

Interactive comment on “A multimodel ensemble approach to assessment of climate change impacts on the hydrology and water resources of the Colorado River basin” by N. Christensen and D. P. Lettenmaier

Anonymous Referee #2

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General comments:

Climate change impacts on water resources and hydropower are certainly very actual issues in scientific and applied hydrology. This study addresses these issues for the macroscale Colorado River basin by mean of an ensemble of GCM data, which are adopted to run the macroscale hydrological model VIC. VIC results are combined with a tailor-made reservoir model of the Colorado River basin. Uncertainties are addressed by adopting 11 different GCMs and 2 different emission scenarios (A2 and B1). Climate

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change impacts on macroscale rivers have also large socio-economics impacts. Studies on such systems are therefore needed in order to provide scenarios and guidelines for adequate water resources management strategies in the coming decades. This study provides a sound example on how science can contribute to all these issues. For this reasons I can recommend this paper for publication in HESS.

A major challenge of such a study is to answer the question on the temperature / precipitation / streamflow equilibrium in the future. The authors conclude that the slight (if any) precipitation increase is small with respect to the increased demand in evapo-transpiration, which finally causes a general reduction of streamflow and storage in the reservoirs.

There is less to comment on the excellent scientific quality of the presented work. This work relies on previous work, which is acknowledged in the text. This would let some place for shortening the sections “Introduction” and “Approach”.

Specific comments:

Page 2: The abstract is way too detailed. I estimate it is >> 400 words. I guess it is possible to shorten it to about 250-300 words.

Page 3: The study is strongly focused on the CRB (Page 4 “Climate Change is a major concern in the CRB Ę.”). Few days after the publication of the youngest IPCC report it is more than clear that climate changes are a global matter. What I therefore truly miss is an open discussion of the outcomes with respect to climate change impacts on other macroscale rivers in North America (done in the introduction), South America, Africa, Asia or Europe.

The introduction is an adaptation of Christiansen et al. 2004. The paper begins with a detailed description of the basin, which is unusual to me. For the review on the CRB you can shorten and refer to Christiansen et al. 2004. I would then welcome that the authors insert a review on climate change impacts for macroscale rivers and on the

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use of GCM ensembles.

Page 9: Figure 3 of the “forerunner” paper Christiansen et al. 2004 shows VIC simulated and naturalized historic observed streamflows by adopting scenarios from one GCM (PCM). In this study 10 additional GCM are adopted but nothing is shown to demonstrate the scatter in skill of all downscaled GCM as forcing for simulating the “historical” behavior of CRB.

VIC calibration: was VIC calibrated for each GCM forcing or only for PCM and the same set of parameters was then used for all other forcings? Or was calibration done by using gridded observations? I can surely find the answer in one of the previous VIC studies, but a line on that would be very useful.

Page 15 The Section “Snowpack Changes” is consistent with many previous studies and fully agrees with the general perception of climate change impacts in mountainous basins. The data are nice but not further used in the paper. I see potential of reducing the length of the paper by dropping section 3.3. Some information on snow cover changes can be still taken from the Tables in the Appendix.

Technical comments

Page 3, Line 11 Units for precipitation for CRB are given here in cm. In the tables you use then millimeters. Use everywhere millimeters.

Page 11 Here I got “Lost in Abbreviations”, but I guess that MWD (line 10) is not defined. Please try to reduce the amount of abbreviations.

Figures 9 and 10 The mixing of units on the y-axis is not very helpful for the reader.

Redundant numbers: Some of the numbers of the result section are presented three times: - In figure 4 - In the text - In the Appendix The enumeration of the quartiles fills the text with many numbers. Please consider removing the quartiles from the main text and introducing them in Tables A1 and A2

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Table A1 Units are missing.

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