Response to the handling topic editor

Dear Dr. Dalei,

We gratefully thanks for the precious time you have spent handling our manuscript. We have carefully considered the suggestions from the Reviewers and made reversions accordingly. Besides, the reference list style is updated following the style recommended by Copernicus. Our response to reviewers' comments is shown below.
We appreciate for Editor/Reviewers' warm work earnestly, and hope that these revisions successfully address their concerns and will meet with approval.
Once again, thank you very much for your comments and consideration of this manuscript.

Best regards,

Zhipeng Xie on behalf of all co-authors

Response to referee report 1

Thank you for the revisions made to the manuscript based on previous feedback. The manuscript has seen considerable improvement, but there are still areas that require further attention to ensure clarity and comprehensive presentation.

Response: We are grateful for your thoughtful feedback and suggestions, which have enabled us to make significant improvements to the manuscript.

1) L58-59: Consider adding specific impacts or key findings that underline the importance of this new dataset, not just use this simplified sentence.

   Response: The following revision has been made to the last two sentences in the abstract. Thank you very much for your suggestion.

   Line 58-62: With the greatest number of stations covered, the fullest collection of meteorological elements, and the longest duration of observation and recording to date, this dataset is the most extensive hourly land-atmosphere interactions observation dataset for the TP. It will serve as the benchmark for evaluating and refining land surface models, reanalysis products, and remote sensing retrievals, characterizing fine-scale land-atmosphere interaction processes of the TP, as well as underlying influence mechanisms.

2) L68-69: Specific the type of "evident changes" observed in the TP (e.g., temperature changes, precipitation patterns) to provide more context and clarity for the reader.

   Response: The following modification has been made to provide more context and clarity about the "evident changes" observed in the TP.

   Line 69-71: Many of the TP's environmental system components have experienced evident changes over the past few decades (Kang et al., 2010), for example, substantial retreat of glaciers (Yao et al., 2012), and dramatically decrease of snow depth and snow cover under the warming climate (Qin et al., 2006; You et al., 2020).

3) L113-114: It would be beneficial to add more discussions about existing datasets and their limitations to contextualize the necessity of the new dataset. This comparison will help in understanding the incremental or significant advancements made.

   Response: Yes, we totally agree with your suggestion on how to contextualize the necessity of the new dataset. That is the strategy we have employed to summarize and comment the existing publicly available field observation datasets in this part. We have made the following revision to clearly show the limitations of the existing datasets. Thank you very much.

   Line 114-117: A rising number of field observation datasets are progressively being made accessible and freely available to the public (e.g., Che et al., 2019; Ma et al., 2020; Liu, et al., 2023; Meng et al., 2023). However, to the best of our knowledge, thorough data quality control procedures have not been implemented to the current publicly available datasets for land-atmosphere interactions over the TP, although these datasets have contributed significantly to the study of climate and environmental change in the mountainous region.

4) The methodology section would benefit from more detailed descriptions of the statistical tests to analyze the data. Clarification on the choice of these methods and their appropriateness for

your dataset would strengthen this section.

Response: Based on your suggestion, we have made reversions on the original manuscript to clarify the choice of methods used in processing the dataset.

The following content is added to clarify the choice of the data quality control procedures used in this study. Line 257-258: The guidelines provide comprehensive documentation on basic quality control procedures used to ensure the accuracy of meteorological observations following World Meteorological Organization (WMO) standards.

To shed light on the rationale behind the usage of constant range thresholds, we include the following information when describing the constant limits used in range checks. Line 273-276: The range limits used in this study were constant, ignoring the seasonal variations, in contrast to the climatological limit check, where the range of limits depends on the season and regional climatic conditions (typically at least 20 years of archived data are required to define climate range thresholds).

The following modification has been made to provide more detail information on the temporal check. Line 284-287: It was discovered during testing that there would be a significant uncertainty if soil temperature, soil moisture, and surface radiations were subjected to temporal consistency test since the former two elements frequently exhibit little to no fluctuation but surface radiations are expected to exhibit substantial variability. As a result, we did not perform similar check for surface radiations, soil temperature, and soil moisture.

