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Atmospheric Chemistry and Physics 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 #2

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This paper examines the effects of hygroscopicity, surface tension and aerosol processes on the NPF contribution to Nccn, based on field observations and modeling of three NPF events at a rural site in southern China. The study results and implications are of interest to ACP readers. The adopted experimental setup and methodology are well-established, comprehensive, and thus reasonable. The manuscript is generally well-written and organized, though some data presentation, interpretation and discussion can be improved.

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Discussion paper

My major comments, followed by minor comments are given below:

1. Because there are only three NPF events, quite thoroughly, analyzed in this study, it is crucial that the authors should somewhat discuss the representativeness of those three NPF events. The dominant mechanisms driving NPF vary with time and location. 2. Although the hygroscopicity and the estimated surface tension were derived under different water saturation ratio (undersaturated vs. supersaturated), two are interlinked with each other. The discussion in Section 3.2 seems to treat the two as unrelated factors. Also, e.g., in the abstract, the authors suggested the surface tension is more important than hygroscopicity (line 37). It is recommended that the authors elaborate/clarify on the rationale of discussion based on adjusting only the surface tension in kccn (but not kHTDMA?), or kHTDMA is the "reference" hygroscopic parameter, and the potential relationships between the two. The discussion and statements should be rephrased to accurately describe the observed cause and effect in a relationship. 3. In Section 3.2, lines 389-397, the use of the term "newly-formed" particles should be more specific and consistent, whether it refers to 40-45 nm particles, or « 30-40 nm particles. It is unclear that the k values discussed therein are kccn or kHTDMA. The "gradual" drop of sulfuric acid (SA) does not necessarily imply it is responsible for the increase of k values because SA condensation is considerably more favorable with larger pre-existing particles, and/or the consideration of oxidant availability. 4. Section 3.3 seems to be an add-on modeling analysis of the NPF events not strongly or quantitatively linked to the hygroscopicity and surface tension. The derived conclusions about formation/growth rates and coagulation loss are not new, but expected. This analysis is then extended to Section 3.4 where the three NPF events from two locations are compared. My concerns are (1) the modeled-Nccn deviate notably from measured-Nccn (Figs 5, 6 and 9), and (2) how the findings herein are related to the other subjects of interest regarding the hygroscopicity and surface tension. Please clarify. 5. With respect to surface tension, the authors are encouraged to review/include recent studies on the impact of morphology of organic/inorganic mixture on surface tension. As such, the discussion would be more in-depth and balanced.

Minor comments: 1. A schematic diagram of the experimental setup is recommended. 2. The lowest measurable particle diameter in this study is 1 nm. Is there any reason not to use this for the estimation of formation and growth rates, instead of 3 nm (lines 227, 253, 265)? 3. Line 415 and other instances, the “fail” is misspelled as “fell.”

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