We thank Peter Spichtinger for his comments on our manuscript. It was not our intention to write pejoratively about Weigel et al. (2016). We modified our manuscript based on his suggestions. In the following, the comments raised by Peter Spichtinger are marked in blue and our answers are written in black.

On behalf of all authors of Weigel et al. (2016) I would like to address some issues in the manuscript concerning the statements about our work.

1. Statement in your manuscript (page 2, lines 27-30)

> "Recently Weigel et al. (2016) proposed a more general correction method for compressible flow mainly based on thermo-dynamical calculations. However, this empirical approach is only partially considering the size-dependent effect of particle inertia on the detected concentration. Furthermore, flow disturbances induced by the aircraft wings are not considered by Weigel et al. (2016)."

The definition of ξ is not empirical but exclusively based on thermodynamic considerations and is indeed essential to account for the compressed sample air volume under measurement conditions compared to ambient (undisturbed) conditions. The inclusion of μ in the overall correction provided in Weigel et al. (2016) factually considers (not 'only partly') the size dependent effect of particle inertia. Flow disturbances by the aircraft wings are not explicitly resolved as they were not observable as such and may be implied in the compressed condition under which the measurement occurs. So, one could understand your chosen formulation as misleadingly pejorative.
Please change the phrasing in the manuscript to account for this issue.

As recommended, we modified the paragraph to make it more clear. The paragraph now reads as follows:

> Recently Weigel et al. (2016) proposed a more general correction method for particle concentrations measured by an under-wing instrument. Its first component is a compression correction factor that is based on thermo-dynamical calculations using simultaneous measurements of the instrument's pitot tube. Its second component is a size-dependent correction factor that corrects the effect of the inertia of particles larger than 70 µm, but not for smaller particles.

2. Statement in your manuscript (page 11, lines 20-22)

> "Weigel et al.(2016) provides a rougher estimation based on the concept that the air compressibility effect will cause particle accumulation near the instrument. However, the concentration at the wing instrument is apparently larger only because particles are slowed down and stay longer in the corresponding region (see Fig. 9) "

The content of the referred paper might not be fully understood by readers of your paper, since the concept is not that particles accumulate. In Weigel et al. 2016, it is explicitly stated: "Under the preliminary assumptions that the particle number per mass M of the air sample is not affected by compression (i.e. remains constant and thus n_amb/M= n_meas/M)"

This is the case if particles and air volume get compressed equivalently. Your added statement, however: "the concentration at the wing instrument is apparently larger only because particles are slowed down and stay longer in the corresponding region" is one of the messages provided by Weigel et al. (2016) from the contrary perspective: small particles are capable to move out of their initial (undisturbed) state, induced by the compression region upstream of the underwing probe, due to the approaching aircraft. Larger particles are less capable to get moved out of this undisturbed state due to their inertia. Please make the relation to Weigel et al. (2016) better visible.

The description of the different perspectives of this effect is helpful. However, a discrepancy between the results of Weigel et al. (2016) and our results remains: The inertia correction factor μ of Weigel et al. (2016) is equal to 1.00 for diameters $d_p < 70$μm, implying that these particles follow the air flow. In contrast, our simulations (see e.g. Fig. 9) show a notable impact of the particle inertia already for a diameter of 10 μm (the μ factor would be around 0.90 for density 1g/cm$^3$) and a strong impact for 50 μm particles (μ around 0.75) with a notable effect on concentration too (see Fig. 10).

We double-checked our results using a simplified numerical approach for the particle movement using our CFD-simulated airflow velocity fields ahead of the instrument as input and accounting for the acceleration due to the drag force on the particles. The drag force was estimated based on Eq. 3.5 of the book "Aerosol Technology: Properties, Behavior, and Measurement of Airborne Particles" by W. C. Hinds. We assumed case *u200_p250* with a particle density of 1 g cm$^{-3}$, a TAS of 200 m s$^{-1}$ and an ambient pressure of 250 hPa. The results of this simplified calculation (see attached Fig. 1) confirm the results presented in our paper and thus imply that inertia needs to be taken into account also for particles with diameters smaller than 70μm. For instance, according to Fig. 1, a 30μm particle still has a velocity of about 179 m/s at the measurement location while the air velocity (PAS) is slowed down to about 142 m/s. Therefore the velocity of a 30μm particle is closer to TAS than to PAS. Even a 5μm particle shows some inertia effects, nonetheless PAS and therefore constant particle number per mass M of the air may be considered a good approximation for small particles. For a 10μm particle, however, the deviation may already be considered significant, because 10 μm particles are about 10% faster than PAS.

