Response to Review 2

(Review comments in Italic, response in upright Roman in blue)

General comments: Integrated observations of land-atmosphere interactions on the Tibetan Plateau are critical to understanding key land surface processes, and the research community has been waiting a long time for the release of the long-term dataset, which is somehow later than expected. This dataset contains the hourly meteorological, surface radiation, EC and soil hydrothermal observations from six sites on Tibetan Plateau, with variables clearly organized. In the manuscript, the data quality control for EC data is introduced in detail, and the manuscript also presents the variations of each variable (except carbon dioxide flux) at diurnal, daily and monthly scales, to some extent, indicating that the data accuracy is reasonable.

Overall, this dataset is valuable, and it represents a major step forward in data sharing on the Tibetan Plateau. These data can support the understanding of land processes such as energy distribution, surface heating, and boundary layer processes. These data are particularly valuable for the development of land models and remote sensing algorithms. However, the following issues should be addressed for user convenience.

Response: We greatly appreciate your constructive comments on our manuscript. We revised our manuscript accordingly, and the detailed responses are given below.

Specific comments:

1. An introduction to data quality control for meteorological variables is needed, such as how to handle fill-in gaps and outliers, although procedures for fluxes are given.

Response: Thank you for pointing that out. In the data quality control procedure, the plausible value check, time consistency check, and internal consistency check were applied. It should be noted that we retained the observations in their original form as much as possible, without any further process except for replacing the outliers with missing value (NaN). However, only cautions were provided in the manuscript when anomalous changes or values were detected. In this case, these anomalous observations should be carefully used and further bias correction or data selection procedures are recommended. Besides, the data gaps caused by instrument failure or outliers' removal have not been filled at the moment. Our continuous efforts will be put forward to explore how to provide more accurate and effective long-term field observations, which aims to address the problems currently facing in this dataset. Based on your suggestion, the following content was added to the original manuscript:

The plausible value check, time consistency check, and internal consistency check were applied to ensure the accuracy and reliability of the observations. However, to retain the observations in their original form as much as possible, there is no further process taken except for replacing outliers with missing value (NaN).

2. Provide a table to illustrate data availability, as long-term continuous data are usually not available. This information is important for users to select data for their own purposes.

Response: Yes, providing long-term continuous field observation is especially challenging, particularly in the Tibetan Plateau because of its harsh environmental conditions. We agree so much that the importance of data availability information in facilitating data selection for user's various purposes. So, as we introduced in the "Data availability" section, the data integrity (the percent of available data to the total number of observations) of each variable was also provided every year,

users can freely download these files through the links in the manuscript. Meanwhile, the heat maps in the Supplement materials were used to show the data integrity information.

3. data consistency check need to be presented. For long term data sets, sensor calibration is important, especially for radiation measurements. The current MS only shows the diurnal, daily, and seasonal variations of each variable, but lacks information on how the sensors are calibrated and whether the quality of the data is consistent throughout the observation period.

Response: For the reviewer's concerns about the sensor calibration, to ensure the accuracy and reliability of the observations, we organize professional engineers to inspect, maintain and calibrate all the instruments at each station every year. Meanwhile, all stations are manned except for the cold winter season. The equipment is checked and data are collected and processed regularly. However, due to the solar power supply in the field and other special conditions, problems still exist om some stations, for example, the SETORS, where the availability of hydrothermal data are seriously affected. The following sentences have been added to the end of section 2: To ensure the accuracy and reliability of the observations, periodic inspection, maintenance and calibration are carried out by professional engineers. Meanwhile, all stations are manned except for the cold winter season. Instruments are checked and data are collected and processed regularly.

As we have mentioned in the response to the first comment, in the data quality control procedure, data consistency check procedures were applied to ensure the accuracy and reliability of the observations, including time consistency check and internal consistency check. But at present, the data consistency check procedures are performed manually, thus it is not possible to provide data quality flag for each variable. In the follow-on work, the anomalous data will be identified and the data quality flag for each variable will be provided. To clearly present the data consistency check procedures we have made, we have added the following information to the original manuscript: Data consistency check procedures were applied to ensure the accuracy and reliability of the observations, but the data quality flag is not available for the moment. Some time series of observations should be used with caution (for example, the soil hydrothermal data in SETORS), as anomalous changes or values were detected. In this case, further procedures such as bias correction or data selection are required.

4 The description of the time used is unclear in the data file. Is it local time or UTC?

Response: Thank you very much for your careful reading! We did not introduce this important information on the original manuscript, so we have added this description in the "Data availability" section. The added content is as follows: The local time was used in all the data files (UTC+8).

5. If measurements are available, it is desirable to provide detailed in situ soil texture information, such as the content of sand, clay and soil organic matter. If measurements are not available, it is useful to provide a more qualitative description than in Table 1.

