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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.

Anonymous Referee #1

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General Comments It is clear that a lot of work and effort was put into this manuscript and the authors did a nice job explaining the statistical tests used to assess data comparability. I especially appreciate the documentation of instrument bias and precision and how that was used to determine when spatial differences were present vs. likely not. While it is the opinion of this referee that additional information and clarifications are needed (see Specific Comments), the authors have put forth a worthwhile method to assess spatial representativeness of air pollution data and the scientific community

would benefit from having this manuscript published.

Specific Comments 1. Methods: some information on the cars should be included, not just referenced in another paper. Were the cars' engines running while parked (e.g., in the garage, near stationary monitors, etc.)? What was used to power the instruments? 2. It is great that the inlets were designed to minimize self-sampling, but were additional steps taken during post-processing to remove potential periods of self sampling, or of sampling the Google car in front? 3. It would be good to document the limitations of the study (e.g., no overnight monitoring on roads or in early morning when the boundary layer is likely at its lowest). 4. Table 1 - was winter included in the San Joaquin Valley measurements (Nov '16-Apr '17) or was it just fall and spring? 5. Section 2.2 - were the cars parked on the roof of the parking structures or on a lower level? Depending, this could explain why GPS uncertainties were not comparable to manufacturer specs at times. Tall buildings nearby (if present) would also impact GPS performance. 6. Lines 286-289: the closely-spaced moving vehicle condition makes it highly likely that the following car is measuring exhaust emissions from the lead car. This point should be mentioned in the manuscript. Did you try to correct for this? Why not drive side-by-side (road permitting)? 7. Could you please provide a list or table in the SI with the manufacturer and model of all instruments used in the study along with response time and measurement frequency. Even if this information was referenced in another paper, it should be reported here. 8. Did you sync all instruments to the same time standard before measurements? Did you check instrument times at the completion of each day's measurement to quantify time drift? At measurement frequency of 1 Hz, time drift can have a major impact on data comparison. These details should be included in the methods section. 9. By comparing 1-min averages, which I understand is important in order to maintain higher spatial resolution, how are you able to separate out the spatial trends due to differences in regional concentrations as opposed to differences in measurements due to some very localized conditions (e.g., driving behind a truck for a short period of time with one Google car but not the other over the same time period)? Would some other comparisons be more appropriate, such as a

60-second moving 5th percentile, or something comparable, to smooth out hyper-local concentrations? 10. I am struggling to understand why plotting the measurements against distance between either the cars or between car and stationary monitor is the best way to present the data. Had the cars been driving different routes than the ones presented, the plots would be completely different. The distance between the cars is not driving the differences observed, it is the difference in the environments of the two cars at any given time. For example, the cars could both be in heavy traffic at 50 km away from each other (thus mean differences in concentrations are low), then at 75 km distance one car is still in heavy traffic while the other is in a quiet neighborhood away from highways (thus mean differences in concentrations are high). For example, Figures S16 and S17 are interesting, but it would be more informative to provide information on where each of the cars are (e.g., land use, traffic conditions, major roadway, etc.) when FAMD is higher or lower irregardless of the distance between the cars. Are all points where the cars are X distance away from each other aggregated together even if the positions were discontinuous? If so, I do not know how one could interpret this plot. 11. Section 3.6 (lines 476-479): An FAMD of 0.5 seems high to conclude that a reference monitor is representative of a neighborhood scale area.

Technical Corrections 1. Figure S3: The figure overlaps text. 2. Line 265: Remove "the" before "Los Angeles". 3. Line 299: Please clarify if minimal traffic was observed adjacent to the site during measurements or not. As written it is not clear if expectations were met or not. 4. Results & Discussion: Consider not using questions for headings.