**Referee 2**

*General Comment: This manuscript presents the newly developed turbulent moist-air wind tunnel, called the Turbulent Leipzig Aerosol Cloud Interaction Simulator (LACIST). LACIS-T is able to study different cloud processes taking into account interactions between turbulence and cloud microphysical processes. Additionally, the authors complemented their LACIS-T experiments with Computational Fluid Dynamics (CFD) simulations to explain their observations. The behavior of the LACIS-T was tested by performing deliquescence and hygroscopic growth as well as droplet activation and growth experiments using NaCl particles. This is as well written manuscript, with a very detailed descriptions of this newly developed turbulent moist-air wind tunnel. The LACIS-T is a great and valuable instrument for the cloud physics community that can be used to fulfill many gaps in knowledge. Given the lack of instruments like this, LACIS-T can have a huge impact in the near future. I congratulate the authors for developing such a great instrument and for the careful characterization. I only have one "Major Comment". The manuscript can be accepted after the following minor comments are added to the revised manuscript.*

We thank referee 2 for his/her remarks/comments/suggestions. They are addressed below and we have revised the manuscript accordingly.

*Major Comment: It would have been nice to add a reference experiment, especially for the droplet activation experiments. I mean, is it possible to run a droplet activation experiment under steady conditions, i.e., without any turbulence? This will show how monodisperse is the droplet size distribution (DSD) in comparison to the DSD shown in Figure 12.*

We agree that such a reference experiment would be very valuable. Therefore, **as kind of a benchmark, we want to evaluate how the droplet size distribution would look like without turbulence affecting droplet formation and growth. Therefore, utilizing the above described numerical model, two additional cases have been investigated, a) a case without grid induced turbulence (i.e., the grid was removed from the numerical simulation) and b) an idealized case based on time-averaged flow fields without turbulent fluctuations. In these simulations, the formation and growth of NaCl particles, with $D_{p,dry}$ = 100 nm for the temperature difference of $\Delta T$ = 16K was considered. The simulation results are shown in Fig. 13 for $z_8$ = 80cm together with measurement results, for which the turbulence grid remains included as shown in Fig. 12.**

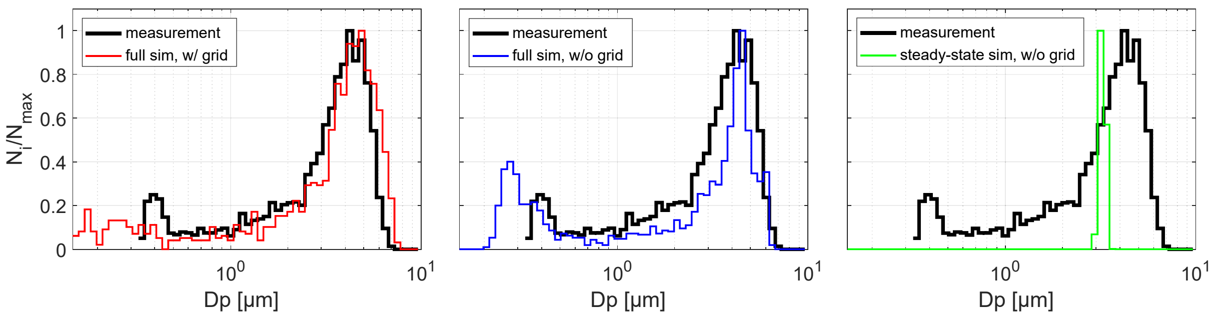


***Figure 13.*** *Comparison between different model calculations for the particle formation and growth on NaCl particles with $D_{p,dry}$ = 100 nm at $z_8$ = 80cm for $\Delta T$ = 16K. Left figure: LES with turbulence grid (as shown in lower right plot of Fig. 12). Middle figure: LES but without turbulence grid. Right figure: simulation with averaged fields used as frozen flow fields, and transient particle calculation. In all plots, the measurement results, for which the turbulence grid is included (as shown in Fig.12), are shown for reference.*

**It turns out that the removal of the turbulence grid does not lead to laminar conditions. We still observe inherent turbulent conditions due to wall effects and the high Reynolds number (order of $10^4$) for the set velocity. But the turbulence intensity and therefore the strength of turbulent fluctuations is decreased. The power spectra obtained for the configuration without grid further suggest that the turbulence is anisotropic in this case (not shown). As a consequence, we still obtain a broad droplet size distribution (see middle plot in Fig. 13) which is however narrower compared to the measurement / simulation with turbulence grid. We further observe a significant number of particles close to $D_p$ = 300 nm.**
**Laminar conditions, which would lead to a very narrow droplet size distribution (see right plot in Fig. 13), can only be simulated if averaged fields are used as frozen flow fields in the simulations, which is not realizable in the real experiment. In other words, measurements without turbulence are not executable inside LACIS-T and the flow regime is best controlled in presence of the turbulence grid. Furthermore, these simulations clearly indicate the distinct influences of turbulence on the droplet size distributions, and consequently, on the formation and growth of droplets inside LACIS-T.**
The text marked in bold as well as Fig. 13 have been added at the end of section 5.2.

