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Atmospheric
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Discussions

Interactive comment on "Effect of spectrally varying albedo of vegetation surfaces on shortwave radiation fluxes and direct aerosol forcing" *by* L. Zhu et al.

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Response to referee #1: Thank you for comments. Below are our replies based on your comments. Reply to general comments: Your comment raises a good point about the limitation of the application of the MEVA algorithm: it is good for green vegetation, not so for yellow vegetation. It is possible to find spectral surface albedo measurements over vegetation in different seasons including both summer and winter but we consider this as our next research step, which is out of the scope of this paper. Discussion of this limitation and way forward was added as the last two sentences of the conclusion:

"In this study, the MEVA algorithm validation used laboratory measurements of leaf reflectance as land surface albedo in radiative transfer simulations. This work can be further improved with the analysis of real remote sensing data where individual pixel might be composed of mixed different land and vegetation types including yellow leaves. "

Reply to specific comments: (1) P4047 lines 8-10: A more detailed introduction about SBDART and the input settings for our studied was added as the 2nd paragraph in section 3: "The SBDART is a radiative transfer model based on the discrete ordinate method which includes aerosols, gases, and surface properties (Ricchiazzi et al., 1998) and can run with different atmospheric input settings and customized spectral surface albedo. For this study, the main input parameters are the spectral surface albedo in a spectral range of 0.3 um to 2.5 μm with a 0.01 μm resolution; the spectral aerosol single-scattering albedo (SSA), aerosol optical depth (AOD), and phase function in a spectral range of 0.3 um to 2.5 μm with a resolution of 0.1 μm to 0.2 μm; and the standard tropical atmospheric profile. The phase function was represented by 128 terms of Legengre moments calculated with Mie theory based on the Amazonian aerosol model presented by Dubovik et al. 2002. The outputs are the flux at TOA in Wm-2 μm -1 from 0.3 to 2.5 μm with a default resolution of 0.005 μm."

(2) P4047 line 15-16: AOD = 0.32 (at 0.55 μm) and SSA = 0.89 (at 0.55 μm) represent possible scenarios for biomass burning aerosols over Amazon, which were used to evaluate the MEVA algorithm. Evaluations with different AODs and SSAs were also studied and produced similar results in terms of showing more accurate flux and aerosol forcing calculation with the MEVA method. Aerosol properties (as shown in Figure 10) were obtained through Mie simulations using aerosol properties based on AEROENT observations of biomass burning smoke (Dubovik et al., 2002) as inputs. Mie simulations produced the spectral extinction coefficient, SSA, and scattering phase function that were used as input for the SBDART simulation. In this revision we have added some sentences in the 2nd paragraph in section 3 to better describe

these inputs. As for the phase function, we have used Mie simulated 128 terms of Legendre moments as input for the SBDART radiative transfer simulations. (3) P4050 lines 22-25: We have focused our simulations on biomass burning aerosols because of their large influence over vegetated areas, in particular over the Amazon. According to aerosol optical properties studies (e.g. Dubovik et al., 2002; Eck et al., 2003), biomass burning aerosols have a relatively spectrally constant imaginary refractive index. This simplification has also been applied to the biomass burning aerosol study by Procopio et al. (2003). In our Mie simulation, the refractive index (both real and the imaginary) was assumed to be spectrally constant. Corresponding contents were added in section 3.3. (4) P4051 line 10-13: For the results shown in Figure 13 and Table 6, the surface albedo values used in the simulation were assumed to be SZA independent. As discussed in Yu et al. (2004, JGR), this assumption would not introduce significant error to the daily averaged aerosol forcing calculations. Corresponding contents were added in the 3rd paragraph in section 3.

Please also note the supplement to this comment:
http://www.atmos-meas-tech-discuss.net/5/C2309/2012/amtd-5-C2309-2012-supplement.pdf

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 4041, 2012.