We appreciate the reviewer' valuable comments and constructive suggestions, which help improve the quality of the manuscript. We have carefully revised the manuscript according to these comments. The reviewer`s comments are in black, our responses are in blue and the corresponding changes in manuscript are in red.

Anonymous Referee #2

This study consists on two different pieces of work. First, a comparison of the aerosol optical properties retrieved by SKYNET and AERONET methodologies, based on data obtained at Beijing. Second, a case study in Beijing using the SKYNET data only, for a limited period.

General comments: the article has some interest given the importance of the comparisons between AERONET and SKYNET methodologies, from the point of view of homogeneity between networks. The authors list a number of previous papers devoted to comparisons between both networks. In this case, the comparison is made between AERONET version 3, and SKYRAD version 5 implemented in the SR-CEReS package, so the results are to some extent, new. However, I think there are some flaws that should be addressed before this paper was accepted for publication in this journal: First, the comparison should be improved by performing a more in deoth analysis of the retrieval differences; second, the example analysis of the episode should be discussed in the light of the different methods; or alternatively, removed or shortened, as to give emphasis to the comparison itself.

Response: Thank you for your valuable comments and constructive suggestions. In the revised manuscript, we do not compare the different SKYNET AOD at all, because the skyrad.pack version 5.0 is included in the SR-CEReS as the main program, it should be only one method. The difference is that SR-CEReS selected the input data from the measurements taken in more than 1 month before and after the target day (to keep sufficient number of data points) using a stricter criterion of error in input data. The frequency distribution of AERONET-retrieved AOPs has given in the revised manuscript comparing with SKYNET-retrieved AOPs for the four seasons. We have added the AERONET data in the pollution event analysis to compare with SKYNET data, and the comparison of AERONET and SKYNET data on the three days (clean, light-pollution, heavy-pollution) are shown instead. Some detail responses are in the following:

Abstract: the analysis of the winter episode has too much weight given the article title. I would expect to focus the paper more on the comparison itself.

Response: Following the reviewer's comment, the revised manuscript now has compared the frequency distribution between SKYNET and AERONET, and a comparison with the AERONET data during the episode has been included. (Line 13-34)

'**Abstract.** This study assesses the performance of SKYNET in comparison to AERONET (Aerosol Robotic Network) for retrieving aerosol optical properties (AOPs) in Beijing, China. The results obtained from simultaneous measurements compare well (RMSE of 0.010-0.020) and show high correlation coefficients (> 0.996) for aerosol optical depth (AOD) at each wavelength. The highest correlation coefficient for Ångström exponent (when AOD_{440nm}>0.4) is 0.992, at 440–870 nm, with the smallest RMSE of 0.042. The RMSE of single scattering albedo (SSA) between SKYNET and AERONET is as low as 0.018 at 440 nm, with high

correlation coefficient (0.851), and adjusting the sky-radiance calibration constant and surface albedo input values can easily affect the value of SKYNET SSA. The real and imaginary parts of the refractive index show deviations of 0.031-0.055 and 0.003-0.005 respectively for all the wavelengths. The fine mode and coarse mode dominated volume size distribution patterns derived from the two networks' instruments are both bimodal but the coarse-mode volume concentration in coarse mode dominated condition is much larger that in fine mode dominated, meanwhile the coarse-mode volume of SKYNET is larger than that of AERONET on average.
According to the frequency distribution of SKYNET and AERONET retrieved AOPs, consistent conclusions are that the relatively high AOD values often occur in spring and summer, coarser aerosol particles often present in spring and finer particles usually exist in winter, and there are more absorbent aerosol particles in winter while more scattering aerosol particles in summer and autumn. SKYNET data, combined with AERONET data, meteorological data, CALIPSO (Cloud–Aerosol Lidar and Infrared Pathfinder Satellite Observations) data, backward trajectories, and WPSCF (weighted potential source contribution function) and WCWT (weighted concentrated weighted trajectory) analyses are used to analyze a serious pollution event in winter over Beijing. The results suggest that it was not only affected by local emissions but also by regional transport. The AOPs under three weather conditions (clean, light-pollution, heavy-pollution) in Beijing are discussed. The AOD shows high consistency for the SKYNET skyradiometer and AERONET sunphotometer on the clean day (27 December 2016), light-pollution condition (2 January 2017) and heavy-pollution condition (4 January 2017), and the RMSE are about 0.005, 0.006 and 0.018 respectively. The RMSE of SSA are 0.022, 0.046, 0.020 and for Ångström exponent are 0.229, 0.289, 0.060, respectively, the large biases of Ångström exponent are due to the low AOD values.'

Line 94-96: Given the different versions co-existent, it would be good to make clear the current choices available. In this sense, the original skyrad version was not 4.2 but previous.

