

Interactive comment on “Bias correction of temperature and precipitation data for regional climate model application to the Rhine basin” by W. Terink et al.

Anonymous Referee #2

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General comments

In this paper a bias correction is applied to downscaled ERA15 precipitation and temperature data, based on observations for more than 100 sub-basins in the Rhine Basin. The method used by the authors produces good results and reduces the warm and wet bias in the ERA15 data. The results are therefore potentially of interest to other researchers. The manuscript is well-written and extensive, yet I do have a few comments that I will elaborate on below.

First of all, the correction method applied by the authors leads to a reduction in the bias

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in the downscaled ERA15 data, but this result is hardly surprising. The authors compare the simulated precipitation and temperature fields with observations, and correct the former based on the differences with the latter. Obviously, the corrected fields are then bound to be closer to the observations. The method used by the authors is not new but proposed earlier by Leander and Buishand (2007). I would therefore challenge the authors to emphasise more what is new in their study that would make it interesting to others. This may require a slightly different focus of their paper. One of the more interesting results is that the downscaled ERA15 precipitation data are generally higher than observed, except in autumn (September–October, see Figure 6). Do the authors have an explanation for this? Is it related to the type of precipitation? Is it regionally different? I think the paper might become more interesting if the authors would focus more on aspects like this and provide a more in-depth analysis of their results.

Secondly, there is very little information about the observations dataset that is being used, and no discussion at all of the uncertainties in it. The authors refer to Sprokkereef (2001) but this turns out to be a non-peer-reviewed technical report in German. How were the station measurements interpolated to the corresponding sub-basins? What concerns me most is that the CHR data seem to be taken as the absolute truth, while it is well known there are major uncertainties in areal precipitation estimates, especially in mountainous areas such as the Alpine region (dependent on the number of stations that is used in the interpolation). Also, snow measurements are highly uncertain and prone to undercatch. In this view it is conceivable that the authors are ‘overcorrecting’ for any differences with the observations, thereby discarding some valuable information that is contained in the ERA15/REMO simulations, for example on orographic precipitation patterns. In this respect, what is really missing from the manuscript is any proof that the bias correction as applied by the authors leads to a significant improvement in the performance of the hydrological model they intend to use. It also raises the question why not to use the observed precipitation and temperature directly in calibrating the VIC model, rather than going through the effort of applying the bias correction to the ERA15 data?

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Furthermore, the authors mention applying bias correction to scenarios of future climate as one of the motivations for their study (section 1). But what would be their strategy for this? There will be no observations available for the future time period and the bias in the REMO simulations for current and future climate may not be the same as in the REMO simulations that were used in downscaling the ERA15 data. Are the authors intending to apply the correction factors found in this study? This particular aspect does not seem to be well thought out.

Specific comments:

- The authors refer to the downscaled ERA15 data as ERA15d, but I think they miss the point that these are essentially REMO simulations where only the boundary conditions were derived from ERA15. In other words, a different RCM may give different (better or worse) results. To reflect this, I would suggest they refer to the downscaled precipitation and temperature fields as ERA15/REMO or something like that.
- As the authors note, the bias correction is not working so well in September and October, when it needs to correct for a dry bias rather than a wet bias (as in all other months). Supposedly, this is due to the long blocks of 65 days that were used in determining the parameters. What is the motivation for choosing such a long period and did the authors test if they get better results with shorter time blocks?
- If I understand the methodology correctly, the correction factors are the same for every year (section 4.2), which implies that the authors ignore any interannual variability. It is conceivable that the bias in ERA15/REMO is different for different circulation or weather types, and that the performance varies from year to year. Have the authors looked into this? I would suggest they should at least discuss this aspect in their paper.
- Looking at Figure 6, it seems the uncorrected precipitation is closer to the observations than the bias-corrected precipitation in (at least) February, April and November. How is this possible?

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- The number of plots seems a bit excessive. Figures 1 and 2 could easily be merged. Figures 7 and 9 might be left out without affecting too much the main thesis of the paper.

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