

Interactive comment on “Dominant climatic factor driving annual runoff change at catchments scale over China” by Z. Huang and H. Yang

Response to M. Ashok

*Overall it is a very good article and it can be publishable after considering the following comments: If the authors do not agree to the comments, a justification can be helpful.*

Response:

We are very grateful for your positive evaluation and detailed comments. And we are revising this manuscript following your suggestions. I believe that it will lead to a great improvement in this manuscript.

*1. Data source: While evaluating the impacts of climate on runoff, we should always use the catchments which are minimally impacted by human disturbances by the ways of dams, reservoirs or irrigation. Else, that would result in improper assessment of influence of climate on annual runoff. Similarly, most of the studies related to climate elasticity and Budyko hypothesis have explored regions which have minimal impact of anthropogenic activities. Is that factor taken into account? If so, please mention that in the text otherwise it can be highlighted as future study.*

Response:

Thanks for your comments. As you pointed out, runoff has been impacted by human activities in most catchments of China. In this manuscript, therefore, our objectives include: (1) to evaluate the contribution of climate change on runoff based on the Budyko hypothesis; (2) to detect the dominant climatic factor and understand its regional characteristics. Consequently, we used the Budyko hypothesis through considering the parameter  $n$  as constant for each catchment in order to evaluate the impacts from climate change, and divided the whole China, into 207 third-level catchments to understand the regional characteristics of the impact from climate change. Following your suggestions, we will add more and explanation and discussions in the revision and on revise this manuscript and improve this method to study the impact from human activities in the future study.

*2. Purpose of Validation of the climate elasticity method: The authors have compared hydrologic model results with climate elasticity results. Based on table 3, one can observe that,  $(\Delta R/\Delta Re)$  is comparatively closer to the observed data  $(\Delta R/\Delta Ro)$  in only upper Hanjiang river basin. The authors have evaluated all the catchments in china based on this single river basin. To prove that the climate elasticity method is superior to hydrologic modeling on this evidence is not statistically significant. Usually, Hydrologic models are more prone to parameter uncertainties and are difficult to calibrate. But, once properly calibrated, they act as proxies for evaluating runoff where data is unavailable. Whereas, the climate elasticity models based on Budyko are easier to compute but cannot be applied to regions were the data is scarce.*

*Each method has its pros and cons. Therefore, the authors can provide a justification on the choice of climate elasticity model in a more informed way.*

Response:

Thanks for your comments. The main purpose of this study was separating the effects of different climatic factors on runoff and detecting the dominant climatic factor driving annual runoff change at catchment scale in China. The climate elasticity method outlined by Yang and Yang (2011) aimed to assess and separate the effects of different climatic factors on runoff. To validate the climate elasticity method, we must evaluate the impacts of climate change to runoff and then compare it with observed runoff change caused by climate change. However, both anthropogenic activities and climate change have become important factors driving runoff change, and observed runoff data include the effects not only from anthropogenic activities but also from climate change. Therefore, we collected the modeling runoff change and the contribution from climate change for the three catchments from literatures, to validate the climate elasticity method. We agree with your comments that there are large uncertainties in parameters of the hydrological models. Those modeling results, simulated by hydrological models through keeping parameters constant, were assumed as the impact of climate change. And this assumption has been making in previous researches. So we compared hydrologic model results with climate elasticity results. Following your suggestions, we will compare the two methods in the revision.

*3. Comments: This article applies the runoff elasticity method as outlined by Yang and Yang (2011) and applies it to the dataset utilized in Yang et al., (2014). Hence, this can be termed as an extension of both these works. It provides the runoff elasticity to net radiation, temperature, wind speed and relative humidity which was not earlier evaluated. Even though this article is novel in this direction, there appears to be very less depth in their discussions and results. For example, in figure 8, what can be a possible reason which explains the dominance of radiation and wind speed in the south eastern and north eastern regions?*

Response:

Thanks for your comments. It is a very valuable suggestion for us, and points out the direction in the revision. We will make a deeper discussion in the revision.