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Hydrology and Earth System Sciences Discussions

Interactive comment on "Uncertainty in climate change impacts on water resources in the Rio Grande Basin, Brazil" *by* M. T. Nóbrega et al.

Anonymous Referee #1

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Comments on discussion paper:

Title: Uncertainty in climate change impacts on water resources in the Rio Grande Basin, Brazil

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General Comments:

This very interesting discussion paper intends to showing how uncertain future projections of river flow at the River Grande - Brazil can be, depending on the future scenario of precipitation and temperature chosen to generate the flow projections. Flow projections are generated by the MGB-IPH hydrological model calibrated for the River

Grande.

The authors use a large amount of future scenarios of precipitation and temperature to support their statement. Scenarios include those generated considering SRES emission scenarios from a total of 7 models as well as prescribed temperature ones.

The results presented show that future river flow projections vary depending on the model used to generate the future climate scenario. However, the paper misses to show a clear concept of uncertainty and how it can be applied to the found results. Such a concept has been large explored under the idea of multi-model ensembles and its advantages over using one only model has been already proved. Some papers that explored the uncertainties of future river flow projections related to different future climate scenarios are Krahe et al. (2009, HYDROLOGIE UND WASSERBEWIRTSCHAFTUNG, vol 53(5), 316-331) by creating projections of River Rhine discharge from different climate projections applied to the HBV-SMHI hydrological model; Christensen and Lettenmaier (2007, HESS vol 11, 1417-1434) for the Colorado River; and Nohara et al (2006, Journal of Hydrometeorology, vol 7(5), 1076-1089) for 24 major rivers of the world. These papers should be cited in this one.

This paper, written in excellent English, is concise and well distributed. Some further explanation of the methods used are, however, necessary. They are specifically pointed in the next section.

Specific Comments:

In Section 3.1 Model calibration and validation (page 6104) the MOCOM-UA optimization algorithm is employed using three objective functions (page 6104 lines 19-21). Despite of these are very commonly used functions, it would be interesting to include in the text a short description of why they were chosen and what kind of flow elements/characteristics are being optimised by optimising the three chosen functions.

At the same Section, but on page 6105 (from line 2), a description is made of how the

MGB-IPH model is forced by gridded monthly meteorological data. Some important concepts are missing in this description related to how data was disaggregated from monthly to daily and the errors included in this step. More specifically, it is mentioned that disaggregation was applied to monthly data to generate daily data following Todd et al. (2010). Disaggregation is an important and sensitive procedure, specially for precipitation, so that the method chosen deserves to be further discussed, including the reasons why to use that specific method.

In lines 14-15, page 6105, it is stated that "daily values for the variables used to calculate evapotranspiration were considered to be identical to the mean monthly values." From this phrase, I could conclude that a constant evapotranspiration value is used for each month. If this is actually the case, a serious error is included in the model as evapotranspiration is highly variable. Same is true for solar radiation and relative humidity. As this paper is aimed to uncertainty issues, it is important to discuss uncertainties related to every step of it. Clarification is necessary on how daily evapotranspiration, solar radiation and relative humidity are estimated from the CRU monthly data and what are the implications of such estimations to the hydrological model results.

Section 4- Climate projections

The text states that "Baseline (1961-1990) CRU data were modified so that any trend relating to increasing global mean temperature was removed.". A better description of how the detrend was made is desirable. Some important questions to be clarified are: which variables were detrended? How was the trend determined? How could it be concluded that the trend is actually related to increase in mean global temperature?

Some points relate to the prescribed temperature increase scenarios deserve some clarification. In line 6, page 6106, it is mentioned "(2) prescribed increases in global mean temperature of 1, 2, 3, 4, 5, and 6 C using the UKMO HadCM3 GCM as well as (3) A1b emission scenario and prescribed warming of 2 C ("dangerous" climate change) using six additional GCMs from the World Climate Research Programme

(WCRP)". In Table 1 Obs one can find "+1 to 6 oC over baseline" and "+1 to 6 oC over baseline". What is unclear to me is which baseline this increase in temperature is applied to. Up to this point of the text, the word baseline has been used to refer to the CRU data and I would not think that it is the case for Table 1. Commonly, prescribed temperature increases are applied to the model control run (often 1961-1990). Can it be the case here? If yes, change baseline from Table 1 to control run and stated its period, otherwise, please clarify what has been used as baseline for the generation of the prescribed temperature increase scenarios.

Along the text, it is used the concept of 95% duration flow (Q95) for low flow and 5% duration flow for high flow (Q5). Such definitions are related to the percentile concept. In tables 2 to 5 it is also used the term average river flow that in page 6108 is represented as Q50. At that point I got in doubt if what is referred to as "average flow" is not in fact the "median flow", that is also related to a percentile concept, differently from "average flow" that is related to the "mean"flow. Please, make this clear in the text.

Technical Corrections:

The first paragraph 1 in page 6104 is a repetition of what is explained in the previous text and so, it can be deleted. Line 8 page 6104: change "station meteorological records" to "records from meteorological stations" Page 6108 line 14: bad location for reference to figure 9. Suggestion: move (Fig. 9) to the end of line 15. Figures 3, 5, 7 and 9 are very small and difficult to see. They can be made somewhat larger. Same for Figure 4 where it is not possible to distinguish the curves related to different models, except if the figure is enlarged.

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