

Interactive comment on “Analysing the temporal dynamics of model performance for hydrological models” by D. E. Reusser et al.

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Reusser et al. have submitted a very interesting paper that assesses the temporal dynamics of model skill. Of all the papers that I have read recently on the topic of model evaluation, Reusser’s paper offers a novel methodology that can be used to identify model weaknesses. Many of the model problems that Reusser et al. identify would not be evident by simply looking at summary skill metrics.

Specific Comments:

1. I would personally find the paper easier to read if the definition of the clusters in Figure 8 was presented before the analysis of skill metrics in Figure 7. Also, before

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introducing Figure 7, it would be helpful to include a table that describes the types of error associated with each cluster (essentially the reverse of Table 5).

2. Also for clarity, I suggest extracting the SOM assignment figure from the top left of Figure 5, and the cluster assignment figure from the bottom right of Figure 5, and presenting these plots as separate figures.

5. A relevant paper (from a different field) that should be cited is [Abramowitz et al. (2008), Evaluating the Performance of Land Surface Models, *Journal of Climate*, 21, 5468-5481]. This paper used SOMs to evaluate the temporal dynamics of errors in land surface models.

6. The philosophy that underlies Reusser's paper is consistent with the theory of diagnostic signatures recently introduced by Gupta et al. [Gupta, H.V., T. Wagener, and Y. Lui (2008) Reconciling theory with observations: elements of a diagnostic approach to model evaluation. *Hydrological Processes*, doi: 10.1002/hyp6989]. It may be worthwhile to include some discussion of the Gupta et al. paper in the discussion section.

7. In the summary and discussion section I suggest listing the model weaknesses identified using this approach as a set of bullet points. This would help to highlight the capabilities of the method.

8. Also in the summary and discussion section, it would be nice to have more discussion on the implications for model design. For example, how exactly would you modify the structure of a hydrological model based on what you learned from the SOM-based model evaluation exercise?

Trivia:

1. A small point of clarification... although the Clark et al. (2008) method allows construction of hundreds of unique model structures, they only constructed 79 models for their study. The restriction to 79 models was done because of limited computing resources. Also, there is no limitation that model structures must be simple using the

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Clark et al. approach. Clark et al. identify the set of decisions the modeler makes when building a model, and provide multiple options for each modeling decision. The approach could be used for more complex models, and is certainly applicable for the WaSIM-ETH model used by Reusser et al.

2. When describing the time window, please also define the model time step and the time interval of the streamflow data, so that it is possible to identify the number of data points in each window.

3. A minor point, but on page 3186 (line 26), please point the reader to the appropriate plot in Figure 5; "For instance on the right hand side and centre of the SOM positive lag times can be found, [as evident in the TL performance metric]" Suggested new text is in square brackets.

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