Response to Anonymous Referee #2

This manuscript could benefit from some organization and focusing on key findings. The manuscript would be much more focused if the evaluation of the differences between the flights and the HYSPLIT modeling could be moved to supplementary material and simply referenced in the manuscript and focus the manuscript on the ozone and aerosols in the mixed and residual layers and the comparison to MOZAIC observations and trends.

Response: Thank you for your comments and suggestions. We have moved the figures about airflow fields and airmass trajectories to the supplement. The related text has been modified and moved section 3.1 to strengthen the discussion there as suggested by Referee #1.

Specific Comments

1. Abstract lines 21-22: What methods were used to determine the mixed and residual layers? Simply stating that potential temperature profiles and aerosol number concentration should suffice.

Response: The depths of the mixed layer and residual layer were determined using two methods. One is the vertical gradient of LIDAR particle extinction (dE/dz), the other is the vertical gradient of aerosol number concentration (dN/dz). Based on individual dE/dz profiles of particle extinction, we were able to determine the tops of the mixed layer and residual layer for the periods with UAV flights by identifying the minima below 2000 m in the dE/dz profiles if there were no obviously unreasonable values in the vertical profiles due to interferences or noises. In order to select the minima that were really resulted from a strong decrease of aerosol burden for a small height change rather than abnormal variation, we compared the minima in the dE/dz profiles during the flights with those before and after the flights. Finally, the MLD and RLD were obtained according to the heights at which the minima were considered to be the most reasonable ones. Similar to the vertical gradient of particle extinction, the vertical gradient of aerosol number concentration were also used for the determination of mixed and residual layer depths. To find out the key inflection points in the vertical profiles, which indicate the tops of the mixed layer and residual layer, we paid attention to the major structures in vertical profiles and gradients of aerosol number concentration during the ascent and descent flights. Due to the slight differences in time and space in the flight, there were some differences in particle number concentrations measured at the same height between the ascent and descent of a flight. Even though, the t-test (α=0.05) helped to judge whether or not the results are accordant.

We have changed the sentence to "The depths of the mixed layer and residual layer were determined according the vertical gradients of LIDAR particle extinction and aerosol number concentration."

2. Page 2 Line 19: The atmospheric boundary layer (ABL) acronym used later in the manuscript should be defined here. Additionally, the introduction of the friction layer as equivalent to the ABL complicates the sentence and the term friction layer is not used elsewhere and should be removed.

Response: Because “planetary boundary layer (PBL)” is more familiar for the community and readers, we have replaced the “ABL” with “PBL” as suggested by Referee #1. According to your suggestion, we have removed the term friction layer.

3. Page 2 Line 22: The sentence “The ABL with vigorous turbulence is often called the mixed layer (or mixing layer)” is not needed because it is discussed in more detail and clarity on page 3 line 1.

Response: We have removed the sentence “The ABL with vigorous turbulence is often called the mixed layer (or mixing layer)”.

4. Page 3 line 8: “deserves attention and studies” is redundant. “deserves attention.”Should suffice.

Response: We have removed “and studies”.

5. Page 10 line 24: What exactly does “significantly low” mean? Compared to the other profiles? How was significance determined?

Response: By “significantly low” we meant that the aerosol number concentration in the early morning of July 1 (Flight 3) was much lower than that in the other two flights (Flight 4 and 5) in the early morning of July 29 and July 31. The original expression was not clear enough. Therefore, we have changed the sentence to “In the whole layer, the aerosol number concentration in the early morning of July 1 (Flight 3) was much lower than those in the other two flights (Flight 4 and 5) in the early morning of July 29 and July 31 (Fig. 1(a2).”. Note that the modified text has been moved to section 3.1.

6. Page 13 line 17: While “severer” is technically correct, "more severe" is more commonly used.

Response: We have replaced “severer” with “more severe”.

7. Figure 3: The caption does not state what figures (a), (b) or (c) designate. I assume that they are the same as in Figure 1 but this should be explicitly stated.

Response: Figure 3 shows vertical profiles of particle extinction averaged every two hours. We divided the whole day into three periods, (a) 0:00-7:00, (b) 8:00-15:00 and (c)16:00-23:00 in order to clearly show the average PBL diurnal cycle of vertical distribution of particle extinction. We have changed the figure caption to “Vertical profiles of particle extinction averaged every two hours for (a) 0:00-7:00 LT, (b) 8:00-15:00 LT, and (c) 16:00-23:00 LT”.