We would like to thank both reviewers for their time and suggestions to improve our manuscript, we really appreciate their effort. Below can be found responses to reviewers' comments as RC - reviewer comment and AA – authors answer.

**Reviewer 1**

This study presents an extensive dataset collected using a drone-based backpack system for air quality and atmospheric state measurements during the Pallas Cloud Experiment 2022 (PaCE2022). The authors detail the instrumentation, calibration/validation, and data collection methods used during the campaign, emphasizing the advantages of drone-based measurements for atmospheric studies, especially in subarctic areas. The dataset includes information on aerosol concentrations, and meteorological parameters, providing insights into the atmospheric conditions of the studied area.

**Strong points:**

The dataset has been rigorously validated through comparisons with reference measurements, which enhances the credibility and usability of the collected data.

The dataset offers valuable information for the atmospheric science community, particularly regarding the use of UAV-based measurement techniques in complex and/or under-studied atmospheric conditions.

**Suggested improvements:**

RC: While the introduction provides a solid background on the importance of UAV-based measurements, it lacks a clear structure that outlines the research objectives and the organization of the paper. Providing a more structured introduction would enhance readability and help guide the reader through the study.

AA: the following paragraph was added to introduction: "Our dataset offers a unique opportunity for the broader scientific community to better understand the vertical structure of near-surface aerosol particles in a subarctic environment, revealing their crucial role in influencing low-level stratiform cloud microphysical and radiative properties. In Section 2, we describe the drone measurement platform, the assembly of the backpack module with all sensors and their operational characteristics. Section 3 details the measurement sites, flight strategy and presents the completed vertical profile measurements. Section 4 explains the dataset structure, quality control and assurance of data. Section 5 provides direct links to Zenodo dataset repository with netCDF and CSV files."

RC: Although the dataset is well-documented, the discussion on its potential applications and future uses is relatively limited. Expanding the conclusion to explicitly address how this dataset could be utilized by the scientific community and integrated into broader atmospheric research (e.g., CCN, INP) would strengthen the impact of the study.

AA: The following paragraph was added to “Summary section”: “We encourage prospective users to integrate the drone backpack measurements with the comprehensive dataset of aerosol physical and optical properties from the hilltop station, as summarized by Backman et al. (2025). Specifically, the online ice-nucleating particle (INP) measurements presented by Böhmländer et al. (2025a) and fluorescent aerosol measurements by Gratzl et al. (2025) offer a valuable complement. Further analysis and inter-comparison of various sensor data can be conducted against other airborne measurements. These include fixed-wing UAV aerosol and cloud in-situ measurements by Girdwood et al. (2025), UAV INP profiling by Böhmländer et al. (2025b), and tethered balloon system (TBS) measurements covering turbulence and cloud microphysics by Schlenczek et al. (2025). Additionally, high-resolution TBS profiling of the boundary layer by Chavez-Medina et al. (2025) and aerosol and cloud measurements by Le et al. (2025) provide further avenues for comparative studies. Moreover, aerosol properties below the cloud base can be analyzed using lidar backscatter, aerosol depolarization ratio, and turbulence parameters derived from the remote sensing dataset presented by Tukiainen et al. (2025). All the datasets from the "Data generated during the Pallas Cloud Experiment 2022 campaign" special issue of ESSD provide a comprehensive foundation for researchers investigating aerosol-cloud interactions and their dynamics.

**Minor comments line by line:**

RC: L10: "against the reference" - Please explain the meaning.

AA: Authors meant :” …and 12 inter-comparison flights against the reference instrumentation at Sammaltunturi station.” The text will be changed accordingly.

RC: L11: "meteorological parameters" - Which ones?

AA: the text was updated as follows: “… and meteorological parameters (temperature, relative humidity, pressure, wind speed and direction) up to 500 m above the ground level.”

RC: L12-14 - The provided links include the coma at the end, thus are not working when direct click on them.

AA: links were corrected.

RC: L24 - "our previous research" - Please specify and cite.

AA: The references are provided in lines 26 and 27.

RC: L42 - Also check https://doi.org/10.5194/amt-2024-162. Can be also interesting to consider as this study used the same OPC in a different drone system to study volcanic aerosols.

AA: Authors would have several objections on the mentioned manuscript especially the design of aerosol sampling e.g. efficiency and non-isokinetic sampling of vertically orientated inlet. However, the authors will add this study as yet another example of use of low-cost OPC on UAV.

RC: L42 - "FMI" - Please specify it properly the first time for people that does not know the Finish Meteorological Institute.

