Referee 1

The design and performance of a new system for studying turbulent effect on cloud microphysics under short timescales up to a few seconds is presented, the LACIS-T system. CFDC simulations using large eddy simulations are also performed to help interpret the system's performance and experimental results. This is an important contribution to the atmospheric science community given the lack of experimental systems to directly study the effects of turbulence. I recommend it for publication, and make a few suggestions to further improve the manuscript below.

We thank referee 1 for his/her remarks/comments/suggestions. They are addressed below and we have revised the manuscript accordingly.

While the system's design and characterization are nicely presented in great detail, it stuck me that a discussion of how finely the revenant parameters can be adjusted and controlled in LACIS-T was not really presented. This would be a valuable addition to the paper.

The accuracy for flow rate, temperature and dew-point temperature adjustments have been added in section 2 where the corresponding devices are described (changes are given in bold here). For example, **the accuracy of the temperature adjustments** in the humidification system and heat exchangers as well as of their monitoring **is +/- (0.03°C +0.0005 x *T*) with *T* being the actual temperature (in °C)**. Note that, **the accuracy for monitoring the set dew-point with the dew-point mirror is ≤ ±0.1 K with a reproducibility of ≤ ±0.05 K**. The **Huber thermostats** used in the humidification system and connected to the heat exchangers **feature a temperature stability of +/- 0.01 K at -10°C**. The volume flow rate is monitored by means of **ultrasonic flow meters each of which features an accuracy of 1.5% of the reading**. **The relative measurement uncertainty of the Hot-wire anemometer is about 3%**.

In the introduction, more elaboration on the importance of atmospheric turbulence and its effects on important properties and phenomena such as cloud microphysics and particle deliquescence/growth and the resulting rather complex and intriguing size distributions is warranted. This will be the results presented in better context.

A respected paragraph has been inserted which is marked in bold:
"Turbulence drives processes such as entrainment and mixing, leading to strong fluctuations in aerosol particle concentration, temperature, water vapor, and consequently supersaturation which affects having implications for cloud droplet activation, growth and decay (Siebert et al., 2006; Siebert and Shaw, 2017; Chandrakar et al., 2016). **Indeed, it has been shown that representation of unresolved fluxes in large-eddy simulations influence properties of simulated stratocumulus clouds (Shi et al., 2018), and that the range of scales captured in direct numerical simulations of cloud entrainment influence the width of the droplet size distribution (Kumar et al., 2018). Even without the presence of strong entrainment, fluctuations in supersaturation can influence the functional form of the cloud droplet size distribution (e.g., McGraw and Liu, 2006; Chandrakar et al., 2016; Saito et al., 2019; Chandrakar et al., 2019). Turbulence also influences particle collision rates and is therefore thought to be central to precipitation formation (Shaw, 2003; Wang and Grabowski, 2009).** These processes, in turn, can have buoyancy and drag effects on turbulence and influence cloud dynamic processes up to the largest scales (Stevens et al, 2005; Malinowski et al., 2008; Bodenschatz et al., 2010)".

Line 91: Is there a reference for the "Göttingen type" of wind tunnel?

The Göttingen wind tunnel goes back to Prandtl and Betz. It is a closed-loop wind-tunnel with a measurement section. A citation was added to the text: Randers-Pehrson (1935) which gives a review about wind tunnels of that time. There it is written: "With the construction of the first wind tunnel at Göttingen we are approaching modern times. This was the first return-flow tunnel, built by Dr. Ludwig Prandtl for Motorluftschiffstudiengesellschaft and completed in July 1908. This tunnel was superseded in 1916-17 by a much larger tunnel with open jet and return flow, which is now called the Göttingen type."

Lines 205-210: To make this more accessible to those less familiar with CFD simulations, please explain "periodic boundary conditions" and the significance and utility of the Courant–Friedrich–Lewy (CFL) number.