*Minor Comments:*
*L19: Add a reference after "Earth".*

Lamb and Verlinde (2011) has been added to the text.

*L20: Add a reference after "interactions".*

Mason and Ludlam (1951), Hobbs (1991), and Kreidenweis et al. (2019) have been added to the text.

*L24: Add a reference after "scales".*

The sentence has been connected with the followed-up sentence in order to avoid citing the same reference twice.

Atmospheric clouds are often non–stationary, inhomogeneous, intermittent, and cover an enormous range of spatial (micrometers to hundreds of kilometers) and temporal (microseconds to hours and days) scales~~. Cross–scale~~ with cross–scale interactions between turbulent fluid dynamics and cloud microphysical processes ~~influence~~ influencing cloud behavior and cloud development (Bodenschatz et al., 2010).

*L28: I suggest to add other references in addition to Siebert et al. (2006).*

The sentence has been changed slightly and additional references have been added:
Turbulence drives processes such as entrainment and mixing, leading to strong fluctuations in aerosol particle concentration, temperature, water vapor, and consequently supersaturation ~~which affects~~ **with implications for** cloud droplet activation, growth and decay (Siebert et al., 2006; Chandrakar et al., 2016, Siebert et al., 2017).

*L28: "It links to phase transition processes". Do the authors refer to "turbulence"?*

Yes, this is right. However, due to a comment by reviewer 1, the sentence has been rewritten: "[…] **Turbulence also influences particle collision rates and is therefore thought to be central to precipitation formation (Shaw, 2003; Wang and Grabowski, 2009)** ~~It links to phase transition processes of water as well as particle collisions and breakup (Shaw, 2003)~~ […]".

*L34: Add a reference after "undertaking".*

Stratmann et al. (2009) has been added.

*L37: I suggest to add other references in addition to Stratmann et al. (2009).*

List et al. (1986) and Kreidenweis et al. (2019) have been added.

*L40: How about Cziczo et al. (2017)?*

The citation Cziczo et al. (2017) has been added to the text.

*L44-49: I do not think it is necessary to cite all this previous papers.*

We agree. Now in almost all cases, two papers are cited per particle type/species.

*L50: I think "those of the other" should be "those of other".*

We agree, it has been changed accordingly.

*L51: Add a reference after "interactions".*

Chang et al. (2016) has been added to the text.

*L62-73: Much of the information provided here can go into methods.*

This part has been written in order to get a first impression about the set-up and benefits of LACIS-T as well as answering the question what distinguishes this wind tunnel from other facilities like the PI chamber. Therefore, we would like to leave the main part here only deleting the last sentence of this paragraph.

*L104: "to remove aerosol particles". In the particle-free air?*

The sentences have been re-written:
Two radial blowers (NICOTRA-Gebhardt, Germany) separately drive the two ~~particle-free,~~ dry air flows (flow branches 'A' and 'B'). Flow rates of up to 6.000 l/min in each flow branch are possible. Afterwards, each flow passes a particle filter (Filter class U16; TROX GmbH, Germany) to remove aerosol particles. Subsequently, a defined amount of water vapor can be added to each of the **now** particle-free air flows by means of a humidification system.

*L137: “Condensational” should be “Condensation”.*

Done.

*L140: Delete "and" before 200.*

Done.

*L259-260: “Large Eddy Simulations” should be “LES”.*

Done.

*L302: I suggest to change it to “Figs. 5a-c”*

Done.

*L333 and 335: “RMS” should be in lowercase?*

Done.

*L398: “size-selcted” should be “size-selected”.*

Done.

*References*

Chandrakar, K. K., Cantrell, W., Chang, K., Ciochetto, D., Niedermeier, D., Ovchinnikov, M., Shaw, R. A., and Yang, F.: Aerosol indirect effect from turbulence-induced broadening of cloud-droplet size distributions, Proceedings of the National Academy of Sciences, 113, 14 243–14 248, https://doi.org/10.1073/pnas.1612686 113, 2016.

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