Comments to Authors:

The manuscript entitled “Climate-induced hydrologic change in the source region of the Yellow River: a new assessment including varying permafrost” by Wu et al. (2017) used the Budyko’s framework to separate the effects of climate change, human activities, and permafrost degradation on streamflow. The main findings are: 1) climate change played an important role in streamflow variations, and 2) degrading permafrost can act as a positive factor for streamflow. The endeavours in adopting Fu’s equation in accounting the permafrost contributions to hydrological cycle is encouraged, and further this is an emerging research topic recently. However, a recently published paper, Wang et al. (2018) used the Yang-Choudhury equation (a Budyko based equation) to quantify climate change, land cover change, and permafrost degradation on streamflow in the same watersheds during the same study periods. One of the main conclusions of Wang et al. (2018) is that frozen ground degradation could reduce streamflow. After an assessment of two studies, I found that Wu et al. (2017) misinterpreted the Fu’s and Budyko’s framework, which led to contrasting results with Wang et al. (2018). I have to, therefore, reject this manuscript for further publication. Here are main comments that may help authors improve their study.

(a) Application Budyko hypothesis

The Budyko’s hypothesis and its several frameworks, e.g., Fu and Yang-Choudhury equations are receiving considerable attention in the recent decade. They are developed based on the water balance equation, in which the Δs or water storage changes are usually neglected in the areas with no permafrost coverage (Please change your express in Page 6 line 6, as Δs can be either positive or negative). However, the degradation of permafrost can either increase (Duan et al., 2017) or decrease streamflow (Wang et al., 2018). As such, the permafrost act as either an extra source (another source of water input in the watershed) or net loss (recharging groundwater). Either scenario would likely lead to significant changes in Δs. In your study watersheds, the inter-annual changes of Δs can be reached to more than 10% of precipitation in your study watersheds (Figure 3 in Wang et al., 2018). In this case, the Δs should be seriously accounted in the water balance equation. Thus, three methods used in your study (climate elasticity method, sensitivity method, and decomposition method) are not appropriate as they are all developed based on watershed without permafrost coverage. In contrast, Wang et al. (2018) considered Δs and provided robust inferences to support their conclusion. Therefore, I think neglecting the Δs is the main reason for the contrasting results.

(b) Watershed property parameter (w) in the Fu’s equation

The authors also tried to employed watershed property parameter (w) to identify the climate impacts. The multiple linear equations only including climate variables suggested by Jiang et al. (2015) that is insufficient. It should be noted that Jiang et al. (2015) used this equation in the non-permafrost region. Hence, it is still questionable to apply such method in the permafrost region. In addition, this application needs to be further modified. The w is closely related to the watershed slope (Yang et al., 2017; Zhou et al. 2015), vegetation (Wei et al., 2018; Zhang et al., 2018), soil properties (Yang et al., 2007; Wang and Alimohammadi, 2012), and climate (Berghuijs et al., 2017; Zhang et al., 2016 and 2018). Especially, Yang et al. (2007) and Wang and Alimohammadi, (2012) revealed that watershed balance is closed related to relative infiltration capacity, relative soil and water storage, and average slope. Moreover, you may check the vegetation change in your watersheds, Wang et al. (2018) revealed that LAI increased during your study period, which could potentially be a negative factor to explain the decrease in streamflow in your watersheds.

(c) Comments on writing

Overall, the manuscript is in moderate shape. However, the literature review is not sufficient. In the introduction, your put much efforts on explaining your hypothesis that human activity is a minor

effect in your study area. You can explain something more in the current research gaps in permafrost regions and highlight the uniqueness of your study. After your reading of the listed references, you may find that Table 1 has been listed in many references. In Methods sections, you introduced details about three methods. However, those three methods and Budyko frameworks have been well-documented in the literature (Dey and Mishra, 2017). This is not necessary. As you mentioned the permafrost in the manuscript title, I suggest you can discuss more in your future revision.

(d) Suggestions for revision

It is good to see this manuscript using Fu's equation to advance our knowledge in understanding climate, human activity, and permafrost thawing, and also advance Fu's application. As I stated previously, the author should try to close the watershed balance in your revision before applying Fu's equation. I suggest author may use analytical solutions to account for permafrost degradation contribution to either increase or decrease streamflow. Please see an example in Duan et al. (2017) and others. Then, using the modified streamflow in Fu's equation to address your research questions. As I can see from your paper, the best thing is that you have the long-term observed maximum frozen depth in your study region, which other studies not. This could increase the credibility in your future study.

Best of luck in your revision.

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