AA: Corrected.

RC: L59 - "minimize the propeller airflow" - Based on what ? You could add some references that indeed show propeller airflow is minimal in this drone area (e.g., https://doi.org/10.2514/6.2018-1266, https://doi.org/10.2514/1.C032828, https://doi.org/10.3390/drones6110329).

AA: Modelling studies are very important for initial estimates, but they provide only theoretical answers to in advance well defined problems. There are many CFD simulations describing the air flow around various UAV configurations, several deal with influence of propeller downwash on aerosol deposition (e.g. agricultural sprayers), but close to none include aerosol dynamics in wide range of sizes above the propeller plane. Authors will include reference of Ghirardelli et al., (2023) that describes in detail the flow structure around multicopter drone.

Our lab has over 15 years of hands-on experience deploying aerosol instrumentation on a variety of airborne platforms, including both manned and unmanned aircraft. Every new aerosol sampling design we develop undergoes thorough field testing against reference instruments, a process that inherently involves numerous failures and iterative improvements. Unfortunately, due to limited resources, we aren't able to conduct CFD simulations for every new sampling design.

RC: L110 - Might be useful to specify here the size range of the measured particles.

AA: The sentence was change as follows: “Those concentrations might include both aerosol and cloud particles, in full size range from 0.3 to 40 μm (PSL equivalent) of the sensor, since the aerosol flow of OPC-N3 was not dried.”

RC: L128 - I suppose that PM are calculated from the raw particle counts of the OPC, but based on which particle density?

AA: The PM values were calculated by using the Alphasense internal algorithm with the default setting for the OPC-N3, the refractive index of 1.5 (real part) and the density of 1.65 g cm−3. That value corresponds to the typical range of densities for various types of airborne particulate matter and is considered as a reasonable compromise.

RC: Figure 5 - Not really clear why you have such errors/uncertainties on the OPC measurements.

AA: The error bars on x-axis (drone backpack) are indeed greater in magnitude. We believe it is due to external forces impacting the drone attitude and thus the particulate measurements, like gust wind or sudden changes in wind direction. In figure 1, the correlation of error bars magnitude and wind speed is evident.

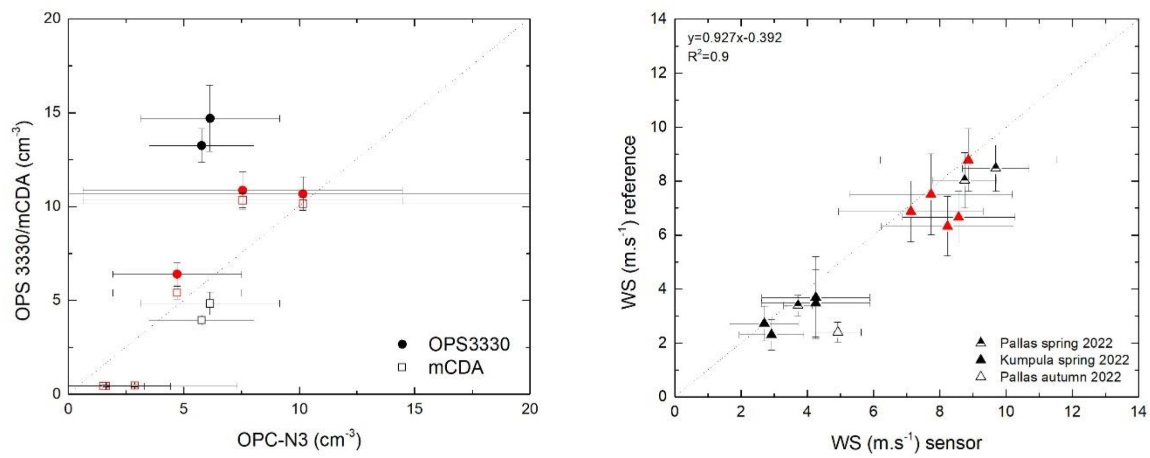


Figure 1. Drone backpack OPC-N3 particulate matter measurements against reference instruments OPS (model 3330, TSI Inc.) and the mCDA (Palas GmbH) on the left-side panel accompanied with wind speed measurements on the right-side panel.

The sentence will be restated as follows: “The variation in particle concentration is naturally higher for OPC-N3 mounted on top of the drone backpack. We believe this is due to external forces, like gust wind or sudden changes in wind direction, impacting the drone attitude and thus the particulate measurements.”

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