

Interactive comment on “Climate change and sectors of the surface water cycle in CMIP5 projections” by P. A. Dirmeyer et al.

Anonymous Referee #2

Received and published: 14 August 2014

General comments

This is a clearly presented, straightforward analysis of future water resource availability and extremes as simulated by the mean behavior of ten CMIP5 models. Some of the details of the analysis require further explanation, but in general, this is an interesting assessment of the likelihood of future changes in extremes of precipitation, soil moisture, and river discharge for two future scenarios (RCP4.5 and RCP8.5). I believe this manuscript should be ready for publication with only minor changes. I also think it is great that it grew out of a class project: those are some lucky students!!!

Specific comments

1. Section 2

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a. Page 4, Line 15: “Only multi-model statistics are shown”. I do not believe you ever discuss how the different native grids of the ten models are dealt with in generating the multi-model statistics.

b. 90 years from both the historical case and the future scenarios are likely to have a large amount of change within these time frames. For the historical, are the 90 years 1921–2010? Do you find a disproportionate percentage of the extremes are from the more recent part of that 90 year period? Are the 90 years in the future already underway: 2010–2100? Wouldn't control runs reflecting fixed time periods produce more reliable statistics than these time-varying runs? I know there is a practical problem here with the availability of model data fitting that requirement, but I wonder how different your results would be if you used only the last 50 years of these runs. ... Would they show larger impacts?

2. Section 3:

a. Page 5, Line 16 wording is inaccurate: “exceeded in at least 50% ... of the years” would mean 45 years. I believe you mean the threshold is exceeded in 50% more years than in the control time period.

b. Page 5, Line 20–21: I cannot see any overlapping color scales in Figure 1. Could you make this clearer in the figure?

c. Page 6, Line 20–21: “consequences would likely depend on the location and crops grown.” And also on the nature of the wet extremes: are they a result of many more light rains or a few more intense rains? You discuss this in the next paragraph, but it is relevant here, as well.

3. Section 4:

a. Page 7, Line 24: “the high-resolution grid used for multi-model results.” I do not believe you discuss this grid. (Also mentioned in comment 1a.)

b. Section 4.2 is written in a misleading way. You mention at the beginning that you are

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discussing “the projected changes in soil moisture in areas where crops are grown,” but language like “yams and cassava also show a strong trend toward increased variability” give the reader the impression that the crops themselves are being modelled. You discuss this in the Caveats section, but I do think the language in this section has to more carefully reflect this important difference.

c. Discussion of Figure 10: Page 13, Line 2-3: This line makes it sound like there are lots of basins with increased variability and decreased mean runoff, but I can only see the Amazon in this category in Figure 10, and Figure 11 confirms this.

4. Figure 4: This is a neat figure, though its appearance is influenced by the order that the colors are laid down. There seems to be blue buried under the yellows and browns, particularly in the top plot. I don’t have a better solution yet. . . .

5. Figure 6: Are all subplots necessary? The crop coverage one is useful, but I’m not sure about the others. . . .

6. Figure 7-9: It would make more sense to me to have the y-axes constant for all the crops across these three figures. Then we would have a sense of the differential soil moisture changes for these different crop cover types. I recognize that the range of changes is large, so some barcharts would look very small with a larger y-maximum, but isn’t that the point that you want to make? It could help emphasize that while wheat, oats, sweet potatoes, potatoes, maize and winter rye all have large vulnerable areas in the RCP8.5 scenario, only sweet potatoes is broadly impacted in the RCP4.5 scenario, though the changes in IASD of soil moisture are substantial for large regions where all six of these crops are grown. This might be hard to implement, but it would facilitate easier interpretation of these charts.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 8537, 2014.