Response to Referee #1 (ESSD-2026-183)

Manuscript Title: **Weather station data from the Mount Everest region, Nepal: 3,810-8,810 m above sea level**

Dear Editor and Reviewer #1,

We thank to both editor and the reviewer for the opportunity to revise our work.

We are very grateful to the referee for the constructive feedback and for identifying gaps in our Supplementary Information and methodological descriptions. These comments have significantly helped us clarify the paper and ensure that the data is presented as transparently as possible.

Below, we provide a point-by-point response to all comments raised by the reviewer. The comments are in *italics*, our response is in blue text and the proposed changes to the manuscript are provided in red text. Note that all proposed changes have been incorporated into the revised manuscript and the supplementary materials.

Comments:

Lines 92-93: Is it Universal Coordinated Time (UTC) or the university? That must be a typo. Check?

Thank you for catching this typo. It refers to Universal Coordinated Time (UTC). We have corrected this in the revised manuscript.

Lines 98-101: The figure 1 caption describes the locations of meteorological and glaciological observations since 2010, denoted by a plus (+). But no mention is made of the installed AWS in the Everest expeditions either, although it is in the legend with some symbol.

Thank you for noticing the gaps in the caption, we have updated the both figure and the caption for Figure 1

"Figure 1. Geographical location of different automatic weather stations (black symbol) installed during the National Geographic (NGS) Rolex Perpetual Planet Everest expeditions 2019-2022 along with other operational stations by EvK2CNR and GLCIOCLIM, in the Khumbu region of Nepal. The plus symbol represents camps in the valley including Everest Base Camp and the Changri Nup point is the area where Meteorological glaciological observation has been monitored since 2010 and the red lines represents the normal climbing route to Mount Everest from South side."

Line 106: Could not find the supplementary information for the photograph links, although it is mentioned.

We would like to clarify that the supplementary materials were already added as separate supplementary documents during the submission. The photographs and associated files have been uploaded and are accessible via the supplementary document: https://essd.copernicus.org/preprints/essd-2026-183/essd-2026-183-supplement.pdf

Lines 127-128: Is there any reason why the AT and RH sensors are installed 1.5 m from the ground for higher AWSs, whereas 2 m for the lower AWSs?

Thank you, we added the reason to install that at 1.5 m.

"The sensors are installed 2 m from the ground for the lower AWSs (PH, BC and CII), and 1.5 m for the higher AWSs. We chose a lower height for the high-altitude stations to protect them from strong winds in two ways. First, wind speeds are generally lower closer to the ground. Second, a shorter pole creates less leverage (torque) on the tripod base, which reduces the risk of the station breaking or blowing over during severe wind gusts."

Will not the heavy snowfall during the events affect the sensors while setting it to a lower level of 1.5 m in higher?

Yes, it's possible that the heavy snowfall can affect the AT and RH sensors, however it is necessary to make the AWS stable with extreme wind gust. Additionally, we estimated that the annual snowfall at higher altitude (>7000 m) to be under 1 m since, much of which is lost via sublimation and wind scouring would therefore not affect the sensors.

Lines 156-158: Is there any standard time to capture the photo? Why is it set at 0937 NPT and 1437 NPT?

Thank you for the question. It is mostly because to synchronize to the other hourly data in UTC (45 minutes past the hour local time), so that the photo capture time and saving and transferring time can be almost similar to the other meteorological variables.

Table 1: What does the 'present weather sensor' work for?

That is the sensor that measures the intensity and form of precipitation. It is an OTT HydroMet Parsivel2.

Section 2.1: AWS details and measured variables

Why does the manuscript in section 2.1 only elaborate on six variables? Table 1 reveals other sensors, too, such as the present weather sensor and the relative surface elevation change.

We thank the reviewer for this valuable suggestion. In response, we have added a description of the optical disdrometer and snow-level sonic sensor to the manuscript. These instruments were installed to complement the precipitation measurements and support additional analyses. The disdrometer provides information on precipitation particle size and intensity, while the snow-level sensor helps identify snow occurrence and surface conditions, improving the overall interpretation and validation of precipitation data. However, we note that the SR50 and disdrometer data have not been analysed in this study, as the present work does not focus on these specific datasets.

"An optical disdrometer (OTT Parsivel^2) and a snow-level sonic sensor (SR50A) were installed to complement the precipitation measurements. However, because these instruments require highly specialized data filtering (e.g., for wind noise and blowing snow) and our current study focuses strictly on baseline meteorological dataset, these datasets are not analyzed here and will be presented in future work (Table1; Löffler-Mang and Oceanic, 2000; Ryan et al., 2008)."

Line 180: Supplementary Table S1 could not be found.

Thank you for the comment, the supplementary document is separately added, may be due to some technical issue it was inaccessible for some period. https://essd.copernicus.org/preprints/essd-2026-183/essd-2026-183-supplement.pdf

Line 201: Supplementary Figure S1 could not be found.

