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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Identification and quantification of particle growth channels during new particle formation" *by* M. R. Pennington et al.

Anonymous Referee #2

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This paper focuses on the chemical composition of 15-22 nm aerosol particles during new particle formation (NPF) events in a boreal forest in Hyytiälä, Finland. The particle composition was measured with a Nano Aerosol Mass Spectrometer (NAMS). According to the analysis, sulfuric acid accounted for less than half of the growth during the events and was not fully neutralized by ammonia. Carbonaceous material accounted for slightly more than half of the growth and its O/C-ratio indicated a freshly formed secondary organic aerosol. Condensational growth of newly formed particles up to larger sizes where they can impact climate is an important process that is still poorly understood, in particular the relative importance of sulfate and different organic compounds to the growth. Through the use of the NAMS this paper provides some valuable insights on nanoparticle growth. I have some minor comments though, that may help

in clarifying some parts of the paper.

Comments:

Page 14122, lines 21-29: "A remarkable feature of Fig. 1d that could not be studied in previous work is that the change in elemental composition occurs at the onset of NPF before the mode diameter reaches the NAMS size range." I do not fully understand why the authors find this observation remarkable. A few more sentences may help. It also seems to me that the sulfur and nitrogen mole fractions start to increase around 06:00 AM on both days which is a several hours before the onset of NPF, even though it is hard to tell from Fig. 1 exactly when NPF starts. Did you observe similar diurnal trends in mole fractions on days with no NPF?

Page 14122, lines 16-17: "The carbon mole fraction is anti-correlated with the other elements, which has been observed in urban locations as well". Do the authors have an idea why this is? The fact that the sulfur mole fraction in Fig. 2b drops in the evenings; is this an effect of the sulfur actually decreasing or only because the carbon increases? If the sulfur decreases, may it be evaporation or is it air mass related? And why is the carbon increasing at night?

Page 14125: The authors refer to measurements with AMS and TDCIMS during the NPF events. These measurements should be mentioned in the Methods section even if they are only complementary measurements.

Page 14125, lines 25-30: The authors write "It is possible that the acidity of the aerosol at 20 nm could be explained by an ammonia concentration that is on the same order as the sulfuric acid concentration. However, ammonia concentrations are typically thought to be two orders of magnitude higher than sulfuric acid concentrations (Kirkby et al., 2011)." What are the typical ratios between ammonia and sulfuric acid during NPF events based on earlier campaigns at this site in Hyytiälä?

Page 14126, line 21: The authors use the term "Carbonaceous matter" and the term

“organic” in Fig. 3. It is better to be consistent, since carbonaceous matter includes both organics and black carbon. “Carbonaceous matter” is also used on line 19 in the abstract.

Page 14122, line 4: The “Draxler and Rolph, 2013” reference should be added to the reference list.

Fig 2: Were the eight NPF events in Fig. 2 the only NPF events throughout the whole campaign from 21 March - 24 April? If not, why were these events specifically chosen? Please give some information here.

Fig. 1d: If the sulfuric acid concentration in Fig. 1d has been calculated by using Eq. 2 which depends on the measured growth rate, how was the sulfuric acid concentration then estimated for instance between 12:00 AM and 12:00 PM on 18/4/2011 when there is no growth event in Fig. 1a and therefore hard to estimate any growth rate?

Page 14122, lines 18-19: “During NPF, the sulfur and nitrogen mole fractions are larger and the carbon mole fraction is smaller than immediately before or after each event”. Did the sulfur and nitrogen mole fractions have similar diurnal trends on days with no NPF?

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 14115, 2013.