RC3: Anonymous Referee #3

Borchers et al. provide a layout for an aerosol sampling system aboard drones. The manuscript is well written and the results are very nice, especially the untargeted analysis. I have a couple of major comments, but otherwise think that this is a nice paper that sets the ground for future work.

We thank the Anonymous Referee #3 for the supportive review and the constructive comments/suggestions that helped to improve our manuscript. We have carefully revised the manuscript accordingly. Below you will find our point-by-point responses. Reviewer comments and suggestions are written in black, responses in blue. Changes in the manuscript are marked with "".

General comments:

Title: My major question is why the manuscript focuses so heavily on organic aerosol? Surely this sampling system is appropriate for submicron aerosol of any composition? One could analyse ammonium, nitrate, and sulfate on these filters via ion chromatography. I think a more appropriate title would be Development and use of a lightweight sampling system for height selective drone-based measurements of organic aerosol particles”

Thank you for this comment. It may be possible to collect inorganic components with this system. The collection, extraction, and evaluation method shown here has not been tested for this particular application, so it is outside the scope of this paper. In the interest of being clear about the paper's focus, which is on organic aerosols, we have decided to include this in the title.

Flowrates: Figure 2 is very worrying—the flow drops hugely across a 30 minute period. Was this data taken in the lab? Were any flowrate measurements taken when the UAV was in the air? Was any flowrate correction made considering that atmospheric pressure is substantially lower at 500 m? I don’t think any of the results are trustworthy if the flowrate is this unsteady and unmeasured. There’s no reason to believe any of the quantifications as they totally depend on the sampled volume. This also applies to the error bars in Figure 5. You’ve decided there is a 2% error, but that would only apply if there was uncertainty but no trend downwards. There’s no reason to believe that the data from Figure 2 wasn’t taken at a sample rate of 10 L min-1.

Thank you for this comment.

You are correct that the flow drops over the 30 min interval. The drop is about 10%. This is to be reduced in the future in the further development of the filter holder shown here by installing a voltage regulator. Since this drop has been taken into account when determining the concentrations, we see no problem with the drop. The flow was determined in the laboratory and no measurements were taken during the flight. We have now made measurements at different air pressures to determine the dependence of the flow on air pressure and to be able to correct the measurements accordingly (Figure 2 (b) and supplement).

Supplement line 38: “The collected air volume (V_{air}) is then determined by integrating the linear equation of the fit for the flow (Q) (Equation S2) through the filter holder, which leads to Equation S3. In the following equations t is the sampling time.

$$Q = (-0.41 \pm 0.01)\ \mathrm{SLPM\ min^{-1}} \cdot t + (102.8 \pm 0.2)\ \mathrm{SLPM} \qquad \text{(S2)}$$

$$V_{\mathrm{air}} = \frac{(-0.027 \pm 0.002)}{2}\ \mathrm{SLPM\ min^{-1}} \cdot t^2 + (18.97 \pm 0.04)\mathrm{SLPM} \cdot t \qquad \text{(S3)}$$

Since the flow through the collector is pressure dependent, it must be corrected for the different pressures at different heights (1.5 m: 920 hPa; 120 m: 907 hPa; 500 m: 870 hPa; measured by FLab). The linear fit for the dependence of flow on pressure (*Q(p)*) is used for the correction (Equation S4).

$$Q(P) = (0.20 \pm 0.01)\ \mathrm{SLPM\ hPa^{-1}} \cdot p + (-93 \pm 12) \tag{S4}$$

The collected air volume $V_{\mathrm{air}}(p)$ is subsequently corrected according to Equation S5. The flow at 980 hPa is utilized as a reference because the time dependence was determined at this air pressure.

$$V_{\mathrm{air}}(p) = V_{\mathrm{air}} \cdot \frac{Q(p)}{Q(980\ \mathrm{hPa})} \tag{S5}$$

The concentration of the compound of interest can then be calculated as shown in Equation S6.

$$c(\mathrm{compound}) = \frac{m(\mathrm{compound})}{V_{\mathrm{air}}(p)} \qquad \text{(S6)”}$$

Line 126: “A linear fit ($y = mx + b$) was performed, with $m = (-0.41 \pm 0.01)\ SLPM\ \mathrm{min}^{-1}$ and $b = (102.9 \pm 0.2)\ SLPM$ as fit parameters. In an additional experiment a second linear fit for the relationship between the flow rate and the ambient pressure was performed this yielded the linear fit ($\dot{V}(p) = m_{\mathrm{p}} \cdot p + b_{\mathrm{p}}$) with the parameters m_p = (0,20 $\pm$ 0,01) SLPM $\mathrm{hPa^{-1}}$ and b_p = (93 $\pm$ 12) SLPM.”

Line 133: “Figure 2: (a) shows the flow through the filter holder as a function of time (at 980 hPa) (blue dots), the dashed line represents a linear fit of the data. The errors correspond to 2% of the measured value, which represents the measurement uncertainty of the flow meter (b) shows the flow through the filter holder as a function of pressure (green dots), the dashed line represents a linear fit of the data. The errors correspond to 2% of the measured value, which represents the measurement uncertainty of the flow meter.”

Specific comments

Line 8: Do you mean natural *and* anthropogenic sources?

Yes, we meant natural and anthropogenic sources and have changed it in the text.

Line 9: “Organic aerosols (OA) are introduced into the atmosphere from a variety of natural and anthropogenic sources.”

Line 73: Will being airbourne have any effect on the stability of the flows? .

Thank you for your comment. We have investigated the influence of the different drones or when no drone is used. The results in Figure 4 show that there is no significant influence of the drone on the flow.

Figure 1: this figure is missing some details about dimensions etc.

You are right. We included the dimensions in Figure 1.

Line 91: I know it’s not a major part of the manuscript, but if you briefly described the FLab system (one or two sentences) it would be useful so we do not have to go to Moormann et al. (2024).

We added a clarification about the benefits of simultaneous FLab measurements to the paper:

Line 98: “A third measurement UAV, FLab (Moormann et al., 2025), was used to simultaneously quantify gas tracers and meteorological data in hourly vertical profiles over the course of a day at the same measurement location. In particular, height-resolved monitoring the O_3 mixing ratio and wind conditions within 500 m range above ground show oxidative potential of air and supports attribution of air mass origin. "

Line 119: Why is the linear fit used here? Surely you can just integrate your points and get a more accurate value.

Thank you for this comment. We used the linear fit method to account for any measurements that did not fall exactly on one of the measured points for the flow determination. In addition, its influence is minimal and compensates for slight flow fluctuations during the measurement.

Line 176: UTC, not UCT.

We have corrected this.

Line 91: „Figure 5 shows three height profiles at 10:35 am, 1:35 pm and 4:30 pm local time (UTC+2) for concentrations of the three biogenic marker components pinic acid (black square), terpenylic acid (blue triangle) and terebic acid (green diamond) in 1.5 m, 120 m and 500 m."