

***Interactive comment on* “Evaluation of drought indices at interannual to climate change timescales: a case study over the Amazon and Mississippi river basins” by E. Joetzjer et al.**

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I found this paper interesting and a useful contribution to the ongoing discussion of drought indices and their application. I have the following comments:

1. It would be useful to cross-reference the following paper, which is also in HESSD, and is relevant to this paper: Contributions to uncertainty in projections of future drought under climate change scenarios

I. H. Taylor, E. Burke, L. McColl, P. Falloon, G. R. Harris, and D. McNeall Hydrol. Earth Syst. Sci. Discuss., 9, 12613–12653, 2012

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2. The paper above did not apply bias correction to the climate data - it might also be useful to consider the findings of this excellent review on bias correction for hydrological applications: HESS Opinions "Should we apply bias correction to global and regional climate model data?"

U. Ehret, E. Zehe, V. Wulfmeyer, K. Warrach-Sagi, and J. Liebert Hydrol. Earth Syst. Sci. Discuss., 9, 5355-5387, 2012

3. Note that there are no flow gauges actually AT river mouths, and they can be a considerable distance away (P13235 line 5)

4. A table describing the drought indices used would be useful.

5. Falloon et al. 2011 showed that GCM-driven annual river flows were moderately skillful for some basins, while in general skill was poorer for monthly flows. How does this affect your results, regarding the comparison of observationally forced or GCM forced river flows?

Falloon, P, Betts R, Wiltshire A, Dankers R, Mathison C, McNeall D, Bates P, Trigg M (2011). Validation of river flows in HadGEM1 and HadCM3 with the TRIP river flow model. Journal of Hydrometeorology, 12, 1157-1180. doi: 10.1175/2011JHM1388.1

6. It was unclear to me which driving data were used in the plots throughout- please can you make this clearer (raw GCM or observationally driven).

7. P13237 line 10: re. precipitation driving the difference in skill: is there any evidence for that? It might be useful to show a comparison of GCM vs observed precipitation (and snow?) as an appendix?

8. P13238 last 2 lines: discussion of Amazon findings: does CNRM include a dynamic/interactive vegetation scheme? Falloon et al. 2012 note that this could lead to additional feedbacks via evaporation changes (from the vegetation changes), and also note the role of carbon dioxide fertilisation on stomatal conductance (and hence on ET/runoff).

Falloon, P. D., Dankers, R., Betts, R. A., Jones, C. D., Booth, B. B. B., and Lambert, F. H.: Role of vegetation change in future climate under the A1B scenario and a climate stabilisation scenario, using the HadCM3C earth system model, *Biogeosciences* 9, 4739–4756, doi:10.5194/bg-9-4739-2012

9. Discussion and conclusions: only one climate model has been applied here, with a relatively small ensemble - the implications of using a wider set of models, or larger ensembles (e.g the Taylor et al. 2012 paper noted above), to better capture uncertainties, would be beneficial here.

10. P 13239 line 0-15, discussion on ET: but these ET calculations also lack consistency with what would be produced by the climate model itself - please can you mention this?

11. Last paragraph on p 13240 (lines 20-21) on the use of LSMs - the following references might also be useful, on assessments of skill, cross model comparison, bias correction, and the role of CO2 on runoff:

Falloon, P, Betts R, Wiltshire A, Dankers R, Mathison C, McNeill D, Bates P, Trigg M (2011). Validation of river flows in HadGEM1 and HadCM3 with the TRIP river flow model. *Journal of Hydrometeorology*, 12, 1157–1180. doi: 10.1175/2011JHM1388.1

Haddeland, I., and Coauthors, 2011: Multimodel estimate of the global terrestrial water balance: Setup and first results. *J. Hydrometeor.*, 12, 869–884.

U. Ehret, E. Zehe, V. Wulfmeyer, K. Warrach-Sagi, and J. Liebert *Hydrol. Earth Syst. Sci. Discuss.*, 9, 5355–5387, 2012

Hagemann, Stefan, Cui Chen, Jan O. Haerter, Jens Heinke, Dieter Gerten, Claudio Piani, 2011: Impact of a Statistical Bias Correction on the Projected Hydrological Changes Obtained from Three GCMs and Two Hydrology Models. *J. Hydrometeor.*, 12, 556–578.

Betts RA, Boucher O, Collins M, Cox PM, Falloon P, Gedney N, Hemming DL, Hunt-

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ingford C, Jones CD, Sexton D & Webb M. (2007). Projected increase in continental runoff due to plant responses to increasing carbon dioxide, Nature 448, 1037-1041 (30 August 2007) | doi:10.1038/nature06045.

12. Linked to points 7 and 8: GCM variation in P and ET in general over river basins needs to be better discussed.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 13231, 2012.

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9, C5922–C5925, 2012

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