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Atmospheric Measurement Techniques Discussions

Interactive comment on "Aerosol optical properties derived from POLDER-3/PARASOL (2005–2013) over the western Mediterranean Sea: I. Quality assessment with AERONET and in situ airborne observations" *by* Paola Formenti et al.

Anonymous Referee #1

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The authors present a 2-part analysis of POLDER-3/PARASOL oceanic aerosol retrievals against ground-based AERONET validation (in the Mediterranean), as well as a comparison of different sub-orbital (in-situ) data taken in the region. For the former, the authors present compelling evidence of POLDER-3 sensitivity to aerosol size, fine/coarse mode discrimination, AOD, and non-sphericity (to some extent). For the latter, the authors compare results from different optical-particle counters, providing a nice summary of retrieved complex refractive index for different aerosol types. The authors have clearly performed a thorough literature review, and this work should be

published after minor revisions.

General Comments:

I would strongly encourage the authors to convert AOD, fine-mode AOD, and coarse-mode AOD to 550 nm rather than 865 nm. Many other retrieval algorithms provide AOD information (such as MODIS DT) at this wavelength (or at least near it), and solar irradiance is much higher (meaning absolute attenuation will be larger) at 550 nm. Fine-mode AOD is typically very small at 865 nm, which will result in a lower RMSE and correlation as compared to the coarse mode (which you see in Figures 4 and 5). I expect that your fine-mode AOD range will more than double by extrapolating to 550 nm, and I expect your RMSE to increase substantially too. Although the lack of absorption is probably not an issue because your retrieved fine-mode AODs are so low (and desert dust is non-absorbing in the red and NIR), you may see a low bias in AODf at 550 nm because the effects of absorption can lead to non-linear errors in retrieved AOD.

As POLDER's sensitivity to sphericity is probably dependent on total aerosol loading, might it make sense to report non-spherical AOD rather than non-spherical AOD fraction?

I might be a bit biased towards the POLDER-3/AERONET analysis, but I think the paper might flow better if all of the in-situ analysis were moved to the supplemental (or into its own paper). It really seems like an add-on to the POLDER-3/AERONET work.

Specific Comments:

Line 255: Should read "can be calculated as".

Line 365: Is this increased temporal window only for AODF and AODC, or for all measurements?

Line 452: I think this should read "retrieved" not "measured", as POLDER does not measure AOD.

Line 580-582: At the risk of sounding like a broken record, I believe that this can be explained by your use of 865nm AOD rather than 550 nm AOD. Table 4: The uncertainties here do not make sense to me [maybe I am just missing something?]: 1. Your RMSE is substantially larger than the absolute term in your AOD uncertainty (which you have as an extremely low 0.003 [should this be 0.03?]) 2. AE uncertainty should be a function of AOD or just a flat envelope. The higher the AOD, the greater confidence you should have in particle properties. 3. Non-spherical AOD uncertainty makes a lot more sense than fNCS uncertainty, as you can account for inherent bias at low AOD.

Figure 2-3: I would move this to supplemental, but up to you.

Figure 4: I would remove the bottom to panels, as you have too few data to provide anything of value from airborne. Maybe then merge Figure 4 with 5?

Figure 6: There appear to be a couple of issues with this figure: 1. Should the caption read "volume distribution at Dcut-off < 1.0 μm (left) and days with AERONET Dcut-off $\geq$ 1.0 μm (right)" or "volume distribution at Dcut-off < 1.0 μm (Top) and days with AERONET Dcut-off $\geq$ 1.0 μm (Bottom)" 2. Figure 6 reads as though retrieved fine-mode AOD is the top plot, and coarse-mode AOD is the bottom plot. a. I assume that this is a mistake, and that the fine-mode retrievals are on the left, and the coarse-mode retrievals are on the right side. b. This should also be clarified in the caption.

Figure 7: I would move this to the supplemental as well.

Figure 8: I would change this to being contingent on AERONET AOD > 0.1, but this is just my preference. I would also remove the airborne data, as there are too few data. Maybe instead you could have 3 plots of AE, with different AOD requirements for each (>0.05, >0.1, >0.2)? This would help demonstrate the dependence of AE errors on AOD.

Figure 9: This figure might make more sense as a color-density plot.

Figure 10: Would it make sense to change this to AODNS vs AODCNS?

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