First of all, we appreciate the reviewer's comments and suggestions. In response to them, we have made relevant revisions to the manuscript. Listed below are our answers and the changes made to the manuscript according to those comments and suggestions. Each comment of the reviewer (in black) below is followed by our response (in blue).

Reviewer 1:

Authors want to note that in addition to dealing with comments below, we further removed unnecessary figures during this second revision process. We believe that this is in line with the reviewer's previous comment that suggested that we should remove unnecessary figures. Frankly speaking, the removal of those figures is partly motivated by our effort to reduce the publication fee. Since this paper is rather long, we need to reduce the fee by removing unnecessary figures and thus shortening the paper, considering our current budget. Although those figures are removed, there is no significant revision in associated text and there are no changes in the qualitative nature of the manuscript.

I feel that the authors have addressed the comments of the previous reviews.

However, I still have some confusion regarding the aerosol data used as input to the model. The authors state (p9, line 237) that only aerosol concentrations from the hour before the simulation starts are used. Observations during the simulation period were excluded, as AERONET sun photometer measurements are not available during cloudy periods. However, in Fig. 4, the authors show aerosol observations for the whole simulation period, and state in the caption that the background aerosol in the control-s simulation follows this temporal pattern. Lines 340-348 state that the simulated background aerosol concentrations change with time.

Are the authors also using aerosol data from national or municipal air quality monitoring stations? This would explain why PM10 was available in one city and PM2.5 was available in the other city, and why data was available during cloudy conditions. If so, the authors should properly cite the source of this data, and differentiate between what aerosol properties were derived from the AERONET data and what was derived from the other data sources.

More than 90% of the surface observation sites only measure up PM2.5 or PM10 (but not aerosol composition and size distribution) and are NOT a part of AERONET in the domains. These sites, which are not a part of AERONET, are owned and operated by the South-Korean or Chinese government. Just less than 10% of the surface observation sites in the domains are a part of AERONET. As stated in text, to represent aerosol composition and size distributions in the domains, data, which are from the AERONET sites and one hour before clouds start to form, are employed. Note that those PM2.5 or PM10 sites, which are NOT a part of AERONET BUT managed by the South-Korean or Chinese government, measure up aerosol mass using the beta-ray attenuation method that can measure up aerosol mass without relying on solar radiation and hence measure up aerosol mass continuously day and night regardless of the presence of solar radiation. Therefore, we obtain PM2.5 or PM10 data, which are from the observation sites managed by the South-Korean or Chinese government, throughout the simulation period in the domains. PM2.5 and PM10 in the data, which are from the sites managed by the South-Korean or Chinese government, vary spatiotemporally, since each of those sites measure its own aerosol mass at every observation time. Hence, PM2.5, which is from the sites managed by the South-Korean government and shown in Figure 4, changes with time.

As stated in text, it is assumed that for the whole domain and simulation period, aerosol composition and size distribution follow their counterparts derived using data from sites, which are a part of AERONET, for each of the Seoul and Beijing cases. As stated in text, with this assumption and using PM2.5 or PM10, which is not only produced by the sites managed by the South-Korean or Chinese government but also interpolated and extrapolated to grid points immediately above the surface and time steps, the background number concentrations of aerosols acting as CCN at those grid points immediately above the surface for simulations are obtained over the whole domain and simulation period for each of the cases.

To indicate the data sources, the following is added in "Code/data source and availability":

(LL983-984 on p33)

Note that in particular, the stored PM data are provided by the Korea Environment Cooperation in South Korea and State Key Laboratory of Severe Weather in China.

To clearly differentiate between what aerosol properties were derived from the AERONET data and what was derived from the other data, which are managed by the South-Korean government or Chinese government, the following is added:

(LL225-240 on p8-9)

There are surface observation sites, which measure aerosol properties, in the domains and these sites are classified into two types; the selected locations of these sites are marked by dots in the inner rectangles in Figure 1. The distance between the observation sites ranges from ~1 km to ~10 km and the time interval between observations is ~10 minutes. More than 90% of the sites belong to the first type of the sites. These first-type sites are managed by the government in South Korea or China, and measure $PM_{2.5}$ or PM_{10} but not other aerosol properties such as aerosol composition and size distributions. Less than 10% of the sites belong to the second type of the sites. These second-type sites are a part of aerosol robotic network (AERONET; Holben et al., 2001) and measure aerosol composition and size distributions. The production of aerosol data in these second-type or AERONET sites is viable only in the presence of the sun. The first-type sites observe $PM_{2.5}$ or PM_{10} using the beta-ray attenuation method (Eun et al., 2016; Ha et al., 2019) and hence, produce $PM_{2.5}$ or PM_{10} data whether the sun is present or not. $PM_{2.5}$/PM_{10} data from the first-type sites are used to represent the spatiotemporal variability of aerosols over the domains and the simulation periods. To represent aerosol composition and size distributions, data from the AERONET sites are employed.

