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Atmospheric Measurement Techniques 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.

Paul A. Solomon et al.

charles.ld.blanchard@gmail.com

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Thank-you for your reviews, which will help us improve the manuscript. We will incorporate responses to all questions and suggestions in a revised manuscript. We will also provide separate responses to each individual review.

In all three reviews, several questions occurred about two topics: measurement limitations and the statistical approach of differencing time-synchronized concentrations.

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Discussion paper

We will address these questions at appropriate places in the manuscript. We will also provide further context and explanation by expanding the brief overview description of the study and study objectives that appears at the end of the introduction (lines 78 – 100). We will add the following paragraph at line 77.

The mobile sampling discussed here and in Apte et al. (2017) is limited to weekdays between ∼9 a.m. and 5 p.m. Sampling is necessarily conducted along roads and streets. Depending on the number of repeated driving segments, vehicles sample different road segments on different days or at different times of day. These limitations are important considerations for studies whose goal is to develop pollutant maps that represent long-term concentration averages, and which are intended to correctly characterize spatial variations at a desired spatial scale. Our objectives are different, however. The principal objectives of our study are to examine the capabilities of research instruments when placed in stationary and moving vehicles, to compare our measurements with those obtained from stationary air quality monitors, to evaluate driving and sampling strategies, and to develop statistical methods that account for sampling limitations. Limitations that are specific to our study are that (1) it was conducted as a series of geographically separated sampling campaigns between May 2016 and September 2017, generally lacking the number of repeated driving routes previously used to generate pollution maps (Apte et al., 2017; Messier et al., 2018), and (2) no collection of driving routes completely covered any specific geographical domain (e.g., San Francisco or specific neighborhoods therein). The results presented here therefore focus on measurement and methodological questions that can be addressed with data available from the individual sampling campaigns. A set of research questions was developed initially and was then used to design the individual sampling campaigns. In analyzing the results, a need arose to distinguish between temporal variability (due, e.g., to sampling different places at different times) and spatial variability. Statistical methods were therefore developed to characterize spatial heterogeneity within and between neighborhoods by utilizing time-synchronized differences in the pollutant concentrations that were measured by different vehicles. Due to limited repeated sampling of individual

road segments, our estimates of spatial heterogeneity do not in themselves identify specific spatial coordinates of long-term high and low pollutant concentrations. However, areas with high spatial heterogeneity indicate where more intense future sampling would be warranted. Additional statistical methods were developed to demonstrate the use of short-term campaign measurements to characterize intermediate-scale (1 km) spatial variations of pollutant concentrations.

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