

Review of “Multi-sensor cloud and aerosol retrieval simulator and remote sensing from model parameters — Part 1: Aerosols” by G. Wind, A. M. da Silva, P. M. Norris, S. Platnick, S. Matoo, and R. C. Levy

Recommendation: This paper presents an excellent description of how an aerosol module within the GEOS-5 general circulation and data assimilation model can be used to simulate satellite radiances, and then used in the operational retrieval of aerosol properties to compare with known input. A detailed discussion of an application of this to two MODIS granules in biomass burning Brazil ecosystems serves to illuminate its immense value for algorithm developers. The text is well-written and the analysis and figures very clearly presented. I recommend this paper be accepted for publication with only minor editorial changes.

General Comments:

1. This important paper is well written and easy to follow, and the offer to make the software developed herein publically available is commendable.

Major Comments:

1. Illustrating the model vs observations for both an Aqua granule (where 1.6 μm band doesn't work properly) and Terra granule (where all bands work well) is a good example of demonstrating the capability of the observations (and model). Also choosing a case in which the model obtains high clouds and the observations low clouds (Aqua example) is a good comparison to the other case in which both model and observations (MODIS Terra).
2. References cited but missing from the References include: Platnick et al. (2003), Hill et al. (2004), Colarco et al. (2014), Wu et al. (2002), Kleist et al. (2009). Also reference in the paper is made to Levy et al. 2007b, although there is only one Levy et al. paper (2007) in the reference list. Please correct or clarify.
3. In Table 1, it would be useful to include a column with the MODIS band centers (and possibly band widths) of each MODIS channel, as readers of this paper from the modeling community may not be familiar with what MODIS channel corresponds to what wavelength. This is also valuable since Figs. 7 and 8 also refer to aerosol single scattering albedo at bands 1-7. It might be useful to actually label the wavelengths in Figs. 7 and 8 as well.
4. Page 18, line 5 – this is somewhat confusing. There is reference to the AERONET only providing measurements to 1.02 μm (Holben et al. 1998). However, the AERONET sensors have optical thickness to larger wavelengths at some locations, but not Brazil. What is likely being referred to in

this context specifically is the retrieval of aerosol single scattering albedo itself, which is derivable from AERONET inversions out to $1.024 \mu\text{m}$. This is discussed in Dubovik et al. (2002) and not so precisely in Holben et al. (1998). There is no capability to derive single scattering albedo from AERONET at wavelengths longer than $1.024 \mu\text{m}$ due to the need for almucantar measurements that are obtained at 4 wavelengths. A possible rewording of this sentence might be 'AERONET is only able to provide direct inversion retrievals of single scattering albedo for four wavelengths out to a maximum wavelength of $1.024 \mu\text{m}$ (Dubovik and King, 2000; Dubovik et al., 2002).'

5. Page 19, line 6 – reference is made to 'Figure 10 panels b) and d) that now matched the source aerosol optical depth reasonable well...' This is confusing as I would have thought you were referring to panels c) and d) (one for each Brazil case) that fit 'reasonably well.' Please check and confirm the intent.

Minor Comments:

1. Page 4, line 9 – Change 'Spectrometer' to 'Spectroradiometer' in the name for MODIS.
2. Page 4, line 25 – not sure what the reference to AERONET is all about, but some instruments go out to $1.64 \mu\text{m}$, though the older ones only went to $1.024 \mu\text{m}$. The three AERONET sites in Brazil used in Figure 3 do in fact only go out to $1.024 \mu\text{m}$, so perhaps clarification in the text is necessary.
3. Page 10, line 12 – delete 'so-called' as this is not appropriate for a publication.
4. Page 11, line 10 – it is more accurate to refer to the SWIR band as $2.13 \mu\text{m}$ (rather than $2.11 \mu\text{m}$).
5. Page 12, line 16 – change Levy et al. (2013) 'has' to Levy et al. (2013) 'have.'
6. Page 13, line 5 – change 'there is no AERONET data' to 'there are no AERONET data.'
7. Page 13, line 14 – change 'in (Wind et al, 2013)' to 'in Wind et al. (2013).'
8. Figure 2 caption – mention that this comparison is made for aerosol optical depth *at 550 nm*.