First of all, we thank reviewer 1 for his effort in carefully reviewing our manuscript and his constructive comments.

Point-by-point answers to the comments of reviewer 1

Reviewer 1: *As outlined in the paragraph beginning Line 341, the authors note that the inferred total flux is significantly lower than the facility's own estimate, and suggest that the discrepancy is due to the fact that only part of the plume was sampled. Line 291 clarifies that the legal operational parameters for the drone flights allowed for a maximum height of 200 m. The authors assessment is therefore highly likely to be correct.This raises the question of how suitable the sUAS is, as a self-contained platform, for inferring anthropogenic point emissions.*

Authors: Technically, the used DJI UAV can fly much higher but its software limits the maximum altitude to 500 m above ground. Whether 500 m is sufficient to fully sample the entire plume structure depends on many factors such as stack altitude, atmospheric stability, distance to the source, exit temperature and velocity of the flue gas, wind speed, etc. However, especially when flying in relatively stable atmospheric conditions, only a couple of hundred meters downwind of the source, 500 m will most likely often be sufficient.

Whether such flights are legally allowed is of course another question that cannot be answered so easily in general. The legal regulations vary significantly from country to country and are subject to frequent adjustments and they often also depend on which organization is responsible for the flights. For example, some government agencies can have far-reaching permissions. In addition, the local aviation authority may grant special permissions, as was the case with our flights. We added this discussion of the legal aspects to Sec. 7 (Summary and Conclusions).

Reviewer 1: *The authors go on to suggest in Line 421-423 that future studies with the sUAS could seek to investigate "how much averaging has to be applied on the cross sectional flux in order to converge on the actual emissions". Would this not, however, require knowledge of the morphology of the plume?*

Authors: Of course, this will depend on the meteorological situation. Turbulent conditions will require more averaging than stable conditions.

Reviewer 1: *I think it would be good to see in this study at least some modelling of the plume stack, such as using SHRMC-4S DAYSMOKE. I think inclusion of this would highlight the limitation of this sUAS for sampling plumes from industrial stacks, while concurrently explaining the difference between the study's inferred CO2 flux and the value taken from the facility. By doing this, it can be argued the sUAS is indeed suitable for point emissions measurements, but that in this example, legal limitations on drone operation prevented a full analysis.*

Authors: We added the following discussion to Sec. 6 of the manuscript: 'We use a Gaussian plume model (Beychok, 2005) to estimate the expected plume extend for moderately unstable conditions (Pasquill stability class B) resulting in a full width half maximum of 197 m horizontally and 124 m vertically. The expected corresponding plume rise can be estimated with Briggs' equations for bent-over, hot buoyant plumes (Beychok, 2005). Most input parameters to the Briggs equations such as temperature and wind speed at stack height have been measured but other parameters require ad hoc assumptions. We assume that the exiting flue gas consists of 21% CO_2 and that it is 50° warmer than the ambient air. By applying the ideal gas law, these values are used to estimate that the annual emissions through the main stacks have an average volumetric flow rate of roughly $78\,m^3\,s^{-1}$. For this scenario, Briggs' equations estimate that the expected center of the plume 500 m downwind of the source has risen to 234 m.

In case of a Gaussian plume morphology, this would mean that roughly 74% of the emitted CO_2 has risen above 200 m. However, it shall be noted that the Gaussian plume shape and a plume rise according to Briggs' equations is only on average a good estimate for reality but on short time scales, turbulence can result in large deviations form that. Also, the results of our simple simulations are relatively sensitive to the made ad hoc assumptions. Nevertheless, they indicate that the width of the flight pattern (about 340 m) was sufficient to sample the expected plume width, but that large parts of the plume may indeed have risen above the maximum flight altitude."

Reviewer 1: *An outline of the operating parameters of the sUAS, such as maximum allowed height of operation, maximum distance from observer, battery temperature etc., would be welcome somewhere in Section 2.*
Authors: As discussed above, the maximum allowed height depends on the legal permissions but we added some technical specifications taken from the fact sheet of the UAV to Sec. 2: "According to the technical specifications of the UAV, it can operate in temperatures between -20°C and 50°C; its maximum flight altitude is reached at 3 km above mean sea level (with special propellers) or at 500 m above ground level (limited by its firmware); under optimal conditions, its radio system can operate over distances of up to 8 km; its maximum wind resistance is $12\,m\,s^{-1}$."

Reviewer 1: *It is also important to clarify why this platform can operate at a 200 m flying height. Current EU legislation limits drones for both recreational and commercial flights to 120 m above surface level.*
Authors: We got a special permission from the local aviation authority (see discussion above).

Reviewer 1: *The x-axis on Figure 9 is labelled "Distance [m]". It is important to clarify what this distance is from. Presumably, it is the distance from the attitude of the drone when measurements were first taken?*
Authors: We added to the caption of Fig. 9: "The x-axis corresponds to the distance from the west-most point of the flight pattern."

Reviewer 1: *CO2 emissions from point sources are often associated with emissions of particulate matter. Have the authors considered the suitability of their sUAS to take downwind measurements of CO2 in plumes that may contain PM? How would drone and sensor performance be affected?*
Authors: The DJI Matrice 210v2 is advertised to feature a rugged design optimized for industrial applications and has a IP43 Ingress Protection Code. Therefore, we do not expect any problems with moderate concentrations of co-emitted PM.

The Vaisala GMP343 NDIR CO_2 sensor analyzes reflected infrared light at two wavelengths around 4µm. In principle, scattering at aerosols within the sensor's cavity can modify (usually reduce) the light path which would be misinterpreted as change in atmospheric CO_2. However, at these wavelengths aerosol extinction is usually far less pronounced compared to the visible spectral region. Additionally, we expect that mainly soot aerosols are co-emitted having a small single scattering albedo. This means, most of the radiance extinction is due to absorption but not scattering. This (spectrally broad-band) absorption along the light path will not significantly influence the sensor results because the measurement principle uses two neighboring wavelengths from which one serves as reference. Therefore, we consider co-emitted PM to be not a significant error source for our flux estimation whose uncertainty budget is dominated by the uncertainty of the wind measurements (8.3%).

Reviewer 1: *The axis labels of all figures are quite small and difficult to read without zooming in. Could the authors enlarge the x-axis and y-axis labels for all figures?*
Authors: Done. We enlarged the font size of almost the entire text shown in the figures.

Reviewer 1: *For Figure 2, a secondary y-axis plot could be used to plot pressure on the same sub-plot as RH.*
Authors: If OK for reviewer 1, we would prefer to keep the simple, clear design of the figure.

References

Beychok, M. R.: Fundamentals Of Stack Gas Dispersion (4th ed.), author-published, 2005.