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Biogeosciences Discussions

Interactive comment on "Aerosol fluxes and particle growth above managed grassland" *by* E. Nemitz et al.

Anonymous Referee #2

Received and published: 2 February 2009

General comments:

This paper is a very good one. It does not only propose a novel approach to observe particle growth on the field scale by using particle flux and size distribution measurements, but also presents some very interesting and novel results on particle and reactive nitrogen (NH3, HNO3, NH4NO3) dynamics over a managed grassland. The data sets presented are well obtained and underwent extremely well interpretation. The intellectual work is very creative. This is a significant step towards further understanding of flux divergencies in the boundary layer, in association with heterogeneous processes between the aerosol particle phase and the gas phase. Congratulations. This paper definitively is acceptable for publication (after some revision, see below).

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Having said that, this reviewer raises specific comments that should be used to further increase the quality of the manuscript. The most important one is the unclear presentation of some sections of the theoretical reasoning (chapter 2.4). Some Figures need editing as well.

Most of the manuscript is densely written, thus a bit hard to read and follow. For example, one can follow the reasoning given in the sentence on page 354 (last line) and the first two lines of page 355. However, the authors require the reader to be very much familiar with the material. That is okay, just may result a negative feedback on the readability for some of the potential audience.

Specific comments:

p 350, lines 3-5: Ke is a good approximation for humidities below the relative humidity of deliquescence (about 80% for (NH4)2SO4 and 60% for NH4NO3): Why do you restrict that to the low humidities? p 350, lines 14 - 15: Particle growth implies that some particles will grow across the lower cut-off of the particle counter (dp=11 nm or r=5.5 nm) as they deposit: This sentence comes out of the blue here. You probably want to say: If one plans to observe particle growth with a simple particle counter without size information, ... The following sentence is even less clear. Where do you assume particle growth (across the detection limit of the analyzer) to occur? What are the deposition velocities of particles of various sizes in relation to each other? Please rephrase this paragraph in a more clear and detailed fashion. After having read the entire paper, it is clear what is meant. However, a reader going through the manuscript does not have sufficient information yet at this point.

page 350, lines 24-26: Please be more specific and clear what delta_chi/delta_t and Q_chi mean, and what exactly is meant with storage in this context. This also refers to page 351, lines 2-4, and line 5 as well. It is clear to this reviewer what is meant with flux divergence here, but the authors are requested to help a reader to follow their reasoning more easily.

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line 352, line 12: Start a new paragraph here. Tell the reader what you are doing and why. Plus you start to become unclear here. A lot of stuff in just a few lines! What, all over sudden, is the flux expected in the absence of chemical reactions in terms of equation (3)? What is the average deposition velocity? Is it average over time, over size classes, over height? What is Ni in equation (10)? Is i an index, if yes, what does it indicate? The latter is a very important point that must be made clear here! (Later in the maunscript, it is said, what it is. But that is not good enough here. Plus, the later explanation is just vague as well). Is the measured flux (line 13) identical to F_N in line 15 and equation (10)? If yes, the r.h.s of equation (10) can be transformed into: F_N (1 - chi_Ni / chi_N) / z_m. Without knowing what Ni means, the meaning (and potential validity, limitations, ...) of the entire equation (10) remains hidden.

Further, what is the specifics of a measurement before fertilization?

page 352, line 18: Please indicate in a more detailed fashion what you mean with the growth rate across the size cut-offs. What is the term in the preceding equations, what is the unit?

page 352, line 21: 11nm: Are you talking about diameters now? If yes, why do you jump between diameters and radius?

page 353, lines 18-20: This sentence is unclear. What do the frequencies indicate exactly?

Table 1: It seems a little awkward to indicate negative deposition velocities. Would it not be better to use the term transfer velocity instead?

Fig. 2: Printed on a s/w printer, there is no chance to distinguish between the lines properly. How it is on a (high quality) color printer, this reviewer is not sure. On the screen it is okay as long as you spend enough time deciphering the lines and coding. In the opinion of this reviewer, the quality of this Figure is unacceptable. This also applies to Fig. 10.

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Fig. 2, lower panel: There is a red line around the zero line that is not explained. The caption section: Also indicated are the periods of the MOUDI impactor runs (B to D) is unclear. If that is the mysterious line, it is presented with too little detail.

Equation (12): Isnt that estimate affected by the compensation point concentration?

page 354, lines 20-21: Isnt that a contradiction to the simplifications that lead to equation (12)?

Fig. 5: Particle radius and particle diameters are now mixed up in one single figure. Why dont you use just one of them?

page 357, line 2 and other spots in the manuscript: What do you mean with deposition rate? Is it deposition flux, or deposition velocity? If something else is meant, please specify!

page 359, line 9: Please indicate which of the three proposed mechanisms you exactly mean with the notion nucleation. It seems that you mean No. 1, but the notion is also used in connection with the other two in the literature.

technical corrections:

p 343, line 23: delete but

p 347, line 1: replace annual by annular

p 347, line 14: delete runs

page 350, line 23: Replace Q_c with Q_chi (using the greek letter chi)

page 355, line 10: Financial constraints ... Well, this is not an argument that should appear in a scientific journal contribution such as this one.

page 356, line 13 and Fig. 6: Please say either Damkoehler number or Damkoehler ratio, but dont use a mixture of the two.

Fig. 7: Only one line can be seen. As one seems to overlay the other one, please

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indicate that in the Figure caption.

page 358, line 5: replace micro m s-1 by mm s-1

Interactive comment on Biogeosciences Discuss., 6, 341, 2009.