Response: The Skyrad.pack algorithms corresponding to Nakajima et al. [1996] and Hashimoto et al. [2012] are denoted by Skyrad.pack (version 4.2) and Skyrad.pack (version 5.0) , respectively. In this study we use the SR-CEReS analysis package, but the main program of the package is version 5.0. One SKYNET retrieval (SKYNET V5.0) has removed in the revised manuscript, because the skyrad.pack version 5.0 is included in the SR-CEReS as the main program, it should be only one method. Because of this, we do not say that SR-CEReS has been improved over version 5.0. So we remove the comparison between the two SKYNET retrieved AOD and AERONET retrieved AOD. The comparison between SKYNET SR-CEReS-retrieved AOD and AERONET-retrieved AOD is shown in Fig.2. (Line 101-105)
'Figure 2 shows the results of SKYNET AOD compared with AERONET AOD. Figures 2a–d show that the AOD retrieved from the AERONET sunphotometer, at all wavelengths, is systematically higher than that retrieved from the SKYNET skyradiometer, and the MBD (mean bias deviation), defined as $\mathrm{MBD} = \bar{\Delta} = \frac{1}{n}\sum_{i=1}^{n}\left(\delta_{skynet,i} - \delta_{aeronet,i}\right)$ at 500 nm, 670 nm, 870 nm and 1020 nm is -0.014, -0.015, -0.008 and -0.006 respectively. The RMSE (root mean square error), defined as $\mathrm{RMSE} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(\delta_{skynet,i} - \delta_{aeronet,i}\right)^2}$ at 500 nm, 670 nm, 870 nm

and 1020 nm is 0.020, 0.020, 0.011 and 0.010, respectively. The correlation coefficient of AOD between the SKYNET SR-CEReS retrieval and AERONET at each channel is larger than 0.996. These statistical parameters confirm that the two networks' instruments are highly consistent in their measurement of AOD. Importantly, the AOD from SKYNET at 670 nm correlates to the AOD at 675 nm from AERONET, which may lead to the relatively large differences. Additionally, the comparison of AOD at shorter wavelengths has larger biases than that at longer wavelengths.'

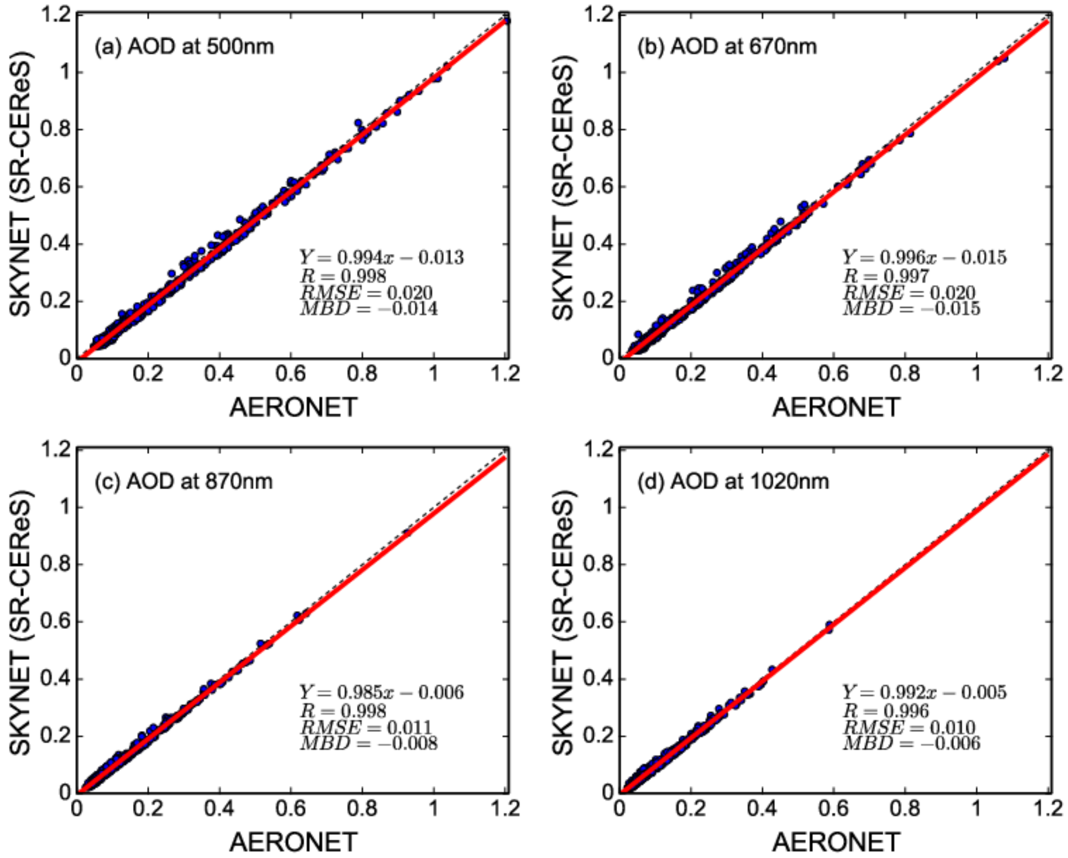

Figure 2: Comparison of SKYNET SR-CEReS–retrieved AOD with that from AERONET (within 1 minute) at 500, 670, 870 and 1020 nm over Beijing. The red solid line is the fitted linear regression curve.

Line 161: if the differences are given in %, then the definition of the MBD cannot be (mean_aeronet - mean_skynet). Please define properly. Do you mean you first compute the mean value for all the aeronet and skynet datasets separately and then compare with the MBD? Or do you compute the differences for every pair of coincident data, and then perform the mean? The discussion of the correlation coefficient is not enough so I would recommend to include other statistical parameters such as RMS.

