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Atmospheric Measurement Techniques Discussions

Interactive comment on "Validating MODIS Above-cloud Aerosol Optical Depth Retrieved from "Color Ratio" Algorithm using Direct Measurements made by NASA's Airborne AATS and 4STAR Sensors" *by* Hiren Jethva et al.

Anonymous Referee #3

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This paper presents an effort to validate a passive satellite imager retrieval of above-cloud absorbing aerosol optical depth using airborne measurements from NASA's AATS and 4STAR instruments. The satellite retrieval is the MODIS color ratio technique developed by the present authors, which uses TOA reflectance at two channels, namely 470 and 860nm, to simultaneously retrieve above-cloud AOD and cloud optical thickness. Comparisons with airborne measurements are shown for five case studies from three field campaigns (SAFARI-2000, ACE-ASIA, and SEAC4RS). The authors show that the MODIS retrievals of above-cloud AOD are in general agreement with the airborne measurements, i.e., a majority of the matchups are within the expected

uncertainty of the MODIS retrievals. In addition, the authors provide a discussion of the challenges that remain for such passive retrievals, focusing specifically on the need to constrain the aerosol radiative models that are at present the largest contributor to retrieval uncertainty.

The paper is well written and provides the sufficient details to understand the analysis. It also represents a significant contribution to the current understanding of aerosol remote sensing, in particular for above-cloud aerosols; as the authors clearly (and rightly) state, this is the first attempt to provide a validation of passive satellite above-cloud aerosol retrievals analogous to the historical efforts to validate clear-sky aerosol retrievals with AERONET. I therefore recommend the paper be accepted for publication in AMT following only minor revisions.

Comments

p. 2, line 19: particular instead of paricularl

p. 2, line 22: The authors here, and elsewhere in the paper, refer to shortwave infrared (SWIR) radiation when referencing what one can infer is the spectral region around 860nm (more obvious references appear later in the paper). Generally speaking, the spectral region from 700 to roughly 1000 or 1100nm is referred to as the near-infrared (NIR), with SWIR referring to wavelengths longer than this but shorter than 3000nm (see, e.g., http://earthobservatory.nasa.gov/Features/FalseColor/page5.php). In the interest of clarity for readers, I suggest the authors verify that their terminology is consistent with general usage, and modify the text accordingly.

p. 5, line 2: "MODIS visible/NIR observations"

p. 5, line 4: I assume the authors use the newest Collection 6 MODIS data? This should be clearly stated.

p. 5, line 34 – p. 6, line 1: Looking at the RGB images in Fig. 1, it appears that the aircraft samples a quite diverse region of the aerosol plumes (e.g., both the middle and

edges), particularly evident in the Apr 20, 2001 ACE –ASIA case and the SEAC4RS case. Is the assumption that the AOD profile is constant throughout the flight therefore valid? It seems to me that the profile could be quite different at plume edge than at plume center. Can the authors comment on this, and perhaps provide the profile statistics for each flight?

p. 7, lines 5 & 7: The authors refer to SSA at 470nm when discussing the absorption effects on the MODIS cloud optical thickness retrievals. However, the MODIS retrievals use either 670nm (over land) or 860nm (over ocean) to retrieve COT. Consider referring to SSA at 860nm instead.

p. 7, lines 9-11: Not only is the aerosol absorption smaller for the radiative models assumed in these cases, but the retrieved AOD is also smaller than what is retrieved in the SAFARI case, which implies a smaller impact on retrieved COT regardless of the aerosol model absorption.

p. 8, line 31: Passive satellite imagers do not “measure” any quantities other than reflected/emitted radiation. All retrievals are therefore derived, or inferred, quantities.

p. 9, lines 19-20: Indeed, constraining the aerosol model is perhaps the most important contribution these campaigns will provide to the passive satellite retrieval science. In my opinion, for these passive above-cloud AOD retrievals, validation efforts such as the one shown here are fundamentally assessments of the aerosol models assumed in the retrievals.

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