

Interactive comment on “Assimilating aerosol optical properties related to size and absorption from POLDER/PARASOL with an ensemble data assimilation system” by Athanasios Tsikerdekis et al.

Anonymous Referee #2

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This study presents an ensemble Kalman filter-based data assimilation system developed for the ECHAM-HAM and applied to POLDER derived observations of optical properties. This paper assesses the added value of assimilating AE, AAOD and SSA, in addition to AOD. The experiment where POLDER AOD, AE and SSA are assimilated shows systematic improvement in mean error, mean absolute error and correlation for AOD, AE, AAOD and SSA compared to the experiment where only AOD is assimilated. The paper is well written and easy to follow. I only have some minor concerns listed below and recommend the paper for publication after these concerns are addressed.

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Figure 1a: Why are there no AOD retrievals available over India and why are the uncertainties larger in the Southern Ocean?

Line 49: Change “disentangles” to “disentangle”.

Line 67: Change “colour, polarization” to “colour, and polarization”

Lines 110-112: Can you provide an estimate of how many data points you gain by using the L1.5 AERONET retrievals rather than L2 retrievals. What is the effect of using L1.5 AOD retrievals on the POLDER uncertainty estimates?

Line 161: Change “~0.03 is” to “~0.03 in”.

Line 184: Since the model resolution is (1.875° x 1.875°) and the POLDER resolution is 1 x 1 degrees, do you use some kind of super observation approach for the assimilation?

Line 343-344: Since you assume the same level of uncertainty for both the natural and anthropogenic aerosols, does this approach not underestimate the background error covariance?

Line 353: Change “initially” to “initial”.

Line 382: What is Section 0?

Line 386: I am not sure if I understood the daily assimilation set-up correctly. Do you run the daily forecast from 00 to 23 hour first and then call the LETKF code for the assimilation of POLDER observations at 00, 06, 12, and 18 hours? Does the next day forecast use initial conditions from the 18 h assimilation? If this is correct, what is the benefit of assimilation at 00, 06, and 12 hours because we are not accumulating the benefits of assimilation at these times in the forecasts.

Figure 15: The correlation coefficient for AE decreases from the Control to Total experiment. What is the reason for that? Is it because POLDER AE has a lower correlation coefficient compared to control?

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Figure 16: Should the title of y-axis be MASS AAOD in panels b and f?

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