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Atmospheric Measurement Techniques 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.

Anonymous Referee #3

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Review of "Effect of spectrally varying albedo of vegetation surfaces on shortwave radiation fluxes and direct aerosol forcing" by Zhu et al., submitted to *Atmos. Chem. Phys.*

The authors examine a way to obtain the reflectance of vegetated surfaces across the shortwave spectrum from MODIS retrievals at a small number of wavelengths. They argue that accounting, in an empirical way, for surface reflectance features at unobserved wavelengths can improve the calculation of radiative fluxes and aerosol direct effects, compared to more detailed wavelength-dependent reflectance datasets.

The subject is interesting, but the paper lacks an in-depth description of the methods and results, and relies too much on figures that are not properly discussed in the text. I therefore recommend major revisions to improve the quality of the discussion, as detailed by the comments below.

1 Main comments

- The abstract is poor. MEVA appears suddenly on line 12 and the reader has to guess that it refers to what was written before. Red-edge and water corrections are described qualitatively as “most sensitive” and “less sensitive”. This must be quantified. The wording is also incorrect here: something can be “sensitive” to a correction (when that something varies by a significant amount after the correction is made) but a correction cannot be “sensitive” in itself. The conclusion is better written, and the abstract could be derived from that section.

- The description of the MEVA method in the last paragrah of section 2.2 can also be improved. The computation of the reflectance at the 7 auxiliary channels involves seemingly arbitrary factors that are only justified by the statement “*The auxiliary channels and the values of ratios were determined here by the general behavior of vegetation spectra*”. That is not detailed enough - someone trying to replicate those choices could not do it.

- The impact of different spectral reconstruction on calculations of radiative fluxes and aerosol direct effect is interesting, but should be discussed. At the moment, the paper is only a listing of the results. In the case of aerosol direct effect, for example, one could discuss the naïve expectation that taking the difference between two radiative fluxes would cancel out most of the impact of the surface reflectance. This cancellation does not happen, certainly because of the wavelength-dependence of aerosol extinction.

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- In addition, the aerosol work should be expanded to include at least the case of a purely scattering aerosol, and to also look at the impact on daily- integrated direct effects, since the integration over solar zenith angles typically smoothes out some of the differences.

2 Other comments

- The paper includes a lot of figures, some of which are only briefly described and discussed in the text. Worst of all is Fig. 2, which is only mentioned in the captions of other figures, and never discussed in the text. Figures 10 and 11 are only given a single sentence.
- Pages 4044–4045, section 2.1: the description of Fig. 3 can be improved, especially for the Liang *et al.* (1999) methods: mentioning some "conversion" is not accurate enough.
- Page 4046, line 12: It is too early to mention Table 3.
- Section 3: Radiative transfer calculations are not described. How is the shortwave spectrum decomposed (wavebands)? What are the vertical profiles of Rayleigh and gaseous absorption? How is the phase function of aerosol represented? How many streams in the DISORT setup? etc.
- Page 4048, line 1: Why does MEVA fail to reproduce the wavelength- dependence of dry grass reflectance? The explanation in Page 4049, line 12 is unclear.
- Page 4049, lines 1–5: The authors seem to be saying that accounting for water (vapor, I guess?) absorption bands has a relatively small impact on radiative fluxes because... water absorption is strong. The reader can guess what they really mean, but current wording sounds like circular thinking.

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