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Line 206: What about data availability on surface elevation change or snow? Three sites have these sensors (ref. Table 1) As it would be very useful for the mountaineers and other communities.

We thank the reviewer for this suggestion and agree that these datasets are highly valuable for mountaineers and regional stakeholders.

Given the broad potential applications of this monitoring network, we intentionally restricted this paper to a core subset of foundational meteorological and radiation variables. Covering all measured parameters would excessively extend the manuscript and dilute our primary focus on spatial and seasonal gradients.

While these quality-controlled datasets are fully available alongside the other variables for future specialized studies.

Line 212: Average annual precipitation? If it is annual precipitation, 'of which year'?

The specific period or the year that was used to calculate the average annual precipitation is for time period between December 2019 to November 2022 where we have almost no data gaps; from winter to the end of post monsoon to capture all four seasons. Which is mentioned in the first line of section **4. Climatology of the region**

"Figure 3 shows the monthly precipitation and temperature (from December 2019 to November 2022; Figure 2) for PH (3,840 m) and BC (5,315 m), the two AWSs in the network that include measurements of precipitation."

Line 221: Is it 'mean monthly' or 'monthly mean'?

The phrase has been standardized to monthly mean.

Lines 226-228: Do the precipitation comparisons between the PH, BC and Pheriche, Pyramid cover the same time frame? If yes, it is not mentioned. Also, two values of precipitation amount from the Pyramid station – what do they mean? Are the values from the two stations at Pyramid?

Thank you so much for the very important question. The time frame of precipitation comparison is different and we have clearly included the period in the manuscript. Also, the amount of precipitation at Pyramid is by two different measurement projects and the period is also clearly labeled now with the reference.

"Overall, the amount of precipitation measured at the both (PH and BC) observing sites is higher than the amount measured at the Pheriche (4200 m asl: 540 mm (Nov 2016-Dec 2020)) and Pyramid (5050 m asl: 449 (EvK2CNR: 1994-2012) and 591 mm (Nov 2016-Dec 2020)) by IRD stations (Khadka et al., 2022; Salerno et al., 2015)."

Section 5: The SC-observed data is compared with ERA5; it is better to give a short overview of ERA5. Why is it not compared with any other stations?

Thank you for this constructive feedback. We have revised Section 5 to include a concise overview of the ERA5 dataset. Furthermore, we have explicitly clarified that adjacent high-altitude physical stations (such as Balcony and Bishop Rock) lack sufficient long-term data continuity due to frequent environmental disruptions. Because the South Col (SC) AWS provides the longest running and still operational record at these extreme elevations, ERA5 represents the most robust baseline available for data validation.

"ERA5, the fifth-generation global reanalysis produced by ECMWF, provides hourly climate and weather variables since 1940 with high spatial resolution with different pressure level and is widely used as a reference dataset (Hersbach et al., 2020). While adjacent higher AWSs (BR and BA) suffer from highly limited data availability, SC AWS features a relatively longer data record and remains operational. Consequently, we compare temperature, relative humidity and wind speed between the SC AWS (the longest record from above Camp II, where extreme weather poses the greatest risk for mountaineers) and ERA5 reanalysis (Hersbach et al., 2020) data extracted from the nearest grid point at the 350 hPa pressure level (most representative of the SC: mean air pressure 2019-2021 = 377 hPa). "

Lines 254-255: As the comparison between ERA5 and observed has an approximation of $R^2 > 0.6$ (for all variables) for the period of monsoon and post-monsoon (June to Dec). Are the comparison limits for all seasons due to missing data?

I am not fully understanding the question. From my understanding, you are asking if data gaps are the reason the evaluation is limited to this period.

Yes, the detailed comparison is focused on the June-to-December period because this timeframe provides the longest continuous data record with the fewest data gaps (Figure 2). Extreme winter and spring conditions at this altitude cause frequent sensor icing and power depletion, leading to significant data gaps during those seasons.

Lines 257-258: Supplementary Figures S3 and S4 could not be found.

Thank you for the comment, the supplementary document is separately added, may be due to some technical issue it was inaccessible for some period. https://essd.copernicus.org/preprints/essd-2026-183/essd-2026-183-supplement.pdf

Lines 280-282: The wind and gust speed were highlighted for the mountaineers for the period; the comparison was missing for April and May (spring expedition).

We acknowledge the suggestion to include comparisons for April and May. Unfortunately, due to an AWS failure at the South Col station, only limited data are available for these months. As a result, we are unable to provide in-situ comparisons for April and May. This limitation has now been explicitly stated in the revised manuscript to clarify the data gap.

We believe these revisions address all concerns raised by the referee and significantly strengthen the manuscript. Thank you again for your time and expertise.