The revised paragraph reads as follows:

> Weigel et al. (2016) provide a method that is primarily based on the concept that the air compression near the instrument causes a corresponding densification of the number concentration of airborne particles. Subsequently, they take into account a size-dependent correction factor that corrects the effect of the inertia of large particles. Their inertia correction is mainly assessed on the basis of the circularity of images taken by an OAP at a resolution of 15 μm. Weigel et al. (2016) conclude that particles with diameters $d_p < 70$ μm follow the airflow and thus require no inertia correction. On the contrary, our simulations (see e.g. Fig. 9) show a notable impact of the particle inertia already for particle diameters of 10 μm (their speed is about 10% faster than the air; particle density 1 g/cm$^3$) and a strong impact for 50 μm particles (about 25% faster than air). These particle simulations are consistent with results (not shown) from a simplified numerical particle motion model using the simulated flow fields (Sect. 3.1.1) as input and Eq. 3.5 of Hinds (1999) (which is based on Clift et al. (1978)) to calculate the drag force on the particles. Therefore, we conclude that inertia needs to be taken into consideration for particles larger than about 5-10 μm.

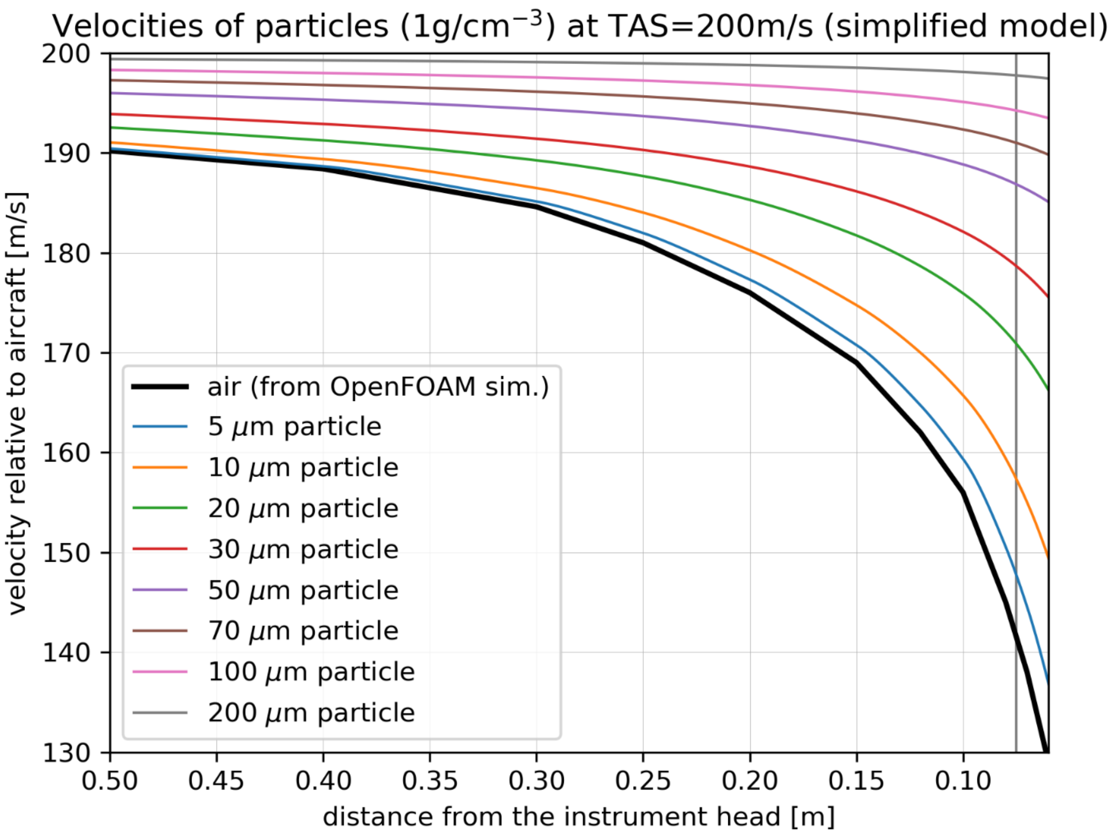

*Figure 1: Velocities of air and particles of various diameters, relative to the aircraft for TAS=200m/s. The air velocity (thick black line) from the OpenFOAM simulation case u200_p250 of the discussion paper is used as input to calculate the motion of the particles caused by the drag force on the particles. The drag force is calculated based on the slip velocity particle, the corresponding Reynolds number, and Eq. 3.5 of Hinds (1999) which is based on a correlation given by Clift et al. (1978). The horizontal axis is the distance from the approaching instrument head. The grey vertical line marks the approximate location of the particle measurements.*

## ***References:***

Clift, Grace, Weber: Bubbles, Drops, and Particles; Academic Press, 1978.

Hinds: Aerosol technology: properties, behavior, and measurement of airborne particles; John Wiley & Sons, 1999.

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