Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2021-174

Anonymous Referee #2

Referee comment on "On the use of reference mass spectra for reducing uncertainty in source apportionment of solid-fuel burning in ambient organic aerosol" by Chunshui Lin et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-174-RC2, 2021

Lin et al. present an interesting analysis of the contributions of solid fuel combustion for heating to PM levels in Dublin. PMF ME-2 modeling is applied to observations from an ACSM using two approaches (conventional "a" value and limits approaches) to assess differences and uncertainties in resulting source apportionments. Both the study findings re: the importance of solid fuel combustion as an evening PM source and more methodological findings re: the ME-2 approaches will be of interest to AMT readers. I have a number of comments for the authors to consider:

- Line 23: It would be better here to refer to normalized peak intensities
- Line 25: It would be better to refer to Positive Matrix Factorization (PMF) analysis using the Multilinear Engine algorithm (ME-2)
- It would be helpful for the authors to provide more detailed information about the fuels burned. For example, there are many types of wood. What wood type(s) are burned in Dublin and what type(s) were used in stove testing? How about peat?
- Line 87: chloride in biomass burning PM is often present as KCl which vaporizes slowly on the AMS vaporizer, requiring a non-standard treatment of the AMS data. See, for example, the SI in Lee et al. (2010) A*erosol Sci. Tech*.; doi: 10.1080/02786826.2010.499884. How was this issue accounted for in ACSM processing for the Dublin study?
- I would like to see a more robust analysis of the comparison between the study site PM1 data and the EPA Ireland PM2.5 site data. Only an R-squared value is given. I suggest adding a scatter plot to SI and discussing not just the correlation but also the slope and intercept of the relationship between the PM1 and PM2.5 measurements. High correlation does not necessarily imply similar PM values at the two sites, just similar temporal variability. Are there other Dublin PM data that could be used to look beyond two locations (e.g., Purple Air monitors) to make a more general assessment of urban PM spatial variability?
- m/z 60 in the AMS comes from multiple anhydrosugars, including levoglucosan, mannosan, and galactosan – and probably from other similarly structured molecules, too (see, for example, the Lee et al. (2010) paper). This should be stated in the manuscript. Levoglucosan is produced during combustion of cellulose. Mannosan and galactosan come from pyrolysis of hemi-cellulose. The authors should also point,

therefore, to the combined fuel content of cellulose and hemi-cellulose, in discussing relationships between fuel and m/z 60.

- Line 173: the text in this line needs to be corrected. I think an extra "m/z" was inadvertently included.
- Line 175: Please define your term **difference ratio** mathematically in the text.
- 2nd half of P. 6: Discussions here about reduced fractional abundance of certain ions are oversimplified. Since f60, for example, refers to the fractional abundance of m/z60, a reduction in f60 is expected when the amount of its solid fuel precursors (cellulose + hemicellulose +?) decreases ***more than*** the amount of precursors for other m/z ions observed in the AMS. The same is true for the fractional abundance of PAH-related fragments.
- The diurnal cycle of secondary inorganic species (ammonium, sulfate, nitrate) in the ACSM obs and the source profiles is interesting. Can the authors say more about the origin of these secondary components? Does a combination of ammonia emissions from the solid fuel combustion and lower evening temperatures drive up ammonium nitrate formation in the evening? How much primary sulfate was observed in the stove emissions?
- page 8: In addition to the daily breakdown of OA contributors, please provide the breakdown for the evening period when stove emissions dominate.
- Lines 272-273: Please add a citation to the statement regarding CO2 capture during biomass growth.
- Lines 283-284: I think the authors mean to say "Therefore, extending the ban ***to*** the use of peat and wood…." As written it sounds as if they are referring to extending an existing ban on peat and wood burning when I think they mean to suggest extending the current ban on burning smoky coal to also forbid peat and wood burning.