

## ***Interactive comment on “Use of a mobile laboratory to evaluate changes in on-road air pollutants during the Beijing 2008 Summer Olympics” by M. Wang et al.***

**Anonymous Referee #1**

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General Comments: This manuscript reports the use of mobile laboratory and its associated instruments for evaluating the effect of air pollution control measures during the Beijing 2008 Summer Olympics. The premise of the measurement campaign was to use a mobile laboratory to circumnavigate the city of Beijing to investigate whether the reductions in vehicle use and relocation of industrial facilities improved the local air quality during the 2008 Summer Olympic games. To accomplish this, measurements were obtained prior to, during and after the Olympics by driving the mobile laboratory on a major highway, 4th ring road, that encircled the city during a prescribed period each day. These measurements are reported and discussed with respect to the vehicle use restrictions that were imposed. The concept of using a mobile laboratory containing a

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suite of high time response instrumentation to characterize the air pollution in megacity environment with the goal of evaluating the impact of short-term pollution strategies is certainly a topic of significant interest to ACP readership. Unfortunately I find that the current manuscript does not meet the standards of set forth by this journal. I have several major concerns that are detailed below. I cannot recommend this manuscript be published in ACP without extensive revision.

1) The present manuscript contains a number of referencing errors. Because these occurred on the first two pages there may be more, as I am not familiar with all the references cited. The Rogers et al. 2006 reference on line 14 page 12859 describes the use of a PTR-MS for on-road characterization of VOC emissions from in-use vehicles and has nothing to do with fine PM. The mobile lab studies described in Jiang et al. 2005, Rogers et al. 2006 and Zavala et al. 2006 all describe measurements made in Mexico City. 2) The authors need to more clearly describe the temporal nature of their measurements so that readers that not knowledgeable with on-road measurements can understand and critically evaluate the results. Statements such as that made on lines 28 and 29 on page 12860 “The temporal and spatial distributions of air pollutants within and around the city were characterized . . .” need to be justified. Measurements made on-road reflect the interception and detection of individual vehicle exhaust plumes superimposed onto the local ambient background. Vehicle density and velocity in conjunction with local wind direction dictate the frequency, magnitude and duration of the vehicle exhaust plume encounters. Measurements were conducted on what appears to be a heavy traveled roadway – several thousands of vehicles per hour. Given this sampling environment it seems certain that the measurements were dominated almost exclusively by emissions from nearby vehicles, potentially obscuring any information concerning the local, much less the regional, background. Some method of distinguishing between these direct exhaust measurements and those representing the ambient background must be made before the authors can substantiate their claim of characterizing the air pollution “surrounding and within the city”. The technique of using simple averages certainly does not adequately address this task.

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3) The description of the sample inlet system is insufficient to demonstrate how it works. The gas phase inlet, as described, appears to be an open tube that relies on the forward motion of the vehicle to push the sample gas through. Given the critical impact that sampling methodology has on the validity of any measurement, a more complete and thorough description of the inlet and its testing must be included. For instance, from what is described it is not obvious why the gas phase instrument don't simply pull sample through both ends of the tube. Given the apparent rudimentary nature of the sampling system, experimental characterization of its efficacy should be presented. A thorough description of how this inlet was modified when the mobile laboratory was parked for the inter-comparison study is also required. Self-sampling is a critical issue and is not eliminated simply by vehicle motion, tail winds and convection currents created by rapidly passing vehicles can also produce self-sampling. These concerns should not be simply dismissed, a well designed mobile laboratory experiment will have specific methods to recognize when its own vehicle exhaust and/or generator emissions are contaminating its sampling system and proven protocols for recognizing and either rejecting or correcting self-emission affected data. There certainly must have been times when the mobile laboratory was not operated at the stated 60 km/hr.

4) The virtue of making high time response measurements is in the ability to distinguish the proximity of the emission source. Any direct sampling of vehicle emissions will certainly lead to obvious correlations between compounds that known to be present in the exhaust. Conversely the lack of temporal correlations with combustion tracer species can be used to confirm the presence of solvent emissions. Daily averages might capture these events, but time series plots in conjunction with correlation scatter plots should be used to help validate or corroborate such an assertion. Vehicle exhaust plumes from passing traffic generally only last several seconds while the duration of solvent plume intercepts of the larger more dispersed solvent plumes should last sufficiently long for the temporal variability in the benzene and toluene responses to provide a clear distinction between vehicle exhaust and solvent emissions.

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Minor Comments:

1) The designation of LDV, MDV and HDV should only be used if the size of the vehicle reflects the type of engine. 2) The authors have contradictory statements: On line 21 page 12870, the benzene and toluene concentrations reported before July 20 indicate a B/T of 0.46. On line 22 page 12872 it states that prior to August 4th that B/T were lower with an average value of 0.26. 3) Section 3.6 This is the best section in the manuscript. It shows real data and describes how the temporal variability in the data was used to discriminate different emission sources.

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 12857, 2009.

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