

Interactive comment on “Design and application of a mobile ground-based observatory for continuous measurements of atmospheric trace-gas and criteria pollutant species” by S. E. Bush et al.

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General comments

This manuscript presents the development and use of a mobile laboratory for measurements of CO₂, CO, H₂O, CH₄, NO_x, O₃, aerosols as well as wind speed and direction and temperature. The need of such a platform is highlighted by the authors by identifying the shortcomings of urban emissions inventories in terms of their spatial and temporal resolution.

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The authors correctly identify a number of developments by several research groups. The key difference between previous platforms and the one discussed in this manuscript is the use of an extending mast to sample at different heights, unfortunately, this feature is not discussed in the results.

The results presented to illustrate the use of the platform focus on on-road measurements of CO, CO₂ and CH₄ in an urban area, a motorway section and at a wildfire site.

In general this article presents a valuable measurement platform but there are some issues with the manuscript that should be addressed before publication on AMT. Also, it would be useful to have access to a sample of the data generated by the platform as well as the scripts used to pre-process the raw data.

Specific comments

The description of the platform is comprehensive from a mechanical point of view but the description of the data flow is confusing. There are some instruments that log their measurements in their internal memories (Picarro, aerosol spectrometer) while other is logged to a laptop (weather station) and the rest to a datalogger (GPS, O₃, NO_x). Also, the sampling frequency of the instruments is different with some recording every second, others every 5 seconds and another every 10 seconds. In the text it is stated that:

Data streams were time averaged and synchronized, and standard corrected where appropriate (Picarro spectrometer data streams), using Matlab software (Mathworks, www.mathworks.com/products/matlab) (page 43 lines 17 - 19)

But there are no specifics about how this synchronisation was performed. Answers to the following questions would clarify this point:

- What was the **reference** timing source (master clock)?

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- How were the different streams synchronised?
- Was there any drift in the timing circuits of the instruments involved?
- How were the different response times dealt with? (specifically referring to the different sampling lines and flow rates as well as the internal response time of the instruments)

The second point is the lack of reference to the aerosol measurements. From the data presented it is not possible to evaluate if the selected sampling inlet for the aerosol spectrometer performs as expected (isokinetic). It should not be hard to obtain the data from the aerosol spectrometer and display it in conjunction with the CO/CO₂ data to evaluate its functionality.

Finally, the main improvement on previous mobile laboratories design is the addition of an extendible sampling mast but in the results there is no mention of this. It would be very beneficial to have data relating to multiple sampling heights as the authors claim this set up can obtain as well as demonstrate that the system can operate both as a mobile measurement platform and as a stationary sampling site.

Technical corrections

Throughout: The use of the word **tower** to refer to a stationary sampling site is confusing as tower is normally reserved to structures of several tens of meters high such as in flux measurement setups. I suggest using a more traditional wording such as "measurement site" or "stationary deployment" or "static site" ... etc.

Page 34, line 4: *surface 50m* not grammatically correct should be *lower 50m of the atmosphere*.

Page 34, lines 16 - 19: These sentences do not read well because the word *emissions* is repeated too many times.

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Page 36, lines 1 - 4: This sentence does not read well because the word *emissions* is repeated too many times.

Page 37, line 16: Both the SNIFFER and EMMA have been used in stationary, mobile and chase mode.

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