

## ***Interactive comment on “Quantifying streamflow and active groundwater storage in response to climate warming in an alpine catchment, upper Lhasa River” by Lu Lin et al.***

### **Anonymous Referee #2**

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Journal: HESS Title: Quantifying streamflow and active groundwater storage in response to climate warming in an alpine catchment, upper Lhasa River MS No.:HESS\_2019\_302

In this work, Lin et al. has investigated the changes in streamflow regimes and climate factors are evaluated based on hydro-meteorological observations from 1979 to 2013. The work is very interesting. This study provides a perspective to clarify the impact of glacial retreat and frozen ground degradation on hydrological processes, which fundamentally affects the water supply and the mechanisms of streamflow generation and change. However, I have some issues with this paper, which prevents me from giving

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a positive recommendation.

1.The title of this paper is: Quantifying streamflow and active groundwater storage in response to climate warming in an alpine catchment, upper Lhasa River. However, the main content of this paper is the relationship between streamflow and active groundwater storage and temperature and precipitation. Moreover, the response of runoff on climate warming is not clearly quantified in this paper. So this topic may not be suitable for this article. 2.In this paper, the mechanism of hydrological process, hydrological cycle and the relationship between recharge and drainage of water in alpine region are not described in detail. Please add it. 3. “ the annual streamflow especially the annual baseflow increases significantly, and the rising air temperature acts as a primary factor for the increased runoff. ” . Climate warming has been a fact. Glacier could be reduced by the increasing of temperature is a fact, too. However, this conclusion should be for the ablation period only in your study area“Cold regions”. I suggest authors make a more detailed analysis of the Year, Month, the ablation period and freezing period, which may be more reasonable and interesting. 4.Diagram depicting surface flow and groundwater flow due to glacier melt and frozen ground thaw of Figure 3 should not be in the alpine region, at least not in the Qinghai-Tibet Plateau. I suggest that the author make major revisions according to the current studies. 5.This work has been found that the increased streamflow is mainly fed by the accelerated glacier retreat due to climate warming. There are many factors for the increase of streamflow. The accelerated glacier is just one of all factors. For example, the increase of precipitation, the degradation of frozen soil, the melting of underground ice, and the supply of supra-permafrost water. So I suggest that authors first figure out what is the main sources of streamflow in the study area? Then analyzed the contribution of the recharge sources to runoff based on the variation of all factors under the climate warming. Finally, the main reason for the increase for runoff is obtained. 6.This study also found that the decreased glacial volume has supplied large quantities of glacial meltwater which recharge aquifers and reside in temporary storage during summer, and then release as baseflow during the following seasons. So I suggest that the au-

thors learn more about the mechanism of the hydrological process in the cold regions. 7. I don't think the discussion section is well written, so I think the discussion section may need to be re-written. 8. On the whole, the idea of this paper is very good, the conclusion of this paper is interesting, but the data support and supporting materials are lacking. In addition, the mechanism of water transformation in alpine region needs to be further studied.

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