

## ***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 #1**

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Review of "Assimilating aerosol optical properties related to size and absorption from POLDER/PARASOL with an ensemble data assimilation system" by Tsikerdekis et al.

The authors tried to implement Kalman Filter technique into a global aerosol model (ECHAM-HAM) and performed various assimilation experiment with aerosol optical properties derived by POLDER to investigate the impact of assimilating multiple AODs, AE, AAOD, and SSA in addition to AOT in single wavelength. They found that the additional information achieved further improvement in aerosol forecasting compared to the forecast where only AOD is assimilated. I found that this paper is well written, will

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be of interest to the scientific community and suitable for publication in ACP with minor revision.

Specific comments:

L121 and L203 Both the retrieval algorithm of POLDER product and the calculation processes of aerosol optical properties in the model include many assumptions (e.g., aerosol model, size distribution, and refractive index etc.). These basic assumptions are consistent? If not, how did the differences affect the assimilation results.

L345 The authors used randomly perturbed wind to make ensemble members. How about air mass? The wind perturbed method can keep conservation of mass and mechanical equilibrium (e.g., geostrophic balance) produced in ERA-interim?

L421 It is well known that dust emissions have large inter-annual (seasonal) variations. My concern is that the yearly-mean based rescaling generate additional biases in the simulation.

L459 Subsection 4.2?

L477 Figure 5i should be Figure 5l?

L477 At first, could you explain why MASS caused a large positive bias in the South Atlantic that CONTROL did not cause.

L484 You did not show any validation result about aerosol mass mixing ratio.

L516-518 What does this mean? Was there problem in BC simulation (e.g., refractive index)? Did model underestimate other aerosol species (e.g., organic aerosols)? Could you make this clear?

Figure 4 It's the wrong way around.

Figure 17f Why does MODIS-DB underestimate AODs where POLDER estimates AOD as about 0.1?

C2

