

Interactive comment on “Long-term evaluation of air sensor technology under ambient conditions in Denver, Colorado” by Stephen Feinberg et al.

Stephen Feinberg et al.

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Received and published: 28 June 2018

Reviewer Comment 1: As there was three of each sensor, I would have liked to see some discussion on the precision of the each sensor.

Author Response 1: We have added Root Mean Square Coefficient of Variation to Table 3 to represent precision and a general description of overall results to section 3

Reviewer Comment 2: Furthermore, throughout Section 3 I would have liked to have seen more discussion on the results and how they compare to previous studies in the literature.

Author Response 2: We have discussed some high-level comparisons with some other studies and programs in Section 4. Our study does not compare directly with other

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studies performed, as the sensors are likely to have different responses in different environments and exposure to different aerosol compositions and size distributions.

Reviewer Comment 3: Section 3: Did you see any evidence for baseline drift in any of the sensors over the 7 month period? For example, did the correlation/slope with respect to the reference instrument change in the first month compared to the last? It would be good to include some discussion on the how the different sensors performed in this regard, as in the literature

Author Response 3: We did not see significant baseline drift over this period of time. If there was any significant change in comparison, it resulted from sensor failure. We have added a statement to Section 3 regarding baseline shift.

Reviewer Comment 4: Page 11, line 246: To me, the TSI Air Assure was the best performing sensor in terms of accuracy relative to reference, based on table 3. Therefore, I would be interested to know if there was any humidity effects observed in this instrument like was observed for the OPC-N2 and Airbeam (fig 3). Was it just these two sensors that appeared to be affected by humidity?

Author Response 4: The TSI AirAssure did not have RH effects to the same extent as the OPC-N2 and Airbeam. Similar plots are provided in the supplemental information

Reviewer Comment 5: Page 11, line 267: My take on Fig 4a is that was the sensors that report particle counts that best captured the diel pattern rather than those that report particle mass concentrations, despite the reference instrument also reporting particle mass concentrations. Perhaps the authors could comment on this.

Author Response 5: These particle count sensors do appear to exhibit the most similar diel patterns., particularly the TZO and Airbeam. We will highlight this; however, we don't have any explanation as to why this may be the case based on the data we've seen in the study.

Reviewer Comment 6: Page 12, line 284: I would be good if the authors could briefly

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indicate what was tried to explain why the PM sensors better captured the wind direction trends compared to the diel as knowing what was not the cause will help avoid duplication of effort in future studies.

Author Response 6: We attempted to explain the differences by examining potential daily humidity and temperature effects, which are likely stronger associated with time of day than wind direction. However, these were not able to explain the differences between the ability to reproduce the different trends. We have added a sentence discussing using RH and T to try to explain differences in trend replication

Reviewer Comment 7: Figure 5: it appears that PM sensors had a wide response range at a north wind direction unlike other direction, that wasn't observed for the ozone sensor. Was there a local source in this direction that may affected the sensor response? This may help understand how aerosol composition affects the sensor reading.

Author Response 7: The highest concentrations did come from the north where there is a railyard and likely other sources. However, we have no evidence from the data alone to suggest that particles from these sources are measured or reported differently, and any conclusion based on those sources would be speculation. It is also important to note that this may result to either muted or enhanced sensor response when exposed to higher concentration, when compared to reference measurements.

Reviewer Comment 8: Page 14, line 301: Why were the OPC-N2 and Airbeam the only sensors to the right of reference in Fig 6? Is due to instrument response time or other artefacts?

Author Response 8: We expect this is due to measurement noise in these sensors, where sensors to the left of reference may have slower response times.

Reviewer Comment 9: Table 2: Please include the data capture for the OPC-N2 in this table

Author Response 9: Added OPC-N2 and other missing sensor measurement capture

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to Table 2. The OPC-N2 data is footnoted OPC-N2 measures at a different frequency (10s) than the other sensors (1 min), but the summary results are still based on 1-minute averages.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2018-12, 2018.

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