

# ***Interactive comment on “Analyzing the Atmospheric Boundary Layer by high-order moments obtained from multiwavelength lidar data: impact of wavelength choice” by Gregori de Arruda Moreira et al.***

## **Anonymous Referee #2**

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### 1- General comments

The paper focuses on atmospheric boundary layer height (ABLH) retrievals and variability analysis from multi-wavelengths lidar measurements. The study highlighted by the authors rely mainly on high-order moments technique developed and described in Pal et al, 2010. The current paper emphasizes the importance of wavelength choice used in the technique. Then comparison and discussion on the results obtained applying the technique with lidar measurements from different wavelengths are presented. Two cases are considered in this study to illustrate and to investigate ABLH retrievals

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using the described technique. Some paper references dedicated to the related field are missing. The paper presents also some inaccurate wording that need to be revised.

## 2- Specific comments

- Page 1, line 6-7-8. Why asserting that previous studies have shown that 1064-nm wavelength provides an appropriate description of the turbulence field which is the reason why you consider this wavelength as a reference? Several other papers, prior and since Pal, 2010 have shown related studies for ABLH retrievals that uses different techniques and different wavelengths, including in the UV domain, applied to lidar measurements: Sawyer, et al, 2013, Detection, variations and inter-comparison of the planetary boundary layer depth from radiosonde, lidar and infrared spectrometer <http://dx.doi.org/10.1016/j.atmosenv.2013.07.019> Pal et al, journal of geophysical research: atmosphere, vol. 118, 9277–9295, doi:10.1002/jgrd.50710, 2013 Martucci et al, 2007, Comparison between Backscatter Lidar and Radiosonde Measurements of the Diurnal and Nocturnal Stratification in the Lower Troposphere DOI: 10.1175/JTECH2036.1 Wang et al, Atmos. Meas. Tech., 5, 1965–1972, 2012 [www.atmos-meas-tech.net/5/1965/2012/](http://www.atmos-meas-tech.net/5/1965/2012/) doi:10.5194/amt-5-1965-2012

- Page 5, section 31.1 and Page 22, table A2. Detailed description of high-order moment parameters are given. However, you do not present how ABLH is retrieved from these parameters as it is shown in diagram A1 and figures A6 and A10.

-Page 12, line 30. Following discussion about autocorrelated function, you conclude that the profiles obtained at 355nm have a strong presence of noise and thus the skewness phenomenon are not as well retrieved at 355nm compared to those at 1064nm. I assume the authors use the term "profiles" to point out the feature of the autocorrelated function and not the one of the lidar backscatter. Nonetheless, the authors should be more precise.

-page 12, conclusion. The authors conclude that the high-order moments technique is applicable to 532nm elastic lidar measurements and shows results for ABLH retrievals

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as well and good as for 1064nm. On the contrary, due to limited validity of the assumption of predominance of aerosol backscatter compared to molecular ones, the retrievals at 355nm are not successful due to noisier signals. The readers are left a bit curious. It would be useful for the authors to conclude whether or not the high-order technique shows limitation for 355nm signal or if the current lidar system used for this study that could be improved or if the technique should be improved using a better assessment of molecular backscatter at 355nm.

- Page 25 & 29, Figure A6 and A10. I do not know why only one ABLH is retrieved since the high-order moments technique is applied for each wavelength independently? I expected to find different retrievals for each wavelength and discussion about which one should be considered as the truth.

3- technical corrections

- Page 5, line 20, equation (7). the authors should define "tf" variable.

- Page 7, line 19. The authors do not define FT. I assume that it means Free Troposphere. You should precise it.

- Page 11, line 34. replace "taking into accounting" by "taking into account"

- Page 20, Figure A1. The diagram indicated PBLH that should be ABLH to be coherent.

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