5) In Section 4 (L520-545), adding comparative analysis with prior data from other studies or contrasting regions will help in emphasizing the unique contributions of this new dataset.

Response: Following your suggestion, comparative analysis have been added to the original manuscript. Besides, a thorough reversion has been made to the potential applications of this dataset based on Reviewer 2, the updated content is listed as follows as well. Thank you very much.

Line 525-531: Compared with prior datasets released (e.g., Ma et al., 2020; Meng et al., 2023), this dataset involves more stations with various surface characteristics, allowing for a more thorough characterization of the spatial heterogeneity of land-atmosphere interactions over the TP. A strict data quality control procedure was implemented to process the dataset and quality flag was provided for each record, this pioneering initiative facilitates data users access to reliable observations, and minimizes the use of erroneous data, enables its widespread usage in studying the earth system of the TP.

Line 533-555: More specifically, field observations conducted across various landscapes and scales are indispensable for gaining a comprehensive understanding of the interactions between the land surface and overlying atmospheres. Taking the lake-atmosphere interactions as an example (e.g., Li et al., 2015; Wang et al., 2019), current field observations can provide fine-scale multi-component integrated observations at spatial and temporal scales ranging from centimeters to kilometers and from and from seconds to sub-hourly. By using the three-dimensional measurements from PBL tower, eddy covariance system, profile measurements of temperature, humidity, and wind by microwave radiometers, wind profiler, and radiosonde system, the physical mechanisms of land-atmosphere and boundary layer processes over the TP can be systematically investigated. Furthermore, field measurements are widely used to derive or calibrate land surface parameters for regional-scale estimate, satellite retrieval, and numerical simulation of energy and water exchange over heterogeneous landscape (Yang et al., 2008; Chen et al., 2013). There is no doubt that this enhanced observation network enables a systematic assessment of model robustness and uncertainty in representing the land-atmosphere interactions in complex mountainous regions, providing better guidance for physical parameterization optimization of numerical models involving cryospheric, hydrologic, and atmospheric processes in the intricate TP terrain. Meanwhile, extensive field measurements are critical for validating, calibrating, and refining of remote sensing retrieval algorithms over the topographically complicated terrain. For instance, Yuan et al., (2021) used in-situ measurements from this dataset to present an enhanced canopy transpiration model as well as an improved approach for calculating soil evaporation using soil moisture and texture. Systemic biases in key land surface parameters in the reanalysis products can be decreased by integrating synthesis ground-based datasets and revised satellite products through sophisticated data assimilation techniques. For instance, Qi et al., (2023) improved the accuracy of land surface temperature retrieval over the TP based on the in-situ data. The combination of credible datasets provides multidimensional insights into the intricate mechanisms driving the recent changes across the fragile environments of the TP. This makes possible to comprehend the TP's critical role in Asian monsoons, water resources, and global climate teleconnections. In addition, predicting future changes and developing adaptive strategies for the environment and communities of the TP that are currently experiencing disproportionate climate change impacts depend on these integrated land surface observations.

6) The conclusion reiterates much of the information from the abstract and introduction and needs to be rewritten. To add value, consider highlighting the most advantages of this new dataset, the important findings from your dataset and specific implications for future research or policy changes prompted by this new dataset.

   Response: We have made throughout reversion on the conclusion based on your suggestion. Thank you very much. The updated conclusion is listed as follows.

