Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2018-338-RC1, 2018

Atmospheric Measurement Techniques Discussions

Interactive comment on "Intercomparison of lidar, aircraft, and surface ozone measurements in the San Joaquin Valley during the California Baseline Ozone Transport Study (CABOTS)" *by* Andrew O. Langford et al.

Anonymous Referee #1

Received and published: 27 November 2018

Review of manuscript "Intercomparison of lidar, aircraft, and surface ozone measurements in the San Joaquin Valley during the California Baseline Ozone Transport Study (CABOTS)" by Langford et al.

General comments

he paper deals with the analysis of comparisons between a UV ozone DIAL (Differential Absorption Lidar) and in-situ surface and aircraft measurements in Southern California during the CABOTS campaign. The objective is to assess differences be-

tween the ozone measurement techniques deployed during CABOTS. Authors focus on the comparibility of measurements close to the surface, thanks to the scanning capabilities of the lidar system. A detailed analysis of the aircraft flight path around the lidar is also essential to separate the role of horizontal variability from that of instrumental differences. Many studies have been published to compare UV DIAL with either aircraft, ozonesonde or surface observation. This is not enough recognized in the introduction where few reference to similar campaign are given. The topic is still sound and of interest for its publication in Atmospheric Measurement Techniques, because the comparison of lidar data with surface measurement is quite difficult. Specific aerosol interferences encountered in Southern California (biomass burning, polluted dust and advection of marine aerosols) also need to be characterized. However, the current paper need some minor revisions before its final publication in Atmospheric Measurement Techniques. My major concern is the lack of synthesis and quantitative discussion about the comparison results. The expected UV DIAL accuracy below 4 km presented in section 3.1 is ± 3 ppb, but this number is not compared with the differences observed during the campaign when taking into account the detailed analysis of the spatial variability conducted in the paper. Also the description of the aerosol interference correction is not very well explained although the ozone profiles shown in Fig. 10 prove that it is probably very efficient.

Specific comments

p.2 l.19 Ozone accuracy needed to address the stratospheric intrusion and long range transport studies could be given as a specification for the ozone measurement accuracy. Do you plan Lagrangian studies between aircraft and lidar observationsÂă?

p.2 l.24 Provide more references to previous lidar characterization using airborne or surface measurements (e.g. DOI: 10.1063/1.1144769, DOI: 10.1023/A:1021354511127, DOI: 10.1016/j.atmosres.2004.10.003, ...)

p.2 l.30 State in introduction the need for a good characterization of lidar retrieval between surface and 100 m, especially for pollution studies

p.4 l.15 Does the iterative technique include the aerosol interference correctionÂă? If yes specify the parameters used for this correction. Does it correspond to the aerosol encountered during CABOTSÂă?

p.4 l. 28 Specify the accuracy and detection limit for the Scientific Aviation (Sc.Av.) ozone monitor.

p. 5 l.6-8 Did you perform flights in formation between the two aircraft to identify differences between the two airborne in-situ ozone measurementsÂă? If yes please provide the range of observed O3 differences.

p.5 l. 37 *"the 27.5 m TOPAZ measurements were usually larger than the VMA in-situ"*. Specify the value of the bias. It seems larger than 3 ppb. Why not using all the measurement days shown in Fig. 3 to make the scatterplot in Fig. 4bÂă? The bias will be more representative, especially if the daytime and SE wind assumptions are included.

p.7 l.6 The sentence *"differences are within* $\pm$*10%"* is not really useful if it is not detailed. Differences are hard to read in Fig. 8. Please specify bias for daytime. It is also useful to report on differences between aircraft and in-situ observations.

p.7 l.13 Why $\pm$10% for the gray envelop and not the expected $\pm$3 ppb lidar accuracyÂă?

p.7 l.16 *"The agreement between the TOPAZ and Mooney measurements in Figure 9 is quite good, with some notable differences"* . Specify how large are the differences or add scatterplot in addition to the vertical profile plots shown in Fig. 9.

p.7 l.22-26. The 10 ppb lidar underestimate in the 0-800 m altitude range on June 3rd is not really discussed while it is larger than differences observed for other flights in the same altitude range. What is the aerosol backscatter on this day ?

p.7 l.37 It is indeed an interesting comparison. Please give the parameters used for

the aerosol correction interference. Is it consistent with biomass burning aerosol optical properties in the UV ?

p.8 l.1 Please specify why you expect an interference from NO2 or H2O vertical distribution.

p.8 l.34 It is very difficult to see the magnitude of spatial ozone inhomogenieties in Fig. 14. Please give numbers or a better figure (x-z cross section along the dimension with largest horizontal gradient would be more explicit and easier to read).

p.9 l.2 The authors could show the 0.5-1.5 km range scatterplot in addition to the 1.5-2.5 km figure. Standart deviations may be larger for profiles with large ozone gradient, but the bias must remains small if the instrument accuracy is not the limiting factor. The issue of this paper is indeed to demonstrate that a good comparison is possible at range below 2 km.

p.9 l.11-13 Please make a quantitative summary of the comparison findings and discuss these numbers with the expected overall bias and single profile accuracy of the TOPAZ lidar.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2018-338, 2018.