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Hydrology and Earth System Sciences Discussions

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

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This is an interesting paper. The authors diagnose the performance of different combinations of model structure to simulate recession and low flow in a watershed. I have several questions. It will be helpful for readers if the authors clarify them.

1. In the section of "Subsurface flow" in page 6840, the authors may describe the difference of "Storage of unlimited size combined with non-linear fraction rate" and "Storage of unlimited size combined with power recession" in Table 1.

2. Are the calibration and performance evaluation (Equations 5 and 6) based on entire time series of streamflow (i.e., both rising and recession limbs) or recession periods?

Authors may clarify this. If the entire streamflow time series are used to compute equation (6), is it possible that a poor performance is due to the poor high flow simulation instead of poor low flow simulation?

3. In equation (9), is there a typo in the left hand side (-dQ/dt instead of (-dQ/dt)/Q)?

4. In page 6844, what's the implication that if a FUSE does not pass the Kolmogorov-Smirnov goodness-of-fit test? I am not sure that my understanding is correct or not: if it does not pass the test, then the recession behavior from the FUSE model doesnot follow the functional type of Equation (9) which is assumed to be the correct form. If this is the case, the author may justify why this functional type is used.

5. For Figures 5b-f, the data points can be computed by two methods when -dQ/dt >0 : (1) from subsurface flow; (2) from subsurface flow + surface runoff. Which method is used in this paper? If the second method is used, then the surface runoff component will also affect Figure 5.

6. Lines 20-22 in page 6845, "low flow values were modelled taht were below the oberved range and their associated recession slopes were too steep (Fig 5)." Authors may explicitly state the subplots for the corresponding cases. The observed lower bound for Q is around 0.2 mm/day, and Q in Figure 5c is a little below 0.2 mm/day but Q in other figures is bounded by 0.2 mm/day. Figure 5e and 5f have steep recession slopes.

7. Lines 22-23 in page 6845, "This behavior was only found for models ..... percolation Plower." From Table 2 and the previous sentence, I guess "this behavior" represents the steep decrease of recession rate at the lower bound of Q in Figures 5e and 5f. This concave shape is similar to the observed recession at the 41 ha Panola site (Clark et al., 2009). This shape of recession slope curve is explained by a nonlinear reservoir (power) with return flow from bedrock storage by Wang (2011) which used two nonlinear reservoirs in series. The authors may consider to include this model structure when they review the model structure for low flows (i.e., linear reservoir, nonlinear reservoir,

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linear reservoirs in parallel).

Lines 15-17 in page 6840, for Plower, the percolation is fast when the lower layer is dry which is corresponding to the small value of Q. Therefore the percolation Plower in this paper is similar to return flow from bedrock in the Panola site.

Minor comments 1. line 3 in page 6836, may change the sequence of the references since it is ordered by year in other places of this paper. 2. lines 13-14 in page 6849, change "quick recessions" to "slow recession" (-dQ/dt is small)?

Reference

Wang D. (2011), On the base flow recession at the Panola Mountain Research Watershed, Georgia, USA, Water Resources Research, 47, W03527, doi:10.1029/2010WR009910.

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