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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Data assimilation of CALIPSO aerosol observations" *by* T. T. Sekiyama et al.

Anonymous Referee #1

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This paper describes the assimilation of CALIPSO aerosols measurements with the 4D-LETKF method and the chemistry transport model MASINGAR. I found the paper well written, the study original and I suggest this paper be published in ACP after having take into account the following comments.

Specific Comments:

1. GEMS does not only focus on the assimilation and forecast of sea-salt, dust, organic and black carbon aerosols. So, on P5787L2, it could be included ", among others," between "forecast" and "sea-salt".
2. P5787L26: "... probably contain retrieval error". Can we have a bit more precision about this retrieval error?

3. P5788L7: change “532/1064” by “532 and 1064”.

4. P5788L8-9: “. . . and these values are not contaminated by retrieval errors due to low-accuracy retrieval algorithms”. This is no very clear to me. Do you mean that the retrieval algorithm does not generate errors nor amplify the instrumental error? Please, clarify.

5. P5788L14-28: This § needs some more details or citations.

   (a) OI and 3D-Var methods do not rely on the assumption mentioned in the manuscript but these assumptions are made in practice. I would write “. . . 3D-Var, practically assume . . . ”

   (b) A reference at the end of “. . . and temporally stationary” would be welcome.

   (c) What do you mean by “. . . 4D-Var implicitly evolves . . . ”

   (d) 4D-Var assumes model linearity during the assimilation window and not during “its iteration procedure”.

6. P5789L20: replace “of 1/3-1 km” by “between 300 m and 1 km”

7. P5790L3: Can you tell us what do you mean by a “direct assimilation”

8. P5790L22: It is mentioned that “selected data were horizontally and vertically averaged to the model resolution”. Do you mean to the model grid? Moreover, I could understand that high resolved profiles be averaged to the model vertical levels (while I would use the term “smoothed”) but not horizontally. Do you mean that using several orbits, data are mapped on the model grid points? Please add some clarifications or, better, show us a plot with the original CALIPSO data and the transformed assimilated data. Finally, I suggest to include a panel in Fig 1 showing the assimilated data, i.e., the data averaged on the model grid with CAD score less than -33.

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Interactive Comment

9. P5791L17: Can you shortly tell us what a “serial assimilation” is.

10. P5793L15-16: What is the “multiplication spread inflation parameter”?

11. P5793L16-17: By “The assimilated model/parameters”, do you mean the system control variable, i.e., the variables optimized by the assimilation system?

12. P5793L18: “. . . and dust emission factors”. Does this mean that, in addition to optimize the model state, the emissions are also optimized? In such a case, this would mean that your system is combining data assimilation and inversion of emission. If true, this would be mentionned earlier in the abstract and in the introduction.

13. Sec 3.2: Several times, it is mentionned that the “4D-LETKF assimilation results” perform better that the reference model run. While this is true, this intents to say that this occurs thanks to the 4D-LETKF methods. Since you do not compare assimilation results of 4D-LETKF with another method, I would suggest to write only “assimilation results” (i.e., dropping “4D-LETKF”). Moreover, the good results are at least as good as they are thanks to the good quality of the CALIPSO data as due to the choice of the assimilation method.

14. P5799L13: “. . . without retrieval errors”. Same comment as above.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 5785, 2009.