Reply to Review #1

We would like to thank the reviewer for the positive comments, which help to clarify certain points in the manuscript.
We provide a point by point answer to the major/minor comments below, comments by the reviewer in blue and our answers in black.
In addition, we realised that while in the figures it says z=XX cm, the text states z=XX mm. We have unified these occurrences to always use cm.

Major Comments

Comment 1: Line 163: It mentions that measurement from the vane anemometer has also been performed 25 cm below the top of the measurement section. Can you include it in Fig. 5?

We have included a statement about the position in the figure caption:
“The vane anemometer was positioned about 25cm below the top of the measurement section.”

Comment 2: Line 189: How do 20000 particles released into the domain per model second compare with the droplet concentration injected from MDG in experiments?

As shown in Table A1, measurements at the outlet of the droplet generator were mostly performed until a count of 100,000 was reached. This was accomplished in about 5 seconds (for the “quickest” cases) or longer. Thus, 20,000 particles per second were chosen in the OpenFOAM setup. Comparing the count distribution for the 2022-03-02 experiment the initial size distributions compare relatively well, see Fig. R1. Some deviation is visible, caused by observed particles that lie outside the size range of the injected simulated particles.

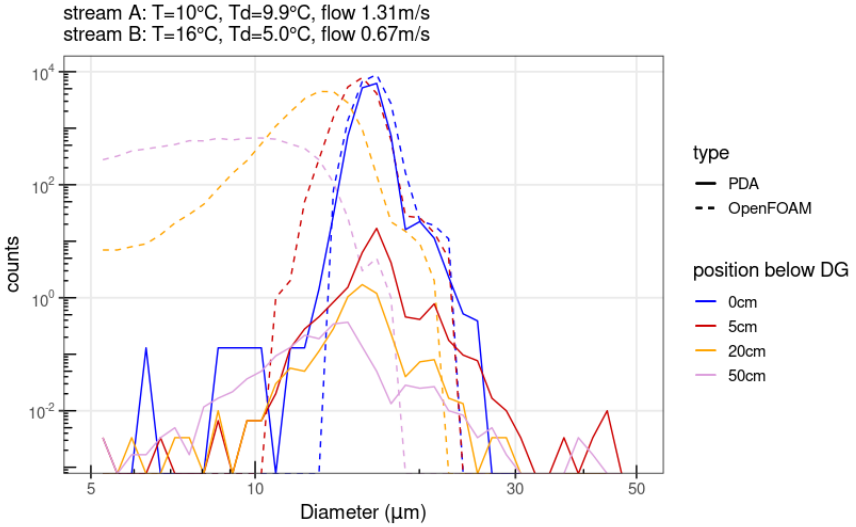

Figure R1: Comparison of particle counts measured by the PDA (solid lines) and simulated by OpenFOAM (dashed lines) for the high shear flow experiment within one second. Colours indicate the position below the droplet generator.

Nevertheless, when comparing OpenFOAM and observed size distributions plotted as dN/dlogDp (Fig. R2), the peak in the initial OpenFOAM size distribution is about a factor of 5 lower than the peak at z=0cm of the observed size distribution. When injecting particles

in OpenFOAM, this is done at specified grid points and therefore, it is not possible, to exactly match the OpenFOAM and PDA sample areas, especially at z=0cm, which might cause the difference in dN/dlogDp seen here. Further downstream 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. Deviations of observed and simulated size distributions are mainly caused by the different size range covered.