   Line 569-581: This paper presents a suite of integrated field observations of land-atmosphere interactions over the TP with the cooperation of several agencies and organizations dedicated to field observations throughout the TP over several decades. This dataset includes hourly measurements of soil hydrothermal properties, near-surface micrometeorological conditions from 12 stations spanning up to 17 years (2005-2021). This paper highlights the complexity and spatial heterogeneity of land-atmosphere interactions over the mountainous region by describing in detail the observation network and presenting the hydrometeorological characteristics, soil hydrothermal properties, and surface energy balance components of these stations covering various landscapes over the decades. All of the data series in this dataset have been quality controlled using a combination of automatic error screening, manual inspection, diagnostic checking, adjustments, and quality flagging, as compared to other similar datasets that have previously been released. Suspicious and erroneous data were identified, and a QC code was assigned to each variable value. The specially designed data processing procedures tailored to handle the data issues of this integrated network is detailed described. It is indisputable that the long-term hourly quality-assured dataset presented here will contribute to a broad research effort and help advance the fine-scale understanding of the land-atmosphere interactions over the heterogeneous TP region, refine land surface models, reanalysis products, and remote sensing retrievals.

Response to referee report 2

Most of the previous concerns have been adequately addressed. The following issues require attention:

1. Please ensure consistent use of scientific notation throughout the manuscript. For example, it should be '5,150' or '5 150'.
   Response: Modifications have been made based on your suggestion. Thanks.

2. I found several typographical errors throughout the manuscript. For instance:
   '5150m'. Please add a space between the number and the unit, like '5,150 m'.
   Each number should have a standard format. Replace '570' with '570 mm'.
   Replace 'Yellow River' with 'Yellow River Basin'.
   Response: We're grateful for your careful review of the manuscript. These errors have been fixed based on your suggestion.

3. Line 170: This paper provides the latest evidence of dramatic hydroclimatic changes in the headwaters of the Yellow River Basin (DOI:10.1088/1748-9326/ab9466).
   Response: Thanks for your recommendation, the paper has been added to the reference list.

4. Figure 1
   Replace 'elevation' with 'DEM' as you use DEM in the figure caption. Otherwise, using elevation in the figure caption. Keep it consistent.
   Part of the caption for subplot b is obscured.
   Response: Corrected as suggested.

5. Figure 3
   In subplots d and e, there is a space between the subplot number and the caption. However, in subplots a, b, and c, there is no space between the number and the caption. Please carefully review the entire manuscript to avoid these occurrences.
   Subplot e: place a space between the number and its unit.
   Subplot f and g: consistently use a range of '0 to 700' in these two plots. The values in subplot f are almost reaching the top.
   Subplot e: the ticks should align with the years instead of being placed in the middle of the years.
   In the vertical axis titles of each subplot, there should be a space between the variable and the unit. This suggestion applies to all subsequent figures. For example, Replace 'temperature(℃)' with 'Air temperature (℃)'. Use 'Air temperature' because it occurred in the figure caption and elsewhere. Please note once you define the variable name, please consistently use it throughout the manuscript.
   Response: Corrected as suggested except for the subplot f and g, where f shows the downward longwave radiation (with values greater than or equal to 0) and g shows the upward longwave radiation (values can be either positive or negative), so the range of '0-550' was used in f and '-100-650' was used in g. Thanks very much for your suggestion and understanding.

