Dear anonymous reviewers,

Thank you very much for your comments on our manuscript [acp-2014-269]. Your comments and suggestions are valuable and very helpful for improving our manuscript. Based on your comments and suggestions, we carefully revised the manuscript, and the point-to-point responses to your comments and suggestions are listed below.

Thank you once again for your time and consideration.

Responds to the comments:

Note: All the revisions are based on the previously submitted manuscript in word format which corresponds to the manuscript. For the modified portions, we provide the page and line numbers of the manuscript format before modification.

Anonymous Referee #2

General comments:

1. The dataset is short which somewhat weakens the general value of the conclusions. The measurements have been going on for four years and the conclusions would be much stronger if more cases would be used. With additional data there would be a possibility to find a solid fog-case too.

We thank you for your kind comments and good suggestions. This

paper provides a case analysis on fog-haze condition influencing CCN and aerosol activity. We have tried to introduce more cases to strengthen our results, but there are short of data collected by MARGA and SMPS (WPS) for solid fog cases and more haze cases. Although this is only a case study, our findings agree with many other relevant researches elsewhere (e.g. DeFelice et al., 1996; Ritesh et al., 2007), I think this may strengthen our results to some extent. Besides, we will continue the investigation on fog-haze impact on CCN in the future, hoping to get a full view of this issue when measurements for aerosol information are all ready.

Specific comments:

1. The diurnal variation has some effect on the results (e.g. foggy-hazy case at night/in the morning other during the day).

We thank you for your good comments. In this case study, the clear and hazy cases both continued more than one day with a reduced effect of diurnal variation. Foggy conditions mostly occur at night and in the morning and seldom last as long as 24 hours in Shanghai, thereby it was inevitable that the diurnal variations had some effect on the results during the foggy-hazy case spanning from 23:00 LT on 6 Nov. to 10:00 LT on 7 Nov.. We have discussed this issue in the conclusion section in our revised manuscript.

Methods:

1. Section 2.2, lidar methods: what is the full overlap of the system (i.e. from what altitude above the ground the data is reliable)? The upper detection limits are mentioned but the lower limit is missing. What is the effect of the overlap on the comparison to ground-based measurements, if any?

We thank you for your good comments. The full overlap of the system is about 4 km and the blind range is 250 m based on the experiment in 2009. Systematic errors of P(r) were mainly observed in the lowest altitudes where an incomplete overlap between the emitted laser beam and the telescope field-of-view can led to an underestimation of aerosol backscatter and extinction coefficients. Welton et al (2002) fully discussed the uncertainties caused by the overlap correction and He et al (2006) estimated it to be less than 10%.

2. Section 2.3, line 254-256: " …without anthropogenic particulate pollutants…". Maybe "with less anthropogenic…" would be a better. There is always some anthropogenic influence.

We thank you for your good comments. We agree with you and have changed this sentence under your suggestions in our revised manuscript. Section 2.3, line 254-256: replace "…without anthropogenic particulate pollutants…" with " with less anthropogenic particulate pollutants…".

Results:

1. Section 3.1., line 292: "clear episode", maybe clear "case" instead if episode.

We thank you for your good comments. We agree with you and have it changed under your suggestions in our revised manuscript.

Section 2.3, line 254-256: replace "clear episode" with " clear case".

2. Section 3.3.1, line 408&Conclusions line 545-546: Is the great influence of wind direction and temperature shown somewhere?

We thank you for your kind comments. We have added some analysis of the great influence of wind direction and temperature in the revised manuscript.