Response: The proper definition of MBD and RMS have shown in the revised manuscript. (Line 174-176)

'the MBD (mean bias deviation), defined as $\mathrm{MBD} = \bar{\Delta} = \frac{1}{n}\sum_{i=1}^{n}(\delta_{skynet,i} - \delta_{aeronet,i})$ at 500 nm, 670 nm, 870 nm and 1020 nm is -0.014, -0.015, -0.008 and -0.006 respectively. The

RMSE (root mean square error), defined as $\mathrm{RMSE} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(\delta_{skynet,i} - \delta_{aeronet,i})^2}$ at 500 nm, 670 nm, 870 nm and 1020 nm is 0.020, 0.020, 0.011 and 0.010, respectively.'

Lines 170-174: the discussion about the Angstrom exponent should be analysed in more depth, for example the exponent is highly uncertain for low AOD. This should be taken into account in the analysis and/or discussion.

Response: When AOD440nm>0.4, the comparison result between the AERONET and SKYNET is better than before. The more analysis about the AE are given in the revised manuscript. (Line 182-190)

'A comparison of Ångström exponent retrieved from SKYNET SR-CEReS and AERONET is shown in Fig. 3. Only data with AOD_{440nm}>0.4 are shown, since AE is highly uncertain at low values of AOD and the comparison result is bad (0.182-0.334 for all the wavelengths). Figure 3a-c show that the AE from AERONET is systematically lower than that from SKYNET SR-CEReS, the MBD of AE at 440-670 nm ($\alpha_{440-670nm}$), 440-870 nm ($\alpha_{440-870nm}$) and 500-870 nm ($\alpha_{500-870nm}$) is 0.063, 0.016 and 0.009; the RMSE at 440-670 nm, 440-870nm and 500-870 nm is 0.080, 0.042 and 0.048; the correlation coefficient at 440-670 nm, 440-870nm and 500-870 nm is 0.986, 0.992 and 0.990. Both the highest correlation coefficient of AE and the lowest RMSE of AE are at 440-870 nm. The simultaneous AE within one minute ($\alpha_{440-870nm}$>1.2) from SKYNET SR-CEReS and AERONET has large RMS differences about 0.060; However, the simultaneous AE ($\alpha_{440-870nm}$ <0.8) from SKYNET SR-CEReS and AERONET has small RMS differences about 0.013.'

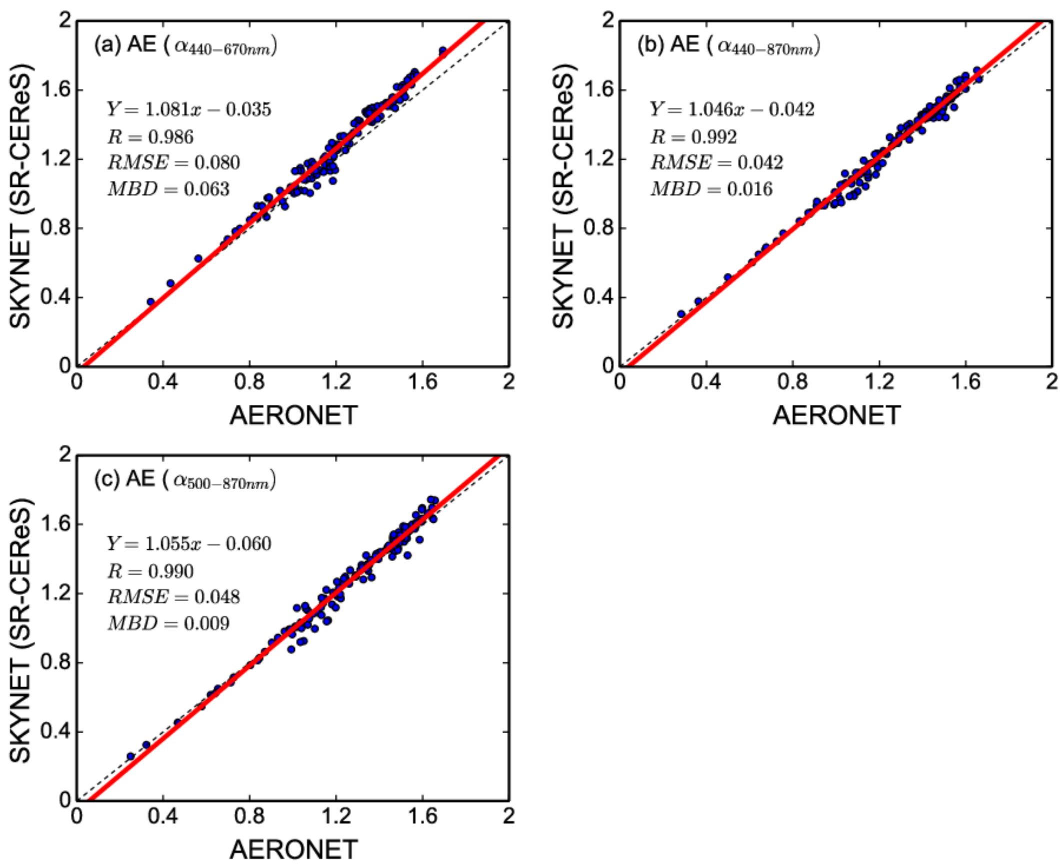

Figure 3: Comparison of SKYNET with AERONET Ångström exponent (within 1 minute) at 440–670 nm, 440–870 nm and 500–870 nm over Beijing. Only data with AOD > 0.4 are shown. The red solid line is the fitted linear regression curve.

