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Comment

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

L. Zhu et al.

zhuli1@umbc.edu

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Response to referee #3: We thank the reviewer for detailed comments. Below are our replies based on your comments.

Reply to general comments:

It appears that there is some misunderstanding about this study, which requires some clarification. We are not arguing that MEVA can “improve the calculation of radiative fluxes and aerosol direct effects, compared to more detailed wavelength-dependent reflectance datasets” as the reviewer points. The MEVA algorithm improves the cal-

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culatation of radiative flux and aerosol direct effects, compared to traditional approaches (noted as Linear MODIS, Average band MODIS, Liang visible and near infrared, and Liang shortwave) and is validated with the “more detailed wavelength-dependent reflectance datasets” (noted as “True” in the manuscript).

More discussions about the methods and results were added and emphasized in the manuscript, as detailed by the replies below to each specific comment.

1. Reply to main comments:

(a) More specific and quantified description about the improvements in aerosol forcing calculation by the MEVA algorithm was added in the abstract.

(b) More discussion about the general vegetation spectral behavior was added in the last paragraph in section 2.2.

(c) The impact of different spectral reconstruction on calculations of aerosol forcing was shown in Table 3, and the discussion was carried out in the last two paragraphs in section 3.1. More discussion about the surface reflectance and aerosol forcing was added in the 2nd paragraph in section 3.1.

(d) Three different aerosol models were discussed in the paper: SSA (at $0.55 \mu\text{m}$) = 0.95, 0.89, and 0.83 as shown in Figure 10. The results associated with these different models were shown in Figure 11 and Figure 12. The results are very consistent for the three models and do not indicate that there would be any important additional information from including extra cases therefore we would like to make the point that the aerosol models presented in the manuscript as sufficient for the purposes of this paper. Also, one of main application of the MEVA algorithm is to improve aerosol forcing calculation for biomass burning aerosols, which strongly absorb solar radiation and should be covered well by the simulated cases.

The reviewer also suggests the addition of “daily-integrated direct effects” but these results are already covered in the paper. The daily integrated direct aerosol forcing

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was shown in Figure 13 and Table 6. These results were also discussed in the last paragraph in section 3.3.

2. Reply to other comments:

(a) Following the reviewer comments, we have now added a call to “Figure 2” in the 4th paragraph in section 1. We also added “Clearly MODIS spectral measurements don’t well capture the rapid increase of reflectance from 0.67 to 0.86 μm and the dips at 1.48 and 1.92 μm . ” after calling Fig.2. Figure 10 was already discussed in the 2nd paragraph in section 3.3. More discussion about Figure 11 was added in the 3rd paragraph in section 3.3.

(b) Pages 4044-4045, section 2.1: more discussion about Liang conversion method was added near the end of the 1st paragraph in section 2.1 as “The approach in methods (a) and (b) is performed through polynomial regressions to convert albedos at MODIS narrow bands to broadband albedos at visible, near infrared, and total short-wave as described in Liang et al. (1999).” Additional details to Liang’s method are referenced to his paper (Liang et al. 1999).

(c) Page 4046, line 12: as suggested by the reviewer the early reference for table 3 has been removed from section 2.2 and was kept at a more appropriate place later in the text.

(d) Section 3: a more detailed description about the SBDART simulations was added as the 2nd paragraph in section 3.

(e) Page 4048, line 1-5: the explanation about why MEVA fail to reproduce dry grass reflectance was revised in the last paragraph in section 3.1: “This might be related with the distinct spectral feature of dry grass in the range of the 0.3 to 0.55 μm (as shown in Fig. 7). In Fig. 7, the spectral reflectance for green grass, conifers, and deciduous is characterized with a reflectance peak starting from about 0.5 μm and ends at about 0.7 μm which is absent from dry grass. This distinct spectral behavior by dry grass might

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be caused by its low chlorophyl and vegetation water content (Hoffer, 1978)."

(f) Page 4049, line 1-5: the text was revised in the last paragraph in section 3.1: "This result indicates that gap filling for the vegetation water absorption missing features has a relatively small impact on aerosol forcing calculation than the impact from the missing red edge. This conclusion is well explained by the relatively weaker solar radiation and stronger atmospheric water absorption around 1.48 μm and 1.92 μm than those around 0.7 μm as shown in Fig. 4 (a)."

Please also note the supplement to this comment:

<http://www.atmos-meas-tech-discuss.net/5/C2315/2012/amtd-5-C2315-2012-supplement.pdf>

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

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