Replies to the Editor are in blue. Editors' comments are in black. Modifications in the main text appear in red.

Dear Editor,
The authors would like to thank the reviewer for their helpful and constructive comments on the manuscript. We believe that, thanks to these valuable suggestions, the revised version of the manuscript has been further improved.
Please find below our point-by-point responses to the reviewers' comments.

REVIEWER:
Overview
The presented study uses data from the recent SOFOG3D experiment in south-west France, and compares observations with numerical model simulations. It concentrates on fog microphysics. The observations have particular value as they include vertical profiles of microphysical data at regular intervals throughout the evolution of two fog cases, which is a rare, but useful observation within fog. Overall I consider the paper is suitable for publishing in ACP. I do however suggest some minor alterations, since there are errors and some areas require a more clear presentation.
We thank the reviewer for their positive and constructive comments. We appreciate the recognition of the value of the SOFOG3D dataset and its potential to improve our understanding of fog microphysics. All of the reviewer's comments have been addressed below, and the manuscript has been revised accordingly.

Points to address
1) Since the CDP is so central to this study I would have appreciated more information on its set-up. For example the device is designed for use on aircraft, so what modifications have been made to make it suitable for use on a tethered balloon? What was the aspiration rate and how was this monitored/kept constant etc.?
Reviewer raise a central point. A special CDP has been adapted to be be used outside of an aircraft and under a tethered balloon. Modifications are explained in the following paper Fathalli et al. (2022); Dominutti et al. (2022); Costabloz et al. (2024). As stated in Fathalli et al. (2022) : *'The CDP was mounted on a wind vane to align the sampling section perpendicular to the wind. In addition, a small fan fixed just to the rear of the laser beam aspirates the air flow. The air speed in the sampling section is therefore equal to the wind speed plus 5 m·s−1. This formula has been empirically determined from comparison with measurements from the instrumented mast and with a Fog Monitor also manufactured by DMT.'* The aspiration rate is not constant and is consequently not monitored, it is equal to the wind speed plus 5 m.s-1.
We add the following sentence l145-147 accordingly : 'To operate under a tethered balloon, a wind vane was used to align the sampling section perpendicular to the wind and a small fan fixed just to the rear of the laser beam sucked in the air flow. The air speed in the sampling section was therefore equal to the wind speed plus 5 m s−1'.

2) Please check that all acronyms are defined at first use.
Corrected.

3) Table 1. There is no uncertainty presented for the radiosonde data. Suggest 'vertical position' column includes 'profile' where appropriate.

Thanks for the suggestion. Radiosonde data corresponds to a Vaisala RS41. Uncertainties have been added in table 1 according to the technical documentation (https://docs.vaisala.com/v/u/B211321FR-L/fr-FR).

4) Line 166. Since there is no aerosol data for this study, why are the instruments listed in table 1?
In lines 217–222, we mentioned: *'To define aerosol concentration, the activation spectra characteristics from Cohard and Pinty (2000) were computed based on the κ-Köhler theory (Petters and Kreidenweis, 2007), as implemented in LIMA. This was done using the entire dataset gathered during the campaign with the SMPS (aerosol size distribution ranging from 10.6 to 496 nm) and the CCNC (activation spectra from 0.06 % to 0.28 %), adhering to the approach described in Mazoyer et al. (2019). The average activation spectra derived from SOFOG3D were shown to align with the Paris-Fog data (Mazoyer et al., 2019), with values of 80 cm^{-3} at 0.05 %, 250 cm^{-3} at 0.1 %, and 1000 cm^{-3} at 0.3 % (data not displayed).'*
Sentence l169-170 has been modified for clarification : 'Due to technical issues, aerosol measurements were not available for these dates but for other cases of the campaign which had allowed to retrieve an average activation spectra. A sensitivity study to aerosol loading is consequently described in the discussion.'

5) Line 268. Grams per square meter.
Corrected.

6) Line 288. 'In order to distinguish between model errors linked to thermodynamical and dynamical conditions and those linked to microphysics, Figure 3 …'. I don't think this section achieves this statement, but is rather a general comparison between model and observed profiles.
Reviewer has a valid point to some extent. This section is intended to verify the consistency between the model and observations for thermodynamics. Misrepresenting thermodynamics would prevent any meaningful comparison of the microphysics. Sentence has been rewritten to :
'In order to verify the consistency between the model and observations for thermodynamics to prevent any meaningful comparison of the microphysics.'

7) Line 383: 'hich'
Corrected.

8) Line 391 and generally. Please use appropriate adjectives to describe verbs, to avoid confusion. E.g. 'gradient is greater' (not higher).
Corrected.

9) Line 559, So this just means that Nc was lower?
Lines 559 and preceding lines mentioned, concerning IOP6: '*During the adiabatic and dissipation phases, the model continues to face challenges in distinctly representing the 10 µm diameter mode in the lower layer. Additionally, it fails to capture the largest droplets, especially near the surface, which accounts for the underestimation of radar reflectivity. Unlike observations, the DSD shows a reduction in the concentration of small- to medium-sized droplets in the bottom layer, despite the lack of large droplets.'*
The profile in Fig. 9 of the paper indicates that, during the adiabatic phase, the concentration in the bottom layer remains unchanged, as the smallest droplet concentrations exceed those in the layer above. However, during the dissipation phase, the profile evolves, resulting in a higher concentration of smallest droplets near the ground.

10) Line 599 'sduring'
Corrected.

11) Line 635. Suggest using 'reasonably well simulated' since 'well simulated' implies no errors.

Corrected.

12) Line 759. ‘reverse LWC profile’ – please clarify.
‘(with the highest values near the ground)’ has been added for clarification.

13) The discussion on DSD modelling is interesting. However, some discussion of DSD shape could be useful. For example, the model DSD was always mesokurtic in shape, whereas observed DSDs are usually leptokurtic in shape and positively skewed. Therefore, even if the currently modelled DSD estimates the width of the distribution correctly, it will always overestimate the number of large droplets and underestimate small ones. What appears to be required is a scheme that can produce leptokurtic shapes with positive skewness (e.g. beta distribution).
Thank you for the highly insightful comments. From our observations, the currently modeled DSD seems to underpredict the count of both small and large droplets while overpredicting the quantity of medium-sized ones. LIMA employs a gamma-generalized distribution for the DSD, which can yield either leptokurtic and positively skewed shapes or mesokurtic shapes, depending on the selection of the parameters alpha and nu. The existing parameters (alpha = 3 and nu = 1) generate a mesokurtic distribution. However, setting alpha = 1 and nu = 3 results in a leptokurtic, positively skewed shape.
For clarification we introduced the mesokurtic and leptokurtic notions in the discussion :
'The selected DSD shape adheres to a mesokurtic distribution, whereas the observed distributions appear leptokurtic and positively skewed, showing a tendency toward a bimodal configuration (characterized by a scarcity of medium-sized droplets but an excess of both small and large droplets). Using $\alpha = 1$ and $\nu = 3$ for the DSD, instead of the other way around, provided a better fit for the DSD and enabled the representation of a leptokurtic and positively skewed distribution (not shown), yielding reflectivity values closer to the observations.'

References

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