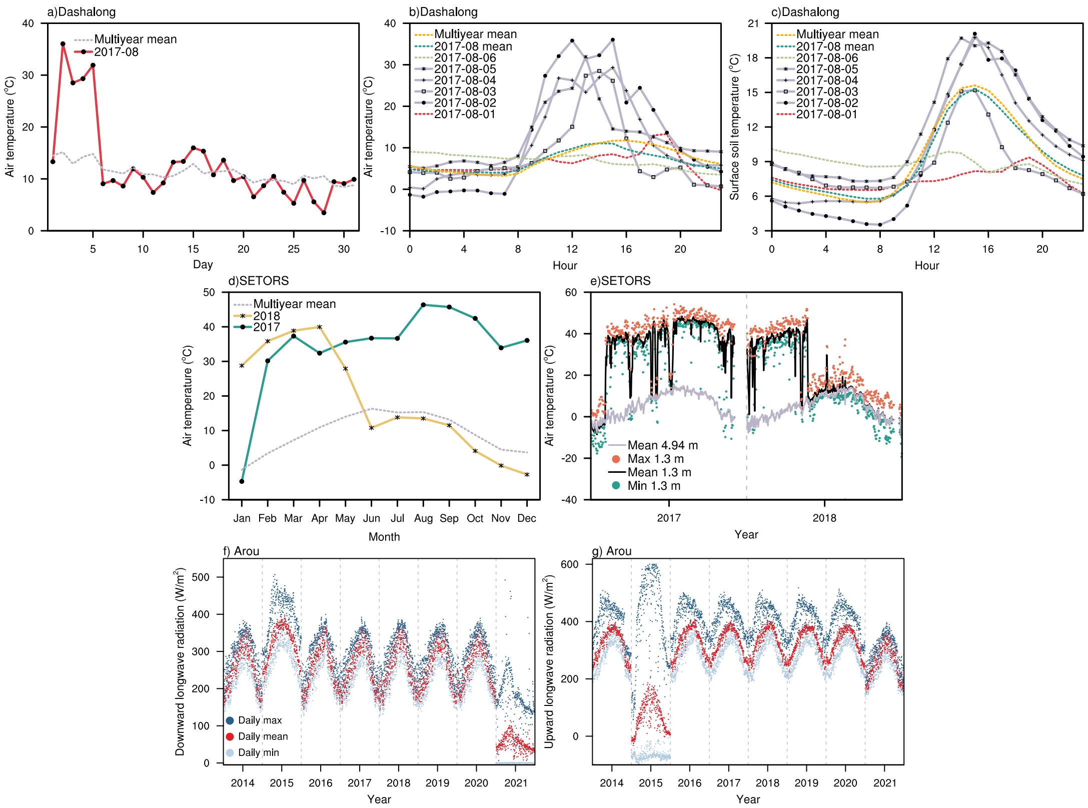

Figure 3

6. Figure 4

Figure 4 needs redesign. It is a little bit difficult to quickly understand the content of this figure according to the current information provided.

My understanding is that the first and second columns describe sub-diurnal and daily variations in four variables at the six sites, and the third and fourth columns describe similar variations at another six sites. If my understanding is correct, please clearly indicate that each subplot in the first and second columns shares the same legend, and each subplot in the third and fourth columns shares another legend. Consider putting two legends at the top of the figure. This suggestion applies to all subsequent figures.

I like the way to describe variations in Air temperature, subplot e-h consistently use the same range -20 – 20. Apply this to the other three variables. This suggestion applies to all subsequent figures.

Response: Thank you very much for pointing these issues out. Most of your concerns are addressed in the new figures (Figure 4, 5, 6, 7, 8). One thing that needs to be clarified here is that the consistency of the variation range between subplots has been considered as much as possible in our design of the measures of variation for each variable. However, because of the difference between the sub-diurnal and daily variation and the difference among stations (particularly the surface radiations and turbulent fluxes), it is challenging to distinguish the variations between stations when using the same range among the subplots as data points will overlap between sites. Our solution to this issue is to maximize the difference in the variations between stations by making some targeted adjustments to the variation range of variables with significant spatial difference (e.g., Rsu, and turbulent fluxes), while maintaining the variation changes of other subplots as consistence as possible (e.g., Rsd, Rld and Rlu).

