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Hydrology and Earth System Sciences Discussions

Interactive comment on "The ability of a GCM-forced hydrological model to reproduce global discharge variability" *by* F. C. Sperna Weiland et al.

Anonymous Referee #1

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General comment

The manuscript is not written clearly, with sometimes sloppy wording, which makes it difficult to understand. As an example, the description of the generation of the reference climate data set is confusing, as on the one hand, it is said that the same method was used as for the GCM data, using bias correction with CRU long-term average temperature and precipiation , while on the other hand CRU time series are mentioned. Besides, no reference to which CRU data are used for bias-correction is given.

There are a number of unfounded conclusions The manuscript assumes that the computed discharge obtained by a PCR-GLOBWB run driven with the reference climate is

more realistic than climate models. One of the conclusions, which is, in my opinion, unfounded is that GCM derived climate discharge quantities are overall too low (in abstract and conclusions). This is not true with respect to long-term average discharge values, where in 12 out of the 19 test basins, the ensemble average of the 12 GCM runs is closer to the observed discharge of GRDC than the discharge computed by using the reference climate (see Table 3). Regarding statistical high and low flows Q90 and Q10, there is no comparison at all of GCM derived results to observed values, only to the reference run. However, a comparison to observed data is necessary to form the mentioned conclusion, and should be possible, as GRDC also provides observed daily river discharge for many stations. Also, I do not understand what the basis is for the conclusion that intra-year variability is not well represented by GCM driven runs, "as exemplified by a limited persistence" (in abstract). Only interannual variability of discharge is analysed, and here the conclusion (that GCM derived runs unterestimate interannual variability of discharge, but is this caused by "limited persistence"?, abstract and conclusions) appears to be well founded (and is innovative). Observed Lag-1 correlation of discharge is not reproduced by most GCMs (which you say on p. 705, l. 1), but neither by using the reference climate data set (which you do not say, but show in Table 3). This may indicate that discrepancies are due to the hydrological model, and that neither the GCMs nor the reference climate data set have a comparative advantage.

Often, explanations for different model results are not convincing. For example, in section 4 Conclusions, the authors write "GCM derived discharge is overall too low, as raw GCM data have too many rain days, resulting in many days with little rain from which a larger amount of rain can infiltrate or evaporate." Not only have GCM data too many rain days, but also ERA40 that was used to derive the reference climate data set, is known to have too many rain days. What is missing is a discussion of the effect of using monthly time series of CRU precipitation and temperature to correct the daily values of ERA40 as compared to bias-correcting GCM daily values by long-term average monthly means, and a discussion of the differences between ERA40 and

GCMs (outputs).

Specific comments:

p. 689, l. 12: Fowler and Kilsby, 2007) not in reference list. Use chronological order. p. 689, l. 21: use of word river regime inconsistent with use in l. 26 p. 690. In section 2.1.1: literature references lack “et al.“ p.692: LPJ model does include river routing. p. 695: reference to CRU data is missing. p. 696, l 19ff: unclear what the precise criterion is for applying correction method. p. 707, l 6: reference is made to Fig. 9 while an additional (missing) figure with hydrological regimes is announced in the text. Table 2: Is Qmean not the same as Q(-/average)? Table 3: Units are missing Fig. 3: Blue colors difficult to distinguish, for 3 c (also in the following figures 4c etc.) indicate which variable was subtracted when forming the difference

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 687, 2010.