

Hydrol. Earth Syst. Sci. Discuss., 3, S1978–S1982, 2007

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HESSD

3, S1978–S1982, 2007

Interactive
Comment

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

N. Christensen and D. P. Lettenmaier

Received and published: 26 April 2007

Response to reviewer comments to hess-3-3727_p

Anonymous Referee #1

General Comments:

Writing is overloaded with detail. Numbers in figures also appear in text. Too many acronyms.

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Response: We have gone through the paper and eliminated repetitions in the figures. We have also reduced the number of acronyms used.

Specific Comments:

1. Abstract is too long

Response: This is also a comment of the other reviewer; we have condensed the abstract.

2. “is there a potential for precipitation to offset evaporative loss”

Response: Given that annual precipitation remains essentially unchanged in the multi-model mean, the short answer is “no”. However, as we explain in Section 4 (conclusions), the actual situation is a little more complicated, since as we analyze in Section 3.4, winter precipitation is more efficient in generating runoff (and hence contributes less to ET) than does summer precipitation. We have altered (and we hope, clarified) our discussion of this point slightly in Section 4.

3. The downscaling procedure should at least be sketched, in particular its ability to reproduce observer hydrologic climatologies.

Response: The downscaling procedure is well documented in previously published work, and in general we believe that the condensed description we include is appropriate. However, we have changed the description slightly, and we have included an explicit statement as to the ability of the method to reproduce observed climatologies.

4. Ensemble means are often compared. Need comments on the corresponding significance, and whether using the mean is appropriate

Response: We have included a brief discussion of this point. We note that the Appendix tables include reasonably complete information as to the variability in responses across the models, and the mean is the most obvious summary statistic.

5. p. 11, l 27 reports a “0% accumulated error”. Is this by chance?

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Response: This simply refers to the fact that Figure 4a in Christensen et al (2004) shows that simulated storage (note that this should not have said “storage capacity”, and we have fixed this) at the beginning and end of the 20-year test period are essentially identical. We have reworded this statement slightly.

6. No quartiles are reported in sections 3.5.2 - 3.5.4.

Response: Quartiles have been added in these sections.

Technical Corrections:

All technical corrections have been incorporated into the manuscript with one exception. The comment of “provide a reference for ‘abnormally high flow years’” was not incorporated because historical streamflows are plotted in Figure 2 in which it is apparent that the years mentioned as “abnormally high” are in fact extreme relative to the observed record.

Anonymous Reviewer #2

General Comments:

1. The introduction and approach can be shortened.

Response: Reviewer #1 suggested that the approach section be lengthened so the author feels it would be inappropriate to reduce text here. However, the abstract has been significantly condensed along with a slight reduction of text in the introduction.

Specific Comments:

1. The abstract is too detailed.

Response: The abstract has been shortened.

2. Reviewer would like to see an open discussion of the global implications of climate change.

Response: A short amount of text has been added on global climate change. This

added text includes a reference to Milly et. al., 2005 which is a global study using a similar group of GCMs and emission scenarios.

3. More of the “Introduction” section can be referenced to Christensen et al. 2004.

Response: The length of the “Introduction” section has been reduced.

4. The Christensen et al. 2004 paper shows a validation plot of historic versus simulated streamflow. This paper should show these GCMs ability to simulate the historical behavior of the Colorado River basin.

Response: The downscaling and bias correction scheme utilized forces the climatologies of the historical GCM simulations to match the climatologies of the base historical simulation. However, it is true that the magnitude of this adjustment varies across the models. There are reasonable arguments for screening models (GCMs) on the basis of their historic simulations. However, the devil is in the details. Milly et al (2005), in their global analysis, screened GCMs on the basis of consistency in simulated trends for 1900-70 vs 1971-98 - which is not the same as the models’ ability to reproduce observed flows. Brekke and others, in a California study that used methods similar to ours, attempted to apply various criteria of GCM fidelity with observations, and found that the models’ performance with respect to the various criteria varied so much as to make censoring of the models problematic. For these reasons, we prefer not to attempt to censor the models, and instead to rely on the range of conditions represented to provide a reasonable basis for assessing changes across the basin, and over the 100-year future that we analyze.

5. Was VIC calibrated for each GCM or only for the PCM.

Response: Lines 10 - 20 on page 9 address VIC calibration. An additional sentence has been added to clarify the reviewer’s confusion.

6. The section on “snowpack changes” is not needed.

Response: The authors feel it is best to retain this section for two reasons; 1) because

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the Colorado River is heavily snowmelt dominated, and 2) because snowpack changes are one of the most identifiable and quantifiable implications of climate change.

Technical Corrections:

All technical corrections have been incorporated into the manuscript with one exception. The reviewer suggests removing the quartiles from the text and adding them in the appendix. The author feels the quartiles add important information that should be reported directly in the text. Adding quartiles in the appendix will also lengthen the manuscript by 24 lines.

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