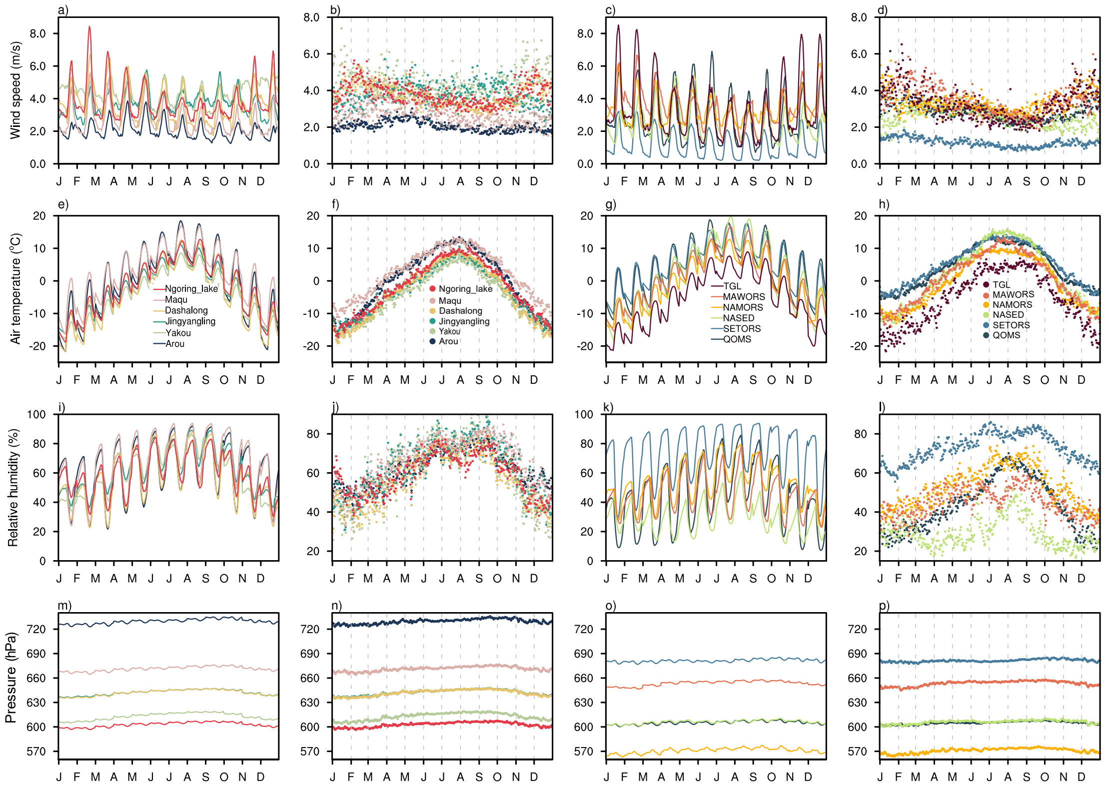

Figure 4

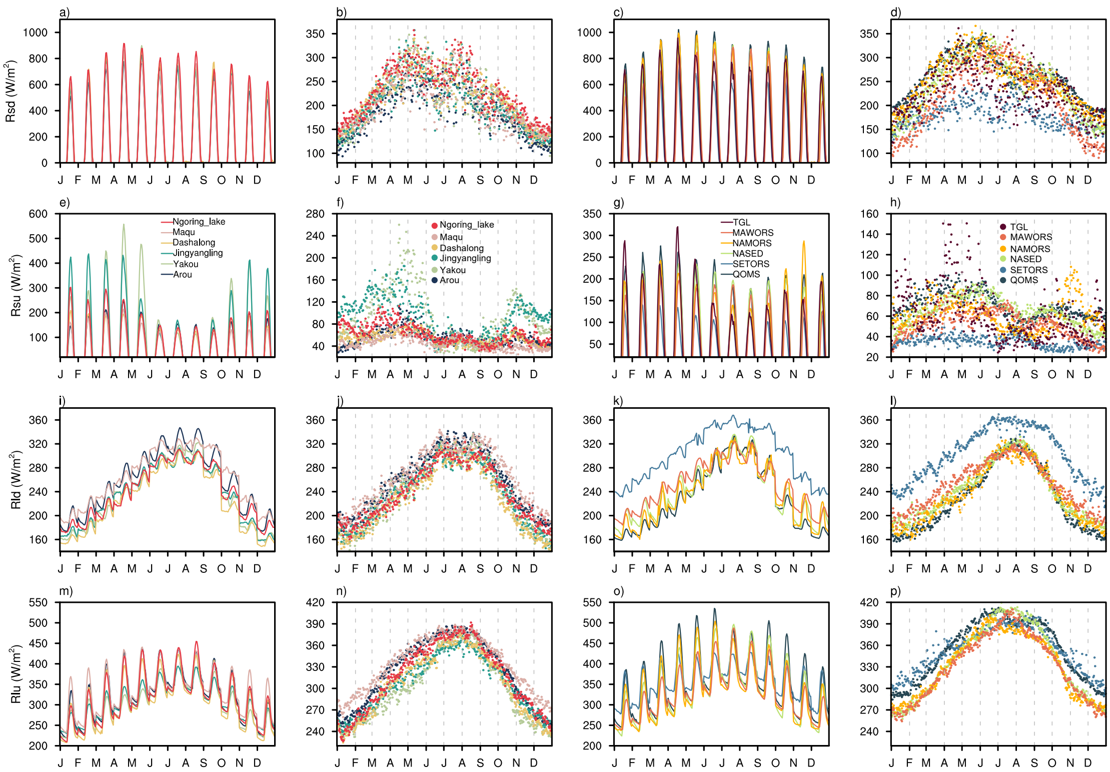

Figure 5

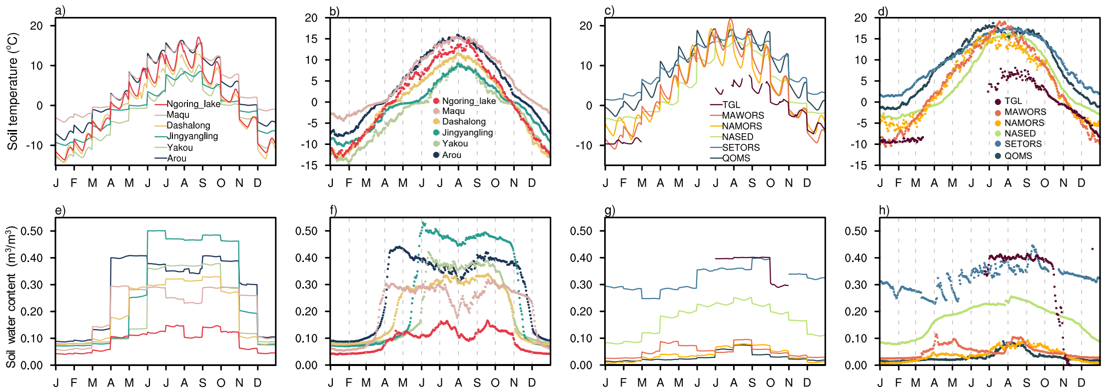

Figure 7

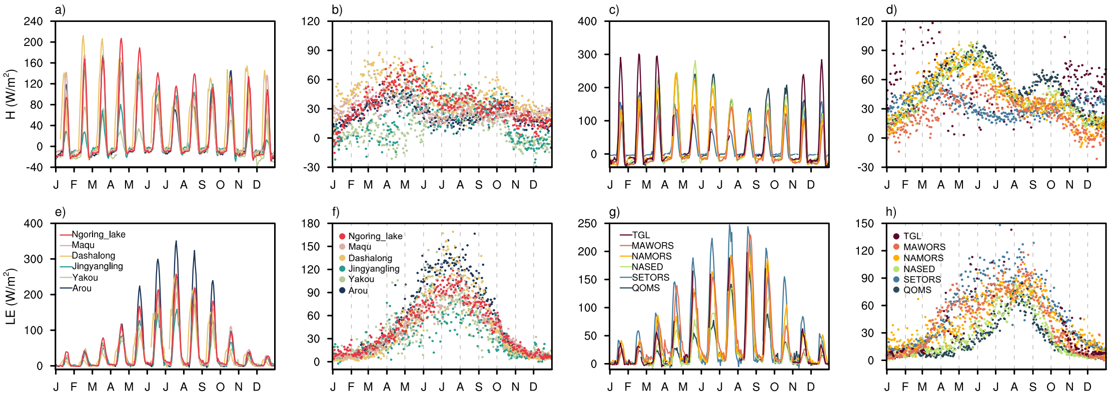

Figure 8

7. Section '4 Potential applications enabled from this integrated dataset': Although the author discussed potential applications, more specific examples should be provided.

