

Interactive comment on “Impact of the choice of the satellite aerosol optical depth product in a sub-regional dust emission inversion” by Jerónimo Escribano et al.

Anonymous Referee #1

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GENERAL COMMENTS:

This paper uses a state-of-the-art data assimilation system to investigate the influence of used satellite input into a dust emission inversion scheme. Inversion is still a relatively young field and it is therefore important to further develop existing systems and to test sensitivities. I therefore welcome this contribution to ACP. Overall the work is of high scientific quality and I have no issues with the content. However, to make this work more accessible for readers interested in dust emission, but not expert in inversion techniques, the authors should make more effort to improve the presentation, particularly the explanation of the methods. Moreover, the English is not always of highest standards; particularly the number of grammar errors (e.g. simple subject-verb

C1

disagreements) and punctuation errors is annoyingly large.

MAJOR COMMENTS:

1) Introduction: To my taste it contains too much technical detail. Some of this could be moved to Section 2.

2) Section 2: With 4.5 pages, this is quite long for a Methods section of a relatively short paper. It is quite technical and a little hard to read. It would be good if the authors could spend a little more time trying to streamline this section and make it as didactic as possible, in order to make it more accessible for readers not so familiar with inversion techniques. I would start out with something like a road map, such that the reader knows what to expect. Then I would describe the model, then the obs, then the observation operator and finally the actual data assimilation. The way it is now is not logical in my eyes. Many readers will not know what the “control vector” is and introducing so early is a little hard to digest. Also the beginning of section 2.4 is hard to understand and the numbers given there all seem a little arbitrary.

MINOR COMMENTS:

1) Title: I would avoid an abbreviation in the title.

2) P1, L5: better have?

3) P1, L17-18: ... combine model and observational information in the best possible way. Their application ...

4) P1, L18-19: In recent years, ... AOD has also been ...

5) P2, top: Add reference for Fe and P fertilisation!

6) P2, L5: Deposition into the ocean ...

7) P2, L7: new paragraph after “quality.” Then “Among other uncertainties ...”

8) P2, L14: emission uncertainties

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- 9) P2, L23: comma before respectively
- 10) P2, L24: However, MODIS products are not free of problems ...
- 11) P2, L25: the MODIS aerosol product
- 12) P3, L24: referred to as SPLA
- 13) P3, L29: aerosol is
- 14) P3, L29: diameters less than ... has diameters
- 15) P3, L31: aerosol tracer
- 16) P4, L4: were performed ... ERA-Interim ... as explained
- 17) P4, L12: tests ... analysis to the grouping ...
- 18) P4, L16: The same sub-regions as in EBCH16, defined depending on the emission category, are used.
- 19) P4, L18: map
- 20) P4, L19: have been defined: 15 over northern Africa, 3 over ... the Middle East
- 21) P4, L26-29: Long and complicated sentence. Reword!
- 22) P4, L32: over the ocean
- 23) P5, L1: ... instrument, as they ...
- 24) P5, L15: ... coverage, although ... hence in the ...
- 25) P5, L29: of the MISR algorithm
- 26) P6, L10: onto the model grid
- 27) P6, L18: ... sample our region of interest only once per day.
- 28) P6, L19: ... PARASOL), and so its ...

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- 29) P6, L23: standard deviation ... is ...
- 30) P6, L27: timescale gives
- 31) P6, L27: avoid repetition of words
- 32) P6, L33: was
- 33) Caption of F1: shown in the left column ... in the right column. Please note the ...
- 34) P7, L4: (EE), which
- 35) Table 1: What is Ck?
- 36) P8, L8: errors, which
- 37) P8, L11: error, assuming
- 38) P8, L15: These help to detect ...
- 39) P8, L16: They assume that ...
- 40) P8, L18: is better to draw ...
- 41) P9, L2: more or less?? Reword!
- 42) P9, L3: retrieval dataset
- 43) P9, L5: where available, that is: ...
- 44) P9, L14: refer back to methods section
- 45) P9, L16: super-coarse
- 46) Section 3.1: odd title
- 47) P9, L23: in the southern Red Sea
- 48) P9, L24: downwind of the ... are hardly evident ...
- 49) P9, L25: Atlantic is more extended than in the rest

C4

- 50) P9, L26: Atlantic Ocean are found close to the ...
- 51) P9, L26: yearly means for fine ...
- 52) P9, L27-28: remove brackets around lat-lon
- 53) P9, L31: To be able to roughly discriminate between the ...
- 54) P9, L33: in Fig. 2. In this figure ...
- 55) Fig. 2: caption too short, explain individual panels, ideally label them
- 56) P10, L6: relatively
- 57) P10, L7-8: in the south). However, total ... Aqua in Fig. 2 is ... counterpart in ...
- 58) P11, L1: still hold
- 59) P11, L13: or in other words that the model ...
- 60) P11, L16: counterparts
- 61) P11, L19: AODs (explained above) we think that ... ; what makes you think so??
- 62) P11, L21: have total AOD available over land is PARASOL.
- 63) P11, L24: eastern Atlantic
- 64) P11, L29-30: plural of analysis is analyses! This part does not read very well.
- 65) Fig. 4: better “analysed AOD”? In the latter, we included the ...
- 66) P13: I'm not sure I understand why it results in LARGE AOD values over land?!?
- 67) P14, L3: even though
- 68) P14, L 12 peaks in September
- 69) P14, L13: better “rule out” than “discard”
- 70) Fig. 5: Note that the three plots ...

C5

- 71) P15, L2: can be inferred to some extent from ...
- 72) P15, L4: of the overall analysed
- 73) P16, L15: move “well” to end of sentence
- 74) P16, L17: capability to report
- 75) P16, L19: (Appendix A); the MISR ...
- 76) P17, L4: some key model parameters ...; which ones do you have in mind??

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