

Interactive comment on “Fluorescent biological aerosol particles (FBAPs) measured with the Waveband Integrated Bioaerosol Sensor WIBS-4: laboratory tests combined with a one year field study” by E. Toprak and M. Schnaiter

Anonymous Referee #1

Received and published: 20 August 2012

This manuscript presents lab characterisation of PBAP and possible false positive particles using the WIBS instrument, as well as a long term seasonal WIBS dataset. Both these areas are almost entirely unaddressed by the current WIBS literature, and the paper should be an important addition. There is also some interesting initial evidence that the WIBS may be able to provide information about PBAP viability. However, the grammar and English of the manuscript need a lot of corrections, and the meaning is occasionally unclear. It seems that English is not the authors' first language, so I will give the authors the benefit of the doubt and provide comprehensive technical cor-

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rections. However, it might be an idea to get a native English speaker to check the manuscript, if possible.

Specific Comments

P17615, L24: Does your baseline have any diurnal cycle? This is something I have encountered in other datasets. Just briefly state the answer somewhere here.

P17619, L3: “our definition” – I presume you mean the one on p17613, L 22. This was confusing. It appears that you are just defining the acronym “FBAP” rather than a definition of category of WIBS measurements. You also clearly state that it's the definition of Gabey et al rather than “yours”. You do not refer to Table 1 anywhere here.

I found the particle category “FBAP” as defined in this table to be very confusing. You talk about N_FBAP of dust or ammonium sulphate measurements which are obviously not FBAP. I think it would be much clearer to give this a more generic name, say N_F1,F3 or something, give its full definition at the beginning of Section 3.1, and then, at the end of the laboratory characterisation section, say that this is a good definition for detecting FBAP. I don't mind you referring to particles which meet this definition as FBAP in the ambient data set, because I think you are right. However, it is very confusing during the laboratory discussion.

I also have a problem with the statement that this definition only includes viable species. I don't think that at this point you have explained why it may not include non-viable species (but then you also haven't defined it very explicitly, so maybe that's why), but presumably it's because the definition relies on both FL1 and FL3. I don't know of any evidence in the literature that the WIBS can successfully distinguish between viable and non-viable PBAP. Either you have to reference another study that I don't know about, make it clear that you have proven this to be the case, or make it clear that this is speculative. I suspect you need to tone down the language to state something like “The discrepancy may be explained if our definition of N_FL1,FL3 is insensitive to unviable fungal spores. This may be the case given the dependence of FL3 on NADH,

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which degrades in non-viable PBAP?" Also, do you have any evidence or a reference that you might expect 80% of your fungal spores to be non-viable?

P17620, L14: You state here that less than 6 particles per litre is a small concentration, but, while it is relatively small compared to the number of dust particles, it is significant compared to ambient concentrations of some PBAP. This is also (to a lesser extent) the case with the soot particles. This needs to be stated and discussed.

Technical Comments

P 17608, I 13: "excitation wavelengths/detection wavebands"

L21: "conditions prevail."

L23: "was always higher" – is this really the case? "Always" is a strong word for a seasonal dataset. Would "usually" or "almost always" be more precise?

P 17609, L4: "solid particles" – I think this is unnecessarily precise. Is something like a virus solid or is it a liquid? In reality it's probably a bit of both, so I think just "particles" would be better.

L11: "they affect public health"

L12: I can't find the reference to Poschl 2005

L14: "aerosol –cloud processes" i.e. remove the spaces, otherwise it's a dash and it means something different.

L21: "EDX" is not defined

L25: "only to a specific size range" Can you briefly state that. It sounds a bit cryptic as it is.

P17610, L7: "bacterial concentrations of less than the limit of detection, up to 1.4. . ."

P17611, L6: "The release of wet actively discharged. . ."

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L9: "The online methods, which have been developed. . ."

L10: "from the ambient atmosphere possible"

L12: "instrument able to detect"

L15: "particles with an aerodynamic"

L16: Could you state approximately what time of day the peak was. I presume from this that it was around midday?

L24: "In Borneo, they found the minimum and maximum. . ."

P 17612, L8: "studies cover only relatively short periods" – monitoring for a couple of weeks with the WIBS is shorter than your study, but it is longer than most PBAP studies, which use filters.

P 17613, L4/5: This assertion either needs a reference, or it needs to be qualified by adding "We will show that the combination. . ." or something similar. L23 and elsewhere: The WIBS does not record "shape". I realise that you do not want to use "AF" here as you go on to define it after, but perhaps "sphericity" is a more precise term.

