

Response to Reviewers' Comments

We would like to thank the reviewers for their comments and suggestions. We have revised the manuscript as possible. Comments from the referees are rearranged and responded one by one as follows, with the responses presented in blue.

Response for referee 1

Comment 1

Many times, the authors provided the permafrost temperature and active layer change rate based on the in-situ measurements. My major concern is that are the trends significant, i.e., p -value < 0.05 ? This is important as permafrost temperature at some sites seems "maintained" without a trend, right? Please clarify.

I also suggest authors use the unit of $^{\circ}\text{C dec}^{-1}$ or m dec^{-1} for the estimated trend. In such a case, authors at least could avoid so many "0".

Response: Thank you for your comments and suggestions. First of all, the ground temperature at the depths deeper than 8 m at most sites except YTLH1 has significant warming trends. According to your suggestion, we have made the trending analysis by using the Man-Kendall method with p values tested. Results show that most of the MK p -values for the warming trend of ground temperature are less than 0.001 (as indicated in figures from Figure 4 to Figure 7) except for the d) panel in Figure 7. We also made a MK trend analysis for the variables in Figure 9 and presented the MK p values in the figure. In addition, in the revised manuscript, we have recalculated all the intercept values for the equations in figures from Figure 4 to Figure 7, by respecting the initial observing date as the original point, which is more meaningful.

Secondly, we have used $^{\circ}\text{C dec}^{-1}$ instead of $^{\circ}\text{C/a}$ for the estimated trend in the revised manuscript according to your suggestion.

Comment 2 Ground temperature amplitude

It is not surprising that ground temperature amplitude decreased with increased depth if groundwater is absent. I suggest authors provided the depth of zero annual amplitude (ZAA), its annual ground temperature is also often taken as permafrost MAGT.

Response: Thank you for your suggestion. We have revised the manuscript and added Table 2 to fully present the thermal states of permafrost in the study area.

Comment 3 Data availability

The authors mentioned the data used in this study are public open via TPDC, but it seems the link does not really work. Could you please double-check the link? This will also be required by the ESSD journal if the paper is accepted for final publication.

Response: We have revised the DOI link (<https://doi.org/10.11888/Geocry.tpdc.271752>), and it works now.

Specific Comment 1

- P1, L34: about "one quarter"
- P1, L36: In this case, the permafrost region over the TP was about $1.59 - 0.31 = 1.28$? Could you please update the statistics based on the latest results from Cao et al., 2019, or Zou et al., 2017?

Response: Thank you for your comments. According to Ran et al. (2012) and Zhang et al. (2021) the areal extent of permafrost in China and Northeast China is about $1.59 \times 10^6 \text{ km}^2$ and $0.31 \times 10^6 \text{ km}^2$ respectively. However, the area of permafrost over the TP cannot be calculated simply by a subtraction

of these two area numbers, i.e., $1.59 - 0.31 = 1.28$, because the subtraction result actually includes the permafrost in some mountainous areas in northwestern China, e.g., Tian Mountain, Qilian Mountain, and Altai Mountain. That is, the area of permafrost over the TP should be less than $1.28 \times 10^6 \text{ km}^2$, as reported to be about $1.06\text{-}1.17 \times 10^6 \text{ km}^2$ by Cao et al. (2019) and Zou et al. (2017). Therefore, we think the various reported numbers are not conflict to each other as so far, although we cannot make a further judgment on their accuracy advantages and disadvantages.

Specific Comment 2

- P5, L196: Please check if the estimate is significant.

Response: we have made the significant tests by using the Man-Kendall method with p values listed in the figures. Results show that most of the trend estimation is significant.

Specific Comment 3

Tables & Figures

Table 1: Could you also please provide the last measured MAGT and ALT? This would then provide clear TSP info at the measured sites to readers.

Response: Thank you very much. We have provided Table 2 in the revised manuscript to show clear TSP information.

Figure 1: Is the permafrost distribution from IPA map? Please clarify.

Response: Actually, the permafrost distribution in Figure 1 is from Jin et al. (2007), and it has been clarified in the revised manuscript.