Final Author Reply to the Editor

RC1

Comment

Lines 148-150: it's probably worth showing this result – the time-invariant parameterization – in a figure (probably in the supplemental), and comparing the numbers against the EPA parameterization.

Author's Response

We thank the reviewer for this comment and agree that such a comparison is useful. The appropriate figure will be added to the manuscript to address this.

Author's Changes in the Manuscript

Figure S3 was added to the supplemental and referenced in the main text. This figure shows the equivalent of Figure 4 for the version of the calibration with time-invariant parameters and compares it to the EPA and time-variant calibrations.

Comment

Lines 168-169 and 192-194: Potential examples of these different "physical processes" (which are probably better described as different "aerosol properties") should be given. These are mentioned later in the paper (section 3.5) but some mention here would be useful. In particular, possible reasons for these being more important in LA than in the Bay Area should be given.

Author's Response

We thank the reviewer for their comment. We do discuss several examples in section 3.5, though we refrain from attributing any specific reason to the LA data as we have no backing for any particular one to be true (the same is true for the non-gaussian distribution of errors the reviewer references as well). However, we can modify the manuscript to provide some speculation and point the reader to the discussion in section 3.5.

Author's Changes in the Manuscript

"This suggests that there are other processes and aerosol properties at play unaccounted for by this calibration, as discussed further in Section 3.5."

"This could indicate that in Los Angeles, factors unrelated to hygroscopicity are being captured in the empirical calculation of κ. These factors could include sub-seasonal changes in refractive index or particle size distribution, though further study is needed to provide evidence for these."

Comment

Lines 183-185: is it possible to find out if these different sensors were from the same manufacturing/calibration batch by Plantower? One could imagine that sensors calibrated together at the factory would have better agreement than ones that were calibrated separately.

Author's Response

We thank the reviewer for this note. In the original analysis we were looking at sensors from the same batch. We have switched the data to include sensors from two different batches for a more robust assessment of the agreement between sensors.

Author's Changes in the Manuscript

Figure S6 (was S5 before) has been updated with the new data and the caption is updated and explicitly states that the sensors come from two batches.

Comment

Lines 220-221: The text says this approach captures changes in particle composition if it "changes slowly and smoothly", but this is only true for about seasonal changes, or when there is continual calibration against regulatory grade monitors. For the main use-case of this approach – calibrating over 1-2 years then applying the calibration to deployed sensors (as in Figure 7) – year-to-year trends in particle composition (even if they are slow and smooth) are not captured. The text should be edited to reflect this.

Author's Response

We thank the reviewer for this comment. The use case of this approach might not have been expressed as clearly as intended. Calibrating a network of sensors in an area with this calibration scheme would involve having one sensor co-located with regulatory-grade instruments to generate coefficients, which could be updated annually to account for year-to-year trends, as is done in this work. Those coefficients could then be applied to the entire region given that particle composition is relatively uniform in that domain. This will now be made more explicit in the manuscript.

Author's Changes in the Manuscript

Modified Sentence: "Additionally, the method assumes that particle composition is uniform across the domain and changes slowly and smoothly over the course of a year to reflect seasonal changes in particle size and composition. As such, non-seasonal changes in particle size and hygroscopicity are not properly corrected by this method."

Modified Sentence: "There are also potential errors associated with slow drift that can occur over multiple years. Due to changes in PM sources and relative source loadings, PM composition is not expected to be the same year-over-year, so periodic recalculation of the coefficients is likely necessary. If one sensor in a network is permanently co-located with a regulatory instrument, it can be used to update the coefficients year to year for all sensors within its region. Though sensors can drift and degrade over time, current literature finds that these sensors tend to be stable for at least 3 years (deSouza et al., 2023)."

Comment

Figure S1 and S6: typo in legend.

Author's Response

We thank the reviewer for this note.

Author's Changes in the Manuscript

The spelling errors in the two figure legends (now figures S1 and S7) have been corrected (empircal to empirical).

Editor Comments

Comment

Pittsburgh is misspelled (missing "h" at the end) in line 54.

Author's Response

Thank you for this note.

Author's Changes in the Manuscript

The spelling error was corrected.