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Hydrology and Earth System Sciences
Discussions
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Interactive comment on "Impact of downscaled rainfall biases on projected runoff changes" *by* Stephen P. Charles et al.

Anonymous Referee #1

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The authors developed a study that analyses the impacts of climate model downscaled rainfall biases on the simulated runoff for the Victoria State in Australia. They use the WRF Regional Climate Model (RCM) driven by two reanalysis datasets and four Global Climate Models (GCMs). They evaluate the raw and bias-corrected (QQM) simulations and scaled observations. In order to evaluate the changes in runoff, they employed the GR4J hydrological model with a lump and a distributed setup.

GENERAL COMMENTS Overall, I can see a heavy load of work involved in this research along with some very interesting results. I have some comments for the authors to consider:

An important part of your work analyses empirically scaled observed data. It might be useful for the readers if you describe a bit of the method from Chiew et al. (2009).

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Similar to the above, you could provide a few sentences to describe the QQM bias-correction method.

In future work, such as the one stated at the end of the conclusions, I would recommend using the last generation of climate models that is available as this would provide an analysis of the current state-of-the-art.

I understand that this works builds up from previous studies, however, could you give a sentence on why you (or the studies that your work builds on) choose to use the WRF model? Would you expect similar results from using other RCMs? The above applies for the hydrological model, would you expect that a fully-distributed integrated model will have different result?

SPECIFIC COMMENTS Pg.1 L27 - The comma is missing in the following: Thus, 'bias correction' methods

In Pg. 2 Lines 2 to 9 - You are referring to some of the limitations of bias correction. I think it would be also important to include the stationarity assumption of the relationship between simulations and observations. I think this is the main concept that supports the idea of bias correction.

Pg.4 Lines 16 to 20 - It is not clear to me whether you use the monthly mean potential evapotranspiration or daily values. Also, you could include a sentence stating whether if including the potential evapotranspiration simulations could change your results considerably.

Pg. 6 Line 16 – You could say how large is the bias of the 99th percentile in rainfall as it can give a background for the bias in the 99th percentile of runoff.

Pg 9. Lines 17 to t20 – Can you include some reference that assess whether the model is good to simulate runoff on a changing catchment. I am not sure that there is a reference for the GR4J model. If not, you can acknowledge that there is no previous study analyzing it.

Pg. 11 Lines 1 and 2 – You could also include the opposite view that bias-corrected outputs should be used with care giving that they are not based in any knowledge of the clime at physics (Ehret et al 2012).

Pg. 11 last line and page 12 first line – Correct the sentence as it does not make sense at the moment.

Table 1. Given that the high flows are relevant for this research, consider including here how the models do when simulating the high flows (i.e. 99th percentile). This will increase the credibility of the results (even if you use the simulated, and not the observed, runoff as benchmark for comparison.

Figure 1. You can add the legend title (i.e. annual mean rainfall (mm/yr)"

Figure 9. Add the title of the y axis title.

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