Response: We agree that more information is needed. The quantitative soil texture measurements are not available, but we have added more information as we can to provide more qualitative description of the soil texture. This description is mixed with the added information on vegetation and terrain complexity, so the added content will be listed on the response of the 7th comments.

6 Similarly, it is useful to provide vegetation information (LAI, vegetation cover, vegetation type).

If not, some local knowledge or data from remotely sensed products would also be useful. The authors can extract information from remote sensing products better than a user because they are aware of the heterogeneity of surface conditions.

Response: As remotely sensed products can not accurately show the vegetation information in such a highly heterogeneous region though the spatial resolution of the products at hundreds of meters level is available, we prefer to provide more local knowledge on the vegetation cover and vegetation type. The added contents will also be list in the next response.

7 Terrain complexity is typical of the Tibetan Plateau and is mentioned several times in MS. Likewise, it is desirable to present detailed terrain (e.g., DEM) around the site, so that users can avoid misuse of the data.

Response: Thanks for your constructive comment. To clearly show the terrain complexity, we calculated the ranges of elevation and the standard deviation of elevation within a kilometer around each station based on the 30 m resolution ASTER DEM data. This information is listed in Table 2. Meanwhile, some descriptions are also added. The added contents on the soil texture, vegetation and terrain complexity are listed as follows:

The MAWORS station was located in the region where the atmospheric circulation was influenced by the westerly wind all year round. Soil at this station was predominately sandy soil and gravel with sparse and short grass-covered. Large scale modern glaciers are distributed around the station (the standard deviation of elevation within a kilometer around the station is 152.92 m, which is the highest among the six stations as shown in Table 1) and exert great influence on the local weather and climate. The observations from this station are of great significance for the study of interactions between westerly winds and monsoon and their effects on land-glacier-atmosphere changes, as well as changes in snow and ice resources.

The NADORS station was built in a flat and open mountain valley in the northwestern TP (with the lowest standard deviation of elevation). The land use type here is Gobi Desert with very short grasses (about 1-2 cm) on the sandy soil and gravel surface. It is located at the convergence zone of the Indian monsoon and westerly wind, where these two atmospheric circulations interact intensively, making the NADORS as an excellent location for the study of westerly-monsoon interactions on the desert landscape.

The BJ site is located in a flat, open prairie except for the north, where there stand low hills (the standard deviation of elevation is 15.14 m). The site is well-vegetation-covered and the dense grasses are relatively high with height up to 5 cm. Soil at the site is predominantly sandy silt loam. The BJ site is an ideal place to observe the land-atmospheric interactions on the alpine meadow ecosystem.

The NAMORS station is located on the banks of Lake Nam Co, with the Nyainqentanglha Mountain behind. The land is covered by alpine meadows and the soil type is predominantly sandy silt loam, but the gravel content is high at 30-40 cm below the ground. As lake has a significant influence on the atmospheric circulation in this region, and plays a certain role in regulating temperature variation and precipitation, etc. Thus, this station is an ideal place to measure the land-atmosphere interactions in the water-land-mountain mesoscale system.

The QOMS is situated at the bottom of the lower Rongbuk Valley, to the north of Mt. Everest. The surface is barren and the ground is relatively flat and open, with sparse and short vegetation. Sand and gravel dominant here from surface to deep soil. The Himalayas acts as the channel for the

exchange of energy and materials between surface and tropospheric atmosphere. Moreover, local circulation patterns, such as valley winds, link the near-surface atmosphere on the north side of Mt. Everest with the upper free atmosphere, making this region the best location for monitoring atmospheric conditions in the Northern Hemisphere.

The SETORS station lies in a mountain valley close to the forested southeastern TP (the terrain is highly heterogeneous, but is not as complex as the MAWORS). It's surrounded by a dense vegetation cover (mainly temperate needle-leaf trees and alpine meadows). The shallow soil here is well developed and the water-holding capacity of the soil is greatly enhanced due to the presence of organic matter, while the deep soil is predominantly gravel. The observations from the SETORS station are important for studying the water and heat transport along the alpine valleys by the South Asian monsoon, the alpine forest-glacier-atmosphere interactions, and the transport of hydrothermal components of the vertical belt in the mountainous regions.

8 As mentioned in the manuscript, self-heating of the instrument can cause signal distortion in the CO2 flux data, but the manuscript does not give references on how to process and obtain ecosystem (i.e., GPP, NPP) carbon fluxes based on the flux data provided. A reference is helpful to the user.

Response: Thanks for your advice. Although we have listed two references that provide detailed information on how to correct carbon fluxes data in the original manuscript (Burba et al., 2008; Zhu et al., 2012), we added a description to lead the user to refer these references. The added content is listed as follow:

However, the heating effect of the instrument was not been considered in the carbon dioxide flux data provided in this manuscript, more detailed information can refer to the studies of Burba et al. (2008) and Zhu et al. (2012).