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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Regional Influence of Wildfires on Aerosol Chemistry in the Western US and Insights into Atmospheric Aging of Biomass Burning Organic Aerosol" *by* Shan Zhou et al.

Anonymous Referee #2

Received and published: 16 November 2016

General comments:

This manuscript reports HR-AMS measurements of fresh and aged biomass burning emissions observed from the Biomass Burning Observation Project (BBOP) field campaign in summer 2013. PMF analysis and other measurements were performed to investigate atmospheric chemistry of biomass burning organic aerosol (BBOA) in Western US. This study observed that all BBOA factors (BBOA-1, 2 and 3) composed of a larger fraction of high molecular weight organics compared to oxygenated organic aerosols factors (BL-OOA and LV-OOA). Thermodeunder measurements further suggested the presence of low-volatility BBOA in aged biomass burning plume, which is consistent to some recent literature. More importantly, a case study provides insight

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into the net production of organic aerosol mass due to atmospheric aging of wildfire plume, which is of great interest to the atmospheric aerosol community. The measurements and data analysis were well performed and the major scientific arguments are convincing. The manuscript is well organized and written in general. I recommend this manuscript to be published in Atmospheric Chemistry and Physics after addressing the specific comments below.

Specific comments:

1. PMF analysis, Line 149-156: It is uncommon to run PMF with inorganic components as those peaks could be too strong that drive the overall PMF solution. Therefore, it is recommended to better highlight the merits and rationales behind to include inorganic components in the PMF analysis, and briefly compare their existing PMF results to that without inorganic fragments.

2. Potassium detection, line 207-211: The author mentioned that the potassium signal was low throughout the whole period of study but it is more important to examine if the temporal variation of potassium correlates with those of the identified BBOA factors. In addition, potassium background in AMS data is high in general due to surface ionization of tungsten vaporizer. Please report detection limit of potassium and compared to the ambient data.

3. Ammonium level in the BB plume, line 235: Figure S7 shows that the concentrations of ammonium were much higher than that required to completely neutralize sulfate, nitrate and chloride when organic loadings were high (e.g. > 50 ug/m3) due to the presence of biomass burning plume. It is well-known that biomass burning can produce significant amounts of nitrogen-containing organics such as amine. Please discuss if the observed NHx fragments in biomass burning plume were due to the increased level of amine in particle phase.

Minor and technical comments:

1. Line 58-60: Please add the recent publication by Gilardoni et al. (2016) that reports SOA formation in the aged biomass burning emission through aqueous-phase processing.

2. Line 158: It is unclear whether time-dependent or average CE applied to the PMF results.

3. Line 167-169: Uncertainties of the mass fraction remaining (MFR) for each factor are increasing with the operating temperature of thermodenuder, especially for more volatile species. Please highlight the potential uncertainties in the revised version.

4. Line 345: It should be “Fig. 4i” instead of “Fig. 5i”.

References:

Gilardoni Stefania, Massoli Paola, Paglione Marco, Giulianelli Lara, Carbone Claudio, Rinaldi Matteo, Decesari Stefano, Sandrini Silvia, Costabile Francesca, Gobbi Gian Paolo, Pietrogrande Maria Chiara, Visentin Marco, Scotto Fabiana, Fuzzi Sandro, and Facchini Maria Cristina (2016). Direct observation of aqueous secondary organic aerosol from biomass-burning emissions. Proceedings of the National Academy of Sciences of the United States of America 113: 10013-10018.

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