Section 3.3.1, line 409: add "For example, the low wind speed (about 2 m s^{-1}) and PBL height (around 0.5 km) favored the mass accumulations of PM$_{2.5}$ and BC reaching their maximums of 242 and 35 μg m^{-1} at 0:00 on 8 Nov. The later disappearance of the haze pollution was mostly owing to the wind speed increasing to 6 m s^{-1} and the PBL height rising to 1.4 km (Figure 2). Temperature is known as a large factor influencing PBL height and thereby indirectly impacts PM$_{2.5}$ and BC. In addition, the wind was frequently northwest direction and brought large amount of anthropogenic particles (e.g. BC) to Shanghai during the foggy-hazy/hazy cases, while it blew easterly or northeasterly (marine area) before and

3. Section 3.3.2, line 447-448: "…significant enhancement of aerosol extinction coefficient on 7 and 8 Nov (Fig 3)." This is difficult to state based on the figure. Maybe some values of extinction coefficients would give more information. Or plotting some hourly profiles in a figure for comparison.

We thank you for your kind comments. The figure is some kind of confused and we have added a new figure providing hourly profiles (the PBL heights and extinction coefficient are plotted as 1 hour averages) to make a more clear presentation in the revised manuscript.
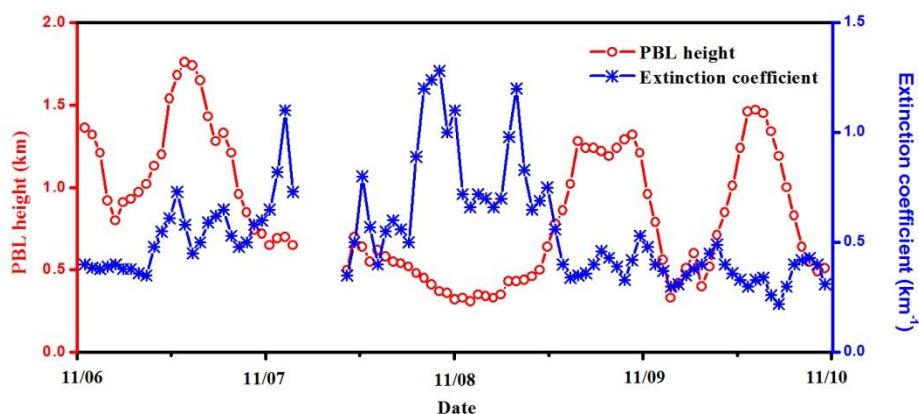

Figure 3 Temporal variations of PBL and vertical extinction coefficient (500 m) measured by MPL lidar. Data from 5:00-9:00 on 7th are labeled as invalid and not shown.

Conclusions:

1. Lines 558-559: "BC was correlated well with N(CCN) in the

foggy-hazy and hazy cases but the clear case, as not N(CCN)/N(CN) did."

Check this sentence.

We thank you for your kind comments and good suggestions. In our revised manuscript, the sentence has been modified into "BC was correlated well with N_{CCN} in the foggy-hazy and hazy cases, while they were less linked in the clear case. Besides, there were no good agreements between BC and N_{CCN}/N_{CN}, with only moderate (R^2=0.43) and poor (R^2=0.07) correlation coefficients for the foggy-hazy/hazy cases and clear case, respectively."

Tables:

1. Table 1: The PBL values should be re-checked after proper calculation/cleaning of PBL data. Does the PBL detection suffer from the fog to that extent that the PBL values would not be valid for that period? Where are the extinction values from? From certain altitude or averaged over the boundary layer or for the whole profiles? Please add a unit for the extinction. I suggest decreasing the number of decimals to one in the weather parameters, due to the measurement accuracies of the instrument (I doubt that the accuracy is this good).

We thank you for your kind comments. Figure 3 is some kind of confused and we have changed it to a new one providing hourly profiles (the PBL heights and extinction coefficient are plotted as 1 hour averages)

to make a more clear presentation in the revised manuscript.

Since the PBL detection suffers from the fog to such an extent that the PBL values might not be valid during this period, but they are solid for the rest. To avoid the possible uncertainty, the data collected during the period of 5:00-9:00 on 7th Nov. are labeled as invalid measurement and are ignored in the new figure. The valid extinction coefficients are for a certain altitude of 500 m which agrees with the backward trajectory analysis. The meteorological parameters are processed into case averages which lead to the number of decimals to two, and we have decreased it to one in our revised manuscript.

