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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A simple topography-driven and calibration-free runoff generation module" *by* Hongkai Gao et al.

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We thank the Anonymous Reviewer 1 for recognising the innovation and the importance of this paper. We also appreciate all his/her constructive comments, which are valuable to improve the quality of this manuscript. For the detailed comments, please find our responses in below.

Replies:

1. The influence of S_{uMax}/Pe on runoff coefficient estimation (Moore, 1985; Wang, 2018) will be discussed in the revised paper.

2. In the manuscript, we have compared the model performance of HSC and HSC-MCT with HBV and TOPMODEL (as benchmarks), and found that the HSC module

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performed better in both calibration and validation. HBV is a good benchmark, because it has a relatively straightforward way of representing the runoff threshold in the root zone, albeit by calibration. TOPMODEL is also a good benchmark, because it uses a topographical index to define the runoff threshold. In our approach, the spatial distribution of the HAND values is used to derive the spatial distribution of the runoff (connectivity) thresholds, but from another topographical perspective than TOPMODEL. We agree that it would be interesting to test the goodness-of-fit of the Cumulative Distribution Function (CDF) of HSC with not only the HBV, but also the Xinanjiang, GR4J and SCS. However it might be worthwhile to clarify that the intention of is to propose a new runoff generation module (HSC), which is, to some extent, supported by large-sample ecological field observation, and free of calibration, rather than comparing the CDF of HSC with other existing modules.

3. The full names of the SEF, and SOF will be clearly defined.

4. The S_{uMax} for each MOPEX catchment in the HSC-MCT module was obtained in our previous study (Gao et al., 2014). We used the amount of root zone storage capacity, which ecosystems need to overcome drought periods (dry spells) with 20 years return period (S_{R20y}), as a proxy for S_{uMax}. The details of the method to derive the S_{R20y} can be found in Gao et al., 2014.

5. Figure 7 and 8 will be revised.

6. It is a good suggestion to put the TOPMODEL and HBV curves together, and compare their shape. But it is a difficult task, due to the different model assumption and concept. And to our best knowledge, we haven't found similar studies that systematically compare the TOPMODEL curves with HBV curves, which might indicate that this is not an easy task to be perform within a short time. Furthermore, in this study we just wanted to compare the model performance of HSC with HBV and TOPMODEL, rather than to unify all model approaches.

7. The effect of other calibrated parameters on model calibration and efficiency will be

discussed.

8. The comparison of the calibrated S_{uMax} and the estimated S_{uMax} by MCT can be found in Gao et al., 2014. For the other calibrated parameters, their effect on model performance will be discussed in the revised manuscript. It is worth noting that all models use the same model structure and prior range of remaining parameters (i.e. interception and response modules) to exclude the impact of other processes, and guarantee that the comparison of runoff generation modules is fair.

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