In the manuscript "Secondary aerosol formation alters CCN activity in the North China Plain", the authors conducted a field study in North China Plain and investigated the influence of second aerosol (SA) formation on CCN activity and on the calculated CCN number concentrations derived from particle number size distribution (PNSD). The CCN activity at 0.05% supersaturation (SS) was discussed. The authors focused on CCN activation at low SS where mainly accumulation mode particles act as CCN and thus on cases of SA in the presence of accumulation mode particles. They found that at two different RH, SA formation had different influence on CCN activity of aerosols. At high RH (minimum RH>50%), SA mass mostly added to larger particles (>300 nm), which resulted in weaker enhancement of CCN activity for per SA mass added as these larger particles were already CCN-active before SA formation. At low RH (minimum RH<30%), SA mass mostly added to smaller particles (<300 nm), which resulted in stronger enhancement of CCN activity for per SA mass added as smaller particles were not CCN-active before SA formation. In addition, they parameterized maximum activation fraction (MAF) using the correlation of MAF with hygroscopic particle number fraction or with mass fraction of SA. The calculated CCN concentrations derived from PNSD using parameterized MAF, campaign average activation diameter and width of activation curve matched better with measured ones compared with using PNSD and kappa from either chemical composition or hygroscopic growth.

How aerosol formation and growth affect CCN activity is an important question. The manuscript provides valuable case study on how secondary aerosol formation influence CCN activity for low stratus clouds and fogs. This study carried out comprehensive measurement of aerosol related to CCN activity/hygroscopicity. The findings are interesting. However, I have some comments about the manuscript to address before it is considered for publishing in ACP.

Major comments:

1. The manuscript only discussed the results at 0.05% SS. How do the findings depend on SS? What about the results at other SS such as 0.1% and 0.2% SS, which is also typical for low stratus clouds? In addition, I suggest explicitly specifying SS when CCN activity or CCN concentration is discussed.

2. I was somewhat surprised to notice that MAF only reached 0.4-0.6 in Fig. 3. Why were the data larger than 300 nm excluded (L148)? Did the activation fraction reach around one at larger sizes? If one fit Eq.7 to e.g. blue curves in Fig. 3a only till 300 nm, the D_a derived at half MAF might be incorrect.

3. The authors reported two cases at high RH and only one case at low RH. It would be helpful to discuss how general these conclusions are regarding the influence of SA on CCN activity. The authors seem to indicate that RH is the dominant factor. What about other conditions? For example, how would the size and chemical composition of existing particle affect the conclusion here?

4. I had some difficult time reading the manuscript. I suggest the authors streamlining the writing substantially. Additionally, there are numerous language problems. For example, in many cases, a space was missing before a unit. More specific problems are listed below.

Specific comments

1. L254, it is half MAF that can represent the number fraction of CCNs to total particles at particle size around Da. Also "represents" should be "represent".

2. L264, how are PA and SA characterized?

3. L276, how are the time ranges of these events defined? By $PM_{2.5}$ concentration?

4. L283-286, for me it is hard to tell from the data that the ratios were really lower after 4th Dec. Nor can I discern the "decreasing trends".

5. L294, by "the increase of hygroscopic particles", do you mean number or mass concentration?

6. L304, is this statement necessarily true?

7. L311, by which metric do you define "CCN activity"? Do you refer to activation fraction?

8. L313, "the enhancement of particle CCN activity was stronger in low RH events", which metric or data is this statement based on?

9. L319, it is not obvious to tell if there is "the increases of Da".

10. L321, again "the enhancement of CCN activity was lighter", what metric or data is this statement based on?

11. L325-327, "unchanged CCN activity at low RH conditions", how is this statement drawn? Is this finding also valid for other SS?

12. L339, "relatively smaller variations of particle density", this needs support from data or literature.

13. L365, "decreased continuously", it seems not to be a continuous decrease.

14. L445-447, it is not surprising that the correlation of N_{CCN_chem} with N_{CCN_meas} was not good as kappa was only derived from chemical composition of the bulk aerosol, which is highly biased to larger particles.

15. L439-440, such a statement is not necessarily true. Primary particles can be CCN active. In addition, the authors defined kappa>0.1 as hygroscopic particle in the method part. Kappa of SOA can be <0.1, which contracts the statement here.

16. L454, "real-time MAF can be estimated by MF_SA", how to estimate, by simple linear regression?

17. L473, how do MAF and its diurnal variation depend on SS?

18. L495, in the abstract, 50% was used while here 40% was used...

19. L509, "mixing state", is the right word here? What is the mixing state of these aerosols based on the "measurements of CCN activity, particle hygroscopicity and particle chemical compositions"?

20. L797, in Fig. 2, it is helpful to describe the OA factors in the method part.

Technical comments:

1. L214, "NF_{hygro}" was written as "NF_hygro" later.

2. L272, "Dec." should be "Dec".

3. L283, "are" should be "is". "Higher" might be better than "stronger".

4. L324, "um" should be "μm".

5. L346, "normalized" is missed before $PM_{2.5}$? "Fig. 4(a1)" should be "Fig. 4(1a)".

6. L356, "of" should be omitted.

7. L376-378, this sentence is hard to understand.

8. L432-433, "there were similar difference between CCN_AvgMAF and N_{CCN_meas}" this sentence is hard to understand.

9. L452, "the application of MF_SA on NCCN calculation were shown", it is in Fig. 6c rather than 6b.

10. L467-468, this sentence is hard to understand.
11. L825, "the" should be "The".