Line 189: the sensitivity tests performed are of interest for SKYNET users. I think the authors should give more emphasis on these results than in the analysis of the episode. How could the comparison improve by finding an effective SVA? Would be the results consistent with Kathri et al 2016?

Response: According to our results, we find that SVA and SA can easily affect the SSA, and the SVA is more important because the effects on the SSA is more sensitive. It is same as Kathri et al 2016. In order to get more accurate calibration constant for sky radiance, the SVA should be calculated in a short period. Average all values to get SVA is not very good, remove some large error points can get more accurate SVA.

Figures 4 and 5: values of SKYRAD lying on the 1 and 0 axis are probably due to by-default values in case of good retrievals and should perhaps be removed.

Response: Thanks for your advice. The values of SKYNET SR-CEReS lying on the 1 and 0 axis have been removed. The new results are shown in Fig. 4.

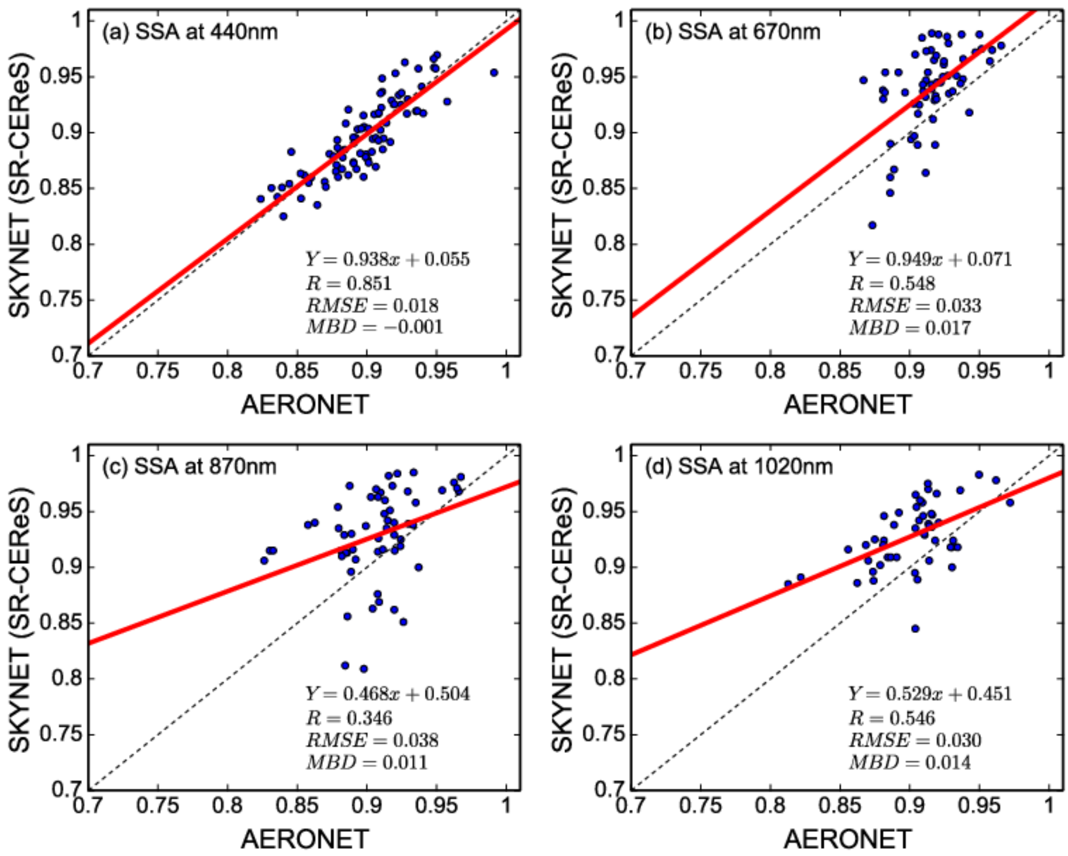

Figure 4: Comparison of SKYNET and AERONET SSA (within 3 minutes) at 440, 670, 870 and 1020 nm over Beijing. Only data with AOD > 0.4 are shown. The red solid line is the fitted linear regression curve.

Line 221: I don't think the linear correlations are clear. The deviation of points relative to the fitted line is high.

Response: The inaccurate description has been removed in the revised manuscript. (Line 245)

Line 225: the comparison of size distributions could also be studied with more detail, for example depending on the radius bands, or depending on the type of aerosol present. Comparison to nominal uncertainties would be informative.

