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Atmospheric Measurement Techniques Discussions

Interactive comment on "The GRAPE aerosol retrieval algorithm" *by* G. E. Thomas et al.

Anonymous Referee #3

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Thomas et al. present an aerosol retrieval algorithm and examine its performance using artificial data. The particularly interesting feature of the algorithm is that it provides an error estimate.

The manuscript is well written, well structured and concise.

I have five more general and a few specific critics to the manuscript:

1) It is somewhat disappointing that no retrievals on real data are compared to reference data. It is understandable, though, that the authors intend to do so in a forthcoming paper. They might consider publishing this as a "Part II" to the present article.

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2) The acronyms are somewhat confusing. If indeed “GRAPE” and “ORAC” both need to be used, the difference between the two names needs to be clarified. “GRAPE” is used in the title, but most of the paper deals with “ORAC” (if both are exchangeable, GRAPE would be preferable since “ORAC” and the also used acronym “OPAC” are quite similar).

3) On p983, l17 it is stated that there are better aerosol retrieval algorithms available in ORAC. A discussion of this statement would be helpful. Why are they more advanced? Importantly, why should then the algorithm presented in this paper be applied?

4) A crucial limitation of the algorithm is the choice of the a priori aerosol characterisation. Why do the authors limit their retrieval to just five types (or, rather, three types considering that “Arctic” and “Antarctic” types are used only in the respective regions, where the retrieval likely anyway gives highly uncertain results due to the high surface albedo)? Well-defined aerosol climatologies exist with much more detailed information about spatio-temporal distributions of aerosol types.

5) The important feature of the algorithms is to provide error estimates. If it can be shown that these estimates are meaningful, then the product would be highly useful even if erroneous. Thus, it would be very helpful to show in Figures 3, 4, and 6-13 as a third column the error estimate minus the “true” error in order to identify where the error estimate works well (and also, where it is exaggerating the error substantially). It would be helpful to show (by hatching or outlining) regions where the retrieval is consistent with the reality (where the truth is within the error bar of the retrieval).

Specific comments:
p986 l6: scattering

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p987 l7: You have done the retrieval on ATSR2 already. Can you estimate how often radii larger or smaller than the extreme values in the LUT occur?
p988 l10: perhaps "ω_l is given as the average"
p992 l19: are these relative errors (fractions)?
p992 l19: The choice how to characterise the measurement uncertainties seems ad-hoc. Can they be justified? Isn't here a discrepancy to the quantification on p1000 l25?
p993 l1: Why would you retrieve the effective radius also in the log space? Have you investigated what would change if you did it otherwise?
p993 l4: What is the justification of using such a low uncertainty in surface albedo?
p993 l15: Have the radiances been produced by the same model (DISTORT)?
p993 l18: What is the correct surface albedo value? (2p995 l18: maybe "error" rather than "precision"
p1000 l2: beginning
p1000 l12: How often is "most"?
p1000 l12: It would be quite useful to break these error estimates down to the individual sensitivity studies. Could you perhaps add a few rows to Table 1 showing for each sensitivity study the fraction of cases with errors < 2p1001 l13: class
p1004 l11: drop "haves"
p1009 l11: against

Interactive comment on Atmos. Meas. Tech. Discuss., 2, 981, 2009.