Hydrology and Earth System Sciences Discussions

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Reply on RC2

Li Zongxing et al.

Author comment on "Soil water sources in permafrost active layer of Three-River Headwater Region, China" by Li Zongxing et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-558-AC2, 2022

Overall comments:

Comment 1:

The manuscript presented huge field works of soil water/ice sampling in the permafrost area of the Headwater region of Three Rivers, obtaining 1140 samples. The isotope data collection in the Three-Rivers headwater region is a meaningful work. The manuscript elucidated the soil isotopic characteristics of different soil layers under different topographic gradients, vegetation and soil characteristics, estimated the contribution of different water sources in the soil water, and discussed influence factors on soil water sources. This work provides data support for the ecological restoration and maintenance of the Headwater region of the Three Rivers. Nonetheless, many results in the article are too repetitive and the discussion provides many new results but no real discussion on what was learned in this study. There are still many issues that need to be carefully modified.

Response 1:

Thank you very much for your guidance and advice. We will revise the manuscript thoroughly according to your comments, especially the sections of Result and Discussion. Frankly speaking, this is the first time that a systematic study of the sources of soil water on the Tibetan plateau has been carried out. As you say, this work provides data support for the ecological restoration and maintenance of the Headwater region of the Three Rivers.

Featured comments:

Comment 2:

The contribution of precipitation and ground ice to soil water was quantified. But the soil water mixing process was very complex, processes of glacier/snow melting, permafrost freezing and thawing, as well as the water exchange between the surface and subsurface were not well considered and discussed.

Response 2:

Thanks for your comment. Indeed, soil moisture processes are extremely complex, especially in permafrost areas. Studies on the sources of soil moisture are minimal due to the difficulty and cost of direct observational studies in Tibetan Plateau. Due to freeze-thaw processes, soil hydrological processes in the study area in fact only occur during the ablation period (May-October), while in July the snowpack has all melted away and all the glacial meltwater has flowed into the rivers, and the active layer of permafrost has largely melted, so that the main sources of soil water are precipitation and ground ice. Of course, the mechanisms influencing the source of soil water need further study, and the main objective of this study was to determine the source of soil water during the sampling period.

Comment 3:

The spatial and temporal differences of isotope data in different water sources are significant, and the uncertainty should be estimated in the quantification of the contribution of different water sources in the soil water. How to consider the heterogeneity of soil properties across such a huge study area? How did the sampling process distinguish the soil water or ice?

Response 3:

Thanks for your comment. The uncertainty of tracer--based hydrograph separations can be calculated using the error propagation technique (Genereux, 1998; Klaus and McDonnell, 2013).

Based on the systematic collection of samples, the central objective of this study is to quantify the sources of soil water. Samples were collected regardless of the soil type, which provided the basis for analysing the influence of soil heterogeneity on soil water sources, so in the revised manuscript we will further analyse soil water sources in different soil type zones. For the analysis of $\delta 2H$ and $\delta 18O$, water was extracted from soil using a cryogenic freezing vacuum extraction system (LI-2000, Beijing Liga United Technology Co., Ltd., China), which can achieve complete extraction with high precision (details in the section of Collection and preparation of samples). ground ice has frozen in the soil and is collected directly in the soil profile as showing in fig.2.

Comment 4:

The influence of various factors on the soil water is difficult to distinguish by simple correlation analysis. What's the meaning of those correlation analysis in the discussion with very low correlation coefficients? How to identify the mutual influence from several factors on the soil water and also the interrelationship among various factors?

Response 4:

Thanks for your comment. The factors influencing soil water are complex and diverse, and require systematic observation if they are to be understood clearly. However, current observational studies in the study region are almost non-existent. Therefore, in this study, systematic sampling was carried out in July, along with observations of soil moisture, temperature and its vegetation, and thus the relationship between these factors and soil moisture was analyzed.

Comment 5:

The authors should carry out a comprehensive language edit of the paper to make it concise and clear.

Response 5:

Thanks for your comment. a comprehensive language has been edited before submission.

Comment 6:

The formatting needs to be carefully laid out, including the formatting of references, etc.

Response 6:

Thanks for your comment. The formatting will be revised again in the revision.

Major issues:

Study Area:

Comment 7:

It is suggested to introduce the types of frozen soil and soil properties in the study area. The introduction of the study area is not specific enough and a little broad.

Response 7:

Thanks for your comment. We will revise the section of Study region, and add the introduction of the types of frozen soil and soil properties.

Sampling methods:

Comment 8:

Repeated sampling methods are not recommended.

Response 8:

Thanks for your comment. The Repeated sampling methods will be removed from the revision.

Results:

Comment 9:

The result part is a little long and the style of writing is not recommended in this part.

Response 9:

Thanks for your comment. The section of Result will be revised again.

Comment 10:

There are too many speculative descriptions, and it would be better to show more definite conclusions.

