Reply to editor comment

We would like to thank the editor Tobias Gerken for his comments.
We decided to provide the main discussion around the simulated versus observed particles in the Appendix C (which already contained some information about the simulated size distributions), to keep the main text focussed. Please see details below (editor comment in blue, our answer in black):

1. The authors provide a considerable amount of discussion in response to Reviewer 1 including specific references to figures R1 and R2. While some changes were made to the main body of the manuscript, I would suggest to expand the discussion in the text with more detail and to explore whether any of these figures should be part of supplementary information

We added to the main text:
"The initial simulated particle count distributions compare well to the respective observations. Differences arise when comparing OpenFOAM and observed size distributions using concentrations (dN/dlogDp), possibly due to differences between simulation and experiment in terms of the injection properties and sampling areas (see more details in Appendix C)."

Appendix C:
"Comparing the simulated and observed particle count distribution for the high shear experiment (2022-03-02) the initial size distributions (blue lines) compare relatively well, see Fig. C1a. Some deviation is visible, caused by observed particles that lie outside the size range of the injected simulated particles. Nevertheless, when comparing OpenFOAM and observed size distributions plotted as dN/dlogDp (Fig. C1b), the peak in the initial OpenFOAM size distribution is about a factor of 5 lower than the peak at z=0 cm of the observed size distribution (the figures show a similar behaviour for the low and no shear experiments). In the present OpenFOAM model, particles are injected at specified grid cells, which makes it difficult to exactly match the injection regions of the experiment in the simulation, as the nozzle outlet is smaller than the model's grid cells. Furthermore, it is difficult to match the sample areas in OpenFOAM and the experiment, as the horizontal cross section of the PDA measurement volume is only on the order of the cross section of a grid cell. Also, the injection rate and size distribution of droplets is not actually known but derived from the point measurements with the PDA, which may introduce further errors. Further downstream the spray nozzle this is less of an issue as the droplet spray widens up and the sample area just covers a part of the area that the droplet stream would cover on that respective level. Here, deviations in droplet sizes start playing a larger role: The simulated particles (partially) evaporate and thus decrease in size too quickly, which causes a too strong shift of the peak sizes to the smaller sizes when moving further downstream. We ran an additional simulation in order to see whether we could achieve a better match in a) peak concentrations and b) peak sizes by using a higher number of injected particles (150000 instead of 20000 particles per second). The decrease of particle sizes was not as strong as in the 20000 particles/second case (more particles lead to more evaporation releasing humidity back into the flow), still the peak sizes decreased in size too much, while the particle concentrations were much too high. At the same time, the high amount of particles released into the domain increased the computing time significantly, and therefore, we chose to keep the injection numbers at 20000, as this number compared well in the particle count distributions"
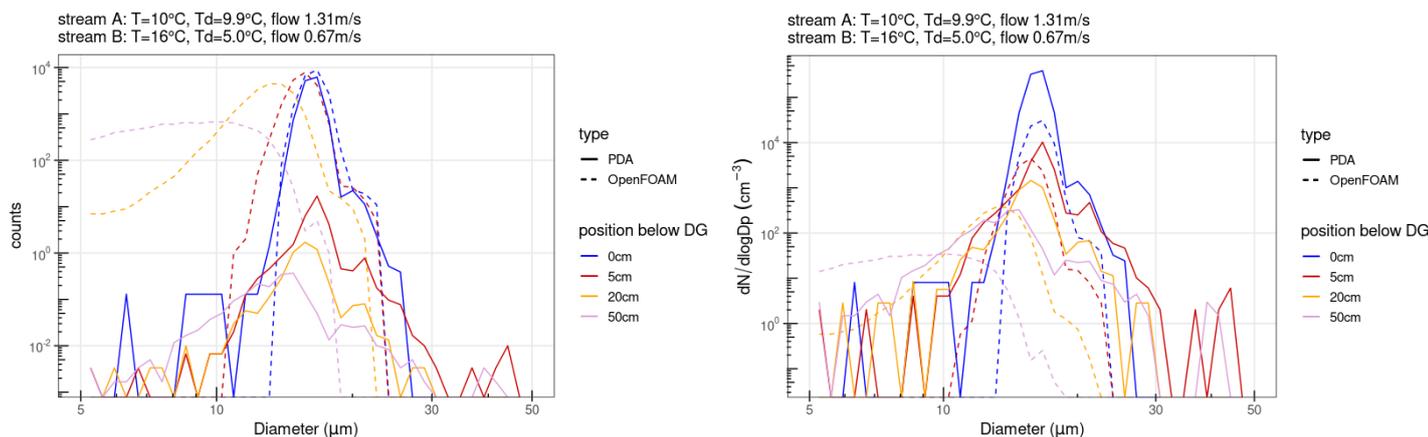
(a) Particle count distributions   (b) Size distributions with dN/dlogDp

Figure C1: Comparison of particle distributions measured by the PDA (solid lines) and simulated by OpenFOAM (dashed lines) for the high shear flow experiment within one second. Colours indicate the position below the droplet generator.

We additionally changed the previous text in Appendix C, to remove repetition of text (was the same sentence as the last sentence of Section 5/before Section 5.1):

"All simulated size distributions for the three different flow settings as used during the experiments on 16-02-2022, 01-03-2022, and 02-03-2022 are shown in Fig. C2, also including the additional simulation for the same flow experiment (16-02-2022) with the slight flow speed deviation."

2. I suggest for clarity: "".. with an uncertainty of ± (≤ 1.5 % (OF measured value) + 0.03 m/s)"

changed

Additionally, we added a copyright statement to the caption for the measurement section sketch in Fig. 1:
"(© by Ingenieurbüro Mathias Lippold, VDI; TROPOS)"