Response: We have made a further reversion on the potential applications of this dataset, the revised content is listed as follows. We hope the modification made on the revised manuscript will cover the reviewer expectation.

Line 533-555: More specifically, field observations conducted across various landscapes and scales are indispensable for gaining a comprehensive understanding of the interactions between the land surface and overlying atmospheres. Taking the lake-atmosphere interactions as an example (e.g., Li et al., 2015; Wang et al., 2019), current field observations can provide fine-scale multi-component integrated observations at spatial and temporal scales ranging from centimeters to kilometers and from and from seconds to sub-hourly. By using the three-dimensional measurements from PBL tower, eddy covariance system, profile measurements of temperature, humidity, and wind by microwave radiometers, wind profiler, and radiosonde system, the physical mechanisms of land-atmosphere and boundary layer processes over the TP can be systematically investigated. Furthermore, field measurements are widely used to derive or calibrate land surface parameters for regional-scale estimate, satellite retrieval, and numerical simulation of energy and water exchange over heterogeneous landscape (Yang et al., 2008; Chen et al., 2013). There is no doubt that this enhanced observation network enables a systematic assessment of model robustness and uncertainty in representing the land-atmosphere interactions in complex mountainous regions, providing better guidance for physical parameterization optimization of numerical models involving cryospheric, hydrologic, and atmospheric processes in the intricate TP terrain. Meanwhile, extensive field measurements are critical for validating, calibrating, and refining of remote sensing retrieval algorithms over the topographically complicated terrain. For instance, Yuan et al., (2021) used in-situ measurements from this dataset to present an enhanced canopy transpiration model as well as an improved approach for calculating soil evaporation using soil moisture and texture. Systemic biases in key land surface parameters in the reanalysis products can be decreased by integrating synthesis ground-based datasets and revised satellite products through sophisticated data assimilation techniques. For instance, Qi et al., (2023) improved the accuracy of land surface temperature retrieval over the TP based on the in-situ data. The combination of credible datasets provides multidimensional insights into the intricate mechanisms driving the recent changes across the fragile environments of the TP. This makes possible to comprehend the TP's critical role in Asian monsoons, water resources, and global climate teleconnections. In addition, predicting future changes and developing adaptive strategies for the environment and communities of the TP that are currently experiencing disproportionate climate change impacts depend on these integrated land surface observations.

8. Overall, the manuscript requires careful reading and editing, including both textual content and figures. Language also requires polishing.

   Response: The revised manuscript was carefully checked and edited for the English language to take into account all suggestions by the reviewer.

Response to referee report 3

In the early stages of the manuscript, I had three main concerns, all of which were addressed by the authors in this round of revisions.

I originally felt that the introduction was too long (Lines 64-155). It has since been updated (Lines 63-142) and it still follows a logical framework needed to introduce the goal/purpose of the study. I also felt that Section 2 (Observation Network and Data Processing) lacked the necessary details needed for a scientific data paper. The authors made significant changes to Section 2.3 (Data Post-Processing Workflow) which helps the reader to better understand the processing workflow and what QA/QC processes actually took place. Lastly, I had questions/concerns about the validity of the EC data and was curious why the heat fluxes were identified to be so 'bad' (Figure 8 and Figure B3) at each site. The authors mentioned that they read/plotted the incorrect data in that figure, and while it has been fixed, the updated figure (to a much lesser degree) still has some 'bad' latent heat flux and sensible heat flux data (which is a bit surprising). Figure 8 also appears to be corrected. Overall, I am satisfied with the revisions that the authors made for my comments and for the other reviewer comments. Following a detailed proofread (and final review by editor), I believe the manuscript can be accepted.

Response: We would like to thank you for your careful reading, helpful comments, and constructive suggestions, which has significantly improved the presentation of our manuscript.