIS datasets are bias corrected with CRU data so you would expect them to behave in a more similar way than the meteorological data. "Correcting" the observed meteorological data with the CRU dataset will most likely make them more "robust" too (but probably decreasing their performance).

Specific comments:

867/18: (about 250 km): the actual resolution of GCMs is very different and therefore 250 km seems a very crude estimation, but yes, in general it is too coarse for hydrological modelling

870: what is the length and the temporal resolution of the discharge data? Are they daily, monthly, ...?

875: How is the sensitivity analysis done? How many parameter sets were used and how where they sampled?

figure 6: as suggested in the general comments, adding the performance of HBV with the original ERA-40 and HadAM3P would greatly improve the ability to assess the value of the PRECIS downscaling.

table 3: biases of up to 371% are fairly dramatic. How much of this bias was present in the forcing data (HadAM3P) and how much is introduced by the model (as explained in 878/20-25)

Technical corrections:

868/13-25: this is a repetition from p.867 and can be omitted.

869/10: river basins are not "the" same

871/1-11: I am not sure if this part (including fig. 2) is really necessary. It is fairly obvious that the HKH region has the potential to benefit from higher resolution topographical data.

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