

Interactive comment on “Catchment-scale groundwater recharge and vegetation water use efficiency” by Peter A. Troch et al.

Anonymous Referee #2

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This research proposed an estimation method of catchment-scale long-term average recharge rates based on simple catchment characteristics with the aim to provide a connection between groundwater recharge, aquifer discharge to streams during dry periods, streamflow regime type, and vegetation water-use efficiency. It was achieved by quantifying relationship between the Horton index (HI) and average base flow and regionalizing HI using catchment characteristics. Although the scope of the manuscript (MS) is suited to Hydrology and Earth System Sciences (HESS), there are some scientific issues with the current MS that do not allow me to support its publication in HESS.

Obviously, the quantified relationship between the Horton index, which is estimated from base flow, and average base flow is some kind of circular argument. The au-

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thors have realized this foundational flaw (L497-499). They argue that it is meaningful to estimate average baseflow by predicted HI from climate and landscape properties (L500-502). But this does not help, using predicted or observed HI has nothing to do with the flaw in HI~Qb relationship. In fact, when reading the manuscript, there is always a question in my mind: may the similar performance be achieved if we predict catchment average base flow using climate and landscape properties directly?

I also find the logic of the manuscript confused: 1) I cannot understand the role of STmax in the manuscript without which the main story almost has no change; 2) The relationship between Q50 and HI (or the relationship between Qb,obs and Q50) seems to be a branch of the story, but they are mixed up in the manuscript now, with some explanation but not clear at all.

L539-540: it seems contradictory with L464-468 where you have claimed the limitation of your method in poorly vegetated catchments. Additionally, an easy work to test the applicability of your method in different landscapes: to compare the estimation performance (e.g., RMSE in GW recharge) in well vegetated and poorly vegetated catchments. But as shown is Figure 11, your method underestimated GW recharge at all catchments with GW recharge higher than 800 mm/year (usually with high vegetation cover according to figure 10)?

I have to say I find most analysis and conclusions (e.g., L430-433, L433-435, L450-452, Key Point (1) and (2)) in this research similar (or repetitive) with these in Arciniega-Esparza et al. (2016) and Voepel et al. (2011). It seems that most of their works are to prove previous findings without new perception or substantial contribution.

Figure 9: Please explain the meaning of red dotted line.

L249-253 and L291-293: We know what you mean. But please try to avoid contradiction in one manuscript.

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