P17614: The AF has been described in a few papers previously. I would be perfectly happy for you reference those papers, and leave most of the first half of this paragraph out, including the equation.

L24: "manufacturer's instrument calibration was checked periodically"

P17615 L6: "always records a finite"

P17616, L7: "aerosol that consists of substances that are able to fluoresce, despite being non-biological in nature, which are a well-known interference to UV-LIF detection."

L14: I think "false triggers" it's a bad choice of words as this normally refers to the baseline measurements. I presume you are referring forward to your results section in these two sentences here. This is unclear – it sounds like you are talking about the

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literature. You say “it was shown” but you haven’t shown it yet! I also don’t know what the sentence beginning “It was shown that these...” is meant to say – it talks about false triggers (false positives) at the same time as saturation. Its also ambiguous what “these” refers to. – FBAP, non-FBAP, both? I don’t know what the first sentence in the paragraph is for. I would suggest rewriting that paragraph something like this (assuming this is what you are trying to say). “We present a laboratory analysis of several representative biological and non-biological particles. We will show that non-biological particles produce few false positive FBAP or saturated measurements, even under high concentrations. On the other hand, the biological particles used never saturate the fluorescence detectors. Hence, we propose a new threshold analysis which excludes particles which saturate a fluorescence channel, as well as those falling below the fluorescence baseline (Eq. 2)” The final two sentences really belong somewhere in the conclusions.

P17617, L2: The csv files do not contain the missed particle counts – that is calculated by the analysis code.

P17618, L19: Could you give details of the manufacturers of the spores, and how they were nebulised.

L23: state the size range of the CPC

P17619, L18: “were performed”

L19: Give details of dust source/manufacturer/nebulisation technique.

L4/5: This makes very little sense and I don’t know what it means. Fluorescence itself doesn’t contribute to the number of particles, as such, and you haven’t given your “definitions of biological particles” yet. Please rewrite it.

P177620, L5: “were found”

L21: Again, “false triggers” is a poor choice of words – “false positives” is better, here, and elsewhere. Also, “or it could be”

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P17622, L18: This is a good discussion of the potential for viable/non-viable detection. P17619, L3 needs to be much more like this.

P17622, L25: “admit” implies that you would rather that this result was not the case, which isn’t the right tone for dispassionate scientific observers. “we show that there was a” is better.

L26/27: It could be...or it could not be. Please add the alternative explanation that it’s just a limitation of the technique.

P17623, L1: “to CAST fossil fuel”

P17623: Please add information on the length of all these inlets, as well as any information you have about transmission efficiency. Line losses is a very big issue for coarse mode aerosol.

P17624, L2: “global solar radiation”, I presume you mean “terrestrial” rather than “global”.

L4/5: You contradict yourself by saying the instrument sampled continuously, but that it stopped sometimes.

L20: “in good agreement”. Also, here and elsewhere, all the seasons should have a preposition before i.e. “In Spring”, “During Summer” etc.

Fig. 9: Can you comment on the spikes at/before about 16:00 during spring?

L21: “In addition, the decrease in the...”

Table 2: I would like some information on the distribution of the data in this table. I have previously found that displaying data as mean(median) _{25th} ^{75th} is a good way to present a lot of data in a clear way (where [^] denotes a superscript and _^ denotes a subscript.)

P17626, L3: Not quite the right use of “analogy”. Try “change of FBAP which was

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similar to that of the spring term.”

Figure 11: Is the image plot at the bottom all particles, or just FBAP? Please add this to the caption.

P17627, L10: “quite eye-catching” is not formal enough. Try “notable” instead. Also I think at the end it should read, “(indicated by distinct diurnal trends of the terrestrial solar radiation)” assuming I have understood correctly.

L13: “obviously” is a dangerous word in science. I would use “apparently” instead.

Figure 17: What is the hatched area indicative of? Add this to the caption.

P17629, L18: “counting statistics were better”, like I say, “obviously” is almost never the right word in a scientific paper.

P17630, L7: Keep the WBS-4 abbreviation the same as it was earlier in the paper.

L16/17/18: This sentence doesn’t make sense.

P17631, L10: “For most of the time. . .”

L16: This assertion needs a reference. I appreciate you discuss this at the beginning of the paper, but it would be useful to the reader to re-reference them here, as this statement is somewhat left hanging.

L24: “how the fluorescence of biological aerosols changes under different. . .”

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 17607, 2012.