Response to Referee #4

We sincerely appreciate your review and the valuable comments on our manuscript, "Permafrost temperature baseline at 15 meters depth in the Qinghai-Tibet Plateau (2010–2019)" (MS No.: essd-2024-114). We have carefully addressed all the points raised and have made the necessary revisions accordingly.

I find the dataset on MAGT at a depth of 15 m and the permafrost model highly valuable for the permafrost research community. I recommend the publication of this paper after addressing the following minor revisions:

- The percentage of data measured in boreholes versus data estimated through linear regression used in permafrost modeling is unclear. It would be helpful to explicitly state this percentage in the Methodology section.

Response:

To clarify, the percentage of data estimated through linear regression has been explicitly stated in the Methodology section. The revised text now reads (Line 93-94):

"As a result, approximately 1732 $MAGT_{15m}$ values were estimated through linear regression, which accounts for 75% of the total dataset."

- Line 126: Please specify the resolution of the digital model used.

Response:

The resolution of the digital model has been specified in the manuscript as follows (Line 126):

"The elevation ***at 1 km resolution*** *was obtained from a dataset compiled by Amatulli et al. (2018)."*

- One interesting finding is the relationship between MAGT15m and slope. How do you explain the presence of colder permafrost in steep terrain? Additionally, could you provide the number of boreholes categorized within each slope class?

Response:

The Qinghai-Tibet Plateau (QTP) is broadly regarded as a mountain permafrost region. Although the extensive distribution of high-plateau has modified the spatial pattern of $MAGT_{15m}$ values to some extent, mountain permafrost is predominantly influenced by the elevation effect. Higher altitudes correspond to lower air temperatures, which subsequently result in lower permafrost temperatures. Our study also indicates that, in higher altitude areas, the decline in $MAGT_{15m}$ with increasing elevation is more pronounced compared to lower altitude regions.

Above the high-plateau, significant mountain ranges such as the Tangula, Kunlun Mountains, and Himalayas are located. The steep terrain typically associated with these mountains is the crucial factor contributing to the extremely low $MAGT_{15m}$ values observed in such areas. In addition to the higher elevations, these steep regions are less favorable to snow accumulation, which plays a critical role in maintaining lower permafrost temperatures. Furthermore, steep slopes are often characterized by exposed bedrock or scree, materials with higher thermal conductivity, which facilitates the transfer of cold energy to the subsurface during the winter season, thereby intensifying the cooling of permafrost. Thus, at the plateau scale, steep regions are concentrated at higher elevations, and their unique snow accumulation and surface cover characteristics further intensified the decline in $MAGT_{15m}$.

Regarding the number of boreholes categorized within the slope classes, the data is as follows: 133 boreholes in flat terrain (slope < 2°), 76 in gentle terrain (2° to 8°), 19 in moderate terrain (8° to 17°), and 3 in steep terrain (slope > 17°). Statistically, 90% of the boreholes in this study are in flat and gentle slope terrain. This distribution is largely attributable to the harsh climatic conditions of the QTP, the poor accessibility of road infrastructure, and the inherent difficulties associated with conducting drilling operations in steep terrain.

- The classification of slope classes may be unclear from a geomorphological perspective. To enhance clarity, please include a reference supporting the chosen slope class intervals.

Response:

To address your concern regarding the geomorphological perspective of the slope classification, we have clarified the classification method in the revised manuscript. Specifically, we adopted the slope class intervals from the USDA Soil Survey Manual, and this reference has been added to both the Results and Reference sections as follows (Lines 193 and 381-382):

"Considering the slope distribution pattern within the study areas, we aggregated the slope gradients into four classes: flat (slope < 2°), gentle (2° to 8°), moderate (8° to 17°), and steep (> 17°) ***(Soil Science Division Staff, 2017)****."*

Reference: "Soil Science Division Staff: Soil survey manual, Ditzler C., Scheffe K., and Monger H.C. (eds.), USDA Handbook 18, Government Printing Office, Washington, D.C., 2017."