

***Interactive comment on* “On the contribution of Aitken mode particles to cloud droplet populations at continental background areas – a parametric sensitivity study” by T. Anttila and V.-M. Kerminen**

Anonymous Referee #1

Received and published: 6 June 2007

The study presents a systematic numerical investigation of parameters over appropriate ranges that determine cloud droplet number concentration. The present analysis uses a new method, namely a probabilistic collocation method (PDM), that allows the simultaneous variation of parameters and, thus, the quantification of the relative importance of each individual property. Even though the present study does not reveal new insights into the importance of size parameters vs. chemical composition for cloud droplet number concentrations in a qualitative sense, I recommend this paper for publication in Atmospheric Chemistry and Physics as it represents a very comprehensive overview and it quantifies the effects that have been identified in previous studies. Before publication, my comments below should be addressed:

General comments

p. 6078, l. 17: replace 'chemistry' by 'chemical composition'

p. 6078, l. 18-21: The last sentence of the abstract is redundant (see lines 7-10)

p. 6079, l. 13: What is the upper limit of the particles considered?

p. 6080, l. 23: What are typical time scales for growth of newly formed particles into Aitken size particles?

p. 6081, l. 5: Here, and in the remainder of the manuscript: I would prefer to call it a 'variability in the input parameters' rather than 'uncertainty' in the input parameters as indeed atmospheric particles (populations) exhibit these properties. Use of the term 'uncertainty' in this context implies that the measurements of these properties are associated with large errors.

p. 6086, l. 22: Internal or external mixtures imply that there are (at least) two different aerosol compounds. You should point out that your assumption of an internal mixture is only of importance for using 'epsilon' as for all other properties you assume one single solute anyhow (as you state earlier).

p. 6086, l. 25: Replace 'Solubility' by 'water-soluble mass fraction' to be consistent with Table 1.

p. 6089, l. 8: Obviously, the numerical approach chosen here cannot account for a concentration-dependent surface tension, as you point out. However, this flaw in the numerical treatment leads to a significant overestimate of the surface tension effect as the Kelvin term only determines drop formation close to activation when the particle size, and thus, dilution increases rapidly (Ervens et al., 2005). It should be emphasized more clearly in the manuscript that the importance of the surface tension as shown here should be considered as an upper limit.

p. 6089, l. 14: Also the mass accommodation coefficient is a concentration- dependent

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

value (e.g., Feingold and Chuang, J. Atmos. Sci., 2002). Thus, any conclusions that are drawn on the importance of the mass accommodation coefficient also represent an upper limit. This fact should be made clear as well throughout the manuscript.

p. 6093, l. 27: It is not surprising that the parameters 'epsilon' and MWavg show similar importance when varied over a similar range. According to Köhler equation, they determine the number of solute moles (Raoult term). A brief comment on this numerical relationship would be helpful.

p. 6095, l. 4: Replace 'solubility' by 'water-soluble mass fraction'.

l. 6096, l. 17: Add here something like (...the number concentration of cloud droplets [...]) 'as a function of updraft velocity'.

Technical comments

p. 6080, l. 5 Rissman

p. 6082, l. 25 one order of magnitude

p. 6083, Eq.-1 Should the first symbol on the right hand side be the variable introduced before ? (check lower/upper case Greek symbol)

p. 6083, l. 7: Table 2 is cited before Table 1

p. 6085, l. 28: ...particles that are able to ...

p. 6086, l. 13: belonging to the first group

p. 6086, l. 26: Switch 'MWavg' and 'rho'

p. 6088, l. 5/7: In Table 1, minimum value is 0.25.

p. 6090, l. 9: 0.12, 0.16, 0.28 %

p. 6092, l. 2: Remove 'as'

p. 6092, l. 18: Replace 'what' by 'when'

p. 6105 Add 'm/s' to Table header

p. 6108: The quality of Figure 2 is poor. At least the legends should be enlarged.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 6077, 2007.

ACPD

7, S2309–S2312, 2007

Interactive
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper