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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Seasonal characteristics of fine particulate matter (PM) based on high resolution time-of-flight aerosol mass spectrometric (HR-ToF-AMS) measurements at the HKUST Supersite in Hong Kong" *by* Y. J. Li et al.

Anonymous Referee #2

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General comments:

The manuscript reports the seasonal characteristics of non-refractory particulate matter with vacuum aerodynamic diameter less than 1 micron (NR-PM1) in Hong Kong based on the long-term observation (i.e. chemical compositions and size distribution) from an Aerodyne high-resolution time-of-flight aerosol mass spectrometer (HR-ToF-AMS). The sampling site (HKUST Air Quality Research Supersite) locates at suburban and coastal region of Hong Kong. Positive matrix factorization (PMF) and air

mass back-trajectory analyses are performed to study the potential sources of organic aerosol in four different seasons. To the best of my knowledge, it is the first study to report the seasonal characteristics of NR-PM1 measured by HR-ToF-AMS in Pearl River Delta (PRD) region that involves a rapid economical growth of South China in the last decade. The manuscript is well written and structured. Overall, I recommend this work to be published in Atmospheric Chemistry and Physics after addressing the specific comments below:

Specific comments:

1. Section 2.4, Page 20266, line 19-22: It is not clear how the initial factors from PMF analysis to be combined to give the final 4-factors solution. It is highly recommended to add a short description (either in the main text or Section 5 of supplement) to explain the approach used for factors combination, which can definitely help readers to follow the figures and tables in the supplementary material.

2. Section 2.4 (Figure S13 and Table S4): Hydrocarbon-like organic aerosol (HOA) mass spectrum obtained in summer has a much higher oxygenated organic signal at m/z 44 (CO_2^+) than those determined in other seasons shown in the current study and pervious studies worldwide. This also results in a higher oxygen-to-carbon ratio (O:C) of HOA in summer than other seasons. Since HOA is primary organic aerosols (POA) from local sources, I would expect the HOA mass spectral features and O:C ratios are very similar in all seasons. Please clarify.

3. Section 2.5: In the back-trajectory analysis, the authors mention the evaluation criteria that local emitted species (HOA and COA) should associate with short trajectories with clam wind (page 20267, line 23-24) and there are some discussions in the Section 6 of supplementary material. However, for the arrival heights of 300m, cluster 4 in all solutions has the highest HOA but a relatively low COA concentration among the clusters (Figure S20), highlighting the fact that those POA are not associated with the air mass in a similar manner. This may affect the interpretation of the cluster results of

back-trajectory analysis. Please clarify.

4. Section 3.3, Page 20272, line 6-8: Table S4 shows that SV-OOA and LV-OOA measured in summer are more oxygenated than those identified in other seasons. Therefore, in addition to a substantial SOA formation from BVOC, other oxidative aging mechanisms (i.e. heterogeneous oxidation of freshly formed and transported SOA) likely play a significant role to make the overall OA more oxygenated with low hydrogen-to-carbon (H:C) raito in summer. To illustrate this concept, it is recommend adding the SV-OOA and LV-OOA data in each season to the V-K diagrams.

5. Section 3.4: Figure 6 b-1 shows that SV-OOA mass loading become much higher in the later period of summer, which is very different to the earlier period of summer and all other seasons. Is it a typical observation in summer? If yes, the authors should provide a more detail discussion on that period in the revised manuscript.

6. Page 20274, line 1-4: As mentioned in this manuscript, COA and HOA are POA from local emissions. It is not clear how meteorological parameters and air mass trajectory influence the seasonal trend of those POA in different ways. Please clarify.

7. Page 20275, line 12-24: What are the size distributions of Org 43, which is considered as one of the major fragment from the freshly produced OOA, in all clusters? Please discuss in the revised manuscript.

8. Page 20275, line 23-24: Similar to comment 4 above, in addition to the conversion of HOA to SOA (i.e. heterogeneous chemistry), SOA formation from gas-phase chemistry is also possible but it is difficult to differentiate the two pathways based on the AMS measurements.

Technical comments:

1. Page 20263, line 1-4: Please provide references to support these arguments.

2. Page 20265, line 13: Please correct the text to "...primary organic aerosols did not contribute significantly...".

3. Page 20266, line 2: Please change "equal to" to "can be estimated by".

4. Page 20269, line 6-8: Please provide references to support the argument about the air mass origin in different seasons.

5. Table 1: Please add a short description (e.g. marine, long range transported form North China, etc.) for each air mass cluster.

6. Figure 2: It is suggested to add the site information (i.e. urban, sub-urban, remote, etc.) in this figure. It makes readers easier to follow the discussions in Section 3.1.

7. Page 20272, line 11-13: Please provide references to support the argument about BVOC emission as a function of temperature.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 20259, 2014.