Response: Thanks for the advice, following the reviewer's comment, the revised manuscript now modifies the comparison of volume size distribution between AERONET and SKYNET, the fine-mode dominated and coarse-mode dominated volume size distribution have added. (Line 247-280)

'Comparisons of the volume size distribution of fine mode dominated ($\alpha_{440-870nm}$>1.2) and coarse mode dominated ($\alpha_{440-870nm}$<0.6) between AERONET and SKYNET are shown in Fig. 7, wherein only those data observed within 5 minutes of each other were considered as simultaneous. The volume of aerosol for an air column of unit cross section is used to express the columnar volume spectrum ($\mathrm{dV/dlnr}$), and the radius is in logarithmic form (Nakajima et al., 1996). There are differences in the assumptions of size distribution between the SKYNET and AERONET retrieval algorithms. The volume at each rated radius is calculated by averaging the values at that radius for both the SKYNET skyradiometer and the AERONET sunphotometer. However, the number of rated radii for SKYNET and AERONET is 20 and 22, respectively, meaning 20 rated radii (0.012, 0.018, 0.026, 0.038, 0.055, 0.081, 0.118, 0.173, 0.253, 0.370, 0.541, 0.791, 1.156, 1.691, 2.473, 3.617, 5.289, 7.734, 11.310 and 16.540 $\mu\mathrm{m}$) are used to retrieve the volume size distribution for SKYNET and 22 rated radii (0.050, 0.066, 0.086, 0.113, 0.148, 0.194, 0.255, 0.335, 0.439, 0.576, 0.756, 0.992, 1.301, 1.708, 2.241, 2.940, 3.857, 5.061, 6.641, 8.713, 11.432 and 15.000$\mu\mathrm{m}$) are used to retrieve the volume size distribution for AERONET. As is shown in Fig. 7a, the size distribution patterns of fine mode dominated from SKYNET and AERONET are both bimodal, which is typical, but the peak volumes bear some differences. Specifically, the two peak volumes from the SKYNET skyradiometer are at the radii of 0.173 $\mu\mathrm{m}$ and 5.289 $\mu\mathrm{m}$, with columnar volume concentrations of 0.060 and 0.093 $\mu m^3/\mu m^2$; whereas, those from the AERONET sunphotometer are at radii of 0.148 $\mu\mathrm{m}$ and 3.857$\mu\mathrm{m}$, with columnar volume concentrations of 0.063 and 0.075 $\mu m^3/\mu m^2$. From Fig. 7b we can see that, the size distribution patterns of coarse mode dominated from SKYNET and AERONET both show a bimodal pattern. The two peak volumes from the SKYNET skyradiometer are at the radii of 0.081 $\mu\mathrm{m}$ and 3.617 $\mu\mathrm{m}$, with columnar volume concentrations of 0.075 and 0.632 $\mu m^3/\mu m^2$; whereas, those from the AERONET sunphotometer are at radii of 0.086 $\mu\mathrm{m}$ and 3.857$\mu\mathrm{m}$, with columnar volume concentrations of 0.092 and 0.561 $\mu m^3/\mu m^2$. The significant difference between Fig. 7a and Fig. 7b is that the coarse-mode volume concentration in coarse mode dominated condition is much larger than that in fine mode dominated condition. One can see is that the coarse-mode volume concentration of SKYNET is larger than that of AERONET on average, whereas, in contrast, the fine-mode volume of SKYNET is smaller than that of AERONET on average. The SSA is a ratio that describes the scattering ability of aerosol particles and, generally, coarse-mode particles have a larger scattering ability, meaning the SSA will be larger when there are many coarse-mode particles. The difference in volume size distribution between SKYNET and AERONET might be one reason why the SSA retrieved from SKYNET is larger than that retrieved from

AERONET. It can be clearly seen that the deviations of the columnar volume concentrations around the peak volumes are larger than for other volumes, which is the same for both the SKYNET skyradiometer and the AERONET sunphotometer. However, the deviations for the volume of fine-mode particles retrieved from AERONET are larger than those of SKYNET in most cases, which is due to changes in fine mode radius from low AOD to high AOD conditions and also from dry to humid conditions; whereas, for the volume of coarse-mode particles, the deviations are larger for SKYNET than AERONET. From Fig. 7 we can see that the columnar volume spectrum retrieved from AERONET is nearly 0 $\mu m^3/\mu m^2$ at the radii less than 0.050 μm and more than 15.000 μm . This is by definition since these are the limits of the size distribution for AERONET and there is a strong constraint in the AERONET retrieval that results in near zero values at the limits.

