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Hydrology and Earth System Sciences Discussions

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 #4

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General comments

The objective of this work is to correct for bias in downscaled ERA15 reanalysis data of precipitation and temperature, which will be used in another study to force the VIC hydrological model. Validation studies that focus on the comparison of statistical characteristics of reanalysis data (or climate model output data) with high resolution station data, or the development of alternative methods to correct for bias in the NWP (or climate model) products are of high interest for hydro-climatological impact studies. This study, however, does not propose a new method for bias correction, nor does it provide

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an in-depth analysis that leads to substantial novel insights in ERA15 reanalysis data.

Specific comments

According to the authors the main importance of this work is that the bias-corrected data are to be used to calibrate the VIC hydrological model, which will subsequently be applied for climate impact studies. As I understand from the manuscript (e.g., page 5380, lines 20-30), this will be done by comparing VIC simulations driven by control and scenario climate projections subject to a bias correction. From what is written there, it is not clear if this refers to the same bias correction derived from the ERA15 reanalysis data. If the same correction factors will be used, the authors assume that the bias in the (REMO) control and scenario climate is identical to that in the (REMO) downscaled ERA15 data (i.e., that the bias is mainly an artefact of REMO). This is very likely not the case, as the bias in the driving boundary conditions (ERA15 vs. ECHAM5) will typically not be the same and cannot be neglected. Why not use directly the high resolution meteorological data set to calibrate the VIC model and derive bias correction factors for the control climate simulation of the RCM (that can then be applied to the control and future climate)? It is well known that one has to be careful when choosing reanalysis data for the description of what we term the present climate (Zolina et al., 2004).

To correct for bias in ERA15 precipitation and temperature the methods proposed by Leander and Buishand (2006) have been used and the same statistics are being analysed (albeit in less depth). Moreover, identical block lengths are being used for calculating statistics, with little justification or a sensitivity analysis on the length of the blocks. When applying an existing methodology to an alternative dataset, the analysis should focus on gaining more insight in the data and finding (physical) explanations for the observations. For example, since this is a well-sampled region, the comparison could involve the analysis of mesoscale spatial variability and its impact on estimates of statistical characteristics (Osborn and Hulme, 1997). Unfortunately, several shortcomings in the study, as well as in the description thereof, inhibit a proper comparison.

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Many of these issues were also raised by the other referees, but a few are listed below.

The models and data are poorly described. Hardly any information is provided about the observational dataset (how many stations, how are area-averaged precipitation values obtained for the different sub-basins, uncertainty in these data, in the interpolation of the data, etc). The description of ERA15 is insufficient for those readers not familiar with (ECMWF) reanalysis products. Some of the known artefacts of ERA15, which may help in interpreting the results, are not described (e.g., in many European areas it rains practically every day in ERA15, or smaller precipitation extremes compared to other reanalysis data sets). Also, how does the 2-step downscaling with REMO work?

The results section merely describes the observations presented in the Figures (of which some are redundant, e.g., similar information in Figures 6 and 7), with very little attempt to (physically) explain the observations (e.g., analysis of 10-day precipitation sums, or the section on variation and sensitivity of parameters) or relating them with previous works (e.g., the work of Leander and Buishand (2007), which covers nearly all topics tackled in this paper but for ERA40). For example, the wet bias is partly a result of the fact that the observed precipitation amounts were not corrected for the systematic undercatch inherent to rain gauges (Leander and Buishand, 2007). Frei et al. (2003) report a systematic undercatch of about 8% for the lowland stations in the Alps.

Part of the analysis (e.g., relation precipitation – temperature) is based on 1 sub-basin, which renders conclusions based hereon rather speculative.

The conclusions and discussion section is mainly a repetition/summary of the content of the results section and lacks a thorough discussion and interpretation of the results.

Given the lack of novelty of the methods used, the rather restricted analysis and interpretation of the data/results, and the limited new insights in the ERA15 reanalysis data, I see little added value of this work in its current status. The authors state that the work of Hurkmans et al. (2009) focuses on the calibration of the model using ERA15 data

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and on hydrological simulations driven by different climate forcing scenarios. I believe that this work could be summarized in a few paragraphs in the Hurkmans et al. (2009) paper, although that, based on this manuscript, it is not clear why the authors choose to calibrate the VIC model with ERA15 when a high-resolution data set is available.

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