Atmos. Chem. Phys. Discuss., 8, S12236–S12238, 2009
www.atmos-chem-phys-discuss.net/8/S12236/2009/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Analysis of atmospheric neutral and charged molecular clusters in boreal forest using pulse-height CPC" *by* K. Lehtipalo et al.

K. Lehtipalo et al.

Received and published: 25 May 2009

Answers to Referee 1

"In the abstract (and also in the results section) the authors mention the median concentrations determined from the campaigns conducted in spring 2007 and in May 2008 thereby giving these numbers some emphasis. However, the explanation for this variability provided in the main text is rather unsatisfactory to me. If the changed settings (homogeneous nucleation level) of the PH-CPC during the May 2008 run really (at least partly) explain this difference as mentioned in the text I hesitate to accept the results from the first half of this campaign. I could imagine that the median concentration of the second half of the 2008 run is quite close to the one from 2007. If there

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

are other reasons for such a difference in median concentration what are these? Can it be related to meteorological conditions? Anyhow, I feel that the absolute numbers measured are highly uncertain or have large error bars and I suggest to remove the median concentrations from the abstract."

The authors agree that giving accurate numbers might be misleading as the results contain large error range. Therefore we remove the median values from the abstract and only give the range in which the concentration typically varies. However, in the text we still want to give some statistical values to characterize the data set, so in the corrected version we give both median value, and 5-, and 95-percentiles for cluster concentration.

In the first half of May 2008 the measured concentration was on average lower than in the later half. In the text we claim that this is partly because we might fail to activate all clusters due to lower supersaturation level. However, as the concentration rises slowly rather than stepwise towards end of May, this is maybe only a part of the explanation. In the last weeks of May we saw intense nighttime cluster formation. These ‘nighttime events’ were less frequent in the beginning of the measurement period – the same was observed in 2007. We speculate that this might be due to increasing biological activity towards summer (which again is related to temperature etc). This would explain both the rise in concentration in May, and the difference between 2007 and 2008. As the referee states, the calculated median of second half of May is indeed very close to the median of 2007. Distinguishing what fraction is real physical phenomenon and what instrumental artifact is unfortunately impossible. Complete understanding of the annual variation would require longer data sets and/or knowledge of the chemical composition and source of clusters.

To clarify the situation we calculate the statistical values separately for the second half of May and include that in the text (section 3.1) together with a shorter version of the explanation above.

ACPD

8, S12236–S12238, 2009

Interactive Comment

"In the conclusion section I somehow miss a closing remark going beyond the applicability limits of PH-CPC. Did PH-CPC technique prove itself for this kind of measurements? Based on the experience obtained, what is needed to improve future field measurements of neutral clusters?"

The PH-CPC was discovered to be suitable and stable enough for long-term field measurements. This has previously been discussed by Sipilä et al. (2008). The primary advantages of using CPC and pulse-height-analysis method for detecting clusters are getting size information without a need to charge particles, and single-particle counting. However, we are operating on the very edge of the detection limit. The on-going development of new CPC-based instruments with lower cut-off size will draw upon these measurements. Improving the calibration methods for neutral particles below 3 nm, and intercomparison with other instruments will also improve the reliability of the field measurements in future.

A short chapter with the above mentioned remarks will be added to the conclusion section.

"Some technical corrections: I suggest to unify the letters/words used for "circa" (last paragraphs of sections 2.1 and 2.2, first paragraph of section 3.2 Section 3.1: ... Fig. 5, further affirms, ... Section 3.2: ... highest cluster concentrations were not measured ... Section 3.2: ... was found to be very similar to the nocturnal ... Section 4: ... of PH-CPC measurements depends on ... Section 4: ..., but the concentrations of 3-5 nm particles..."

These will be corrected. Thank you for the valuable comments and corrections!

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 20661, 2008.