Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2019-501-AC3, 2020

Atmospheric Measurement Techniques
Open Access
Discussions

Interactive comment on "Mobile-Platform Measurement of Air Pollutant Concentrations in California: Performance Assessment, Statistical Methods for Evaluating Spatial Variations, and Spatial Representativeness" *by* Paul A. Solomon et al.

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Received and published: 24 March 2020

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Responses to Anonymous Referee #2

Thank-you for your constructive review. We summarize our responses to your questions and suggestions here. We will add these responses at appropriate places in the revised manuscript or in the supplement.

1. There is no discussion or comparison between Aclima instrumentation and capabilities to other sensors in the market (e.g. Purple Air), including technical and accuracy information. Have the authors done any comparison studies at similar times and locations to demonstrate Aclima outperforming other sensors?

Our study used only measurements from research-grade instruments (lines 78 – 79) but we have conducted sampling efforts using sensors during the past year. When we analyze our sensor data, we will attempt to compare them with other sensor-based studies. For this manuscript, we focused on comparisons to EPA-approved equipment at stationary sites in Los Angeles. We will add a table of technical specifications for our instruments. The instrumental methods, resolution, ranges, and response times are listed in the Lunden and LaFranchi (2017) citation and can be added to our supplement.

2. This analysis provides information on mobile air quality monitoring in a certain environment. The measurements represent air quality in urban locations near roads and that covers certain points/line measurements yet does not create a continuous air quality map.

Please see the proposed new paragraph in our "General Response" reply.

3. PN is measured by the Aclima platform for different size bins. It is not clear how this measurement is evaluated, as the EPA monitors particulate matter mass concentration?

We were not able to do an "apples-to-apples" field comparison to EPA monitors, as the reviewer notes. Nor could we do laboratory zero and span checks, as was done for the gas instrumentation. Instead, PN measurements were evaluated as described in lines 148 – 153.

4. It is not clear why the distance between cars is important in the discussion.

We will add text to discuss the utility and limitations of considering intervehicle variability versus distance. Please see also the proposed new paragraph in our "General Response" reply. Because our study was conducted as a series of short-term campaigns in several widely separated geographical areas, we did not attempt to develop pollutant maps that represent long-term concentration averages and which could be used to characterize spatial variations. Our study was conducted as a series of geographically separated sampling campaigns between May 2016 and September 2017, generally lacking the number of repeated driving routes needed to generate stable, long-term pollution maps. Instead, we used statistical metrics, such as FAMD, to characterize the spatial heterogeneity of pollutant concentrations. Because vehicles sample different road segments on different days and at different times of day, we compiled time-synchronized differences between the concentrations measured by two cars to remove the confounding effects of day-to-day and diurnal variability. Random differences between vehicles, such as short, intermittent exposures of one car or the other car to a high emitter, are averaged out in the FAMD statistic. In contrast, systematic car-to-car differences yield higher FAMD values. Systematic differences could occur if the instrumentation in one car was biased relative to the other car. After eliminating that source of systemic car-to-car difference through the side-by-side sampling comparisons, we can conclude that larger FAMD values (e.g., > 0.20 or 20%) represent spatial heterogeneity, e.g., due to the two cars sampling different neighborhoods (as indicated in Figure 6a or in Figures S6 and S10). Considering the relationship between FAMD and distance on a small (1 – 10) number of days provides a measure of the spatial scales over which concentrations changed by more than a specified amount (e.g., 20%). This is a useful metric for evaluating the spatial scale of representativeness of stationary monitors, for example. The relationship between FAMD and distance does not, of course, indicate which neighborhoods experienced higher pollutant concentrations. For that purpose, we developed the visualization shown in Figure 6.

5. All the measurements have been done for periods of several weeks and there is no 'long-term' monitoring campaign presented (e.g >1 year) that captures, for example, seasonality. This limitation of measurements period should be addressed in the discussion.

Please see our "General Response" and our response to #5. We will add both to our revised manuscript.

6. A description of the climatology at the different measurement locations is missing (e.g. temp, RH, and wind profiles, built area, type of road, no. of cars etc.). That can help understand some of the results.

By focusing on time-synchronous car-to-car measurement differences, we ensure that both vehicles are experiencing the same meteorological conditions. The figures and photos (Figures 6 and 7; Figures S3 – S4, S6 – S10) provide an indication of road density, built area, and proximity of driving routes to freeways. Population data for cities in the San Joaquin Valley are provided in lines 437 – 440 to complement Figure 7. Figures S11 – S15 indicate when the driving routes were in San Joaquin Valley cities and when they were on freeways. We will add text to better highlight how this information was used, or can be used, to help interpret the results.

7. The authors should do a better job in stating the limitations of the Aclima platform in this study set and in general.

Please see our "General Response."

8. Did the authors consider validating their results with continuous modeled data (CMAQ)? Or satellite data?

Because we focused on interpreting the results of a series of short-term campaigns, we did not compile pollution maps. Comparison of pollution maps generated from stable, long-term data to satellite data or modeling predictions could indeed provide complementary corroborating results. For such a comparison, one challenge would be the incommensurability of the fine-scale mobile data and the coarser spatial scales of gridded modeling output or satellite imagery. The mobile data would need to be aggregated to the coarser scales for the comparison. Presumably, if results on consistent spatial scales were reasonably consistent, it would then be valuable to compare mobile monitoring maps generated from spatially-aggregated and -disaggregated data to better understand what is gained by the high-resolution mobile sampling.

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