Figures:

1. Please mention the meaning of the red and black boxes of the plots in the Figure captions. Now this is in the text but it would help the reader if the figures would explain themselves.

We thank you for your kind comments and good suggestions. We agree with you that it would help the reader if the figures would explain themselves and we have the meaning of the red and black boxes of plots mentioned in the Figure captions in our revised manuscript.

2. -Figure 3: I assume the orange triangles in the upper figure are the PBL top values which come from some automatic routine. These values are in many parts unrealistic and the plot needs some polishing. For

example on 6th Oct there are values from 300m to almost 2 km at the same time. Also the missing data on 7th Oct 5:00-9:00 and the PBL top points around the period seem odd and unrealistic. Further on there are many PBL top points that need to be re-checked in the Figure. What do the two subplots actually show? Check the z-labels of the colorbars and Figure caption. Now they do not match.

We thank you for your kind comments and reminds. Figure 3 is some kind of confused and we have changed it to a new one providing hourly profiles (the PBL heights and extinction coefficient are plotted as 1 hour averages) to make a more clear presentation in the revised manuscript.

Since the PBL detection suffers from the fog to such an extent that the PBL values might not be valid during this period, but they are solid for the rest. To avoid the possible uncertainty, the data collected during the period of 5:00-9:00 on 7th Nov. are labeled as invalid measurement and are ignored in the new figure. The valid extinction coefficients are derived for a certain altitude of 500 m which agrees with the backward trajectory analysis.

3. - Figure 5: This shows the distribution to some extent. Even more clear presentation would be a plot with just three curves, size on the x-axis, number concentration in some format on y-axis (e.g. dN/dDp, depending how the instrument size bins are distributed).

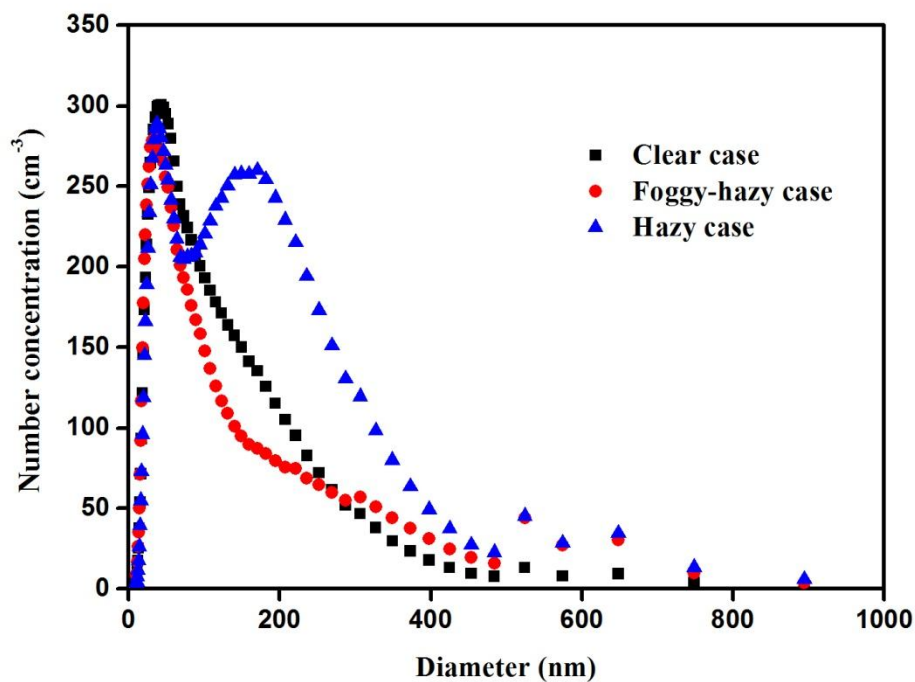We thank you for your kind comments and good suggestions. We

Figure 5 Average aerosol size distributions (10nm-1 μm) for the clear,

foggy-hazy and hazy cases.

4. Figure 10 & 11: These figures present nearly the same results. Are

both needed as figures?