

Interactive comment on “A new mobile and portable scanning lidar for profiling lower troposphere” by C.-W. Chiang et al.

Anonymous Referee #1

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General Comments

This manuscript provides a description of a new instrument for profiling the lower troposphere. The instrument choice and methodology employed is of interest to the wider scientific community and worthy of publication.

There are some specific issues to address, namely the understanding of the physical processes in the boundary layer that are being measured. There is no discussion of the potential impact of multiple scattering with a laser divergence of 0.5 mrad. What is the telescope FOV? Additional information is also required on the data processing, as this system is not identical to the system referred to in previous papers by the authors. For example, deriving extinction profiles from non-vertical scans are subject to additional

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assumptions.

The manuscript would be improved with editing from a native English speaker, but is otherwise written in a clear and logical style.

Specific comments —

Page 168, line 20: Here it is stated that the laser repetition rate is 10 Hz, but Table 1 states 20 Hz.

Page 172, section 3.3 The SNR of the system depends on the amount of signal.

Page 173, Equation 5: This method of calculating the overlap function should contain a reference to Sasano et al. (Campbell et al.)

Section 4.2

State briefly how you calculate the aerosol extinction coefficient at 532 nm from this particular instrument. What is the impact when performing these calculations at non-vertical elevations?

Section 4.3

It seems from the figure (Fig 4.) that you plot range-corrected signal intensity. Is this the case? Has the data been corrected for the overlap function? Why not normalise the data with respect to the molecular signal since you have this at 532 nm.

Turbulence does not necessarily increase when the land/sea breeze strengthens. Humid air from over the sea may contain its own aerosol (salt for instance). It is aerosol hygroscopic growth that causes the signal to increase as the aerosol particles grow. Although the amount of growth is dependent on the hygroscopicity factor, it is the growth itself that is important.

When is sunrise for the morning case (Fig. 5)? In general, convection is the mechanism by which the boundary layer grows, but here, it seems as though it is the sea breeze

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(cooler, denser air) which is flowing in from the sea underneath the land boundary layer.

Section 4.4

State where the CEMS instrument is located. If the lidar beam is at 5 degree elevation, how high is it above the in-situ site?

Technical comments _____

Title: Suggest 'A new mobile and portable scanning lidar for profiling the lower troposphere'

Abstract - lines 6-7: Suggest '..measurement of atmospheric pollutants with a temporal resolution of 1 minute.'

Abstract - lines 10-13: Need to rewrite this sentence. I'm not aware of damage to detectors due to merely extended measurement duration.

Introduction

Page 166, line 20: Modify 'alters' to 'alter'.

Page 167, line 25: How about sensitivity?

Page 173, line 7: Start sentence with 'The ..'

Page 176, line 5: Replace 'refer' with 'infer'.

Page 176, line 18: What do you mean by 'fugitive emission'?

Figure 3: Add location and start date-end date of PM measurements to figure caption.

Figure 4-5: Add location, date and time to figure caption. I know these are in the figure title. What are these figures displaying, and at what wavelength? Is it range-corrected signal (equivalent to uncalibrated attenuated backscatter)? Has the data been overlap-corrected? State whether the times are local time or UTC.

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Figure 5: Annotation for top-left panel should state 'Clean air penetrating..'

Figure 6: Can you not also show the retrieved SO₂ concentrations as a function of range?

Figure 7: Why are there NaNs on the time axis? State location of measurement in the caption.

Figure 8: What lidar measurement is being plotted here? Is it range-corrected signal? At what wavelength? What is the color scale? Add location and date of measurement to caption.

Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., 4, 165, 2014.

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