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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 #3**

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GENERAL COMMENTS: The paper presents a DIAL system for ozone profiling in Baltimore-Washington DC region. In fact the system presented here, is based on previously developed DIAL systems during the end of '80s and early '90s. Therefore, in no case it can be regarded as "new". As a consequence the title of the paper has to be changed to "An ultraviolet differential. . .". The authors present their O3 DIAL system, in detail, presenting experimental SRS data using H2, D2 as active Raman gases with He as a buffer gas. Based on previous published work on existing UV DIAL systems and the corresponding SRS technique at 266 nm (using H2, D2 as active Raman gases and



He as a buffer gas) the methodology and data presented here are not at all new, they are of low scientific significance, and therefore, they are not of any interest to publish them again in a Journal as the AMT, which promotes new work and new ideas. As a conclusion, the paper should not be published in AMT but i. Relevant previous work on DIAL and SRS systems: Browell et al., A.O., 1985 Ancellet et al., JAOT, 1989another journal, and should focus more on data case study analysis. Hanner and McDermid, IEEE JQE, 1990 Papayannis et al., A.O., 1990 Tzortzakis et al., Appl. Phys. B, 2004 SPECIFIC COMMENTS P4322 L15: Replace . . ."deuterium" with "deuterium, using helium as buffer gas". L22-23: The uncertainties estimated here are not at all realistic ones; they are optimized. It is well known that aerosol concentrations in the lower troposphere, alone, can induce very large errors in the retrieval of the ozone profiles (if not corrected) of the order of 25%. If they are corrected by using the Klett or the Raman technique they can be lowered to 15 and 5%, respectively (cf. relevant papers by Browell et al., Applied Optics, 1985; Papayannis et al., Applied Optics, 1990). In the paper the authors do not specify how they correct the aerosol induced errors. Therefore, the errors presented in the abstract should specify this. Also, after revising the retrieved uncertainties, the authors should add "according to the relevant aerosol concentration aloft" after the ". . .to 12 km."

P4323 L17: Add after Langford, 1999" also "Stohl et al., 2003)

P4325 The section in L12-14 is confusing. It should be stated in the text that "Aside from the site at. . ...this is the only instrument implemented in the Mid Atlantic currently utilizing high-pressure. . ."

P. 4326 L6: cite here all relevant work. L22: cite here work by Pelon and Megie (JGR, 1982), Trickl et al. (ACP, JGR. . .), Galani et al. (JGR, 2003)

P4328 L14: Replace "This method. . ." by "The DIAL method. . ." L16: at the end of the phrase cite : Pelon and Megie, JGR, 1982; Measures, 1983. L25: After ". . . 300nm" add a citation (Pelon and Megie, JGR, 1982). P4329 L4: Cite also (Ancellet et al.,

1989; Papayannis et al., 1990; Tzortzakis et al., 2004)

Section 2.1 is well known and detailed presented in the literature. The authors could just provide a short description of the DIAL equation referencing all relevant papers (by Measures, 1983; Browell et al., 1985; Papayannis et al., 1990).

P4331 Section 3.1. This is very well known. This section has to be shortened, as it has already been published (Measures, 1992; Tzortzakis et al., 2004 and references there in).

P4335-4336 All pressures have to be reported in bar. L20. The authors present a photon conversion efficiency of 10% or less, without the use of a buffer gas in SRS generation. The use of He as a buffer gas increases the photon conversion efficiency up to 53% (P4336, L6) for H2 and up to 27% (P4336, L10) for D2. However, it is well known these efficiencies are quite lower than the relevant ones reported in the literature (cf. >70% for H2 and >45% for D2, in Tzortzakis et al., 2004). Therefore, section 3.2 is not worth publishing and can be combined with section 3.1, by just mentioning, in a couple of lines, the obtained conversion efficiencies at H2 and D2 using the He as a buffer gas.

P4336 L26: The emitted laser energy per pulse at 266 nm has to be mentioned.

P4342 L1: How the S=60sr is chosen? The authors should make a sensitivity analysis about the possible values of the lidar ratio for the Baltimore-Washington region. L1: Please correct the units of S. It is in steradians (sr).

P4347 This section can be put in an Annex, as it is well known in the published literature. To my opinion, this section could focus on a discussion of the different error sources in the retrieval of O3 by DIAL in the lower atmosphere. More excessively, the authors should focus on the role of aerosols in this uncertainty of the retrieval of ozone (the work of Browell et al., 1985 and of Papayannis et al., 1990 could be the source of the literature used). It is important that the authors show how they correct the aerosol



interference and how they estimate the relevant errors due to the presence of aerosols (see also my comments previously provided in for P4322, L22-23).

P4350 L9: The use of 266 nm in the retrieval of O3 by DIAL inide the PBL (together with 289 nm) is already presented and used in the literature (cf. Papayannis et al., 1990, as well as other later papers of the same author).

P4358 The vibrational Raman frequencies of S1 for H2 and D2 have to be updated. The values given by Measures 1983, have been updated in the later years. The authors are invited to use the new values, referring ONLY to papers dedicated in the Raman spectroscopy and not to a book (Measures, 1983) which is just reporting old values.

P4360 Table 3. The aerosol uncertainty has to be more precisely estimated. Please update and see my previous comments.

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