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Hydrology and Earth System Sciences Discussions

Interactive comment on "Future humidity trends over the western United States in the CMIP5 global climate models and variable infiltration capacity hydrological modeling system" *by* D. W. Pierce et al.

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Dear Reviewer 3,

We would like to thank you for taking time to provide constructive and helpful comments on the manuscript. We will endeavor to incorporate them into the final version. We did want to offer thoughts on what we believe are some of your main points, which are given below.

1) Possibly your main point is "does this really matter?" I realize that the reviewer probably understands this, but in order to be clear to any future readers of this archived discussion, please let us note that the relative humidity trend error is -2 to -8 percentage *points* over the century, not -2 to -8%. Since summer RH in the arid interior western U.S. is typically in the 30-55% range (e.g., Gaffen and Ross 1999, J. Climate v. 12 p. 811, or from the NCDC climate maps of the U.S., available at http://hurricane.ncdc.noaa.gov/cgi-bin/climaps/climaps.pl), this represents an error of roughly 4 to 16% in the end-of-century RH values.

There are reasons to think that errors of this magnitude matter. For instance, the fire model in Westerling et al. 2011 (Proc. Nat. Acad. Sci. v. 108 p. 13165-70) finds that the distribution of fire sizes is sensitive to moisture deficit, which is directly affected by relative humidity. The distribution of fire sizes is highly non-gaussian, with a heavy tail of large events that have a tremendous impact on the western landscape, so a possible change in fire size could be significant for understanding future climate impacts in this region. In addition to fire size, Westerling et al. 2011 also model large (>200 ha) fire occurrence as a nonlinear function of moisture deficit. Over their model estimation period (1972-1999), a systematic 5% decrease in relative humidity from within the range of relative humidity values where fire is more likely to occur increases the average probability of a large fire occurring by 13% to 60%, with the larger percentage increases corresponding to higher initial relative humidity values (i.e. lower initial probabilities of fire).

As to whether a 4% error in Colorado River flow is enough to worry about, it is worth noting that the Southern Nevada Water Authority (SNWA) has begun a 0.8 billion dollar project to maintain their unimpeded access to 0.3 maf/year of Colorado River water (e.g., http://www.tunnelingonline.com/building-lake-meads-third-straw/). This represents about 2% of the historical Colorado River flow at Lees Ferry. Obviously water issues are highly complex and location dependent and one does not want to oversimplify, but given that a public utility is willing to spend nearly a billion dollars to safeguard

an amount of Colorado River water that is half the error we describe in this paper, we feel that an error this size in Colorado River flow is potentially something to be concerned with.

2) Regarding pointing out that VIC uses MT-CLIM earlier in the paper, thank you for the suggestion, we will do that.

3) As to whether dry coastal stations matter, we have stakeholders who are concerned with correctly modeling relative humidity in the Southern California coastal region (where most of the population is concentrated), mostly for purposes of human comfort (heat index), health, and air conditioning use. So for some applications this is an important issue, although of course not for all applications.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 13651, 2012.