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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Time-span and spatial-scale of regional new particle formation events over Finland and Southern Sweden" *by* T. Hussein et al.

T. Hussein et al.

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We thank this reviewer for his crticial comments at this stage and during the quick review. his comments really enhanced the script and how to present the results soundly. We will submit a revised version to the ACP after considering his comments along with the comments by other reviewer.

1) The literature embedded into the article is not very balanced. Relevant literature on the field from outside Scandinavia seems to be completely ignored. This is in slight contrast to the obvious global relevance of the new particle formation events. I am not sure why the authors ignored the other literature, since the group can look back on a comprehensive review of particle formation observa-

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Interactive Discussion
Discussion Paper

tions by Kulmala et al. (2004).
–Because we already cited the review article by Kulmala et al. (2004), there is no need to cite every study about the new particle formation.

I recommend some literature that has a direct mention of the spatial scale of new particle formation, using methods that are similar to the authors Approach I and II: Wehner, B. et al., Tellus B, 59, 3628211;371 (2007) Birmili et al., ACP, 3:3618211;376 (2003), Charron, A. et al., JGR Atmospheres, 112, D14210, doi:10.1029/2007JD008425, 2007. Also, the group of Colin O8216; Dowd (University of Galway) examined spatially limited coastal nucleation events and how these may evolve into regional nucleation events. There are more observations and classifications of nucleation events available from the US (Atlanta), the University of Manchester group (UK), the University of Kuopio group (Po Valley), and many other recent observations worldwide. I think it is mandatory to study and discuss that literature. Then, I believe that the authors can give a confident statement whether their results can be "generalized to many of the air parcels traveling over the European continent." (see Abstract). I get a slight impression that the article is over-used as a vehicle to promote as many of the authors8216; own citations as possible, even if they bear only a distant relationship to the present article. An example is the multiple citation of urban background aerosol characteristics (Hussein et al., 2004, 2005b, 2006, 2007). This looks a bit quaint in view of urban new particle formation being explicitly excluded as a topic from this paper.
–We did not mean to use the article as a vehicle to promote our own studies! In fact, (Hussein et al., 2004, 2005b, 2006, 2007) occurred only once and just in the methods section. In any case, the references Hussein et al. 2005b, 2006, and 2007 were removed. We have indeed overseen three studies dealing with the spatial scale of NPF events, namely: 1. Stanier et al. (2004), Birmili et al. (2003), and 3. Wehner et al. (2007). The results of these studies have been added to our manuscript at the end of sections 3.2.1 and 3.2.2. We have also added references to work by the O8217;Dowd

ACPD

9, S2330–S2334, 2009

Interactive Comment

group and to work done with Po Valley and southern England measurements. However, the other references suggested by the referee have not been considered for the manuscript, since these were not dealing with the specific scientific question of spatial scale, merely about the frequency of regional type of NPF events. This is however an important issue, which should thouroughly be dealt with in a different paper.

Self-citation is natural and healthy, but here it is exaggerated to an extent that is gives a misleading impression on the achievements made in the field. I am happy to hear the authors8216; opinion on this issue.
–The way we used our references was not to mislead the impression on the achievements in the field. We did not cite every previous study because we already cited the review article by Kulmala et al. (2004), which includes a comprehensive citation about the secondary particle formation.
After all, we thank the reviewer for this comment. In the revised version we considered the suggested references in addition to more others.

2) The results presented in the article are sound, but seem rather phenomenological. Much space is devoted to the case studies 8212; fine, but I miss a more analytical examination of the critical issue why particular new particle formation events are limited in space, and others are not.
I imagine that the spatial extent of a particle formation event (Approach I) might also be due to the same meteorology in multiple places. The authors could relate some simplistic local variables such as solar irradiation (or cloudiness) to discriminate local events (one site only) from regional events (multiple sites). I feel that such an analysis is mandatory for the revision of the paper.
–We added this explanation at the end of section 3.2.

From reading some of the references I assume that growth rates of the nucleation mode might also be available for the data sets. It would be worth looking into correlations of growth rates between the sites in the case of simultaneous events (Approach I). High correlations would confirm that the concentrations of aerosol

ACPD
9, S2330–S2334, 2009

precursors might be similar over a large area, and contribute to the simultaneous occurrence of particle formation events in different sites.
–The number of data points is not sufficient for correlation analysis. Instead we made scatter plots for the GR between Helsinki and Hyytiälä for regional events observed over Southern Finland (SMEAR II and III) and another one for regional events observed over Finland (SMEAR stations). Please note that the available analysis of the GR is not equal to the actual number of events because we omitted the data point-pairs whenever one of them is not accurately estimated or missing.

3) Fig. 5: What is the significance of the blue areas far off the receptor site? In Figs. 4 and 5 something like a borderline of significance, maybe based on a minimum number of observations per geographical unit area, should be indicated.
The blue areas simply represent the lowest probability for nucleation at that grid. It is just low frequency.

4) The results are important for future attempts to validate regional and global aerosol models, particularly considering the secondary formation process. I am wondering if the authors could discuss some ideas how their analysis/results might be made available for that purpose.
–We have added a paragraph to the conclusions, discussing some possibilities.

5) Formal points
Page 143: Equation 1 seems unnecessary. It can be omitted since it represents rather general knowledge and appears in many of the references cited.
–We agree with the reviewer, we removed this equation.

Section 2.5, "Air mass back-trajectory": it seems more logical to move this section before 2.4.
–We exchanged the location of sections 2.5 and 2.4.

"median=27 h" is not a valid expression.
–The equal sign 8220;=8221; was replaced by 8220;value8221;.

ACPD
9, S2330–S2334, 2009

The geographical coordinates of Aspvreten indicated in the paper seem wrong. How are 80 arc seconds possible? This seems to be copy-pasted from Tunved et al. (2003), where the coordinates are already wrong.
–We corrected the coordinates.

Use "time span" and "spatial scale" (spatial is an adjective) rather than the version with the hyphen.
–We corrected these terms through the manuscript.

We don8216;t say "evidences", there is just "evidence".
–This typo was corrected.

"Air parcels" is typically used to describe small scale motion of air, up to a few kilometres. The authors certainly mean "air masses?"
–Corrected.

Reformulate awkward axis labels such as "Day number in".
–8220;day number in the year8221; is a common term. For simplicity, we used the term 8220;day number in the month8221;.

Practically all Figures need to be drastically improved regarding bigger and uniform font sizes, bigger dot sizes, thicker lines. At the moment most readers will probably need a magnifying glass to detect writings such as in Fig. 8. The authors might also consider showing smoothed time series when appropriate instead of scattered clouds of raw data.
–The font size on the figures was made to be ready for A4-size prints. This should not be a problem for the ACP production of this article.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 135, 2009.

ACPD

9, S2330–S2334, 2009

Interactive Comment