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Hydrology and Earth System Sciences
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Discussions

Interactive comment on "Quantification of Ecohydrological Sensitivities and Their Influencing Factors at the Seasonal Scale" *by* Yiping Hou et al.

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We greatly appreciate the effort made by Referee #1 in reviewing the paper. Please see our detailed responses to your concerns.

1. The authors proposed an index called ecohydrological sensitivity, and used many factors to see the impact of catchment characteristics on ecohydrological sensitivity. Honestly, I am not fully convinced to accept such a new term, and its scientific contribution to ecohydrology community.

Response: Ecohydrological sensitivity is a useful term for hydrological science and wa-

tershed management. Although the term has often been mentioned in existing studies, there lacks a commonly-accepted definition for its quantitative assessment and comparisons. To our best knowledge, our work is the first study to define and quantify ecohydrological sensitivity at the seasonal scale. Based on our tests and analyses on 14 large watersheds in China, we believe that the ecohydrological sensitivity index developed in this paper provides a useful and common basis for assessing hydrological sensitivity.

It would have been more constructive if referee # 1 could explain why he or she is not fully convinced by this definition. An unfounded statement is not helpful and convincing.

2.The method is too superficial, without any new convincing method. Data set is too small, only with 17 basins, it is hard to get solid conclusions. I suggest to involve large number of basins.

Responses: We strongly disagree with this statement on the method. The method used in this study is a well-established technique for separating the relative contributions of vegetation change and climate variability to seasonal mean flows in any individual watershed. This way, the effects of vegetation change are quantified. This technique developed by our research group has been successfully applied in some Canadian and Chinese watersheds and our relevant works have been published in peer review journals including Water Resources Research, Hydrology and Earth System Sciences, Journal of Hydrology, Ecohydrology (Wei and Zhang, 2010; Zhang et al., 2012; Zhang and Wei, 2012; Liu et al., 2015; Li et al., 2018; Hou et al., 2018; Giles-Hansen et al., 2019). For this study, we applied this technique to 14 watersheds with detailed analyses and results presented in the Supplement. Based on those results from 14 individual watersheds, we assessed hydrological sensitivities and analyzed their contributing factors. I believe that our research approach and the applied method are solid and the conclusions are scientifically supported.

Another important reason why this statement is not convinced is that we used 14 large watersheds as examples in our study rather than 17. This number is clearly described at the beginning of the abstract, and thus we assume the referee #1 might just quickly go over the manuscript rather than carefully reviewing it. Regarding the dataset from 14 watersheds, we understand the referee # 1's point. We agree that the more watersheds used for the study, the more robust conclusions we can derive. Given tremendous analyses involved for each individual watershed, we need to take a stance between the number of watersheds and the detailed levels of analysis. We think that 14 watersheds should be a reasonable number for this study.

3.The conclusions are either too obvious or too farfetched. For example, the first key finding in dry basins. Sf=deltaQ/(Q*deltaLAI). since Q is small in dry basins. Even with the same change of deltaQ, the Sf is large anyway. The third one said "3) the dry season ecohydrological sensitivity was mostly determined by topography, soil and vegetation, while the wet season ecohydrological sensitivity was mainly controlled by soil, landscape and vegetation." the only difference between dry and wet season is topography (matters in dry seasons) and landscape (matters in wet seasons). it is hard to accept this conclusion. Does topography or landscape significantly change in dry and wet seasons? With a statistic model, any input data will generate certain relations. But whether the relation has physical meanings or not, which needs more evidences.

Response: There is no doubt that the ecohydrological sensitivities depend on climate (Q), but they are also affected by delta Q. According to our analysis, drier regions may not be necessarily more hydrologically sensitive. For example, in our calculations (Table S4 in the Supplement), the dry season Sf in a temperate watershed, the Tangwang River (27.75) is greater than that in the Dongchuan (6.54), Heshuichuan (3.45), Jingchuan (8.27) and Rui River (6.03) watersheds in the Jing River located in semi-arid region, indicating that the hydrological sensitivity to vegetation change in this temperate watershed is greater than that in the watersheds with lower precipitation.

Regarding the comment on the third finding "3) the dry season ecohydrological sensitivity was mostly determined by topography (slope, slope length, valley depth, downslope

distance gradient), soil (topsoil organic carbon, topsoil bulk density) and vegetation (LAI), while the wet season ecohydrological sensitivity was mainly controlled by soil (topsoil available water holding capacity), landscape (edge density) and vegetation (leaf area index)". Response: we think the referee #1 might misunderstand this result. For any individual watersheds, topography is not a driving variable for hydrological changes as it remains unchanged. However, it comes into play when the differences in hydrological response to vegetation change among various watersheds are compared.

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