

Interactive comment on “Applicability of condensation particle counters to measure atmospheric clusters” by M. Sipilä et al.

Anonymous Referee #1

Received and published: 28 April 2008

Review of ACPD, Sipilä et al., “Applicability of condensation particle counters to measure atmospheric clusters”

General

The author team has provided an interesting paper on the experimental detection of sub-3 nm atmospheric particles and/or clusters. Their analysis is based on two measurement techniques (PH-CPC and E-CPC), which were characterized in the laboratory, and then deployed in the field. While these techniques themselves are not new, their combination and careful characterization proved to be useful in approaching one of the frontal lines of current knowledge in atmospheric science, the origin of natural nano-particles. The salient result is that neutral molecular clusters seem to exist in the

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atmosphere at most times — at least in the lower atmosphere over the boreal forest; these clusters can eventually evolve into particle formation bursts. Although the origin and composition of these clusters continue to remain unknown, this paper is the first to suggest their existence by multiple measurements.

I therefore recommend to publish this paper in ACP with minor revisions outlined below.

Improvements can be made by supplying more concrete numbers when illustrating measurements and comparing instrumental performance (see details below). More concrete recommendations are also given below.

Since this paper is expected to be cited many times, special care is also advised with respect to the writing. While the language level is satisfactory in general, there plenty of unnecessary and re-occurring flaws which distract from the reading. Most notably, the definite and the indefinite articles are missing on plenty of occasions. I therefore appeal to the native speaking authors to make this also a literally “appealing” article. Otherwise, additional proofreading might be required.

Abstract:

“Both instruments showed similar concentrations”: Quantify the deviation. The same also in the conclusions section.

Section 1, Introduction:

This section could be improved by adding one or two sentences at the beginning stating the general relevance of aerosol particles in the atmosphere.

p. 4375, l. 5, “some investigations”: Write concretely what kind of investigations — laboratory, field, theory? This is hard to grasp for a non-specialized reader.

l. 14, “are challenging”: Why are such measurements challenging? Outline the most important physical constraints and technical drawbacks for a reader not familiar with

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aerosol science.

Section 2:

Structural deficits: The first text block has no section numbering nor header, but should be called “2.1. General approach” or similar.

Section 2.1:

Same as above: The first text block is very long but has, again, no section numbering nor header. (Should be “2.2.1. ...”).

Section 3:

General comment: In the laboratory, the authors studied solid and insoluble particles (Figure 1). The CPC battery paper of Kulmala et al. (2007) shows that the detectability of the smallest particles in a CPC may be pending on the affinity of their chemical composition to the CPC working vapor. In the atmosphere it seems that the smallest particles tend to be hydrophilic. Could you comment on how this effect may degrade the comparability of your laboratory and field PH spectra?

p. 4381, l. 15, “challenging tasks”: Again, state briefly what the most important limitations of the existing measurement apparatus are. The same also in the abstract, p. 4374, l. 12.

p. 4381, l. 15, “ions were filtered away”: State briefly how this was done.

p. 4382, l. 5, “Gaussian” → “Gaussian-shaped”

p. 4382, l. 7. This sentence can be dropped.

p. 4382, l. 17, “water” - which degree of purity?

p. 4385, l. 14, “was measured ... from time to time”. How often did you perform these checks concretely?

Section 4:

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p. 4389, l. 3: Can you comment on the expected probability of survival (in orders of magnitude) for thermodynamically unstable clusters between the inlet and the point of activation?

p. 4390, l.25, “organic chemistry” is a very broad term. Which is the particular role the authors think organics could play?

Section 5:

Last sentence of the section, “without doubt”. It is difficult to understand what you mean by this statement. Reformulate.

Figures:

Figure 2: “ambient indoor”? Do you mean “indoor air”, i.e. “room air”?

Figure 4: The subfigures should be labeled (a) and (b) and referred to in the text the same way.

Figure 5: Make a brief comment how the concentration minimum between 08:00 and 10:00 comes about, possibly on the basis of meteorological measurements. Is this horizontal advection or vertical mixing? Also, indicate by vertical bars the events of the four measurements shown in Figure 6.

Figures 6 and 10: What is the presumed reason for the dip in the data around MCA channel 630?

Language/Style

This is just an incomplete list I made.

The 1st sentence in the abstract could be improved.

“during 1 March to...” → “between 1 March and...”

“were from ca. 1000 to” → “ranged between ca. 1000 and”

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“Somewhat” is a quite redundant word in a scientific paper. Try to support the arguments by concrete numbers.

“to get an idea” — too informal.

“pulse height”, “pulse-height”, or “Pulse-Height”?

“PH spectrum” of “PH-spectrum”?

“vast amount of ions” — maybe better a vast “number of ions”?

p. 4389, l. 2, “extend” → “extent”

p. 4389, l. 4, “should be rather poor” → “is expected to be rather poor”

“from few tens to few hundreds”, “up to few tens”: missing articles

The definite and the indefinite articles are missing on plenty of occasions.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 4373, 2008.

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