**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Applying an ensemble Kalman filter to the assimilation of AERONET observations in a global aerosol transport model" by N. A. J. Schutgens et al.

Anonymous Referee #2

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This study contributes to the relatively new field of aerosol assimilation by presenting a new global assimilation system based on the SPRINTARS model and the Local Ensemble Transform Kalman filter. The system assimilates 2-hourly averaged AERONET aerosol optical depth (AOD) and Angström exponent (AE) centred on the latest model time-step. The state vector corresponds to the fine and coarse mode mixing ratios at every grid-point. The assimilation system was applied to observations of July 2005 and the results were validated against AERONET stations not used in the assimilation and independent data such as SKYNET and MODIS. The authors, using a few selected locations illustrate in a clear and comprehensible way the strength and shortcomings of the system. The assimilation of AOD at 670 nm improves the simulation of AOD

by SPRINTARS compared to the case without assimilation, however the usefulness of assimilating AE is limited to cases of high AOD (>0.4) and low AE.

General comments

Section 2.3: The state vector is composed by the fine (carbons and sulphate) and coarse (sea salt and dust) mode aerosol mixing ratio. Any particular reason why the fine mode of the desert dust was not included? How many of the 10 dust bins considered in SPRINTARS correspond to the fine mode? Is its contribution negligible? I believe the authors should explain why the dust fine mode was left out of the state vector, especially considering that the authors discuss in section 6 on the definition of the fine mode aerosol. Another aspect that should be explained in this section is the number of levels considered in the state vector. AOD as well as AE are vertically integrated variables and have therefore only two dimension whereas mixing ratio is a three dimensional variable. How many levels were used? All of them or just the ones in the troposphere? Although this is clear later in the text it should be made explicit when the state vector is defined in the first paragraph of section 2.3. This can be done by simply changing the end of the second sentence to "…at every grid-point and every level".

Section 4.1 and 4.2: The explanation of the way the errors were computed is not so clear (eq 7 and 8), it would be better if the authors could develop this further and make it easily understandable.

Section 5.1: The month of July 2005 is used to illustrate the performance of the assimilation system. The reason given is the high number of measurements available for that month. Up to 2007 this is the month with the largest number of observations; all in all 131 stations were operational. How do the results change if only half of the stations are used in the assimilation? How many stations need to be used in order to have an improvement in AOD? and AE? How often does this occur? ie is the number of stations available most of the time enough for the assimilation system to produce important improvement? Can the authors comment on this and include something in

this paper or will it be addressed in the forthcoming one?

Section 5.3: A few lines should be spent in describing the MODIS data. Are MODIS data from Aqua or Terra used? Even though this is clear later in the text it should be explained in this section. Furthermore, which dataset are the authors using, collection 5?

Technical corrections

Page 23837, line 21: eliminate period between "research" and "owing" or replace it with a coma.

Page 23847, line 16: replace "in" with "is".

Page 23849, line 23: remove parenthesis "(which is not shown)". Experiment A2E1(blue) is actually plotted in Figure 8.

Page 23850, line 21: change "quite a bit" with a more formal expression. How much is "quite a bit"?

Page 23855, line 21: remove "quite"

Page 23856, line 8: replace "of" with "or"

Figure 2: Some of the stations used for validation are difficult to identify. Since the number of stations used is reduced, each station could be plotted with a different symbol. The legend should be changed accordingly to know the corresponding symbol for each selected station.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 23835, 2009.

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