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Atmospheric Measurement Techniques Discussions

Interactive comment on "Application of mobile aerosol and trace gas measurements for the investigation of megacity air pollution emissions: the Paris metropolitan area" *by* S.-L. von der Weiden-Reinmüller et al.

Anonymous Referee #1

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This is close to being a very good measurement methods paper. It does a good job presenting stationary and on-road data from two high quality van mounted mobile laboratories equipped with interesting suites of reasonably fast response trace gas and fine particle measurement instruments that were simultaneously deployed to characterize the megacity pollution plume of the Paris metropolitan area. Three generic types of urban pollution plume characterization measurements are discussed and illustrated, cross- sectional plume transects, axial transects along the plume length and stationary measurements relying on wind direction changes that sweep both plume and ambient

background air masses over the measurement site. It contains valuable illustrations of both the considerable strengths and some unavoidable weaknesses of mobile lab urban plume measurements. There are also useful discussions about planning and executing ambient pollutant distribution measurement strategies. The important discussion of methods to identify and remove data dominated by nearby emissions sources so they don't unduly corrupt studies of larger scale ambient background variations should be moderately expanded and made less pessimistic.

Several interesting trace gas and fine particle trends are presented in four complex data plot figures, but there is no quantitative attempt to demonstrate whether and/or how the various pollutant concentrations trends are related. While this is primarily a measurements techniques manuscript, if some of the data presented were actually analyzed, at least for a few illustrative examples, the scientific value of the paper would be greatly enhanced. For instance, other investigations of megacity plumes have used combinations of fixed site, mobile laboratory and aircraft measurements to demonstrate that odd oxygen ([Ox] = [O3] + [NO2]) production is closely correlated with oxidized secondary organic aerosol production. The two mobile labs described measured both components of Ox in the Paris plume and have computed PMF oxidized organic aerosol (OOA) components from their on-board aerosol mass spectrometer data for axial plume transects and/or stationary plume intercepts, but this paper does present plots of [Ox] versus [OOA] to determine if key photochemical products in the Paris plume behave like other sampled megacity or near-megacity plumes. As another example, Figure 4 presents plume axial and background plots of hydrocarbon-like organic aerosol (HOA), particulate sulfate (SO4=) and black carbon (BC). Plots of [HOA]/[BC], as well as [OOA]/[BC], and [SO4=]/[BC], as a function of plume axial distance (or transport time) and their comparison with the same ratios in the out-of-plume background ambient might tell a very interesting story. They might reveal in-plume chemical conversion rates of primary pollutants like HOA and SO2 and how fast their secondary products reach typical background levels, assuming that deposition, not heterogeneous oxidation, is the primary BC loss process. I'm sure the distinguished

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authors of this manuscript could identify other illustrative mobile lab data analysis opportunities to help convince their readers of the value of their efforts.

There are some minor flaws in the current manuscript that deserve attention:

Frist, I believe that Figure 1 introduces an unfortunate nomenclature choice. While the yellow arrows, representing cross plume trajectories are reasonably labeled "cross section" measurements (should be cross-sectional if you want to use the adjective form) are reasonable, the black double ended arrow along the plume's axis labeled "radial measurements" is misleading. While these transects are "radial" with respect to the city's geometry, they are "axial" with respect to the pollution plume's flow geometry, which is the natural reference frame for the reported measurements. Transects along the plume's axis should logically be called "axial;" radial plume measurements are those already termed "cross section." I suggest that axial replace radial everywhere in the manuscript. This includes the abstract, where "radially away from the city center," should be changed to "axially along the flow of the city's pollution plume."

Second: The important discussion of methods to identify and remove data dominated by nearby emissions sources in section 4.2 fails to clearly explain that in most mobile laboratory sampling modes pollution exhaust plumes from motor vehicles, and even many industrial point source emission plumes, produce data spikes lasting a few to a few tens of seconds that are much shorter in duration than intrinsic variations in background pollution concentrations. If pollutant sensors with real-time ($\sim$1s or less) response times are deployed these nearby pollutant source data spikes are relatively easy to recognize and remove. More importantly, they can be (and often are) separately analyzed to yield very useful emissions data, such as fleet averaged fuel-based pollutant emission indices for on-road motor vehicles or pollutant emission fluxes from individual fixed site point sources like factories, commercial operations or road maintenance activities. Of course, if traffic is too heavy or moving too slowly, especially in low wind conditions, it becomes too difficult to remove the influence of nearby discrete pollution sources and ambient background data has to be designated as contaminated,

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as noted in the manuscript.

Third, the current manuscript also needs some moderate copy editing beyond the “axial” for “radial” terminology swap noted above. For instance, “aircrafts” appears in several places (e.g. page 4 - line 8, page 7 – line 2, and page 9 – line 6); however, the plural of aircraft is aircraft. There are also problems with prepositions; for instance: on page 13 - lines 19 and 26, where “with about” would normally be “at about;” and page 25 – line 24, where distance “to” should be “from” and “cross sections in” should be “cross sections at.” Also on page 25 – line 24, as noted above, “cross sections” is more properly “cross sectional transects.” Please note that I recognize the manuscript is generally well written and its English usage and grammar is far better than any manuscript that I could produce in either German or French.

After some modest condensation, clarification and copy editing the current manuscript will be a very good Atmos. Meas. Tech. paper. Adding a few selected analyses illustrating the scientific value of the some of the data presented would, in my opinion covert it to an excellent Atmos. Meas. Tech. paper. I recommend publication after the author’s have considered and addressed the suggestions listed above.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 7659, 2013.