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Interactive comment on "Cloud condensation nuclei (CCN) and HR-ToF-AMS measurements at a coastal site in Hong Kong: size-resolved CCN activity and closure analysis" *by* J. W. Meng et al.

Anonymous Referee #2

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General comment:

The paper "Cloud condensation nuclei (CCN) and HR-ToF-AMS measurements at a coastal site in Hong Kong: size-resolved CCN activity and closure analysis" by J. W. Meng presents a valuable data set of size-resolved CCN number concentration and chemical composition measured in a coastal site in Hong Kong. The statistics of CCN measurement are shown. The hygroscopicity parameter kappa and D50 yielded from CCN and AMS measurements are compared in different episodes. Closure between measured and predicted N_CCN based on different methods and assumptions are shown. These results are valuable in understanding the aerosol activation properties

in the region. However, there are some points need to be revised, as shown below.

I would recommend the publication of this paper in ACP if the comments and questions below are addressed.

Major comment:

The advantage of size-resolved CCN measurements is that it can provide information on both hygroscopicity and mixing state. The size-resolved N_CCN was measured in this study. However, most of the discussion is limited in kappa and D50. It will be also interesting to see the variation of size-resolved activation ratio during the three episodes. Size-resolved activation ratio may also helpful in the explanation of the closure results in sect. 3.3.

The author showed the measurement in three cases: a foggy, a hazy and the rest. It will be better if the author can explain the results in respect of the differences of these cases (such as meteorology information, pollution condition, air mass type, etc.).

In p.9075 line 2 it is mentioned that "Then, the size-resolved CCN activation ratio was obtained by fitting the activation fraction with the sigmoidal function described by Eq. (1)…". Is the fit result of activation ratio used in the calculation of N_CCN? How does the fit result represent the measured activation ratio? Why not using measured activation ratio in the calculation? It will be also interesting to see the result of N_CCN calculated with individual measured size-resolved activation ratio.

There are a lot of figures show linear regressions of parameters. Some of them does not bring much information. For example, fig. 5, 6 and 8 do not bring any extra information compared to table 4. Please consider to merge or delete them.

Minor comment:

p.9073 line 10 and fig. S1: Does fig. S1 include the measurement at all the four SS? The slope of the fit of N_ccn from column A and B is quite close to 1. But the correlation is so weak comparing with other studies (e.g. Deng et al., 2011). Does the author have

any explanation?

P.9073 line 14: Does the lasting time 22 min and 12 min include waiting time? It is mentioned that the time resolution of SMPS is 6 min. The lasting time of 22 min can be a waiting time of 4 min plus three scans. But what about the lasting time of 12 min? For me also, a waiting time of 2 min for increasing deltaT and 4 min for decreasing deltaT might be not sufficient.

P.9074 line 18: The EC mass mainly concentrates at small size. Although accounting for only 5% of PM1 mass, the volume fraction of EC can be high at around 100 nm, which is the size range of D50 for the SS in this study. It would be good if the EC was taken into account in the calculation of kappa. If size resolved EC information is not available, at least the author should include this issue when explain the bias in CCN closure.

p.9076 eq.(1): Equation is not correct. Should be $1/(1+(Dp/D50)^C)$.

p.9077 line 8 and table (1): It does not make much sense to provide the statistics of bulk N_CCN, since this value is mainly dominated by the aerosol number size distribution. It would be more valuable to give the statistics of D50 in table 1. Are the statistics in table (1) based on 6-min data?

p.9077 line 24: A fog event with average RH of 91%? I think a low visibility event can be named "fog" only if some of the particles are activated at supersaturation, otherwise it should be called "heavy haze".

p.9078 line 8: Again, I can not get any idea from these N_CCN values, since these values are mainly determined by N_CN. It is better to give bulk N_CCN/N_CN or D50 here.

p.9081 sect. 3.3.1 and table 4: It seems that to use individual D50 does not bring a better result in the closure than to use average D50 for the whole period. Could the author give any explanation?

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p.9084 line 9-13: It would be much clearer if the equations with which the N_CCN is calculated are given here

Fig. 3(d-f): right y-axes: it is better to use "kappa" rather than "hygroscopicity".