Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2017-208-RC2, 2017

Geoscientific Model Development Discussions
Open Access
EGU

Interactive comment on "Fast matrix treatment of 3D radiative transfer in vegetation canopies: SPARTACUS-Vegetation 1.0" *by* Robin J. Hogan et al.

Anonymous Referee #2

Received and published: 21 October 2017

The modelling of radiative transfer in plant canopies is an important aspect of the land surface component of weather forecasting and climate models, with impacts both directly on the radiation field and indirectly on photosynthesis. An accurate and reliable scheme is therefore required; but typically those employed in such models are relatively simplistic. The authors describe a new scheme that takes better account of horizontal heterogeneity in vegetative canopies and test it against two benchmarks, finding significant improvements from the representation of heterogeneity and the associated lateral transport of radiation. The paper is well written, scientifically sound and certainly within the scope of GMD. I recommend that it should be accepted subject to minor revision. Specific comments follow.

Printer-friendly version

Discussion paper

1.) Page 3, line 7. Please add “ly" after “explicit."

2.) Page 6, lines 10–21. I am unclear about the fundamental parameter here. The equations require L^{ab}. Is this what you would measure in the field, or would you measure D and infer L^{ab}? In the former case, D is just an illustrative diameter, but is more fundamental in the latter case. In the case of dense canopies, if L^{ab} is measured, what is the purpose of S, the meaning of which is unclear? Conversely, if you infer L^{ab} from S, how is S determined in the field?

3.) Page 11, lines 6–9. I assume that regions b and c still have the same area, as noted on page 6. It would be useful to remind the reader of this. On line 8, the argument should apply to any sphere, not just one with an LAI of 5. It is not clear to me why factors of 0.5 and 1.5 have been chosen. If the distribution of zenith optical depth is split into two equal parts by projected area, I expect the denser region to correspond to a core of radius $r/\sqrt{2}$ excised from a sphere of radius r. In this case I think the core will contain about 65% of the volume of the sphere and so the same fraction of the total leaf area. I would therefore expect the proportions to be 0.707 and 1.293, not 0.5 and 1.5.

4.) Figure 6. Previously, results for both the VIS and NIR regions have been shown. Why is the NIR omitted here? Unless the differences are trivial I would suggest showing this region too.

5.) The authors note (page 13, line 12) that there are large uncertainties in the LAI used in weather and climate models. The underlying datasets are derived from remote sensing, so it would be interesting if the authors could comment on the possible application of their model in the retrieval of LAI. The use of a consistent modelling framework in these two areas would be of considerable value.

Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2017-208, 2017.