HESSD

Interactive
comment

Interactive comment on "A topographic index explaining hydrological similarity by accounting for the joint controls of runoff formation" *by* Ralf Loritz et al.

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Loritz and his colleagues attempted to propose a new topographic index, named dissipation per unit length (DUNE). Generally, this is an interesting paper. The authors wanted to increase our understanding between topography and hydrology, which I think is still a big treasure to be further exploited. The paper has potential to be an important paper. But when I read the content, I found there are still several places need to be clarified before being considered for publication.

Comments 1:

Please plot precipitation data in Figure 2, otherwise we cannot see how runoff responses to rainfall events.

The hydrographs in six catchments present two interesting regimes: 3 marl catchments have sharp peak flow and fast recession, while 3 schist catchments have dampened peak flow and slow recession. If my understanding is correct, the authors wanted to conclude that topography controls the shape of hydrograph, rather than runoff generation (water balance), right? You probably intended to say runoff transfer or response or transition, right?

What I want to say is that Figure 2 clearly shows that topography greatly impacts the shape of hydrography (runoff transfer/transition) rather than the amount of runoff (runoff generation). The authors should clarify these two terms, which are very important to communicate your results.

Comments 2:

Figure 3 showed that, comparing with TWI and HAND, DUNE has the best ability to distinguish different regimes of hydrograph response. The six DUNE curves show clearly two classes, which are well correlated with different hydrography regimes (Figure 2). This is an important conclusion, which is also the highlight of this research!

From my understanding, the catchments with less DUNE values (Platen ,Colpach, Weierbach) have steeper topography and larger dissipation per unit length (kind of gradient divided by length), and subsequently resulting in sharp peak flow and fast recession process, right? But the observed hydrograph in Figure 2 shows an opposite regime. How can you explain this contradiction? Are there other factors influencing the shape of different hydrographs? If topography cannot be used to interpret different shapes of hydrography, why shall we use DUNE to analysis the relation between topography and hydrological processes? Please correct me, if my understanding is wrong.

So I think it is really necessary to clarify the physical connection between DUNE and hydrographs.

Comments 3:

The authors also mentioned the similar index from Hjerdt et al. (2014) and Harman and Sivapalan (2009). But I did not see the comparison between DUNE and these two indices. If you want to propose a new index, you should also compare it with its ancestors and show your advantage. Right?

Comments 4:

I found several very important relevant publications are missing in the reference list. I list some for your reference.

Reference:

Gao, H., Birkel, C., Hrachowitz, M., Tetzlaff, D., Soulsby, C. & H.H.G. Savenije (2019). A simple topography-driven and calibration-free runoff generation model. Hydrology and Earth System Sciences. DOI: 10.5194/hess-23-787-2019.

Gao, H., Hrachowitz, M., Fenicia, F., Gharari, S., and Savenije, H. H. G.: Testing the realism of a topography-driven model (flex-topo) in the nested catchments of the upper Heihe, china, Hydrology and Earth System Sciences, 18, 1895-1915, 10.5194/hess-18-1895-2014, 2014.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2019-68, 2019.