# Responses to the Reviewer

Text in red are the reviewer's comments; **those in black** are the authors' replies and explanations to the reviewer's comments; and those in blue are the revised texts appeared in the revised manuscript.

First of all, we would like to thank Dr. Samuel Gagnon for providing invaluable comments and enhancing the quality of our manuscript. Below please find our responses to the comments:

Line 36: "complex local factors", could you give one or two examples?

Line 94: temperature: could you give the range and also the mean for a specific time period, e.g., 1990-2020? Could be something like "The mean annual air temperature for the 1990-2020 period ranges from -5 to 5°C (mean = -2.4°C).

Line 101: You mention that permafrost has formed extensively, but could you specify if it's continuous or extensive discontinuous?

**Response:**

Thank you for your valuable input. We have incorporated your suggestions by adding examples of "terrain, vegetation cover, soil properties, and hydrological conditions" as local factors. Additionally, we have specified the time period as "during the period 1981–2010" when discussing the temperature range. Lastly, we have revised the description of permafrost distribution as "Extensive alpine permafrost has formed across the QTP, featuring continuous permafrost in the central region and discontinuous permafrost in the southern parts (Yi et al., 2014)"

Refs:

Yi, S., Wang, X., Qin, Y., Xiang, B. and Ding, Y.: Responses of alpine grassland on Qinghai–Tibetan plateau to climate warming and permafrost degradation: a modeling perspective, Environ. Res. Lett., 9, 74014, https://doi.org/10.1088/1748-9326/9/7/074014, 2014.

Line 332-333: Do you not report DDF in negative values? According to your definition, they should be. You should either mention at the beginning (line 133) that DDF are in absolute values to facilitate comparisons with DDT, or change in the text for negative values (and change figures like Fig. 3) accordingly.

**Response:**

Thanks. To adhere to the definition provided in equation (1) where both DDT and DDF are placed within the square root, we define DDT and DDF as absolute values.

Line 311: As in my previous review, this type of sentence describing the figure should be avoided in

the text, I suggest you go directly in what you want to say, e.g., "In-situ DDT (DDF) was compared with raw-LST-derived DDT (DDF) to determine the fit of the model (Fig. 3)."

**Response:**

Yes, we understand and still avoid to rewrite it like describing methodology because this is in the section presenting the results. The revised text reads as follows:

"Figure 3 illustrates the comparison between average annual in situ DDT (DDF) values, calculated as averages over 2005-2010 from daily mean GSTs at 131 weather stations on the QTP, and the average annual satellite DDT (DDF) values at the corresponding MODIS pixels derived directly from daily mean MODIS LSTs. The raw LST-derived DDF values exhibited a perfect match with the in situ DDF values, echoing the limited effects of thin and short-duration snow cover on the thermal states of underlying soils on the QTP (Wu and Zhang, 2008; Zhao et al., 2017). "

It still begins with Figure 3 but we focus on its function as comparing the two sources of DDT/F values.

Line 403: Please add the percentage cover for non-frozen ground to be consistent with the rest and facilitate reading.

**Response:**

We have added the percentage covers: "The non-frozen ground was about $2.24 \times 10^4$ km$^2$ (0.85% of the QTP), and the rest consisted of glaciers (about $4.08 \times 10^4$ km$^2$, 1.55%) and lakes (about $4.17 \times 10^4$ km$^2$, 1.58%)."

Line 458: "showed fewer permafrost areas", is this compared to the local survey map or compared to the Wang map? Please specify.

**Response:**

We have specified it: "……, both the Zou map ($\kappa$ = 0.48) and our map ($\kappa$ = 0.68) showed fewer permafrost areas compared to the local survey map"

Line 465: Table 4, should it be Table 3?

**Response:**

It should be Table 4 here. In line 465, we evaluated maps by boreholes, the Cohen's Kappa between maps and boreholes were shown in the last row of Table 4, while Table 3 demonstrates the Cohen's Kappa between modelled maps and survey-based maps.

Line 635: "In typical regions with distinct differences", to rephrase, I'm not exactly sure what you mean.

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**Response:**

The sentence has been rephrased as "In some regions where we found distinct differences between our map and Zou map".

Line 449: Could you add an example of "thermal perturbations"? E.g., "highly susceptible to thermal perturbations such as a warmer summer".

Line 56: remove "that require sufficient accuracy"

Line 92: The coordinates both indicate East, change one for North

Line 92: Change the sentence to "The QTP (bounded within 73.5–104.5°E and 26–40°N) is a high-elevation flat terrain of about 2.6×106 km2 surrounded by surrounded by high mountain ranges (Fig. 1)."

Line 95: remove "in most areas between 3000-5000 m a.s.l."

Line 96: Change "In the last five decades preceding 2010" to "From 1960 to 2010"

Line 97: Change to "Mean annual precipitations decrease from more than 700 mm in the southeast to about 50 mm in the northwest, and about 90% of precipitations fall during the growing season from May to September"

Line 99: Move this sentence to the beginning of the section, I suggest as the second sentence, right before "Most of the QTP lies between…"

Line 101: Change sentence to "Alpine permafrost has formed extensively on the QTP (ADD SOMETHING ABOUT CONTINUOUS/DISCONTINUOUS). Ice-rich layers are often found near the permafrost table, which is generally 2–3 m deep (Zhao et al., 2020)."

Line 158: Change times to "2:00, 8:00, 14:00, and 20:00" and remove o'clock

Line 165: could you list the three sources with first, second, third to facilitate reading? E.g., "First, a newly published […]", "Second, seven boreholes were collected […]", and "Third, in the Yangtze River […]"

Line 202: remove "where DDF and DDT represent annual ground surface freezing and thawing indices (°C·day), respectively", already defined earlier in the text, you could directly explain E.

Line 239: Change beginning of paragraph to "Conversely, vegetation cover affects DDT by providing a strong […]"

Line 265: Remove "Since there is no simple way to determine wk and wb"

Line 301: Remove "(Zou et al., 2017; Wang et al., 2019)", since you defined the names of the map from those references, you don't need to cite them every time (like in the next sentence). To correct everywhere.

Line 323: Could you replace "below the 10% level" with something like "below our accepted level of error (<10%)", otherwise this information is useless.

Line 422: End sentence after (Fig. 9). Then, start a new one "Our map had a Cohen's Kapa coefficient

of about […]"

Line 453: Change "For the Wang map" to "Since the Wang map"

Line 455: Change sentence to "Together, all of these factors caused the Wang map to overestimate permafrost extent in Gaize"

Line 479: Change decent to statisfactory

Line 501: Change "terrain, vegetation, soil properties and so on" to "e.g., terrain, vegetation, soil properties"

Line 522: Remove "especially"

Line 572: Change to "The red boxes in a) and b) cover two boreholes of […]"

Line 580: Change "Our map proved to be more accurate" to "Our map was more accurate"

Line 593: Change sentence to "Despite the better performance of our map compared to other available products, our mapping approach had limitations and left room for potential improvements"

Line 594: Change "leveraged" to "extracted"

**Response:**

All done as suggested. For more detailed revisions, please refer to the track-changes doc.