The following sentences have been added to the manuscript:

"[…] At the front and back of this section, periodic boundary conditions are used. **Periodic boundary conditions in one or more space directions imply that any fluid field is periodically continued across the domain size in this direction, e.g. the temperature field is periodic in x if $T(x+L,y,z,t)= T(x,y,z,t)$ with the box length L in x.** […]"

"[…] it is adjusted automatically to ensure a CFL number below 0.95. **The CFL number is a parameter for the numerical solution of partial differential equations. The discrete time step width Δt in numerical simulations has to be chosen depending on the local velocity magnitude U in the mesh cells and their local widths Δx to guarantee the stability of the numerical method. In detail, it should hold that $\Delta t \leq \Delta x/U$. The CFL number is the corresponding dimensionless quantity, $C = \Delta t U/\Delta x$. In our case, C should be smaller than 1.** […]"

Line 225: What is the relevant particle size range and fluid velocity range being considered when evaluating the particle Reynolds number?

We have re-written this part of the manuscript including a statement about the relevant particle size range and fluid velocity:

"[…] being the particle's density and diameter. **The coefficient C_D depends on particle Reynolds number Re_p and is usually calculated according to Stokes (1851) for low Re_p, and for higher Re_p according to Schiller and Naumann (1933):**

$$C_D = \begin{cases} \frac{24}{\mathrm{Re}_P} & \text{for } \mathrm{Re}_P < 0.5 \\ \frac{24}{\mathrm{Re}_P}\left(1 + 0.15\mathrm{Re}_P^{0.687}\right) & \text{for } \mathrm{Re}_P \geq 0.5 \end{cases}. \quad (5)$$

Re_P is calculated with the current values of D_p and the slip velocity $|U_f - U_p|$ at every Lagrangian time step:

$$\mathrm{Re}_P = \frac{D_P|U_F - U_p|}{\nu_F}, \quad (6)$$

with ν_f being the kinematic viscosity of the fluid. As the particles/droplets are rather small ($1\cdot10^{-7}$ m < D_p < $1\cdot10^{-5}$ m), they are assumed to follow the advecting flow field nearly perfectly, i.e., the slip velocity is small compared to the fluid velocity. Thus, Re_P is assumed to be small.

C_{LS} is calculated [...]"

Fig. 1: Please indicate the air flow direction in the various channels.

The air-flow direction was added to the figure.

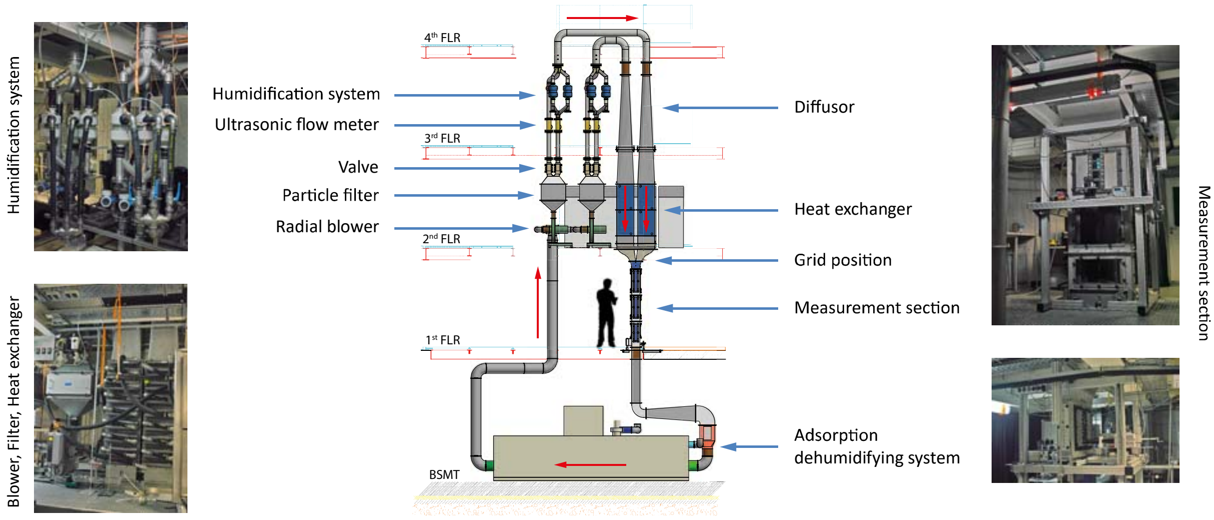

Figure 1. A schematic of LACIS-T including photos of individual components (© by Ingenieurbüro Mathias Lippold, VDI; TROPOS). **The red arrows indicate the flow direction.**

References

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