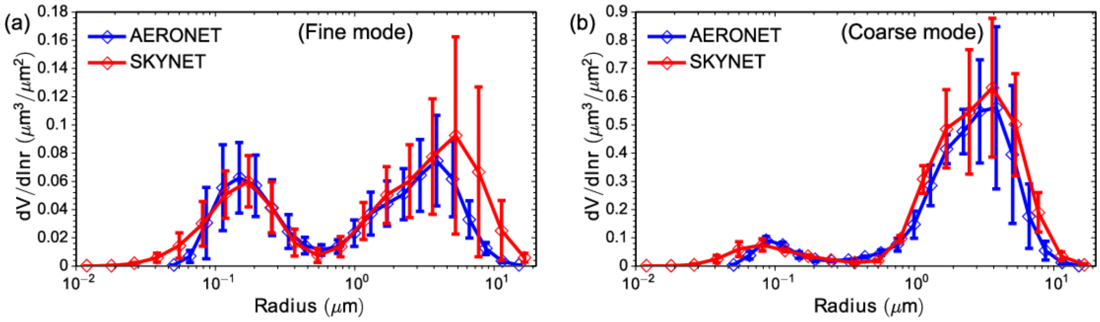

Figure 7: Comparison of SKYNET- and AERONET-retrieved volume size distributions (within 5 minutes) of (a) fine mode dominated (AE(440-870)>1.2) and (b) coarse mode dominated cases (AE(440-870)<0.6) over Beijing.'

Section 3.2: I understand to include the analysis of an episode to demosntrate the uselfulness of the SKYNET retrievals, however, I think more effort should be put in the comparison than in the example analysis. Possibly a comparison with the AERONET data during the episode should be included too.

Response: Thanks for the advice, following the reviewer's comment, a comparison with the AERONET data during the episode have added. (Section 3.3)

'Figure 11a shows the daily averaged 440 nm AOD variations from the SKYNET skyradiometer measurements and the AERONET sunphotometer measurements, and the daily averaged $PM_{2.5}$ during the study period. The missing values of AOD were caused by the accumulation of cloud. It can be clearly seen that the trend of AOD is similar to that of $PM_{2.5}$, and the daily averaged AOD values of SKYNET and AERONET are similar in Beijing. From 27 December 2016 to 29 December 2016, the SKYNET and AERONET AOD show a slow growth trend, but the values are lower than 0.2. On 30 December 2016, the AOD increases to 0.67 and 0.57 for SKYNET and AERONET, respectively. According to the volume size distribution on that day (Fig. 11d), the coarse mode dominates, with a peak volume concentration of 0.362 $\mu m^3/\mu m^2$ at the radius of 5.289 μm. Compared to the other days, the highest coarse-mode volume concentration indicates that there are dust aerosol particles over Beijing area. As can be seen from Fig. 11c, the SKYNET Ångström exponent is lower than 0.8 and the AERONET Ångström exponent decreased on 30 December 2016, which suggests that the proportion of coarse aerosol particles in the air is very large. Moreover, the instantaneous ratio is as low as 0.72, indicating a short-lived dust event happened over Beijing. The CALIPSO satellite can show the vertical variation of aerosol subtypes (see Supplement), which can be used to distinguish these different subtypes, such as marine, dust, and polluted dust aerosol (Omar et al., 2009; Tao et al., 2014). Figure S5 shows that was a heavy aerosol layer under 3 km, including dust, smoke and polluted dust, near Beijing (39.93°N, 116.32°E), which helps explain the much higher volume concentration of coarse-mode particles on that day. According to the volume size distribution during 27 December 2016 to 31 December 2016, the peak fine-mode volume concentration of SKYNET increases gradually from 0.005 $\mu m^3/\mu m^2$ to 0.066 $\mu m^3/\mu m^2$with the AERONET one increasing gradually from 0.006 $\mu m^3/\mu m^2$ to 0.089 $\mu m^3/\mu m^2$, which might also be related to the development of a haze event. The SSA reflects the effectiveness of aerosol scattering in the total extinction, which is one of the most important variables in assessing the influences of aerosols on the radiation budget (Khatri et al., 2016). As shown in Fig. 11b, the daily averaged SSA between SKYNET and AERONET show a same variation trend during these days. Owing to the accumulation of absorbing aerosol particles such as black carbon aerosols, which have strong absorption abilities, the SSA shows a downward trend from 30 December 2016 to 31 December 2016. Based on the variation trend of $PM_{2.5}$ values and the meteorological data, we can see that the air quality temporarily improves on 2 January 2017, because cold air blows through the Beijing area. However, a more serious pollution event happened from 2 January to 4 January in 2017. The daily averaged SKYNET AOD increases sharply from 0.33 to 0.85 and the AERONET ones varies from 0.32 to 0.96. The daily averaged $PM_{2.5}$ value increases from 204.12 $\mu m^3/\mu m^2$ to 313.92 $\mu m^3/\mu m^2$; and the ratio is as high as 0.82, indicating that the proportion of $PM_{2.5}$ is higher and the fine-mode aerosol particles played a key role in the formation of this haze event. Meanwhile, the volume size distribution of SKYNET shows a gradual increasing trend of fine-mode peak volume concentration from 0.021 $\mu m^3/\mu m^2$ to 0.053 $\mu m^3/\mu m^2$, the AERONET one varies from 0.030 $\mu m^3/\mu m^2$ to 0.057 $\mu m^3/\mu m^2$, and the ratio continuously increases to 0.94 during these three days, indicating that the proportion of fine pollutants became greater. The value of Ångström exponent is almost larger than 0.8 in the heavy haze event, which is similar to the findings of Eck et al. (2005), Xia et al. (2007) and Zheng et al. (2017). The SSA values for SKYNET and AERONET are both at low level on 31 December 2016 and 3 January, which indicates there are many absorbing aerosol particles. Both SKYNET and AERONET AOD are as low as 0.15on 9 January 2017, indicating the end of this pollution period.

