

Interactive comment on “Droplet activation, separation, and compositional analysis: laboratory studies and atmospheric measurements” by N. Hiranuma et al.

Anonymous Referee #2

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The present manuscript describes an innovative experimental setup based on the coupling of a Pumped Cloud Virtual Impactor (PCVI) downstream to a cloud condensation nucleus chamber (CCNc) in order to separate activated particles from non activated ones prior to their chemical analysis by aerosol mass spectrometer (AMS or PALMS). This setup represents a useful tool to improve our understanding of the link between aerosol chemical composition and droplet activation. The authors also present both laboratory validation of the system using different kinds of lab generated particles (ammonium sulphate and a mixture of ammonium sulphate and PSL particles) and results of a first field deployment.

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The present manuscript is suited for publication after the following general comments and suggestions have been addressed.

General comments:

- p 692 line 16: The two last sentences of the abstract are actually not clearly discussed in the body of the manuscript. Only one field sample using the PALMS shows an increase for the size of the activated particles compared to the ambient measurements. Influence of the particle size on activation has to be developed.
- p 692 line 18: Could the authors explain the term “not irrelevant” regarding their measurements?
- p 694 line 5, 17 and 19: Authors referred to “recent studies”, “other field studies” or “studies”, please, provide some references.
- p 695 section 2 “Methodology”: The description of the experimental setup and its validation does not meet its requirements. It is too condensed and difficult to follow. The readability of the section would be highly improved by dividing it in several subsections (for example a general description of the different instrumentations, an exhaustive presentation of the coupling CCNc-PCVI-AMS/PALMS and a more detailed description of the different experiments conducted during the validation).
- p 699 line 22: the description of the validation procedure is the core of the presentation of a new setup. The authors solely used pure ammonium sulphate and a mixture of ammonium sulphate and PSL particles. More details are expected here, e.g. the range of the tested particle sizes and concentrations, the ratio between ammonium sulphate and PSL concentrations, the detection limit of the system, the temperature of the AMS vaporizer during the experiments (600°C or higher)? Did the authors test different mixtures of aerosol? As PSL is not relevant for the atmosphere, mixtures of different organic compounds with known hygroscopic properties should be expected and could, for example provide similar profiles to those presented in Figure 2.

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- p 700 section 3: A short presentation of the sampling place is needed here. Is it a rural, suburban, or urban station? The AMS sample presented was performed on 20.10.2010 and the PALMS one was performed on 9.11.2010; so did the system continuously worked during this period? It would be more informative to illustrate the field section by at least two different examples for each aerosol mass spectrometer. This would also be helpful for the discussion of the AMS sensitivity and the influence of the chemical composition on particle activation.

- p 700 line 23: Could the authors explain the reason for a supersaturation of 0.4% (instead of 0.5%, as mentioned in the rest of the manuscript) during the AMS measurements? Why the authors did not present any results at a supersaturation of 0.75%?

- p 700 line 25: The authors indicate an AMS detection limit during ambient measurements of 0.1, 0.03, 0.02 and 0.15 $\mu\text{g m}^{-3}$ for organics, nitrate, sulphate and ammonium, respectively. As mentioned in the manuscript, the results presented in Fig. 6 II-b are very close to these values. In such conditions, it appears to be extremely difficult to integrate the PCVI dilution ratio and to deduce any influence on activation from this. This point should be discussed in more details.

Specific comments:

- p 692 line 2: please add CCNC.

- p 692 line 5: please add AMS and PALMS.

- p 696 line 16: please put 18.2 $\text{M}\Omega \text{ cm}$ in brackets.

- p 696 line 27: The authors report that the transmission efficiency of the AMS aerodynamic lenses was nearly 100% in the range 70-500 nm while in the conclusion (p702 line 24) they indicate a range of 70-1000nm.

- p 696 line 24: reference Jayne et al. 2000 is missing in the references section.

- p 699 equation 1: Could the authors describe a bit more this equation and the origin

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of the different numbers?

- p 699 line 26: it is before the CCNC not before the PCVI.

- p 700 line 19 and p 701 line 13: please, used the same time unit (Pacific Daily Time or Pacific Standard Time).

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 691, 2011.

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