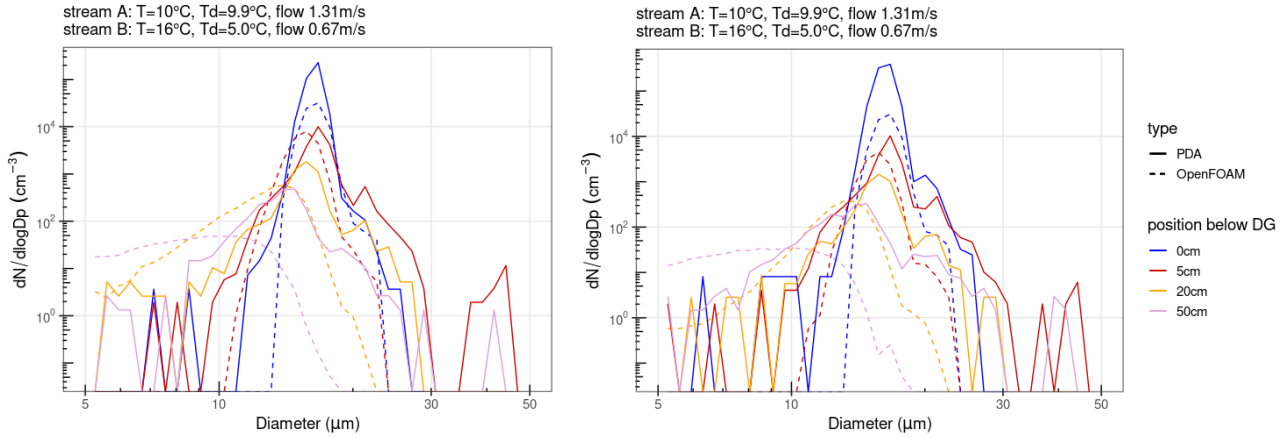

Figure R2: Comparison of size distributions measured by the PDA (solid lines) and simulated by OpenFOAM (dashed lines) for two experiments with different flow settings, the low shear flow experiment on the left and high shear flow experiment on the right. Colours indicate the position below the droplet generator.

We added in the manuscript
“There are 20000 particles released into the domain per model second, which roughly corresponds to the 100,000 particles observed during the shortest initial measurements at z=0cm that took about 5 seconds (see Table A1).”

Comment 3: Although the size distribution from the OpenFOAM simulation deviates significantly from the experiments. It would be helpful for data users if one snapshot of size distribution from the simulation at different heights could be included in the Main text or the Appendix, as you prefer.

Thank you for this comment, we included a size distribution plot including all simulations in the appendix and added a reference to the appendix in the main text.

“The simulated size distributions are shown for completeness in Appendix C”

“Appendix C: Simulated size distributions
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 Figure C1. The figure also includes the size distribution for one additional simulation for the same flow experiment (16-02-2022), where a slight deviation of 0.05 m/s was imposed on the flow speed in channel B, to identify whether a potential deviation in flow speed during the measurements would have a noticeable effect on the turbulence characteristics and potentially on the droplet size distributions.

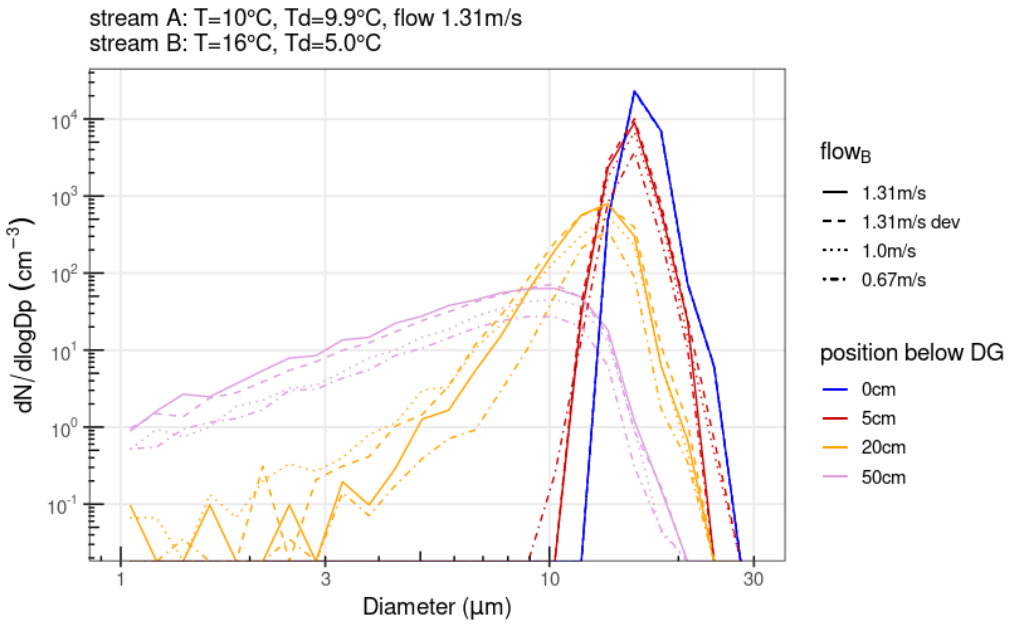

Figure C1. Simulated size distributions for all flow setting used during the experiments (and one sensitivity on small flow deviation), sampled at the same locations downstream the droplet generator as in the experiments. The size distribution at z=800 mm is located outside the model domain, and thus, not simulated."

