

## ***Interactive comment on “Flood and drought hydrologic monitoring: the role of model parameter uncertainty” by N. W. Chaney et al.***

**M. Zappa (Referee)**

massimiliano.zappa@wsl.ch

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General remarks:

The authors setup a quite impressive experiment for global scale simulation of hydrological extremes. The paper is nice, the approach is sound and the results allow learning very much about uncertainty of model parameters. The use of the CDF-distance is interesting. A figure on the concepts would be useful to present it. I do not catch why the authors used the whole 1948-2010 period to select their parameter ensemble and do not include any validation of their ensemble estimations of discharge. I argue that if they would have split their period into two or three slices, they could have isolated an even more narrow parameter ensemble.

C903

Issues to be addressed (Page(s) – Line(s)):

1700 – 12-14: Please provide some references here.

1701 – 15-20: I understand that the Sheffield et al. (2006) is a well cited source for having a description of the meteorological forcing. I wonder if it anyway possible to elaborate here on the impacts of using TRMM (available since 2002) on the homogeneity and accuracy of precipitation estimates. It can be here or in the discussion.

1704 – 5-14: I think I understand how you manage the parameter ensemble, but help me if I'm wrong:

- You sample your parameter space from table 1 10'000 times (this is well declared)
- You apply each set to all 1° grid cells of your domain. Eg. 10'000 simulations with no spatial distribution of the parameters (this is hinted at lines 1704:7-8, but I'm not sure this is what you mean there.)
- You evaluate separately for each cell the behavioural parameters (well declared)
- You make the analysis

Another question here: Why using the whole period 1948-2010 to discriminate the parameters and not dividing into let's say 20 to 30 years slices and have for instance a periods for training and evaluation?

1708 – 4-9: I think that when the number of “behavioral parameter sets” rapidly declines when introducing additional constraints, then many of the realization fulfilling the first constrains were right for the wrong reason. Nice way to show this here!

C904

1708 – 20-26: True statements. Does this in any way deviate from your expectations?

1709: Section 4.2.1 reads well, but I ask myself what can a non-VIC user learn from this model specific sensitivity analysis. Some general recommendations for readers willing to explore such approaches would be welcome.

1711: Again, here you elaborate on parameters and hydrological extremes in a very VIC-focussed perspective. Does this somewhat deviate from the perceptual model implemented in the VIC algorithms? Do you learn something here that you could later implement to reduce uncertainty? In this respect: Currently a paper by Pechlivanidis and Arheimer (2015, HESSD) is being also discussed for publication in HESS. They also look at large scale hydrological modelling and try to implement the PUB recommendations. Could your approach also being adapted to implement the PUB recommendations?

1714-1715: How long do you think the FAO Map would be still the state of the art?

Artwork: I know that it is difficult to create adequate visualization of global data, but my eyes are really struggling when inspecting Figure 1,3 and 5. I would welcome a supplement with high-resolution versions of these Figures.

Minor comments:

1703 – 1-9: Concerning the Köppen-Geiger climate you might find some ideas in Teuling (2011). Just something that came to my mind reading the paragraph, no need to implement anything to reply here.

C905

1705: I find the described approach quite interesting. I wonder if I am the only person that would welcome here a graphic rendering of the steps involved here (flowchart with boxes, arrows and references).

1707 – 22-23: “However, the most prominent feature is the lack of runoff observations (grey areas)”. Well, this finding could have been made also a priori and so further reduce the number of grid cells to be computed (or increase resolution to 0.5 degrees).

1708- 1-9: You describe Figure 2 (top panel) as follows: “Tropical and dry climates see the largest decrease in behavioral parameter sets while continental, polar, and temperate regions experience the least.” I understand what you mean, but I find the formulation could be improved. When the number of “behavioral parameter sets” decreases, than what is the maximum number of “behavioral parameter sets”? I think here you should use a more straight formulation and just say: “According to the evaluated criteria Tropical and dry climates see smallest portion of behavioral parameter sets while continental, polar, and temperate regions experience the highest number.” Please also consider to switch the two sentences “In this case, the number of acceptable parameter sets over arid regions is significantly smaller than other climates.” and “This is especially true over the North American mountain west, the Sahel, and most of Australia.”

Final considerations:

This is sound, well written manuscript. Very compact and with the right balance of pictures and tables. I experienced all along the manuscript that the authors assume that all readers are perfectly familiar with VIC. I can recommend publication after minor revisions.

C906

Best regards

Massimiliano Zappa, WSL  
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References:

Teuling, A. J.: Technical note: Towards a continuous classification of climate using bivariate colour mapping, *Hydrol. Earth Syst. Sci.*, 15, 3071-3075, doi:10.5194/hess-15-3071-2011, 2011.

Pechlivanidis, I. G. and Arheimer, B.: Large-scale hydrological modelling by using modified PUB recommendations: the India-HYPE case, *Hydrol. Earth Syst. Sci. Discuss.*, 12, 2885-2944, doi:10.5194/hessd-12-2885-2015, 2015.

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Interactive comment on *Hydrol. Earth Syst. Sci. Discuss.*, 12, 1697, 2015.