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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.

**Anonymous Referee #3**

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Review of Pierce et al.

This is a nicely written and well-thought-out paper. Great idea to do this analysis and point out what could be a pretty serious problem with hydrologic simulations of the future.

Most of my remarks concern possible ways to improve the presentation, but I do have two science issues to raise. Perhaps the problem at dry coastal stations doesn't matter

much in the end because the basins there are small and relatively inconsequential from a water supply perspective? The paper doesn't seem to include any stations in the big snow-producing mountain ranges of the coastal states, so it's hard to gauge what the effects might be. The biases in Fig 6 (middle) seem to be somewhat inconsistent as to sign for stations west and east of the Sierras, and the mountain station KMHS near Mt Shasta seems to have opposite biases from many of the lower-elevation stations. The second is - does this really matter? the errors in relative humidity are rather small, and although Fig 13 shows that the runoff changes when Tdew changes by 0.75°C, most of the percentage changes are in very dry places. Have any of the changes computed in any figure been subjected to a statistical significance test? The "up to 4%" flow change in the routed flows for the Colorado seems about right. Is this error enough to worry about?

this isn't a big deal, but it might be worth pointing out a little earlier (maybe even in the abstract, if it can be done succinctly) that VIC uses the MT CLIM algorithms - the "VMS" is introduced on the 4th page. this would share the blame a little more fairly :) Also some of the figures use VIC when VMS appears to be intended

13653 line 25 "well regarded" and "good job" - slightly subjective statements. any way to quantify these? VIC has been used in at least N papers, and in an evaluation against M other hydrology models based on error metrics on X river basins it ranked highest?

13654 line 1 - spell out ENSO and PDO, or just say "patterns of climate variability" since it's not that important for the point being made.

13655 line 18-10 this is the crux of the problem - deserves mention in the abstract (I know, I'm suggesting adding more things into the length-constrained abstract)

p 13660 - it would be useful to evaluate, for maybe 2 representative and complete stations, how ignorable the problem with data gaps really is. that is, pick a station with complete records and randomly omit 10% of the days, and see whether it affects the results



HESSD

9, C6992–C6995, 2013





p 13664 line 20 and p13665 line 28 - trends of -2 to -8% in RH over the century (and errors of 1-3%) don't seem very important...

line 25 - would be easy to check the precipitation field rather than speculating

p13365 line 16 'sense' -> 'sign' ? p13665 line 21 for parallelism, 'in autumn in the Pacific Northwest' p13669 line 18 - if I'm reading the map correctly, the big patch of large decreases in eastern Washington is far from 'high elevations ... Cascade mountain range' - it's in the Columbia plateau, where average annual precipitation is around 40cm, not in the mountains. For most of the Sierras and Cascades it appears to be in the 2-4% range.

p13670 - this section reads like a summary. Nothing wrong with that, but it doesn't warrant the title 'conclusions'.

Fig 1 - because the dots saturate the field, it's a little hard to tell what the relationships really are especially in the bottom row for values <0.04 - I suggest overlaying some kind of density measure (# dots per .005x.01 rectangle or something like that) as white contours

Fig 6 - The panels don't seem to be additive: take KMHS and KACV, for example. The biases in the two halves of the year are both negative, but the annual mean is positive. Is this because the ranking of the halves is done separately from the ranking of the water year mean? This figure is a little tough to distill visually in part because the color scale is so unusual - I suggest going to a clean blue-white-red and omitting the pink and orange - and because there is no clear pattern - in any climate zone (S. Calif coast, Utah e.g.) the biases span the range.

Figure 7 and 8- color scales - please follow the standard convention that brown or red is drier and green or blue is wetter, and use consistently from figure to figure.

Figs 8 and 9 are a good pair.



HESSD

9, C6992–C6995, 2013





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9, C6992–C6995, 2013

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