Minor comments:

Comment 1: The title seems a little vague. It does not convey the message that which properties of water droplets have been measured. Include keywords such as microphysical properties or size distribution.

Thanks for the suggestion. We changed the title to:
"Measurements of water droplet size distributions in a turbulent wind tunnel"

Comment 2: Line 27: Include the relevant citations for " it is homogeneous on small scales"

It's actually the same as for the inhomogeneous mixing, thus we moved the citations to the end of the sentence.

Comment 3: For clarity, mark the height of droplet injection in the left or middle subplot of Fig. 1.

We included an indication of the droplet generator height:

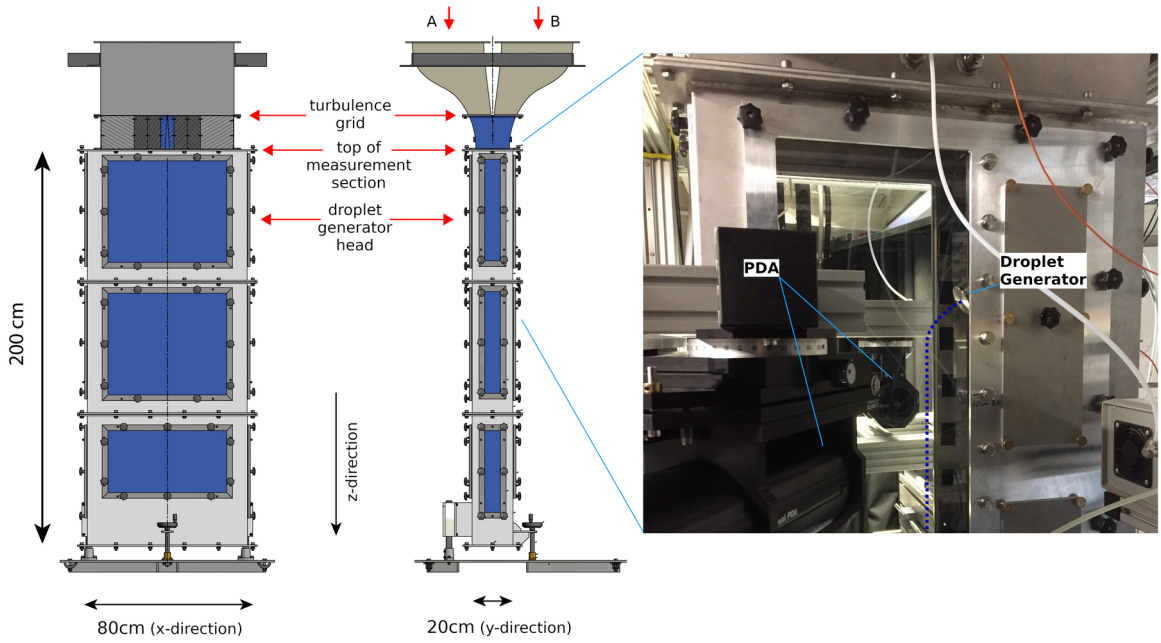

Fig. 2

Comment 4: Line 95-97: Also show the unit of pressure in hPa or a commonly used unit for the atmospheric science community.

we added the pressures in mbar:
“The inlet air and flow focussing air pressure were set in a range of 12.0 psi to 12.2 psi and 2.81 psi to 2.83 psi, respectively (i.e. 827.4 mbar to 841.2 mbar and 193.7 mbar to 195.1 mbar). The flow focussing air pressure was later changed to 3.15 psi to 3.18 psi (217.2 mbar to 219.3 mbar) after some additional testing of the droplet generator.”

Comment 5: Line 99: Does “ as close as possible” represent z=0? Mention here also, although it is already in the Caption of Fig. 1 and later.

added
“as close as possible to the droplet generator head (z=0 mm)”