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Discussions

Interactive comment on "The important roles of surface tension and growth rate in the contribution of new particle formation (NPF) to cloud condensation nuclei (CCN) number concentration: evidence from field measurements in southern China" *by* Mingfu Cai et al.

Anonymous Referee #1

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Cai et al. present measurements of how new particle formation events and hygroscopicity impact cloud condensation nuclei concentrations. These observations were done in Guangdong Province at a rural site. The authors also modeled particle formation to see how it would impact CCN concentrations. The manuscript was at times difficult to understand due to frequent typos and unstructured paragraphs. However, the science done by the authors is sound as it has been implemented by numerous groups before. Also, their conclusions are logical. This paper fits ACP and should be published once

the authors address the below comments.

Major comments:

The authors used a DEG SMPS to measure the particle size number distribution but instead used formation rate at 3 nm and growth rate from 3-60 nm. Is there a reason the <3 nm bins were not used? I would think the growth rate from 1-3 nm would play an even larger role in their particle number concentration modeling done in section 3.3 Can the authors comment on this and maybe look into their 1-3 nm data to see how that would impact their data analysis?

Page 10, line 207: The authors did not directly measure sulfuric acid concentration but instead used a proxy based on SO2. How accurate is the proxy for the region they are measuring in? Every 1-2 years, a new proxy sulfuric acid paper is published from a new measurement location. Each of these proxy equations is different, with different parameters and different coefficients. See (Mikkonen et al., 2011). Why did the authors choose this proxy? Could they provide some gauge of uncertainty as a function of time? The authors say 40% (line 313) but how was this estimated and how does it vary with CS and OH concentrations? This would be especially useful as the authors compare trends of when sulfuric acid concentrations peak at specific times of the day compared to growth rate and when hygroscopicity increased (page 19 line 397).

Generally, the terminology used is confusing. Particle formation rate is used to described nucleation and of CCN (page 19 line 389). The convention is newly formed particles are small (<10 nm). It would be helpful if the authors could find a better phrase to call 30-40 nm particles. Also, measured, averaged, recalculated D50 are used. However, in the text, they often just say D50. Which D50 is it? Example (though not the only one) is page 19 line 403, page 20 line 406, etc. Maybe add a subscript to the D50 to make it clearer? Page 21 line 436: How does doubling the GR result in increasing particle concentration because of higher coagulation source? More coagu-

lation would mean lower particle concentrations?

Page 21 paragraphs starting with line 427: This section is very repetitive and difficult to understand. What do the authors want us to take away from this section? Is there a more efficient way of communicating this information then just listing off every possible configuration of the model? The findings in this section are not new science so sticking to highlights of why this section is needed to convey the purpose of the paper would be helpful.

Minor comments: Line 27: environments and depend

Line 29: investigates

Line 38: than assuming pure water

Line 43 fact

Line 51: controlling factor is a weird phrase. What do you mean by controlling?

Line 56-60 these two sentences are wordy and difficult to understand

Line 61: controlling factors, again what do you mean by this?

Line 63: also marine?

Line 75: matter

Line 76: and more easily

Line 77: matter

Line 80: awkward statement of constraining an accurate quantification of the aerosol. . .

Line 82: NPF event is

Line 103: growth rates

Line 124: have reported

Line 135: that manipulate is awkward phrase.

Line 234: necessarily the case, also this entire sentence should be rewritten to be more clear

Line 265: represents the smallest detectable particle size. The smallest stable size is likely much smaller than 3 nm.

Line 357: D50 is shown

Line 359: shows a difference of what?

Page 20: all fell should be failed

Line 429: measured NCN and NCCN and the modeled one is awkward phrasing

Line 451: what is double background PNSD condition?

Line 454: NPF events a minor contribution, awkward phrasing

Line 547: profound impact, awkward phrasing

Line 758: linear fit

Line 772: space after activation ratio

Figure 2: is there a way to not use shades of the same color on this graph? The blues cannot be easily distinguished. Maybe adding symbols would help?

Figure 6: maybe helpful to write in the legend 0.5xGR and 2xGR, etc. to make it clearer.

Table S1: background particle distributions

Figure S2: Is average value during the campaign mean it was averaged over that time of day interval over the whole campaign?

Figure S7: What is it meant by "new" GR, formation rate, and background PSND?

Reference cited in this review Mikkonen, S., Romakkaniemi, S., Smith, J. N., Korho-nen, H., Petäjä, T., Plass-Duelmer, C., Boy, M., McMurry, P. H., Lehtinen, K. E. J., Joutsensaari, J., Hamed, A., Mauldin III, R. L., Birmili, W., Spindler, G., Arnold, F., Kulmala, M. and Laaksonen, A.: A statistical proxy for sulphuric acid concentration, At-mospheric Chem. Phys., 11(21), 11319–11334, https://doi.org/10.5194/acp-11-11319-2011, 2011.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-1203, 2020.

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