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Atmospheric Measurement Techniques Discussions

Interactive comment on "Development of a bioaerosol single particle detector (BIO IN) for the fast ice nucleus chamber FINCH" *by* U. Bundke et al.

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Authors answer to "comments and suggestions" by anonymous referee 1

We wish to thank the referee for his/her valuable comments and suggestions which help us to improve the manuscript considerably.

Detailed answer on Referee 1 comments:
General comments:

RC: One may question whether this report is based on sufficient testing. Certainly true

that only minimal amount of test results are being presented. It is hard to imagine that no more tests were done, and that only the two most successful ones are included. Once set up and working, why were only 709 particles counted from ambient aerosol?

AC: The aim of this technical report was to present the setup of our newly designed detector and to show first results. Most tests and optimizations during the development process were done using the silica test particles. The study of ambient aerosol was intended to be supplementary to show that it also works with "real outdoor" aerosol. Certainly we will further improve the performance of the detector and do more measurements. These will be the subject of scientific papers in the future.

RC: As a detector of biological particles, could it be compared with other methods? Since bacteria, or their fragments, are of special interest as IN, can anything be said, and tested, that would show the detection probability for them?

AC: The fluorescence detection is a common method for study of biological material. The detection probability with 340-380nm excitation wavelength is directly connected to metabolites which are mostly present in vegetative cells. However, organisms in dormant state like bacterial spores show weaker fluorescence emission. We added some text to the introduction section about this point.

RC: Once coupled to FINCH, what additional factors come into play? Will ice covering on the particles change the detection probability and size thresholds?

AC: There are three additional factors to be considered: a) the growth of ice covered small IN to detectable size (depolarization channel), b) the optical properties of the ice shell and c) the lowered temperature. We added a short discussion

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about this factors in the discussion section of the manuscript. In summary, all three factors are not critical. a) and c) will enhance detection probability while b) is neutral, because fluorescence is omni-directional and will not be altered by scattering in the ice shell and absorption by ice is neglectable at the fluorescence- as well as excitation wavelengths

Minor points:

RC: 2404/16 Why are aerosols like ammonium sulfate not mentioned?

AC: We added it to the text

RC: 2404/22 "heterogeneous freezing process“ is not a good choice of words, nucleation is heterogeneous, not the process of freezing

AC: Text adapted accordingly

RC: 2406/18 2mm refers to the diameter of the outlet?

AC: It refers to both the diameter of the nozzle outlet of the virtual impactor, which is the same 2mm as the inlet nozzle of the detector, as well as the diameter of the sample beam. We changed the text to clarify that.

RC: 2407/6 Isn’t “broad-band“ and “narrow-band“ the more usual expression for “long-pass” and “short-pass”?

AC: The terms “long-pass” and “short-pass” are the usual expression for both types of “edge- filters” we used in our set-up. The terms “broad-band” and “narrow-band”

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are in use for “band-pass”-filter types.

RC: 2407/8 No text refers to this equation

AC: The text section 2406/18 – 2407/4 refers to this equation

RC: 2407/16 “perpendicular“ not “rectangular“

AC: Text changed accordingly

RC: 2408/6 “sampling“ rather than “probing“

AC: Text changed accordingly

RC: 2408/14 lower case “l“ as symbol for liter is easily misread

AC: We changed it to “LPM” (liter per minute)

RC: 2408/15-17 Two sentences are redundant for this content

AC: Text changed accordingly

RC: 2408/18 Strictly speaking the figure shows a graph not a “snapshot of two particles”

AC: Text changed accordingly

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RC: 2409/2-8 More quantitative information here would be helpful. Was there only one test made? How many particles counted? How reproducible are the tests from one test to another? How broad were the distributions?

AC: We added some information including three new figures: the two frequency of occurrence histograms (a) as function of the total signal intensity (sum of both polarization signals) of the depolarization detector (which is proportional to the square root of the particle diameter) b) as function of the fluorescence signal intensity (which depends on the amount of fluorescence dye in the particle) and the scatter plot of the fluorescence signal versus the total scattering signal intensity on the basis of single particle analysis of the 10μm test particles.

RC: 2409/22 Why assume that bio-particles were the largest ones? This is not necessarily so.

AC: We do not assume that. We did some changes in the text to clarify this misunderstanding.

RC: 2409/26 The meaning of PD and PM in Fig. 8 is not given

AC: PD and PM are acronyms for photodiode and photomultiplier. We changed the figure captions.

RC: 2410/4 There is a promise of that but it may too early to talk about an “important contribution”

AC: Text changed accordingly

Interactive comment on Atmos. Meas. Tech. Discuss., 2, 2403, 2009.