Figure 12a shows the temporal variation of AOD from the SKYNET skyradiometer measurements and the AERONET sunphotometer at 440 nm on clean day (27 December 2016), light-pollution condition (2 January 2017) and heavy-pollution condition (4 January 2017), respectively. The daily averaged AOD from SKYNET and AERONET are less than 0.12 on 27 December 2016, which can be treated as the background AOD of Beijing. It should be emphasized that only when AOD at 440 nm is greater than 0.4 on 2 January 2017 do we consider it as light pollution (the results of the calculation of the pollution data is based on the standard of this day). It can be clearly seen that the AOD is very close between SKYNET and AERONET at the same time under the three weather conditions. The RMSE of AOD within 1 minute between SKYNET and AERONET are 0.005, 0.006 and 0.018 on the clean day (27 December 2016), light-pollution condition (2 January 2017) and heavy-pollution condition (4 January 2017), respectively. It indicates that the significant consistency of AOD for SKYNET skyradiometer measurements and the AERONET sunphotometer.

A comparison among the daily variations in SKYNET and AERONET SSA at 440 nm on clean day (27 December 2016), light-pollution condition (2 January 2017) and heavy-pollution condition (4 January 2017) is depicted in Fig. 12b. We can find that the SSA of SKYNET has much more data than AERONET so that it can reflect the variation of one day in more detail. Because the number of daily measurements of sky radiance by the SKYNET skyradiometer was more than that of the AERONET sunphotometer, and thus it is an advantage for SKYNET to use SSA values to analyze the daily variation. The newest AERONET instruments now take hybrid scans hourly that providing more frequent retrievals throughout the entire day, which can make up the defect. The RMSE of SSA within 10 minutes between SKYNET and AERONET are 0.022, 0.046 and 0.020 on the clean day (27 December 2016), light-pollution condition (2 January 2017) and heavy-pollution condition (4 January 2017), respectively. The biases of SSA are lower when AOD is high.

The temporal variations of SKYNET and AERONET Ångström exponent between 440 and 870 nm on clean day (27 December 2016), light-pollution condition (2 January 2017) and heavy-pollution condition (4 January 2017) are shown in Fig. 12c. The RMSE of AE within 1 minute between SKYNET and AERONET are 0.229, 0.289 and 0.060 on the clean day (27 December 2016), light-pollution condition (2 January 2017) and heavy-pollution condition (4 January 2017), respectively. The large differences of AE between SKYNET and AERONET are due to the low AOD values (AOD<0.2). The high consistency of AE occur when AOD is as high as 0.4.The volume size distributions of aerosol particles retrieved from the SKYNET skyradiometer and AERONET sunphotometer are shown in Fig. 11d and Fig. 11e, respectively. Furthermore, the volume size distributions on clean day (27 December 2016), light-pollution condition (2 January 2017) and heavy-pollution condition (4 January 2017) are selected to show individually. On clean day (27 December 2016), the volume size distribution is a typical bi-modal pattern, which is similar to the two networks, indicating the proportion of coarse-mode particles is much larger, which results in the Ångström exponent being very low. There are some differences of volume size distribution between SKYNET and AERONET on 2 January 2017, which is due to lacking AERONET data in clean condition (AOD<0.1) on that day. Both SKYNET and AERONET volume size distributions demonstrate a classic bimodal pattern on 4 January 2017, the volume concentrations of fine-mode particles on 4 January 2017is larger than that on 27 December 2016 and 2 January 2017 which clearly indicates fine particles have an important influence on heavy-pollution condition (4 January 2017).’

