

Interactive comment on “Collocation Mismatch Uncertainties in Satellite Aerosol Retrieval Validation” by Timo H. Virtanen et al.

Timo H. Virtanen et al.

timo.h.virtanen@fmi.fi

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We thank the Referee for the positive feedback, constructive comments, and for improving the language of the manuscript. The general and specific comments are answered below and the changes to the manuscript are indicated in a separate pdf file.

General comment

The DRAGON data set allows quantification of 'real' spatial and temporal variabilities of AOD, thus quantification of 'real' CMU (as opposed to the simple standard deviation of AOD shown in this paper). I believe that adding discussions on the real CMU and potential limitation of the satellite-derived CMU will improve the quality of the paper.

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Discussion paper



We recognize the value of the DRAGON data set as a rare source of information on the 'real' AOD variability. The use of this ground-based data is crucial in evaluation of the satellite based CMU estimate, and we have tried to emphasize this throughout the manuscript. The limitations of the satellite-based CMU estimate with respect to the ground-based data is brought up several times in the text: in the abstract (p. 1, lines 10-18), in the introduction (p. 2, lines 3-10), in the methods section 3.2 (p. 7, lines 20-26), again in the results section 4.2 (p. 10, lines 11-17), and finally in the conclusions (p.16, lines 13-15).

The aim of the paper is to provide a simple estimate of CMU, obtainable globally from the satellite data alone, and hence the simple metric (standard deviation of AOD in a sample) was chosen. We used the same metric (standard deviation of AOD for a sample of sites or a sample of measurements for a given site) for the 'real' CMU obtained from the AERONET sites for consistency.

The standard deviation of AOD from a limited number of observations in a given area may not be the best metric for the CMU. We are aware of the airborne data from DISCOVER-AQ, which shows that the AOD can vary by more than 0.2 within 10 km (Munchak et al. 2013; this is cited on p. 2, lines 31-34 of this manuscript). Thus, even the dense network of AERONET sites provided by the DRAGON campaign may not capture the aerosol variability in full detail. Also, as Anonymous Referee #1 pointed out, the use of a symmetric circular area for sampling may not be the optimal choice due to aerosol transport and varying topography. Surely there is room for more detailed studies of aerosol variability and CMU, possibly using high resolution aerosol dispersion models, but that is beyond the scope of this study.

Specific comments

- *Page 1, line 13: the local AOD variability values correlate only weakly for short distance → the spatial variability correlates only weakly with that of AERONET*

for short distances

Corrected as suggested.

- *Page 1, line 18: the total uncertainty estimates → the total uncertainty estimates including the CMU*

Corrected as suggested.

- *Page 2, line 14: based on the them → based on them*

Corrected as suggested.

- *Page 3, line 10: and conclude that → and concluded that*

Corrected as suggested.

- *Page 3, line 21 and some other places: on the average → on average*

Corrected, also on p. 11, line 2.

On p. 10, line 7 we have replaced 'The AATSR AOD variability (σ_{AATSR}) is much larger than the corresponding AERONET value ($\sigma_{\text{AERO}}^{\text{NEAR}}$) on the average' by 'The AATSR AOD variability (σ_{AATSR}) is much larger on average than the corresponding AERONET value ($\sigma_{\text{AERO}}^{\text{NEAR}}$)'.

- *Page 7, lines 12-19: It is recommended to move this paragraph to the end of the section and modify to reflect connections between the statistics of this paragraph (number of data points, mean, standard deviation, etc.) and those of the following paragraphs (N-AATSR, N-AERO, sigma-AATSR, sigma-AERO, etc.).*

We have moved the paragraph to the end of the section and added the terms σ_{AATSR} , σ_{AERO} , $\sigma_{\text{AERO}}^{\text{NEAR}}$, N_{AATSR} , N_{AERO} , and N_{NEAR} where appropriate.

- *Page 9, line 4 and other places: effect . . . to → effect . . . on*

Corrected, also on p. 7, line 4 and in Fig. 8 caption.

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- *Page 16, line 9: sampling distance increases → sampling distance increases further*

Corrected as suggested.

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