

Interactive comment on “Hydrological connectivity from glaciers to rivers in the Qinghai-Tibet Plateau: roles of suprapermafrost and subpermafrost groundwater” by Rui Ma et al.

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General Comments: This study addresses an important issue of hydrological connectivity between glaciers in high mountains and river in the low plain within the alpine headwater catchment with big elevation difference and complex hydrogeological settings. The hydraulic head, temperature, and chemical and isotopic composition of groundwater, streamflow, precipitation and glacier meltwater were monitored along altitude gradient. The work has produced a remarkably rich data set that is clearly presented by the authors. The authors interpret the data to indicate that supra- and subpermafrost aquifers, as well as stream channels and slope surfaces, play an important role in transporting glacier, snow-meltwater and precipitation from the high mountains

C1

to the plain and then to the mainstem. The authors also suggest that a decline in hydrological connectivity between the piedmont plain aquifer and the downstream channel in cold seasons may be the mechanism maintaining streamflow (baseflow) in winter. It is worth pointing out that the authors present a logical and clearly illustrated conceptual model of hydrological connectivity in the alpine catchment by combining the above results. Given the wide distribution of this kind of headwater “mountain-plainriver” catchments in the Qinghai-Tibet Plateau and other cold regions, this conceptual model may contribute fundamentally to permafrost hydrology and can be more broadly utilized. The authors tentatively suggest that river icing and riverbank soil freezing may form a confining layer to reduce groundwater discharge from the plain to the stream, i.e., reduce the hydrological connectivity between the two pools. This is a very interesting hypothesis that can expand the existing mode for interpreting the slow release of stored groundwater during cold seasons, and it may be testable using field hydrometric measurement and numerical simulation. Overall the manuscript is well written and quite clear. I also have a few minor comments that I hope the authors to address before publication as listed in below.

Response: We thank the reviewer for carefully evaluating our manuscript and for constructive and helpful comments and suggestions. Our specific responses are given in below.

Comment 1: P2, L5: ‘surface-water’ should be ‘surface water’.

Response: Changes have been made as suggested.

Comment 2: P2, L24 and L25: Two ‘;’s after ‘hydrogeological’ should be type errors.

Response: The type error has been corrected as suggested.

Comment 3: P3, L6: ‘Heihe Basin’ should be ‘Heihe River Basin’.

Response: ‘Heihe Basin’ has been changed to ‘Heihe River Basin’.

Comment 4: P3, L22: ‘Qinghai-Tibet plateau’ should be ‘Qinghai-Tibet Plateau’.

C2

Response: 'Qinghai-Tibet plateau' was changed to 'Qinghai-Tibet Plateau'.

Comment 5: P4, L15: Is 'the October to May cold season' a type error? 'ice covered' should be 'ice-covered'.

Response: Here we mean that the period from October to May is cold season. To avoid confusion, we have changed 'the October to May cold season' to 'the cold season (from October to May)'. 'ice covered' has also been changed to 'ice-covered' as suggested.

Comment 6: P6, L14: Citation is missing for the Gran titration method.

Response: We have added the citation for the Gran titration method as given in below. Gran G.: Determination of the equivalent point in potentiometric titrations. Part II, *Analyst*, 77: 661-671, 1952

Comment 7: P7, L27: What value does the $\delta^{13}\text{C}_{\text{rech}}$ take?

Response: As described in the texts (P7, L27-28), the $\delta^{13}\text{C}_{\text{rech}}$ was taken -18% as suggested by Han et al. (2011) for north China.

Comment 8: P8, L22-23: This sentence is hard to understand. Please rewrite it.

Response: We have rewrote this sentence as following to make it more readable. The revised sentence reads now: "Although the water table depth differed greatly between the cold and warm seasons, it was relatively stable during each of the two seasons."

Comment 9: P10, L15: Two 'respectively' should be removed.

Response: They have been deleted as suggested.

Comment 10: P11, L9-17: These results contrast with the statements in Abstract section.

Response: We have revised the abstract and make them to be consistent. In the revised abstract, we deleted the sentence "3H and 14C data indicated that the age of supra- and sub-permafrost groundwater, and groundwater in Quaternary aquifer of

C3

seasonal frost zone, ranges from 30-60 years."

Comment 11: P13, L9: 'in water' should be 'in water table'.

Response: Change has been made as suggested.

Comment 12: P13, L29: I don't think that the dry sediment layer at depths between 12 m and 12.5 m is related to the subpermafrost groundwater.

Response: This sentence has been deleted.

Comment 13: P13, L29-31: Citation is missing for this statement.

Response: We have added citation for this statement as shown in below. Zhang, R., Liang, X., Jin, M., Wan, L., Yu, Q.: *Fundamentals of Hydrogeology* (6th Edition) (in Chinese), Geological Publishing House, Beijing, 2011.

Comment 14: P14, L24-25: Citation is missing for this statement.

Response: We have added citation for this statement as shown in below. Clark, I. D. and Fritz, P.: *Environmental Isotopes in Hydrogeology*, CRC Press/Lewis Publishers, Boca Raton, Florida, USA, 1997.

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C4