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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Investigation of nucleation events vertical extent: a long term study at two different altitude sites" *by* J. Boulon et al.

Anonymous Referee #1

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General Comments

The manuscript presents particle formation event characteristics at the puy de Dôme station based on over three years of data, and analysis of the vertical extend of particle formation frequency based on simultaneous measurements at the puy de Dôme and Opme stations during almost two years. The manuscript is in the scientific scope of ACP, and can be published in the ACP after considering following comments to further improve the manuscript.

Specific Comments

1.Please indicate clearly in the abstract (on page 8250) and introduction (on page

8251) that the particle formation events were characterized at the puy de Dôme station, and the data from Opme station were utilized when studying the vertical extend of particle formation event frequency. In the conclusions (starting on page 8268, on line 12) this was clearly explained.

2. The presented average particle formation and growth rates (on pages 8256-8258) at the puy de Dôme station were unconnected with the results and discussion of the vertical extend of the particle formation (Sect. 5). There were 87 particle formation events measured at both stations simultaneously, 70 events only at the puy de Dôme station and 4 events only at the Opme station. Therefore, I think that the authors should extend their analysis and discussion of particle formation and growth rates at the Opme and puy de Dôme stations (e.g. compare Fig. 6 on page 8282).

3. On page 8257, starting on line 11: The NAIS has large uncertainty when measuring particle (sum of neutral and charged particles) concentrations down to 2 nm (Asmi et al., 2009; Gagné et al., 2011). CoagS2 is typically determined from SMPS data to be able to include the effect of larger particles. Therefore, I strongly recommend including discussion and estimation of uncertainties in J2(neutral + ion) and J2($\pm$ion) presented in the manuscript. Does this change the conclusions of IIN fraction?

Technical corrections

1. In general, English was good. However, please proofread the manuscript to avoid any misspelling.

2. I recommend including only one topic in each paragraph to help the reader (e.g. Introduction on page 8251, or new topic on page 8257 starting on line 11).

3. Abstract (on page 8250, on lines 6-7), introduction (on page 8251, on line 28) and particle measurement devices (on page 8253, on line 25): different diameter rages were given for AIS/NAIS. Please indicate clearly, did you have one NAIS and SMPS at both of the sites. Now the reader may get confused between the AIS and NAIS

devices.

4. On Page 8256, on lines 22-24.: "Different steps can describe the NPF process. We chose 4 different boundary diameters (1.3, 3, 7 and 20 nm) as representative of different growth steps and to compute growth rates between 1.3–3, 3–7 and 7–20nm for Ia and Ib classes of event." I think that this should be rewritten to better describe the method.

5. On page 8258, on lines 2-3: "From those results, the ion-induced nucleation (IIN) rate was computed and the mean contribution. . .". I think that it should be IIN fraction.

6. On page 8258, on lines 8-9: " in comparison to boundary layer sites (Manninen et al., 2010 and Iida et al., 2006, 2.6% in average on both study)" and on page 8268, on line 21: " Compared to other European low elevation sites (IIN=3.55$\pm$3.73)". This is confusing. Please, check these IIN fractions.

7. On page 8258, on line 12: A short (i.e. one sentence) description of the applied parameterization should be included.

8. On page 8258, on line 12: "Petäjä et al. (2008)" should probably be "Petäjä et al. (2009)".

9. On page 8260, on line 12: "Venzac et al. (2008)" should probably be " Venzac et al. (2009)".

10. On page 8260, on lines 17-27: This paragraph should be written more clearly. Please, reconsider which of the presented percentage values are the most important. The Table 3 (on Page 8276) was unnecessary, and could be removed.

11. On page 8262, on line 9: Please give reference for the condensation sink.

12. On page 8277, Fig. 1: Please include the unit for the color bar.

13. On page 8283, Fig. 7: The results of the figure are well presented in text (on page 8262, lines 8-25). Therefore, I recommend removing the figure.

References

Asmi, E., Sipilä, M., Manninen, H.E., Vanhanen, J., Lehtipalo, K., Gagné, S., Neitola, K., Mirme, A., Mirme, S., Tamm, E., Uin, J., Komsaare, K., Attoui, M., and Kulmala, M.: Results on the first air ion spectrometer calibration and intercomparison workshop, Atmos. Chem. Phys., 9, 141-154, 2009.

Gagné, S., Lehtipalo, K., Manninen, H.E., Nieminen, T., Schobesberger, S., Franchin, A., Yli-Juuti, T., Boulon, J., Sonntag, A., Mirme, S., Mirme, A., Hõrrak, U., Petäjä, T., Asmi, E., and Kulmala, M.: Intercomparison of air ions spectrometers: a basis for data interpretation, Atmos. Meas. Tech. Discuss., 4, 1139-1180, 2011.

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