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Atmospheric Measurement Techniques Discussions

Interactive comment on "A new differential absorption lidar to measure sub-hourly fluctuation of tropospheric ozone profiles in the Baltimore–Washington DC region" *by* J. T. Sullivan et al.

Anonymous Referee #2

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General Comments

Overall, this is a well written paper with a clear description of the recently developed lidar system at Goddard Space Flight Center. A good example of the application of the lidar is presented which demonstrates the power of this instrument to make an important observation of a stratospheric ozone intrusion into the troposphere. These types of instruments and ozone measurement are important to many groups including atmospheric scientists, policymakers, health officials, and the general public as they try

to more fully understand the various contributions to tropospheric ozone pollution.

Specific Comments (PxxxxLyy = Page xxxx, Line yy)

P4324L5-6 Clarify that while CO2 is measured in the IR, measurement of O3 is generally carried out in the UV. The current text makes it seem that CO2 is also measured in the UV.

P4325L11-14 There have been several O3 lidars developed using Raman shifted laser sources in the past. It may be appropriate to mention some. A few other systems include those described in the literature (separately) by E. Uthe, G. Ancellet, Y. Zhao, or R. Alvarez.

P4326L25-29 Consider including reference to the stratospheric ozone lidar work (including long-term measurements) by Langford and Proffitt.

P4327L12-16 The paper cited (Banta) includes ozone lidar and Doppler (wind) lidar profiles in the lower two kilometers of the troposphere. It is not clear what the author means regarding the lack of information in the first few kilometers.

P4333L10 The length of the Raman cell is stated as 76 cm here, but is given as 1.8 m later in the text and in Figure 3. Is the 76 cm referring to the effective interaction length?

P4337L17-19 The numbers of telescopes (4 vs 3) and wavelengths (2 vs 3) described in the text do not agree with Figure 3.

P4337L21-22 It may be clearer to state that the wide FOV channel allows collection of signals from nearer ranges so that, in conjunction with the larger, narrow FOV channel, the lidar can accommodate a wider dynamic range of signals.–The wide FOV itself causes an increase in the dynamic range of the signals reaching the detector (by allowing the very large signals from the near-field into the receiver in addition to the existing weaker signals from the far-field) rather than accommodates it.

P4339L5-9 How does interleaving the pulses cause an offset in the signal? Is it a temporal offset or a signal level offset?

P4339L15-17 The background correction is described as linear. Is it a constant value, or does it have some slope over the range of data? If so, over what range is the linear fit calculated?

P4339L23-25 Is this correction for just the PMT pulse "pileup" or does it include the counter dead time as well? i.e. would a faster counter improve this result?

P4341-4342 What is the typical reference height used for the aerosol profile calculation? Also, generally, these inversions are sensitive to the direction that the iterations are carried out (from far to near ranges or from near to far ranges), so a comment on the stability of the inversion and how it influences the choice of reference range is useful.

P4343L13 The humidity and temperature profile information mentioned here should refer to Figure 7 as well.

P4345L13 On 25Oct2013, 1519-2218 UTC would be 1119-1818 EDT or 1019-1718 EST.

P4348L28-P4349L1 It would be good to describe the saturation correction and how it is determined. What saturation effects have been included? (Note that this is one of the two larger corrections that cannot be reduced by additional averaging.) Also, see earlier comment regarding dead time correction.

Table 2. Add the diameters of the transmitted beams and the focal lengths of the telescopes to the specifications. This allows readers to more fully understand the overlap ranges for the various receivers.

Figure 3. What is the beam that passes through the angled mirror/beamsplitter on the left side of the figure? It currently seems to just pass out of the detection system.

Figure 6. It would very useful to add a mark on the map to indicate the location of the TROPOZ lidar.

Technical Corrections

P4324L6 "ultraviolet" does not need a hyphen.

P4325L23-25 This is a run-on sentence. Consider replacing first "and" with a comma (and add a comma before the second "and").

P4328L22 "above" is repeated

P4331L2 Equation (5) has an extraneous comma that should be removed.

P4335L1-3 The use of "internally" may be ambiguous here (could refer to the design and fabrication of the cell interior or the location of the cell construction). Perhaps "in-house" is clearer?

P4336L21 "comprised" should be "composed"

P4336L24 "optic" should be "optical"

P4339L12-14 This is a run-on sentence and seems to say the same thing twice.

P4340L20 "of" should be "or"

P4345L21 "maintaing" should be "maintaining"

P4346L12 "small yield" should be "small to yield"

P4350L1-3 The use of the word "obtainable" is ambiguous here. It seems to suggest the use of the ozonesonde to collect the proposed lower altitude ozone data (rather than the lidar data being extended to lower altitude ranges).

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 4321, 2014.