Reviewer 1 (Reviewer's comments in black and our responses in red)

General comments:

Using in situ measurements, satellite observations and the WRF modeling the authors investigated the contributions of chemical and physical processes to the evolution of haze extremes. Findings show that chemical process that plays a leading role in PM production varies with the development stage of the haze event. And the haze-PBL interactions accelerate the accumulation of aerosol particles and water vapor at the ground level, amplifying the haze severity. The findings help to demonstrate the potential for achieving co-benefits for air quality and climate via black carbon mitigation. I recommend it to be accepted after minor revision.
We thank the positive comments to our manuscript by this reviewer and have fully addressed the issues raised by this reviewer below.

Fig. 3 show the concurrent increases in OOA, PM2.5 and Ox concentrations during the transition period. Is that also the case for the clean days? Why or why not?
The shaded area for the correlation in Fig. 3 was selected to represent the largest variation in O_x, which covered both clean and transition periods. This point has been clarified in the caption.

Generally, the PBLH increases from morning to afternoon, and then decreases to the midnight. While it seems that the rate of growth in PM during the polluted period (from afternoon to midnight) is comparable to that during the transition period (from morning to afternoon) in Figs. 3a-b. Does it mean that photochemistry produced more PM? I suggest the authors to provide additional information on the diurnal evolution of the PBL for the two selected cases, and further explore the role of boundary layer evolution and chemical processes in the development of pollution.
We have checked the ceilometer-retrieved PBL heights on 27 September and 4 October, 2013 (see Figure S4) and have provided the following explanations, "Note that both the photochemical production and PBL evolution contribute to PM accumulation at the group level, since the PBL collapse during the daytime leads to vertical dilution for PM. For example, the ceilometer-retrieved PBL height increases about 200 m (150 m) from morning to afternoon and then decreases by about 150 m (400 m) from afternoon to midnight on 27 September (4 October) (Fig. S4). Clearly, the largest PM increase as well as the strong correlation between OOA and O_x during the morning and early afternoon hours indicate that the photochemical PM production dominates the PM increase during the transition period".

In my opinion, the relative humidity calculated by the Nozaki's equation (Lines 402-407 and 501-503) may suffer from large uncertainties that originated from 1). errors in PBL height, especially for the clean cases (Line 257), 2). inappropriate selection of Pasquill stability level (Line 255) due to the lack of cloud fraction measurements. 3) the uncertainty of the empirical formula itself. Since the model simulations agree well with the observations (Fig. s2), why not use the modelled results to show the changes in RH from the ground to the free troposphere?
Here we want to estimate how sensitive of RH in response to the change in PBL height, and Tie et al. (2017) has proven that the Nozaki' equation can well serve our purpose. In our calculation, the two inputs of wind and PBL height to Nozaki' equation were based on observations (we used a new observation dataset of PBL height to replace the reanalysis data), and the results show that

our calculated RH is comparable to the observations. We would expect that there are uncertainties by using Nozaki's equation, but we don't need to worry about at least the uncertainty source 2), since there was no cloud effect on Pasquill stability level selection at all because all the days simulated were under cloud-free condition. We took Tie et al. (2017) as a reference when selecting Pasquill stability level in our study.
As for simulation results, the correlation between simulated RH and PBL height was much more complicated since RH calculation in model is influenced by many other factors besides PBL height. It is not straightforward for us to use simulation results to simply quantify the changes in RH in response to the changes in PBL height. As such, the modeling results may not serve our purpose here.

Line 300, the '(Li et al. (2015)' should be '(Li et al., 2015)'.
Corrected as suggested.

I cannot find tables. 1-3 in the manuscript.
The missing tables have been included.