Hydrology and Earth System Sciences Discussions

Interactive
Comment

Interactive comment on "Comparison of hydrological model structures based on recession and low flow simulations" *by* M. Staudinger et al.

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We herewith reply to the topical questions of D. Wang. We also appreciate all editorial comments, which are straightforward and will all be implemented into the revised manuscript.

1. Difference of "Storage of unlimited size combined with non-linear fraction rate" and "Storage of unlimited size combined with power recession": The options are described in more detail in Table 1 of Clark et al. (HP 2011), and an explanation will be added to the revised manuscript. We also noticed that there is a typo/mix-up in Table 1 of the current manuscript. Option "unlimfrc" should be linear and option "fixedsiz" should be non-linear. We will correct this and add proper references.

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2. Calibration and validation by the two objective functions is done on the entire series, but objective functions were chosen that emphasize the lower parts of the hydrograph. Of course, the overall performance will still be influenced by the peaks to some extent. We suggest to discuss this in more detail.

4. Assessing the performance of a model with respect to recession limbs of the hydrograph is not as common and straightforward as assessing a model with respect to the entire hydrograph. The polynomial fitted to the observed recessions is used as a benchmark model similar to the mean streamflow being used as a benchmark model for the NSE. Hence, passing the KS test, similar to a NSE above zero, is used in the first place as an objective decision for acceptable models (similar or better than the benchmark). In general, the choice of objective functions is always subjective or based on focus. The choice of a polynomial follows Kirchner (2009). It is used because it is both flexible enough to follow the data and smooth enough to allow modest extrapolation beyond the binned relationships. We will clarify the idea as well as discuss the implications of this choice.

5. In the paper, the data points used are subsurface flow + surface runoff, routed as channel discharge as described in the model setup. Regarding the surface runoff, we are aware that the upper ranges could be affected when there is overland flow. We will mention in the revised version that their interpretation should be taken with more caution than the other ranges.

7. We appreciate the suggestion for including two non-linear reservoirs in parallel, and agree that these might allow a good representation of initially steep recessions. Certainly many different combinations of linear and non-linear reservoirs in parallel and/or serial could be implemented. This was not done here for two reasons: (1) the version of FUSE used here relies on specific parent models (full hydrological models, not only the reservoir combinations) and their original components, namely PRMS, Sacrameto, Topmodel and Arno-VIC). (2) Additional reservoirs as the two non-linear reservoirs suggested by the reviewer would require more parameters, and we wanted to keep the

number of parameters low for the sake of parsimony. However, more structures may be an option for extensions of FUSE and we will add this aspect to the discussion.

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