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Atmospheric Measurement Techniques Discussions

Interactive comment on "Comparison of dust layer heights from active and passive satellite sensors" *by* Arve Kylling et al.

Anonymous Referee #3

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This paper compares dust layer heights retrieved from various passive remote sensing algorithm to those detected by an active space lidar, the CALIOP. In particular, authors considered four IR algorithms applied to IASI measurements and two oxygen-band algorithms applied to GOME-2 and SCIAMACHY measurements in the O2 A bands. While aerosol height is the one of the most important variables that determine how aerosol affect climate and air quality, passive remote sensing of aerosol height is extremely more challenging than sensing the aerosol loading. This paper thus address an important study and falls into the scope of AMT journal. I agree with the first reviewer that, while the science and used approaches are sound, this manuscript still needs to improve its presentation of the results and discussion. And, a major revision is necessary to improve the logic and clearness of the paper.

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Discussion paper

Major comments:

1. I have the same feeling to the first reviewer that Figure 2-7 and their discussions are difficult to follow. I also suggest Figures 2-5 and 6-7 be merged, so that readers can easily compare the spatial distribution of heights between different algorithms. I would also recommend a legend be added to the curtain plot to indicate the meanings of each symbol.

2. Table 3 is particularly hard to follow. I recommend, instead of using table, use bar plots to compare those statistics to different algorithms.

3. Too much text is used to present Figures in the Appendix. Those figures should be briefly mentioned, so only the major findings from them be presented.

4. This study found that solar algorithms yield larger bias (> 1 km) for the case of dust aerosol height than the IR algorithms. However, it should be noted that some studies have shown an accuracy of about 0.5 km of dust layer height from O2-A might (studies listed below). So authors may need to compare and justify the performance of the current study to those studies:

Kokhanovsky, A. A., and V. V. Rozanov (2010), The determination of dust cloud altitudes from a satellite using hyperspectral measurements in the gaseous absorption band, International Journal of Remote Sensing, 31(10), 2729-2744, doi:10.1080/01431160903085644.

Dubuisson, P., R. Frouin, D. Dessailly, L. Dufor$\surd^{TM}$t, J.-F. ß. L$\surd^{©}$on, K. Voss, and D. Antoine (2009), Estimating the altitude of aerosol plumes over the ocean from reflectance ratio measurements in the O2 A-band, Remote Sensing of Environment, 113(9), 1899-1911, doi:10.1016/j.rse.2009.04.018.

Xu, X., J. Wang, Y. Wang, J. Zeng, O. Torres, Y. Yang, A. Marshak, J. Reid, and S. Miller (2017), Passive remote sensing of altitude and optical depth of dust plumes using the oxygen A and B bands: First results from EPIC/DSCOVR at Lagrange-1

point, Geophysical Research Letters, 44(14), 7544-7554, doi:10.1002/2017GL073939.

Specific comments:

P2, L11: I'd to bring an attention to a recent review article about passive remote sensing of aerosol height by Xu et al. 2018, which is worth to cite: Xiaoguang Xu, Jun Wang, Yi Wang and Alexander Kokhanovsky, Chapter 1 - Passive Remote Sensing of Aerosol Height, In Remote Sensing of Aerosols, Clouds, and Precipitation, Elsevier, 2018, Pages 1-22, ISBN 9780128104378, https://doi.org/10.1016/B978-0-12-810437-8.00001-3

P3, L5-10: It mentioned here that these selected dust events are of Saharan origin, but the studied area are also frequently affected by dust emitted from Middle East, India, and Western China. Please be accurate.

P14, Figure 2(bottom): Symbols are hard to follow. A legend may be added to indicate the meaning of each symbol.

P15, Table 2: I don't quite understand the bracketed numbers in the third and forth rows. Please clarify in the Table caption (or using table footnote, as the caption is already very long).

P21, Figure 8: A colorbar is needed for the density of the scatters (similarly in Figure 9-10). The definition of the density is also necessary in the figure caption.

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