

Geosci. Model Dev. Discuss., referee comment RC2  
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## **Comment on gmd-2021-178**

Anonymous Referee #2

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Referee comment on "SSolar-GOA v1.0: a simple, fast, and accurate Spectral SOLAR radiative transfer model for clear skies" by Victoria Eugenia Cachorro et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-178-RC2>, 2021

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The authors present a "simple, fast, and accurate" hyperspectral solar radiative transfer model for clear skies (SSolar-GOA v1.0). They evaluate the model against a state-of-the-art radiative transfer model (libRadtran) and observations, showing an impressive accuracy and promising applicability in a multiple of different disciplines. Although, the overall analysis, focus, and results are, to an extent, appropriate for Geoscientific Model Development, as well as novel and important, I found the writing, organization, and presentation of results severely lacking. I would recommend thorough revising before further consideration. I provide more detailed comments below, however I do think considerable revision is needed before a proper evaluation can be completed.

### PRIMARY COMMENTS

As stated throughout, I found the writing rather awkward, poor, or extremely confusing in several areas. This makes it challenging to follow the rationale, results, and discussion. Please consider a careful review of the writing with extra attention paid to sections/sentences that are awkwardly written.

The presentation of results focuses are merely visual or limited to percentual differences. A lot can be learnt from linear fits, and their  $r^2$ 's and RMSE's values. See specific comments for more context.

The model seems to do a great job, but the paper would be more interesting if the authors could explore limitations of the model as well, and move faster to results and discussions. Maybe add more discussion describing how the model could be improved, what areas are lacking, what type of simulations and scientific questions cannot be explored with this model, and how other areas could potentially benefit from this. I know the authors refer to other studies, but without really giving any concrete example in the paper. This is a real breakthrough and I can indicate a few:

Yang, P., Prikaziuk, E., Verhoef, W. and Van Der Tol, C.: SCOPE 2.0: a model to simulate vegetated land surface fluxes and satellite signals, *Geosci. Model Dev*, 14, 4697–4712, doi:10.5194/gmd-14-4697-2021, 2021.

Braghiere, R. K., Wang, Y., Doughty, R., Sousa, D., Magney, T., Widlowski, J.-L., Longo, M., Bloom, A. A., Worden, J., Gentine, P. and Frankenberg, C.: Accounting for canopy structure improves hyperspectral radiative transfer and sun-induced chlorophyll fluorescence representations in a new generation Earth System model, *Remote Sens. Environ.*, 261, 112497, doi:10.1016/j.rse.2021.112497, 2021.

Abstract.

The abstract is too long and contains some methodology. The abstract should be concise and describe general relevance and main results. Line 12-18 could be removed. Starting the abstract with the general applicability of the study may attract interest. This section should be re-structured.

Line 10: are adapted? It looks like something is missing. It looks like it is a direct translation.

Line 14: "sufficient accuracy" – can you provide a  $r^2$ ? A RMSE in percentage? Anything that exemplifies what that means.

Line 28: Avoid wording like "obviously" in scientific writing.

Introduction.

Line 32- Earth-atmosphere System

Line 36- energy?

Etc is a vague word and should probably be used minimally.

Line 45 – what is etc? be precise. Please define the spectral wavelengths associated with UV, visible, etc.

Line 55 – do not refer other studies in this way. Just write these between brackets.

Line 60 – etc.

Line 71 – 1-10 nm is low to medium? Don't you mean medium to high?

Line 79 – libRadtran reference?

Material and methodology.

This sections is way too long and could be substantially reduced, with some of the sections moved into a Supplementary material or appendix.

Line 139 – etc.

Line 142 – Earth

Line 159 – the BLB law.

Line 160 – which component?

Line 161 – This gives rise? What does that mean?

Line 163 – etc. Paragraph 3.1?

Line 164 – there are two verbs in this sentence.

Line 165 – you already defined RTE before.

Line 166 – to solve -> solving

Line 168 – specific problem involved? This is so general. Give examples.

Line 172 – ETR?!

Line 173 – for the diffuse component only.

Line 174 – Not only to the atmosphere, but adapted for canopies to:

Sellers, P. J.: Canopy reflectance, photosynthesis and transpiration., *Int. J. Remote Sens.*, 6(8), 1335–1372, doi:10.1080/01431168508948283, 1985.

Line 179 – ETR?

Line 197 – BLB law.

Line 212 – period missing.

Line 224 – Again, 1-10 nm is a very resolution.

Line 226 – what is this error?

Line 231 – Thank you for giving the link to the model. How can the direct component be higher than the global one for some wavelengths?

Line 233 – You already defined BLB.

Line 289 – Use the symbol of micrometers.

Line 321 – 1 DU instead of 1 dobson.

Section 3.3. This list of items could be a Table.

Results.

Fig1. Add degrees to the numbers next to SZA. Write down Direct-horizontal instead of dir-how. Figures should be directly interpretable.

Line 444 – Before the comparison? What?

Fig 1 and 2 could be combined into one single figure, with the top row being fig 1 and bottom row fig 2. Ozone = 300 DU, not Dobson. Add units of all the other parameters too.

Fig3 should include SZA= 6 deg as well. Be consistent.

Fig 4 is repetitive and could probably be moved into supplementary material.

Line 533 - see libRadtran user [I<sup>2</sup>S](#) guide, 2015? Please reference appropriately.

Fig 4 and 5 could be combined into a single one too. Same thing about adding degrees next to the SZA numbers throughout.

Fig 6 – what are the different colors? Please use an include color scheme suitable for colorblind people.

Fig 7 – Please add the runs from libRadtran here for comparison too.

Line 586 – How do you know the agreement is “excellent”? Visually, it looks great, but could add some statistics into your evaluations? A linear fit with observed/simulated with libRadtran versus SSolar-GOA ( $r^2$ , RMSE, and slope) could tell us so much about model performance.

Fig 8 - Please add the runs from libRadtran here for comparison too.

Fig 9 – This is not your work, could probably be moved into supplementary material. Please add the full citations in the figure, e.g., Kurucz, 1992.

Line 634 – add comma after ‘To this’.

Fig 10 – show linear fit with  $r^2$  and RMSE.

What is the purpose of Fig 11?

Fig 12 – show linear fit with  $r^2$  and RMSE.

Conclusion.

Line 708 – avoid huge and extensive.

Line 711 – avoid enormous.