(LL265-269 on p9-10)

By using $PM_{2.5}$ or PM_{10}, which is not only from the first-type sites but also interpolated and extrapolated to grid points immediately above the surface and time steps, and based on the assumption of aerosol composition and size distribution above, which is in turn based on data from the AERONET sites, the background number concentrations of aerosols acting as CCN are obtained for the simulation for each of the cases.

Also, my understanding is that the current AERONET inversion algorithm (https://aeronet.gsfc.nasa.gov/new_web/Documents/Inversion_products_for_V3.pdf) is limited to estimating size distributions of aerosol in two lognormal modes with sizes above 0.05 μm, but the authors show in Fig. 3 size distributions that extend down to 0.01 μm with three lognormal modes.

In fact, we used the current AERONET inversion algorithm pointed out by the reviewer here to retrieve aerosol size distributions. These size distributions retrieved using the current AERONET algorithm were actually used for the calculation of aerosol concentrations which were used to get results displayed and discussed in the old manuscript.

The presented size distributions in Figure 3 in the old manuscript were not used to calculate aerosol number concentrations which were used to get results displayed and discussed in the old manuscript. We find that the nuclei modes with radius smaller than 0.05 micron in these distributions in Figure 3 in the old manuscript were created by measurement by an aircraft during an intensive observation period that was not associated with cases adopted by this study. Somehow, by error in the program code, this nuclei mode was combined with bi-modal aerosol size distributions which were based on the AERONET measurement in cases adopted by this study and retrieved by the current AERONET inversion algorithm. Resulting size distributions with this error were displayed in Figure 3 in the old manuscript. However, as mentioned, these distributions in the old manuscript were not used for results discussed and displayed in this study, and bi-modal distributions retrieved by the current AERONET inversion algorithm were actually used for the calculation of aerosol number concentrations which were used to get results displayed and discussed in the old manuscript. Accordingly, text is revised.

Here, we note that Figure 3 in the old manuscript is removed as a part of our effort to reduce the number of figures as we stated above. Figure 3 is removed, since in text, we give values of size distribution parameters (i.e., modal radii, standard deviations and the partition of aerosol number among modes), and we believe that this is enough to describe aerosol size distributions and showing them in a form of figure is redundant.

Technical corrections:

p7, line 188: 33 bins for each of how many size distributions? 5 (water, ice crystals, snow, graupel, hail)?

There are seven size distributions for hydrometeors that are classified into seven species. These seven species are water drops, snow aggregates, graupel, hail and three types of ice crystals which are plates, columns and dendrites. Each of seven species has its own size distribution and hence, there are seven size distributions for hydrometeors.

To clarify this, the corresponding text is revised as follows:

(LL181-185 on p7)

A set of kinetic equations is solved by the bin scheme to represent a size distribution function for each of seven classes of hydrometeors and aerosols acting as CCN. Hence, there are seven size distribution functions for hydrometeors. The seven classes of hydrometeors are water drops, three types of ice crystals, which are plates, columns and dendrites, snow aggregates, graupel and hail.

p8, lines 211-213: Please repeat the citation to Brown et al 2012 here.

Done.

p17, lines 496-498: "differences in freezing become at an order of magnitude, which is similar to that of differences in deposition, and become around one order of magnitude smaller than those in condensation" Do the authors mean "differences in freezing become similar in magnitude to differences in freezing and about one order of magnitude smaller than differences in condensation"?

Here, the difference in freezing is ~3 times smaller than that in deposition, while the difference in freezing is ~30 times smaller than that in condensation. Hence, in the old manuscript, we stated that the difference in freezing and that in deposition are at a similar order of magnitude, while stating that the difference in freezing is around one order of magnitude smaller than that in condensation. Regarding the difference in absolute magnitude, although the difference in freezing and that in deposition are at a similar order of magnitude, it is true that the difference in freezing is ~3 times smaller than that in deposition. Based on this, to remove confusion, text pointed out here is revised as follows:

(LL496-500 on p17)

After 06:00 LST until time reaches 12:00 LST when the overall differences in the cumulative precipitation frequency between the runs are established, differences in freezing become ~3 times smaller than those in deposition and ~one order of magnitude smaller than those in condensation (Figures 6c and 6d).

First of all, we appreciate the reviewer's comment. In response to it, we have made relevant revisions to the manuscript. Listed below are our answer and the changes made to the manuscript according to the comment. The comment of the reviewer (in black) is listed and followed by our response (in blue).

Reviewer 2:

My previous comments have been mainly addressed and corrections to the manuscript has been made accordingly. As a detail I would be still asking why the changes seen in cloud fraction are estimated to be insignificant? Up to 10% change does not sound small.

To remove confusion caused by the word "insignificant", the corresponding text is revised as follows:

(LL465-466 on p16)

We see that cloud fraction varies 0-~6% between the runs.

(LL623-624 on p21)

Here, we see that cloud fraction varies by ~2-12% between the runs.