

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 #1

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General comments:

This paper addresses the impact of a projected global warming on the hydrology of the Colorado River basin (U.S.). The analysis is based on the two scenarios B1 (local sustainability) and A2 (rapid economic growth) of the IPCC SRES emission suite, conducted by an ensemble of eleven GCMs. Via a twofold downscaling procedure, each scenario is transformed into Colorado river flow from which the corresponding reservoir system performance is determined. It turns out that as a mean effect a considerable

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reduction of streamflow and reservoir performance is projected under both scenarios.

It is probably true that the study is, as the authors maintain, "the most comprehensive to date of the implications of climate change on the Colorado river reservoir system". Because of this, and because of its direct societal importance, the study certainly deserves publication.

The antagonistic drivers temperature and precipitation could have been explored more deeply. This applies in particular to the latter, and especially so to the performance/uncertainty of the GCMs and the downscaling. In several cases only ensemble means are reported, without confidence estimates, which is somewhat problematic for an ensemble of 11 and with such non-normal and uncertain quantities. At the end of the study, hence, I was not fully convinced that no residual chance remains of an increased precipitation offsetting the temperature signal after all.

The writing is clear and precise, but sometimes overloaded with detail. For example, what is graphically clear from a Figure is often repeated in the text by reporting numbers. This is cumbersome and redundant, and should be replaced by qualitative statements. Moreover, there is an overdose of abbreviation which hinders easy reading for the non-specialist.

Hence, there is room for streamlining and shortening parts of the study. This applies also to the logical structure: As I understand, the study is built upon Christensen et al. (2004) who basically do the same with a single GCM and a slightly different emission scenario. So naturally there is some redundancy with this earlier study. Therefore, describing the main points of that study first and then addressing which of them remain true and which are modified by this new study should improve the logic of the manuscript, and should better reveal the added value of using ensembles.

Specific comments:

1. The Abstract is much too long. Any detail should be removed.

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2. From the introduction it seems that precipitation is the main unknown in the scenarios. But only one study is reported to produce a streamflow *increase* driven by enhanced precipitation. One may wish to know here a little more about the potential of precipitation offsetting the evaporative loss.
3. The downscaling procedure should at least be sketched, in particular its ability to reproduce observed hydrologic climatologies.
4. Often ensemble means are compared. Here I missed some comments on the corresponding significance, and whether using the mean is appropriate (for precipitation, streamflow).
5. On p11, l27, one wonders about a reported "0 percent accumulated error". Is this by chance?
6. No quartiles are reported in sections 3.5.2 - 3.5.4

Technical corrections:

Please avoid abbreviations as much as possible (e.g., "MSCP" is used only once).

p3, l5: Declare "BCM".

p6, l28: "Monthly aggregates..." unclear.

p7, l1: A comma is missing.

p9, l14: What is "naturalized observed...".

p10, l14: Explain "run-of-the-river reservoirs".

p12, l13: What are the dashes in Fig. 3?

l24: I don't see the 1st and 3rd quartiles in Fig. 4.

p13, l8: repl. "to the fact".

l10-17: Are the reported changes significant?

I17: Here and later you probably mean "respectively", no?

I16: What is the "base run"?

p14, I4: "is in fact driven" is a confusing phrase.

I7-13: This logic is beyond my grasp, but that may be my fault.

I13: Put "It should be noted ..." at the beginning of the paragraph.

p15, I9: Why ensemble means, and not this study's PCM?

I22: How are the levels in Fig. 7 calculated?

p16, I18: Can you provide a reference (or data) for the "abnormally high flow years"?

p17, I7-11: This paragraph is somewhat misplaced (should be earlier).

I8: Define "ACPI" in Fig. 8?

p19, I5: I have not been able to fully understand Figure 9. For example, what is the unit of the y-axis?

I28: "0.73MCM/yr"?

p20, I21: Define "MAF".

p22, I15: repl. "reverse it".

I15: Does the shift reverse it in *no* ensemble member?

p22, I17-22: That has just been said before.

p23, I4: What is "are about double"?

I18: "long term sustained droughts" should be placed in a climate change context.

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