

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

Anonymous Referee #3

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General comments

This study presents a new concept for runoff generation description in conceptual hydrologic models. The new approach is based on HAND (height above nearest drainage) information derived from digital elevation model. The methodology is tested for two cases: (1) small experimental catchment in Scotland; (b) MOPEX dataset in the US. Results are compared against observed saturation patterns (in case 1) and discharge observations (both cases), as well against simulations of two other conceptual hydrologic models. The authors conclude that the new concept compares well with other two calibrated models and allows to describe spatial distribution of the root zone storage capacity.

Overall the topic is interesting and within the scope of HESS. However I fully agree

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with referee #2 that manuscript will benefit from some strengthening of the take home message, i.e. by providing more thorough and additional process based evaluation of results. I missed some more thorough process based interpretation of the reasons for similarity/differences in saturated area patterns for case 1 (catchment in Scotland). It seems to me that the differences between observed and simulated saturated area patterns are quite large and does not support well the interpretation that the new concept is better than the other approaches (yes, it is a little bit better than the models but for some days quite far from the observations and not convincing well the benefits of the proposed approach). The results for case 2 (MOPEX dataset) present mostly a statistical comparison of efficiency numbers (average, median), but does not tell much about the seasonal, geological, vegetation, climate and flow characteristics impacts on the efficiency evaluation. Some classification of catchments according e.g. similar TWI or HAND based indices, runoff regime indices, etc. and subsequent separate analysis of results for such groups will allow to more clearly indicate the role of different physiographic conditions on the results. I'm not sure to what extent can be the presented example for one catchment generalised for the other catchments, so some more assessment will be useful here. For example the results indicate that the new concept is better for mild sloped catchments, so a figure showing the results for all such catchments compared to the others will be interesting. Along the same line, similar evaluation for different geological/vegetation/climate groups of catchments with some process based interpretation of results will shed more light about what new and different information is obtained in the new HAND based storage capacity estimates compared to TWI (research question 2). (I'm missing a clear answer here - the maps are quite difficult to read, particularly for people which are not experts on the local situation). The discussion of the results is in some parts too vague and not linked well with the results (e.g. section 6.2). On the other hand there are much more MOPEX based studies and some of them indicate better model performance (e.g. for HBV model, e.g. Kollat et al, 2012, <https://doi.org/10.1029/2011WR011534>) than found here. So, some more thorough link with existing MOPEX studies will be thus suggested.

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Specific comments

1) Abstract: Please consider to be more specific about how much better the HSC concept is in reproducing the spatio-temporal pattern of the observed saturation areas, as well as in comparison with calibration and validation efficiencies of other conceptual models.

2) Figure 1 and associated text. I wonder to what extent the new concept (HAND is proportional to storage capacity) reflects different geomorphological and geological processes? In which geological conditions one can apply the concept?

3) Figure 6. The colour legends are very confusing. It will be easier to have the same legend for all maps.

4) It will be interesting to provide, as a supplement, a list of used catchments with the results.

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