Response 10:

Thanks for your comment. many speculative descriptions will be changed to the definite conclusions.

Comment 11:

About point 6, please confirm that the runoff segmentation result only refers to July in the study area? The sampling time described is from June 2019 to July 2020. Why does the author only analyse the water source in a single month? Is it the average value of the whole basin? More discoveries may be made according to watershed zoning.

Response 11:

Thanks for your comment. precipitation samples were collected during from June 2019 to July 2020, whereas other samples for Ground ice, River water, Supra-permafrost water and Glacier snow meltwater in July 2019. So the soil water sources in July 2019 have been analyzed. In the revision, In addition to the average conditions in the study region, we will further analyse the sources of soil moisture in the permafrost and seasonal frozen zones of the Yangtze River, Yellow River and Lancang River sources region.

Discussion:

Comment 12:

Some contents of the discussion part and the results are repeated, and it is not recommended to put too much data.

Response 12:

Thanks for your comment. The sections of Result and Discussion will be revised again, and the repeated part will be removed.

Comment 13:

It is suggested to compare and discuss the research results of other scholars in this regard, and it is not recommended to put the research views of others behind the findings of the article.

Response 13:

Thanks for your comment. The sections of Discussion will be revised again, and we will compare and discuss the research results of other scholars in this regard.

Conclusion:

Comment 14:

The conclusion is repeated with the summary. It is not recommended to put too much data and refine it again.

Response 14:

Thanks for your comment. The sections of Conclusion will berefined again.

Figures and Tables:

Comment 15:

Please note the format of the table. You can see the requirements of submission.

The correlation information on the figure has been discussed in the article, so it is recommended not to repeat it.

Response 15:

Thanks for your comment. These figures and tables will be revised again.

References:

Comment 16:

References are repeated and check if there is a problem with the format.

Please check that the DOI and title of some references do not correspond.

Response 16:

Thanks for your comment. These references will be revised again.

Minor issues:

Comment 17:

Line229 Please explain the relationship between supra-permafrost water and soil water.

Line 224, Line235, Line243 repeat the narration.

Line 344 The relationship with the previous logical reasoning is unclear.

Line 410 Please explain what the same pattern is.

Response 17:

Thanks for your comment. These minor issues will be revised again.

TECHNICAL CORRECTIONS

Comment 18:

Pay attention to the format of the article, the upper and lower symbols of the text should be unified, and there are small details such as punctuation.

Response 18:

Thanks for your comment. The format will be revised again.

Comment 19:

It may be necessary to explain the definition of soil water in this paper, the relationship between soil water and supra-permafrost water, and the relationship between the depth of soil water research section and the depth of active layer.

Response 19:

Thanks for your comment. Based on our data, we will explain the definition of soil water in this paper, the relationship between soil water and supra-permafrost water, and the relationship between the depth of soil water research section and the depth of active layer in the revision.

Comment 20:

It is suggested to put forward the dominant influencing factors affecting the soil water content of different soil layers in permafrost according to different regions. There are many influencing factors mentioned in the article, but there is no focus.

Response 20:

Thanks for your comment. Based on our data, we will put forward the dominant influencing factors affecting the soil water content of different soil layers in permafrost according to different regions in the revision.

Comment 21:

This paper repeatedly mentioned the effects of evaporation and soil water migration on soil water isotopes, and there are few explanations for the isotopic characteristics of the soil layer near the underground ice.

Response 21:

Thanks for your comment. Based on our data, we will explanations for the isotopic characteristics of the soil layer near the underground ice.

Comment 22:

Please explain that only two end elements are considered in the runoff division, whether the contribution of snow and ice meltwater is considered, or why snow and ice meltwater is not considered.

Response 22:

Thanks for your comment. Based on our data, we will study the isotopic characteristics of the soil layer near the underground ice.

Comment 23:

The part of runoff segmentation need to add uncertainty analysis.

Response 23:

Thanks for your comment. The uncertainty of tracer--based hydrograph separations can be calculated using the error propagation technique (Genereux, 1998; Klaus and McDonnell, 2013).

Comment 24:

At present, the distribution of water content in each soil layer under different conditions reflected by isotope monitoring is beneficial or harmful to the ecological environment. It is suggested to supplement it, so as to promote the goal of better maintaining the ecological environment.

Response 24:

Thanks for your comment. Furthermore, there is an urgent need to develop technologies for fragile ecosystem restoration and improve the water conservation capacity for wetland ecosystem restoration/conservation, soil and water conservation enhancement, and ecological adaptation and regulation of climate change. Based on the above-mentioned aspects, it is necessary to vigorously implement ecological protection and construction projects, natural forest protection projects, and the conversion of cropland to forest and grassland projects. Such strategies could effectively deal with ecological problems, such as decreased water conservation capacity, increased soil erosion, and vegetation degradation, caused by future permafrost degradation.