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Geoscientific Model Development Discussions

Interactive comment on "A benchmark for testing the accuracy and computational cost of shortwave top-of-atmosphere reflectance calculations in clear-sky aerosol-laden atmospheres" *by* Jeronimo Escribano et al.

Anonymous Referee #2

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Review for Manuscript #gmd-2018-216 "A benchmark for testing the accuracy and computational cost of shortwave top-of-atmosphere reflectance calculations in clear-sky aerosol-laden atmospheres" by Escribano et al.

General comments:

This paper gives very comprehensive comparisons between a benchmark radiative transfer model and other similar but simplified RT models. RT model is one of the most important components in both remote sensing applications and atmospheric modeling

studies. However, just a few papers or reports document the performances of different RT models. The primary object of this study is to provide a benchmark that can help people understand RT model performance in terms of computational cost and accuracy. In my opinion, this work is important, method is solid, results are reproducible and reliable, and the paper is well organized and written.

Generally, I just have one concern about the comparison. The authors gave comparisons at different geometries (SZAs, VZAs, and Azimuthal angles), as described in Table 2. However, I believe it would be more important to give comparisons as a function of scattering angle. For aerosols with "rainbow" feature, aer_ss for instance, the accuracy of I and/or Q/U components may be largely influenced by the number of streams when scattering angles are close to 140 deg.

Other minor points are listed below:

1. Table 2, second line: Solar viewing angle –> viewing angle

2. You may want to put this paper in the references: Ding S, Xie Y, Yang P, et al. Estimate of radiation over clouds and dust aerosols: optimized number of terms in phase function expansion. 2009;110:1190–8.

3. Page 2, Lines 28-32: Please consider add the two papers which describe fast IR and SW RT models and performance comparison against DISORT in the references:

Wang, C., P. Yang, S. Platnick, A. K. Heidinger, B. A. Baum, T. Greenwald, Z. Zhang, and R. E. Holz, 2013: Retrieval of ice cloud properties from AIRS and MODIS observations based on a fast high-spectral-resolution radiative transfer model. J. Appl. Meteor. Clim., 52, 710-726, doi:10.1175/JAMC-D-12-020.1.

Wang, C., P. Yang, S. Nasiri, S. Platnick, B. A. Baum, X. Liu, and A. Heidinger, 2013: A fast radiative transfer model for visible through shortwave infrared spectral reflectances in clear and cloudy atmospheres. J. Quant. Spectrosc. Radiant. Transfer, 116, 122-131, doi:10.1016/j.jqsrt.2012.10.012.

4. Page 5, vertical profiles: For aerosols with the given vertical profile, is there a minimum AOD value that is considered for each layer? If there is a minimum value, then the computing time of AOD=2 case should be longer than AOD=0.2 since for the latter case, less layers contain aerosol particles, right? The computing time comparison maybe biased.

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