

Interactive comment on “On the sources of global land surface hydrologic predictability” by S. Shukla et al.

S. Shukla et al.

shrad@geog.ucsb.edu

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This paper is direct and to the point, quantifying the relative impact of initial states to meteorological forecast quality in contributing to skill/errors in simulations with the VIC model, examined globally. I suggest only minor revisions.

General comments:

1. The Reverse-ESP method, when used in conjunction with ESP, is very instructive for helping to separate out the IHC versus FS impacts. Presumably, the Reverse-ESP will converge to the "control" run, given enough time. It would be helpful to say something about the typical timescale for convergence (space and seasonal structure)

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for the different hydrologic variables validated here. Presumably that has a lot (maybe everything) to do with the patterns found. Furthermore, is there a means to infer the corresponding time scales in nature, at least for some locations?

Response: Indeed! However that typical time scale varies a lot globally and seasonally. That is why we see the variability of the relative contributions of the IHCs in the hydrologic predictability globally. We have added a sentence to that affect. The reviewer makes an interesting point about the timescale for convergence. The time scale at which reverse ESP would converge to the control run should depend on soil moisture memory (water holding capacity), snow accumulation and melt rate and equally importantly at the precipitation variability during the target forecast period. Nevertheless we think that estimating that time scale for a region is beyond the scope of this study.

2. This is a "perfect model experiment" by design - "validation" of the test cases is against output of the same model with a different combination of past/future forcings from the test cases. Thus, the term "skill" should be carefully and specifically defined early in the paper for this context (not the conventional definition of model forecast skill, which is validation against actual measurements), or the term should be replaced with something more appropriate, like "predictability".

Response: Agreed! We have now defined what we mean by "skill" earlier in section 2 and use the phrase hydrologic predictability in the place of hydrologic forecast skill.

Specific comments:

1. Abstract: It seems the "control run" is never named as such again in the paper - either change the term here or in the first paragraph of Sec 2.

Response: It's been changed!

2. P1991, L10-23: This really well justifies the ESP approach for this study.

Response: Thank you.

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3. Sec 2.2.2: Please give some more description of VIC: does it have transpiration, vegetation effects, etc.?

Response: Although we have cited those studies that describe the VIC model in details in that section, we now briefly describe VIC's vegetation scheme.

4. Sec 3.1: Please define to what (effective) soil depth kappa is applied. This can have a big impact on the values calculated.

Response: Good suggestion. We have now added a sentence defining how the soil depth varies in the VIC model parameters that we used for this analysis. The Kappa parameter is based on the total soil moisture (sum of moisture in all soil layers)

5. Fig 1 vs other Figs: It would be instructive to give the values of the global pattern correlations between corresponding panels, as the authors infer a connection between the two. This should be made quantitative.

Response: Great idea. We now show pattern correlation between Kappa parameters and the RMSE ratio for the predictability of soil moisture and CR.

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