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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Long-term observations of positive cluster ion concentration, sources and sinks at the high altitude site of the Puy de Dôme" *by* C. Rose et al.

Anonymous Referee #3

Received and published: 31 July 2013

As these are the third referee comments to the work by Rose et al. published in ACPD, I will not repeat what is already said by the other two referees. The strong point of this paper is that Rose et al. are just not reporting the numerical values measured for the ion concentrations at PDD high altitude site but also trying to explain why these numbers were measured, and what causes their seasonal and diurnal behavior.

I recommend publication at ACP after correcting the referees comments. Both polarities of ions should be included into this paper.

Some comments:

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Interactive Discussion

Discussion Paper

I agree that both polarities should be added to the study, and when the ion spectrometer is fully operating there is no scientific reason to neglect the other polarity. I understand that here the reasoning was that they wanted to focus on just positive polarity, as in the negative cluster ion concentrations they didn't observe a clear seasonal behaviors especially during the NPF events. This is not totally true as Fig. 2 shows a diurnal cycle for the negative cluster ions.

In Fig. 3, at winter the positive ions had a minimum during noon in cluster ion concentrations. Was this seen also in the negative polarity? Could it be coupled with rain or snow episodes? Does it rain at PDD site? During rain and snowing the negative intermediate ion concentration increases and usually a small decrease is seen in the cluster sizes. See the paper by Tammet, Hõrrak and Kulmala (ACP 2009).

Atmospheric (di)electrode effect is not mentioned in the paper. The effect causes the depletion of negative ions near the ground. Thus, higher positive ion concentrations should be measured close to earth (effects works up to few meters from earth's surface) as the ground works as negative electrode attracting more positive ions.

In the introduction section, there should be added few words about the importance of the ions for the atmosphere and the climate. See review by Hirsikko et al. (ACP 2011).

Add more clear definitions to the text, starting with instrument measured and when, and whether the measurement set-up and locations was exactly the same during the whole time. Also more technical issues like how to convert the mobility mobility equivalent Millikan diameter, and what kind of corrections was done to take into account the high altitude measurement site. It's important to add more information to figure and table captions: when the data what collected and which size range is under inspection.

One more interesting question is that how did the size distributions look like for the positive and negative ions? In the paper (p. 14941, line 26) Rose et al. says "Indeed the measured small ion concentrations could increase on event days, not because the concentration of the cluster ion mode is changing but only because the fraction

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detected by the instrument is larger since ions are getting bigger." Does this mean that the reason why you observe smaller number for the negative cluster ions is that negative ions are more mobile (also smaller in mobility diameter) are thus likely lower range of the cluster band out of the scope of the instrument?

Reference:

Hirsikko, A., Nieminen, T., Gagné, S., Lehtipalo, K., Manninen, H. E., Ehn, M., Hõrrak, U., Kerminen, V.-M., Laakso, L., McMurry, P. H., Mirme, A., Mirme, S., Petäjä, T., Tammet, H., Vakkari, V., Vana, M., and Kulmala, M.: Atmospheric ions and nucleation: a review of observations, Atmos. Chem. Phys., 11, 767-798, doi:10.5194/acp-11-767-2011, 2011.

Tammet, H., Hõrrak, U., and Kulmala, M.: Negatively charged nanoparticles produced by splashing of water, Atmos. Chem. Phys., 9, 357-367, doi:10.5194/acp-9-357-2009, 2009.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 14927, 2013.