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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Significant seasonal changes in optical properties of brown carbon in the mid-latitude atmosphere" *by* Heejun Han et al.

Anonymous Referee #2

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Han and coauthors describe off-line analysis of filter samples collected over four seasons in Seoul, Korea in order to investigate relationships between brown carbon (BrC) and water soluble organic carbon (WSOC) and how they change throughout the year. Potential sources are also discussed using complementary off-line techniques including high performance liquid chromatography (HPLC), excitation-emission matrix (EEM) analysis and isotope ratio mass spectrometry (IRMS). The seasonal behaviour of the relationship between humic like substances (HULIS) and WSOC is interesting, with a pronounced increase in the HULIS/WSOC ratio in the winter months. The authors propose that this pattern is due to more effective reduction of HULIS mas through photodegradation during atmospheric transport in the summertime when photolyis rates and photochemical activity are higher. The absence of a seasonal pattern for potassium, in

particular adds weight to the argument that the HULIS/WSOC ratio seasonality cannot be explained only by changes in biomass burning source contributions throughout the year. Although levoglucosan exhibits higher wintertime values, this tracer can also be degraded through photochemical processing. Overall I find the manuscript to be well written and structured and only have some minor comments:

In the Introduction it is mentioned that "the origin of BrC is often attributed predominantly to HULIS". It would be helpful to discuss known sources of HULIS here.

Through EEM analysis, the extracted HULIS component agreed temporally with the extracted HULIS concentration as shown in S4. How do the other extracted EEM factors agree temporally with HULIS concentration? If the agreement is strong between all three factors, then it is likely that they are associated with the same source. If C2 is characterized by tryptophan then is vegetative debris a likely source for this factor? Are C1 and C3 interpreted to have the same source but differ only in their EEM characteristics? This section (3.1) could be clearer.

Either in the Introduction or Discussion it would be helpful to discuss the findings here in the context of previous on-line measurement studies that have observed similar photodegradation of brown carbon from biomass burning sources during atmospheric summertime transport, for example (Forrister et al., 2015; Selimovic et al., 2019; Healy et al., 2019).

Fix error in Formula 1

In Figure 3 many of these correlations are referred to as 'good' when 'moderate' would be more appropriate.

Line 154: "originates"

Define "RU"

Line 186: What is the likely source of the non-crustal V- oil combustion, shipping ? It would be useful to discuss.

Line 195: Define C3 plant-origin materials

Line 209-210: The last line of this paragraph is unclear and should be rephrased.

Line 244: Remove “followed”

References

Forrister, H., Liu, J., Scheuer, E., Dibb, J., Ziemba, L., Thornhill, K.L., Anderson, B., Diskin, G., Perring, A.E., Schwarz, J.P., Campuzano-Jost, P., Day, D.A., Palm, B.B., Jimenez, J.L., Nenes, A., Weber, R.J., 2015. Evolution of brown carbon in wildfire plumes. Geophysical Research Letters 42, 4623-4630.

Healy, R.M., Wang, J.M., Sofowote, U., Su, Y., Debosz, J., Noble, M., Munoz, A., Jeong, C.-H., Hilker, N., Evans, G.J., Doerksen, G., 2019. Black carbon in the Lower Fraser Valley, British Columbia: Impact of 2017 wildfires on local air quality and aerosol optical properties. Atmospheric Environment 217, 116976.

Selimovic, V., Yokelson, R.J., McMeeking, G.R., Coefield, S., 2019. In situ measurements of trace gases, PM, and aerosol optical properties during the 2017 NW US wildfire smoke event. Atmos. Chem. Phys. 19, 3905-3926.

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