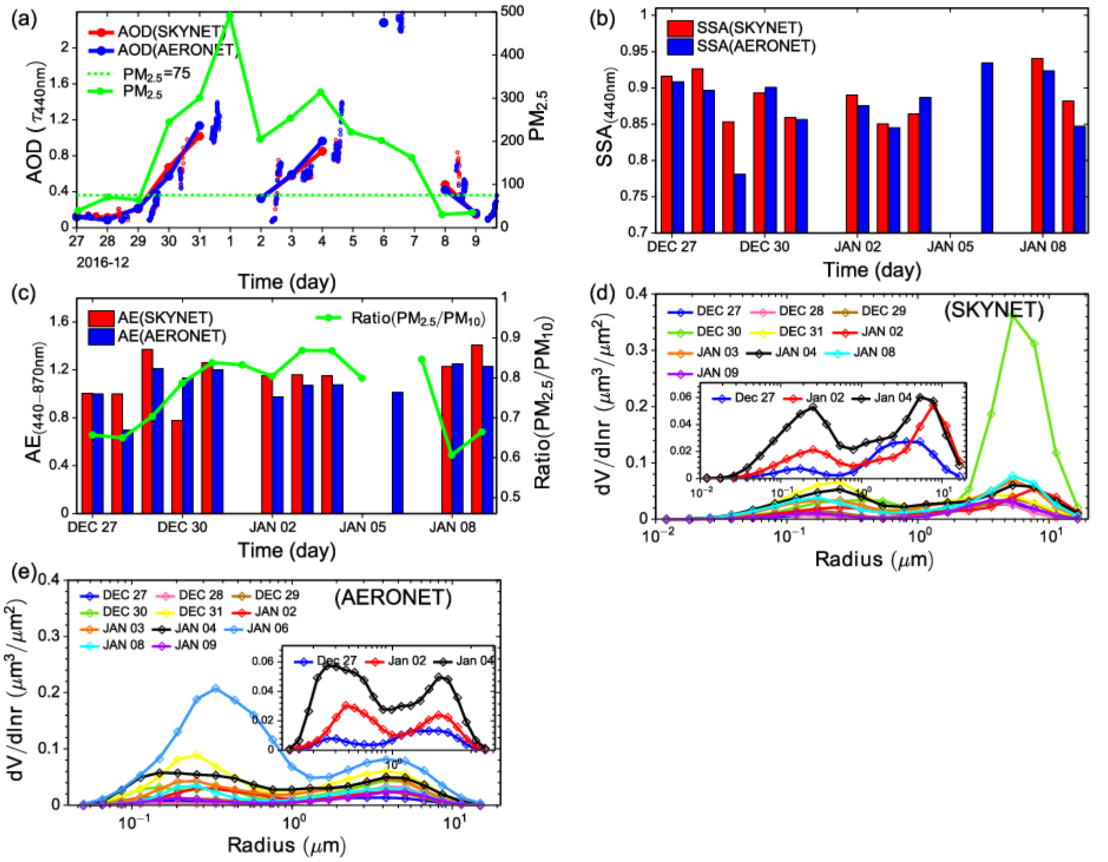

Figure 11: Comparison of daily averaged variation in AOPs from SKYNET and AERONET measurements in Beijing from 27 December 2016 to 9 January 2017: (a) volume size distribution of SKYNET; (b) volume size distribution of AERONET; (c) AOD; (d) SSA; (e) Ångström exponent.

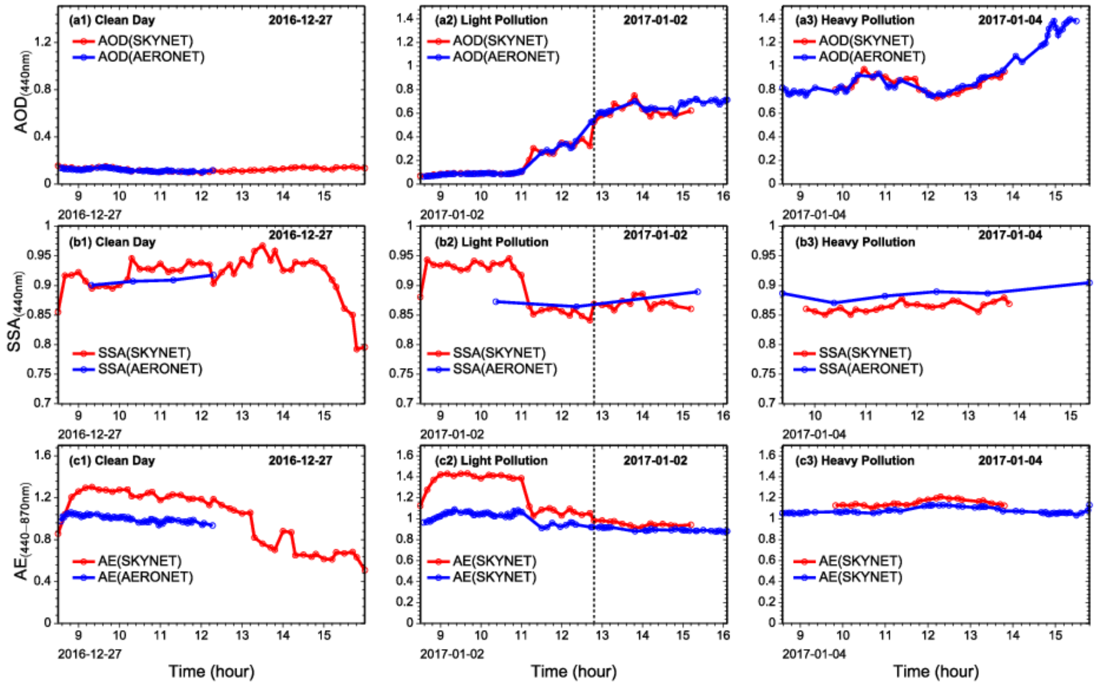

Figure 12: Temporal variation of (a) AOD, (b) SSA, and (c) Ångström exponent from the SKYNET skyradiometer and AERONET sunphotometer under (a1, b1, c1) clean, (a2, b2, c2) light pollution, and (a3, b3, c3) heavy pollution weather conditions in Beijing on 27 December 2016, 2 January, and 4

January 2017, respectively.

Line 301: negation correlation should be negative correlation

Response: We have replace ‘negation’ with ‘negative’ in the revised manuscript. (Line 339) ‘The correlation coefficient between visibility and RH is about − 0.80, showing a significant negative correlation during the study period.’

Section 4. The discussion section looks redudant. It should be included in the results or conslucions.

Response: The discussion section has removed, and it has been included in the results and consluctions.