

## ***Interactive comment on “Estimating interaction between surface water and groundwater in a permafrost region using heat tracing methods” by Tanguang Gao et al.***

### **Anonymous Referee #2**

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This paper presents some results on the river infiltration rate in the head water regions of Heihe River with permafrost distributed using heat tracer. The heat tracer is widely used and the signal analysis method is well established. While heat can be a tracer to explore the groundwater and surface water interaction, the hydraulic connection between the river and groundwater is a prerequisite for the exchange between them. However, the information of the riverbed sediments and aquifer lithology were all not given in the background information. Especially, for such a paper that focus on “groundwater and surface water interaction”, little information was given on groundwater and surface water such as groundwater level and river discharge. For a paper with a title that includes “permafrost”, this study provides very little information or back-

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ground about this region’s permafrost. At least, the active layer depth, seasonal frozen depth, the temperature change within active layer and the talik distribution should be described.

The impact of permafrost on groundwater and surface water interaction was not adequately discussed. For such a large area, only 4 piezometers with two at seasonal frozen area and two at permafrost area and 500 m long cable measurements are representative of the GW-SW interaction in the area? The background of four locations were not given. The measured depths are only 0, 20 and 50 cm below streambed. Could these really can indicate the GW-SW exchange in the area?

The specific comments are given in below:

1. In introduction part, the author haven’t reviewed if the method have been used in the permafrost area? If yes, what are the difficulties in using this method and what’s about the feasibility?
2. The author pointed out the temperature at the depth of 0 cm is representative of streambed temperature. How about the river water? Have you measured groundwater temperature from the wells?
3. Line 7 at page 5: I don’t understand how the streambed temperature is related to the thick permafrost. As I understand, the talik should occur below the river channel.
4. The results and discussion section are mixed together and many conclusions are speculative. The more data and evidence are required to further support them. For example, the authors concluded that “ As expected, the 5 streambed temperature at P2 was lower than those at S2 and P1, because of its higher elevation and the thick permafrost; In the streambed at P2, the mean temperature at 0 cm was higher than that at S2 and P1, likely because of the shallower depth of the stream and the lower discharge”. These conclusions are too arbitrary.
5. Line 20 at Page7: please provide related parameters used to calculate the velocity.

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What is the depth of the velocity plotted in the figure? Averaged? How to validate these values? Are there any numerical models in there?

6. It seems that the authors only measured the temperature during July to September in 2015 which are within the thawing season. For investigating the GW-SW interaction in permafrost area, it is hard to use these data to analyze the impact of the permafrost on GW-SW interaction.

7. Line 15 at Page 8: how did you get this conclusion “The losing condition at all the observation sites and the less temperature anomalies demonstrated the low connectivity between the stream and the underlying aquifer”?

8. For section 4.1 “Implications of SW-GW interaction in permafrost region”: the discussion should be based on the results obtained from this study and the condition that related to the study site. Many discussions are the common knowledge or existed understandings.

9. From discussion part, I can’t see how the permafrost affect the GW-SW interaction based on the analysis from the measured data. Also, I can’t see any differences of SW-GW interaction processes between permafrost and permafrost-free area.

Section 4.2.1: the limitations talked about here are not really the limitations of the application of the heat tracer in permafrost area. Line 26-29 at Page 9: One could encounter this kind of situation at other places which are not specific in permafrost area. Lines 30-31 at Page 9 and lines 1-4 at Page 10: these are not really the difficulties since the measurements are simple. Lines 6-11 at Page 9: These statements are unrelated to the study topic “GW-SW interaction”.

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