

# Reply to Referee 2

July 11, 2025

Dear Referee,

Thank you very much for reviewing our manuscript. We are very grateful for the helpful and constructive comments. In the following, we provide point-by-point replies to the points raised in your report. We have written the original text of the reviews in black colour and our response in red colour.

## Summary:

This paper introduces a valuable dataset collected using the Advanced Max Planck CloudKite instrument (MPCK+) during the Pallas Cloud Experiment (PaCE) in Finland, September 2022. The dataset comprises high-resolution airborne measurements of turbulence, wind shear, and cloud microphysics from a unique tethered Helikite platform operating within the Arctic boundary layer. Key strengths include the high spatial resolution achieved due to the platform's low airspeed and the long-duration, low-altitude flight capabilities compared to traditional aircraft. The manuscript effectively details the instrumentation, campaign, data structure, processing, and provides useful examples. The authors are commendably transparent about data characteristics and potential challenges. This dataset represents a significant contribution for researchers studying boundary layer dynamics and cloud processes. This manuscript presents a unique and valuable high-resolution atmospheric dataset collected using the innovative MPCK+ tethered balloon platform during the PaCE 2022 campaign. The data provides important insights into Arctic boundary layer conditions and cloud microphysics, complementing other measurement strategies. The authors have provided a thorough description of the instrument, campaign, and data, including transparent discussion of data quality aspects. Overall recommendation: Addressing the minor comments listed below will strengthen the paper significantly. Therefore, I recommend this paper for publication in Earth System Science Data after these minor revisions have been addressed.

## Minor comments:

Line 21-22: The similar acronyms "MPCK" for the platform and "MPCK+" for the instrument package could be confusing. Consider clarifying the naming convention. Does the "+" specifically denote "Advanced"? Is there a non-advanced instrument package, and if so, does it share the platform's acronym?

In previous publications we have already used the acronym MPCK for the platform and also for the instrument box. We have also built another instrument called mini-MPCK and a distinction had to be made between these instruments and the platform. In hindsight, the names could have been better chosen, but changing the names now would only cause more confusion. We have provided further details and explanations of various instruments developed for the MPCK platform in the main text.

Line 26-41: The detailed technical descriptions of the PIV/Holography units and other sensors currently appear in the Introduction. Consider relocating this information to Section 2.3 ("Instrumentation: the MPCK+") for better structural flow, keeping the introduction focused on the overall goals and dataset overview.

Thank you for the suggestion. We moved the text between "inline holography unit" and the end of the Introduction to Section 2.3 and merged it with the existing text in Section 2.3 to avoid duplications. After "inline holography unit" in Line 24, we added two sentences to describe the structure of this paper: Details about the field campaign, the MPCK platform, the instrumentation and the measurement flights are presented in Section 2. The data structure with examples is described in Section 3. Section 4 is dedicated to provide information for usage of the data.

Figure 1 Caption: Please add context to the caption, for example, specifying it shows a test flight and its approximate location (e.g., "near MPI-DS").

We added the following text: "next to the institute location of MPI-DS".

Table 1: For the PIV/PTV and Inline Holography entries, please specify the effective particle size range they can resolve or their measurement resolution limits.

We added the size range of particles for the imaging units.

Table 2: The "Instrument" column appears redundant as all flights use the MPCK+. Consider removing it.

Agreed. We decided to remove this column as it does not provide useful information to the reader.

Line 141: The current flight ID format is yyyyymmdd.hhmm. Consider providing a simpler, sequential flight identifier (e.g., PACE22.FLT01, PACE22.FLT02...) in the metadata or tables for easier referencing across datasets or publications.

We appreciate the suggestion and agree that a simplified sequential flight identifier can be helpful for referencing. However, for consistency across the campaign, we decided to adhere to the naming convention used by all instruments and teams—based on yyyyymmdd.hhmm—since not all platforms were deployed in every flight. A purely sequential flight numbering system would have made data integration and cross-platform comparisons more cumbersome and potentially confusing. That said, we did include a flight number identifier in the metadata of the flights.

Line 305: Clarify explicitly whether the noted 10.4° pitch offset correction required

for the powerinterlock device data has already been applied in the distributed NetCDF files or if users must apply it themselves. Table 5 appears to present uncorrected data.

In the previous version of the data and manuscript it has not been corrected. It is already corrected in the revised version of the data and the manuscript. The sentence has been removed.

## **Other author comments and modifications**

Figures 4 and 5 were updated. The plotting style was changed to increase readability. Figures 6 and 7 were updated by using the new temperature and relative humidity data.

We removed the text in line 301 - 305 and adapted the sentence before in the following way: Moreover, the hmp7 sensor is heated, which may lead to a positive bias in temperature. Due to that, we recommend using the temperature recordings of the rht sensor and the relative humidity and dewpoint data in the corrected\_rht data group.