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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Why does a conceptual hydrological model fail to predict discharge changes in response to climate change?" *by* Doris Duethmann et al.

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This is a nice example of a study that attempts to determine exactly what it is about rainfall-runoff models that means they are not capable of predicting well runoff under changed climate conditions. One major thing that would improve the paper would be to quantify for the reader what the change in relevant hydroclimatological characteristics during the verification period actually are. The authors state that the area was subject to significant climate changes, but do not tell us what these actually were. Were the evaluation periods drier/hotter? If so, by how much. What were the relative runoff coefficients?

Despite these issues, I have just three comments on improving the paper:

1. The title is misleading. Almost every model will predict discharge changes in response to climate change. The questions is why they do not 'accurately' predict discharge changes? The addition of a qualifier like 'accurately' would be useful.

2. Changes in anthropogenic influences are largely ignored as the authors claim that the catchments are largely unregulated and existing diversions were introduced before the beginning of the study period. I would question this. While the diversions may be in place before the beginning of the study period, are there operating rules related to this diversions which may vary from year to year, for example allowing larger diversions during periods of low flow (or vice-versa). I ask as we have identified catchments in Australia that not only behaved abnormally (gave lower than predicted yields during the Millennium drought), but that have not returned to 'normal' yields post-drought. One hypothesis for this is that farmers sank groundwater bores to access an alternative water supply during the drought when they were unable to pump from surface water. Any lowering of the groundwater table resulting from this activity would obviously lead to lower than expected yields. Once this 'sunk cost' had been incurred, there would be no benefit to farmers in ceasing the pumping of water from these bores, thus they may still be doing so post-drought. Such anthropogenic influences are of course hard to determine (and even harder to quantify), but the authors would do well to keep them in mind.

3. The assessment that problems with the model calibration can be the source of the poor performance during the evaluation period is a good one. In particular, that processes that are relevant in the calibration period are not present (or 'activated' to use the author's terminology) in the calibration period. I am not sure that extending the calibration period from 5 to 25 years will actually evaluate whether this is the case. It may be that these processes will be seen in the 25 year period, but it may not. One thing that could be done is to compare the model that is calibrated on the evaluation period (or perhaps part of it) to the model that is calibrated on the calibration period.

If different processes are dominant in the evaluation period, this would be seen in how these models perform on an independent data set.

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