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Atmospheric Measurement Techniques Discussions

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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Referee comments are preceded with "RC" in the following text. Author response to referee comments are preceded with "AC" in the following text.

RC: General comments:

RC: 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

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this feature is not discussed in the results.

AC: We disagree that the key difference is the use of an extending mast to sample at different heights – that represents one difference among many depending on the platform type, comparison and setup – see paragraph starting P37L8 where this is addressed.

RC: 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.

AC: It is possible to have access to the scripts by contacting the authors.

RC: Specific comments:

RC: 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, NOX). 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: 1) What was the reference timing source (master clock)? 2) How were the different streams synchronised? 3) Was there any drift in the timing circuits of the instruments involved? 4) 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)

AC: We are willing to add the following information to the text:

(text to be added under section 2.1 of manuscript): Two cavity ring down spectrome-

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ters for measuring trace gas species were installed on the instrument tower. One measured CO2, CO, and H2O (Picarro model G1302, Sunnyvale, CA) at approximately two second intervals, and the other CO2, CH4, and H2O (Picarro G1301) at approximately three second intervals. Additional technical information for these systems can be found in Crosson (2008). Both instruments were plumbed to sample air from a continuous stream of either atmospheric air, pulled from an inlet mounted outside the vehicle on top of the sample mast, or from known calibration standard tanks.

(text to be added under section 2.4 of the manuscript): P 43 L17: ...collected and stored on a laptop computer. Data streams collected on different platforms and frequencies were synchronized based on the user's cell phone time. Discrepancies between each instrument time and the user's cell phone time were recorded before and after each transect. During any given transect (up to 12 hours), no appreciable instrument time drift was observed. We corrected each data stream for time lag against the user's cell phone clock before time synchronization with MATLAB software (Mathworks) that linearly interpolated data and resampled data at a uniform 5 s interval. We matched the CO2 data streams with correlation analysis to account for different response times between the two Picarro instruments. Similarly, we used GPS location to check synchronization of Garmin and Airmar data streams.

RC: 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.

AC: Although the lab is equipped with an isokinetic sampling probe for mobile aerosol measurement capability, it is not currently mounted and we only ever used that sensor while stationary.

RC: Finally, the main improvement on previous mobile laboratories design is the ad-

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dition 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.

AC: We do not agree that the telescoping sampling mast represents the defining novel characteristic of this measurement platform – see previous comment.

RC: Technical corrections:

AC: We are willing to incorporate the suggested technical corrections that follow.

RC: 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.

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

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

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

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

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 33, 2015.