Atmos. Chem. Phys. Discuss., 5, S2706–S2709, 2005
www.atmos-chem-phys.org/acpd/5/S2706/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evolution of aerosol optical thickness over Europe during the August 2003 heat wave as seen from CHIMERE model simulations and POLDER data" *by* A. Hodzic et al.

Anonymous Referee #2

Received and published: 20 September 2005

This paper presents an interesting case study of the modelled and derived aerosol optical depths over Europe during the heat wave of 2003. I find the results interesting and an appropriate subject for ACP, and would recommend publication after the points raised below are addressed.

Important points:

General:

While the paper points out that the POLDER retrievals appear to have a low bias with

respect to the observations (primarily AERONET), there is little quantitative assessment for why the errors in the retrievals exist. Indeed, p4120, l10–15 suggests that over land the biases should be less than 20–30% in 'medium and high' aerosol optical depth conditions. Subsequently (P4126) the authors point at three potential sources of errors, but do not investigate which (if any) of these sources of error are the most likely culprits. With regard to the aerosol model, it would be worthwhile modifying the POLDER retrieval with (for example) a modification to the aerosol absorption to see what single scattering albedo would be needed to bring the results into agreement with the AERONET data. Similarly, the size distribution assumed in the POLDER retrievals could be varied. In this way the shortcomings of the POLDER retrieval could be systematically assessed. I would suggest that the data from AERONET be used in these retrieval algorithms as a starting point.

Regarding the modelling, an arbitrary amplitude passive tracer is added to account for the fires. Why not just add emissions of organic/black carbon/inorganic components to account for the changes in the optical depth. The authors could iteratively adjust the emission per square metre until agreement between the model and the observation was reached. It would be interesting to see whether the emissions in terms of particle mass per square metre could be reasonably estimated by this technique.

Generally the authors should be more quantitative in their descriptions; terms like huge, medium and high are used throughout the paper, but leave the readers with a lack of quantitative understanding. For example 'huge AOTs' (P4128, line1) is certainly rather overstating things when one considers that the AOTs in Figure 5a do not exceed 0.25.

Specific:

P4123, section 4.2. I like the analysis, but it could be improved by including pdfs of the AOTs for each case.

P4126. Three potential areas of error are highlighted, but not investigated further. Given that AERONET provides some data on the aerosol size distribution and the

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refractive index, it would be worth modifying the POLDER algorithm to see if this source of error can explain the differences.

P4127. l1–10. The authors should look at the AERONET Angstrom coefficients as well as the POLDER Angstrom coefficients as AERONET is considered to give the best estimates.

P4130, l12–15. With some more effort the reasons for the differences between the model and the POLDER observations wrt AERONET could be elucidated. In this way, both the model and the POLDER retrievals could be improved. The paper currently only points out that there are differences, and stops short of suggesting why these differences occur (for POLDER) and short of quantifying the emission of biomass burning aerosols necessary to bring the model into line with the observations.

Suggested grammatical corrections:

The authors generally do a good job in conveying their messages, but occasionally the language is awkward. These changes would help:

Abstract.

L19. Replace 'with a factor between 1 and 2' with 'by between a factor of 1 and 2'.

L20 Replace 'AOTs do' with 'AOTs'

Introduction:

P4117, l3. Replace 'also conduced' with 'was also conducive'

P4117, l5. Replace 'hit by important' with 'influenced by significant'

P4117, l12. Change 'made function' to 'a function'

P4118, l14. Replace 'Despite those ... to surface one' With 'Despite this recent progress ... to that from the surface'

P4118, l19. Acronym for ATSR.

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P4118, l 23. Replace ‘allow to improve aerosol observations’ with ‘allow improvements of aerosol retrievals.’

P4119, l7. Remove ‘content’.

P4119, l18. Change ‘during’ to ‘for’.

P4123, l20. There is potential confusion using ‘observed’ here as the observations from POLDER have a systematic bias. I suggest replacing ‘observed’ with ‘the POLDER satellite retrievals’.

P4125, l14. Replace ‘difficulty of the model . . . ’ with ‘difficulties in simulating Saharan dust’.

P4126, l21. Change ‘difficulty’ to ‘inability’.

P4127, l29. Change ‘important’ to ‘significant’.

P4128, l1. Change ‘huge’ to ‘enhanced’

P4128, l3. Change ‘fires smoke have’ to “fires’ smoke has”

P4128, l25. Change ‘on several’ to ‘for several’.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 4115, 2005.