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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Assessment of climate change impact and difference on the river runoff in four basins in China under 1.5 °C and 2.0 °C global warming" *by* Hongmei Xu et al.

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There are some fundamental problems with this paper that make me very uneasy about recommending it for publication. Firstly, the choice of five GCMs from a much large available set of AR5 projections needs to be justified. At the very least, we need to know why these five were chosen and whether they differ from the larger set in terms of their future projections. I'd also like to know how these five perform under historical conditions. Related to this, we need to know how the historical projections from the GCMs compare with the historical data used to calibrate the model. Section 3.2 is very unclear about this. If the historical GCM data is wildly different from the historical

calibration data, I cannot see how it can be used to assess current conditions and therefore used to assess projected changes. Similarly, the SWAT calibration statistics are rather poor. The biases in calibration of 16% and 25% are much greater than the projected changes in runoff. How can we have any confidence in these projected changes when the calibrations are unable to get even the correct volume of runoff? Using the model to project seasonal changes when historical seasonal statistics were not examined is also unacceptable. The inadequacy of the model for use in climate change studies is re-iterated by the -11 to +18% change in precipitation for the Shiyang River leading to reductions in annual flow of 10% to 60%. This is not credible, and clearly the model is giving too much weighting to the impact of increases in PET.

There is some value in the estimates of changes in temperature and precipitation across the four river basins, but the large bias in the hydrological model calibrations means that I cannot see how these changes in precipitation can be converted into changes in even annual runoff. Also, the changes in temperature and precipitation are predicated on just five GCMs, and we would need to know where these fall within the range of all GCMs in AR5.

The authors have pretty much ignored the very large body of work emanating from Australia, the US and Europe on estimating impacts of climate change on water availability. I'd strongly suggest they go back and read the approaches that have been used elsewhere and modify their approach based on this.

Specific comments: From the abstract, it appears as if the focus of the paper is on the impact of an additional 0.5 degrees global warming, not the impact of 1.5 and 2.0 degrees compared to current conditions. However, the paper does not focus on this 0.5 degree difference.

Line 6. The target of 1.5 degrees is thought to be the one which might limit dangerous climate change impacts, not 2 degrees as proposed here. In fact, the comparison of 2 to 1.5 degree warming can be considered to be 'what if' we don't manage to keep

to 1.5 degrees of warming? What might the additional 0.5 degrees do? That could be a useful focus of the paper, however the problems raised above mean that this cannot be done with the current approach.

Considering the enormous range of projected changes across the AR5 GCMs, the reader needs to know why the authors selected the five GCMs used in this study. Were they just more accessible? How does the range of projections from those GCMs compare to the larger set of GCMs in AR5? Without knowing this, we have no idea if these projected changes represent a wetter/drier hotter/cooler part of the spectrum of future climate change projections.

One of the key issues in hydrological modelling studies is whether the model is able to represent the current conditions well enough to be able to be used in climate change studies. In this paper, the authors claim that the model calibration and validation results are 'satisfactory'. While this may be true to some extent for the Huiaihe and Fujiang Rivers, the calibration and validation statistics for the other rivers are poor at best (remembering that they are only attempting to produce monthly, not daily streamflow). Even more concerning however in a study such as this one is that the calibration bias is 25% for the Baihe and 16% for the Huaihe River. As the projected change in annual runoff is much less than that, I cannot see how the authors can justify using such a poor calibration. I am not familiar with the WFD climate data, but I strongly suspect that is the main reason the calibrations are so poor. Are there any other datasets (local precipitation for example) that could be used instead? Also, was SWAT run on a monthly or daily basis? No information is provided. It is not at all clear which precipitation data were used to drive the SWAT model under the future climate scenarios. Section 3.2 is confusing and not at all clear. Did the authors simply take the precipitation from the climate models directly and run SWAT for both the historic and future scenarios? If so, how did these precipitation projections, particularly the historical 'projections' compare to those used in the historic calibration? If they were significantly different, this gives us some information about how well the GCM's are predicting historical conditions and

some confidence (or likely not) in their use in the future projections.

Figure 2 shows that all future projections for the Shiyang River are for reductions in annual flow (of between 10% and 60%), but Table 3 states that annual precipitation shows a range of changes from an 11% decrease to an 18% increase. If the modelling indicates that an 18% increase in precipitation will lead to a reduction in annual runoff then the model is clearly inadequate for use in climate change studies.

While it is written well overall, considering the authors all presumably have English as a second language, there are a few sentences that do not make sense, such as line 23-25.

Figure 1. What does the light grey shading signify? What is the inset attempting to show?

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