This study improves the simulation accuracy of particle and CCN number concentration through adjusting serval parameters such as the mass accommodation coefficient. The results are interesting and has a good potential to improve the model of NPF and its impact on CCN number concentration. This study is within the scope of the journal ACP. I recommend this paper for publication after the following issues are resolved.

A major concern is that this study is based on the comparison of measurement and model data at only one costal site. However, aerosol and CCN data has a large difference between the costal and inland sites. It is expected that the concentrations of aerosol and CCN is higher at inland sites than those in costal sites. Therefore, the Base overestimation of CCN may not exist or is weak in inlands. There are many measurements of aerosol and CCN in China. I suggest that the authors can do this work based on more measurement data, especially the data from polluted regions.

Line 147. Li et al (2015) shows the measurement of bulk CCN, not the measurement of size-resolved CCN. The authors should give more information about the size-resolved CCN measurement, including the flow set, multi-charge calibration method, data quality control and so on.
Line 262: The extremely low volatility volatile organic compounds (ELVOCs) can also have a contribution for the nucleation events.
Line 458-460: The activation critical particle size at SS=0.2% is about 120~130 nm. It is interesting that the $CCN_{0.2\%}$ has an obvious underestimation when $CN_{10\text{-}1000nm}$ has an overestimation (Figure 3c) for the RACD scheme. The change of activation ratio (N_{CCN}/N_{CN}) can be further analyzed.
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Figure 5. The authors emphasize that the model modification has a largest impact on the simulation of CCN over the North China Plain. It is necessary to verify the result based on the measurement in this region.

Technical suggestions:
Line 249: “particles growth” should be “particle growth”
Line 269: “NFP” should be “NPF”
Line 316-328: This paragraph use “*a*” and “MAC” as the abbreviation of “mass accommodation coefficient”. I suggest using a unified symbol in text.