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Comment on acp-2022-560

Anonymous Referee #1

Referee comment on "Measurement report: Atmospheric fluorescent bioaerosol concentrations measured during 18 months in a coniferous forest in the south of Sweden" by Madeleine Petersson Sjögren et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-560-RC1>, 2022

The study by Sjögren et al. is very interesting and provides very important results. As the Authors state themselves, long-term observations of biological aerosol particles have only rarely been conducted so far. Hence, only few spots on Earth were sampled. The study shows similarities and differences to previous similar studies that took place mostly in different environments. The study therefore clearly shows the need for further studies on the topic as generalization for bioaerosol release worldwide seems difficult seeing the partly differing relations between meteorology and biological aerosol particle concentrations in the few similar studies. The provided manuscript is therefore highly relevant for the atmospheric sciences since it provides further insight in the release of biological aerosol particles and the magnitude of their concentration in rural mid-to-high-latitude forests, which cover a large fraction of Earth's surface.

The manuscript is well written and the drawn conclusions are justified by the provided figures and tables. Although the data has the potential for much deeper analysis (e.g., including trajectory data and precipitation radar data to derive more insight in FBAP sources and their connection with precipitation on a regional scale), there is no need to enhance the analysis at this stage. The presented results are sufficient for a sound study. In my opinion the manuscript can be accepted with minor revisions.

General remarks

Although, I don't have serious doubts that the applied instrument (BioTrak) is able to measure biological aerosol particles in ambient air, the manuscript could be much stronger if the authors would include a discussion on the known quality of the instrument. As the instrument was not applied yet to ambient air, probably some conclusions on its validity could be drawn from other applications. I'd be surprised if there were no reports on validation experiments in the literature or by the manufacturer. Furthermore, in section 2.2 a comparison of the BioTrak and instruments used for previous studies (UV-APS, WIBS), including, if possible, a discussion of potential implications, would be very helpful for the reader.

Specific comments

l. 21: ' a ~3-fold difference between these seasons'. Which values does this statement relate to? Dividing the summer (0.0126 cm⁻³) by the winter value (0.0025 cm⁻³) results in a factor of 5.

l. 134: Was there any evaluation of the BioTrak instrument against different methods, e.g. by this or previous studies? If not for ambient aerosol, then maybe in pharmaceutical and clean environments, which is mentioned later in the manuscript as the purpose of the BioTrak instrument.

l. 146-149: Since the N_FBAP was measured within the canopy (5m), it would be interesting to know or estimate how in particular air temperature and humidity deviate between 30m / 70m and within canopy values.

l. 225-226: Was this also observed during this study? The sentence could be understood

in this way and that this compares with other studies.

I. 282-284: Since Hyltemossa is an ACTRIS and ICOS site, are there other aerosol number concentration or size distribution measurements available or at least nearby?

I. 284-286: Could the authors please explain in a few more sentence how the higher flow rate might influence the N_TAP concentration? In case the higher flow rate would have an influence on the N_TAP concentration, how could it affect the N_FBAP concentration?

I. 288: How does the counting efficiency and cut off size compare to the other instruments (UV-APS, WIBS)? Presumably, a difference of a few hundred nm in cut off size in the accumulation mode might result in large differences in N_FBAP (and perhaps N_TAP if done also within the UV-APS / WIBS instruments and not externally in other studies).

section 3.2.2: Can the relative humidity affect the measurement signal of the BioTrak?

section 3.2.3: Are the wind direction results significant? If yes, wouldn't this indicate a measurable difference between, roughly speaking, north-westerly and south-easterly wind directions in terms of FBAP sources at the Hyltemossa site?

section 3.2.4: As mentioned in the figure caption to fig. S5, there is some indication in fig. S6a for increasing N_FBAP with increasing rain intensity. Could you explain more, what in Fig. S6a is indicating this?

How do the statistical results change if different higher maximum rain intensity thresholds within a rain event would be used (not just on hourly basis but also shorter time periods)? Does a higher threshold such as 1 mm hr⁻¹ or higher lead to a more robust, maybe even significant correlation between N_FBAP and intense rain? However, this might limit the number of rain events in the statistics per season.

I. 470-471: Such could be elaborated a bit more in section 3.2.3.

section 4: The size range (1-12 μm) in which FBAP could be observed with the BioTrak instrument should be mentioned in this summarizing section.

I. 481-482: The summer and winter median values differ from those given in the abstract.

Also there is little discussion of figure 3 in the respective section.

I. 486-487: 'this suggests that the NFBAP concentrations were more influenced by the biological

activity than by boundary layer meteorology.'? Could you please elaborate a bit more on the basis for this conclusion?

Other minor comments, typos, etc.

l. 77: here listed -> listed here

l. 78-79: Perhaps mention in the text as well that these values are averages over the time period of different campaigns. I think, giving also the maximum observed concentrations (if they have been reported) would be interesting for potential readers. Furthermore, the lowest value given in the table is 0.0053 cm⁻³, not 0.015 cm⁻³.

l. 80-81: The authors cite here only 2 of the eight studies, but the table mentions a number fraction for most of the studies. Further, the minimum reported number fraction is 1.1 % (only season mean though).

l. 154-155: Since the authors have also used hourly data (e.g. for the diurnal cycle), the statement on averages over days, months and seasons is misleading. Perhaps the first sentence of this paragraph is not really needed.

Table 2 and throughout the report: Since the ratio $N_{\text{FBAP}}/N_{\text{TAP}}$ is so small, using % leads to easier understandable (shorter) numbers (as was done in the abstract). Also, the author's could consider to provide values of the N_{FBAP} in scientific notation instead of decimals for easier readability.

I. 275-276: Suggestion to add the year of the given months.

I. 278: 'here' -> 'in this study'. Just sounds better in my view.

I. 280: A.E. Valsan et al. -> Valsan et al.

I. 281: 2012/2013 -> 2012, 2013

I. 290-291: This might be very important. This statement could be mentioned earlier (e.g. section 2.2?) together with the difference in flow rate.

I. 330: 'effects' seems redundant as 'associations' was mentioned in the beginning of this sentence.

I. 336: 'Fig. 5b)' misses a '('.

l. 339: 'fig.' missing before '5b'.

l. 339: indicate -> indicates

l. 343-344: Mentioning 'nonsignificant' and 'significant' in the same sentence, although for different things, is a bit distracting. Perhaps, 'significant' could be substituted (e.g., large, considerable, ...)?

l. 348-349: If needed at all, this sentence should be moved to the beginning of section 3.2.1.

l. 377 (caption of Figure 6): The horizontal lines are dashed not dotted.

l. 396: here reported -> reported here

l. 402: Space missing between 'speed' and '(b)'

l. 415: correlated -> are correlated. Sounds more familiar to me, but I am not a native English speaker.

l. 463: 'to be negatively correlated' or 'to have negative correlations', similarly adapt 'positive correlations' later in that sentence.

l. 477: 'the' can be deleted in 'in the Southern Sweden'.

figure caption of Figure S2: The 5min data averages are shown by a red line. The caption mentions 'small dots'.

figure caption Figure S3: ')' missing after 'time of the day'.