Answer to Reviewer 1

Answers to the reviewer CrVirac for the manuscript
"SSolar-GOA v1.0: a simple, fast, and accurate Spectral SOLAR radiative transfer model for clear skies" submitted to Geoscientific Model Development (GMD) by Victoria Eugenia Cachorro, Juan Carlos Antuña-Sánchez and Ángel Máximo de Frutos

The authors thank to the reviewer for the effort to review the manuscript and for its fruitful and detailed comments.

General Comments

The paper presents the SSOLAR-GOA model, which is a spectral radiative transfer model for the solar radiation under clear skies. The model provides global, direct and diffuse irradiances at the surface. The model is rather simple, since it assumes the atmosphere is a single homogeneous (plane-parallel) layer – a mixed layer of molecules and aerosols. The paper describes all components of the model in a clear manner. In addition, the model code is well documented and easy to use with a nice graphical user interface. The SSOLAR-GOA irradiances are validated against those simulated with the radiative transfer package libRadtran as well as field measurements. The results of this comparison are thoroughly elucidated. The model generally shows a good agreement with libRadtran simulations and measurement data throughout the majority of the solar spectrum under presented clear-sky conditions.
However, my research focus is radiative transfer in the presence of clouds – therefore my principal concern lies in the general applicability of this clear-sky model. Clouds are the main atmospheric modulators of solar radiation and profoundly impact surface irradiance. The incorporation of cloudiness in radiation codes is well established and should be considered in the next stage of the SSOLAR-GOA model development.
Overall, the paper is well structured and written (although grammar should be improved at several places). I support it for publication in GMD after a few comments are addressed as outlined below.

Response: We answer to the main concern of the reviewer. The main aim of this work is to deliver a simple spectral solar radiation model under clear skies to a broad users community, not familiar with radiative transfer theory and specially to people in solar energy applications or educational frameworks, thus the applicability of the model is well defined. Spectral solar radiation models based on physical fundamental are scarce in most of these communities, being the majority of models obtained by parameterizations or expressions based on experimental data. The objective of this paper is to fill the gap between the Radiative Transfer Codes and those more simple solar models, working as an intermediate stage between them. The same reviewer emphasizes the simplicity of the model, "a single layer and not include clouds". The model emphasizes the Ambarsumian´s methodology of "addition of layers" to get an effective layer where the transmittance is given by a very easy expression. The simplicity of the expression against the two fluxes methods existing in the bibliography is a merit to mention, together with the fact that this methodology is less known comparatively to the different two flux methods.

As recommended, our purpose in future works is to include a plane-parallel cloud layer giving an "effective cloud-layer" which can produce the same surface irradiance that multiple layers for cloudy cases. Also to compare the Ambarsumian method with other two fluxes methods, well known in the bibliography but with a most complicated expressions. First results indicate a different behavior in the range 350-450 nm between them, and further research should be carried out

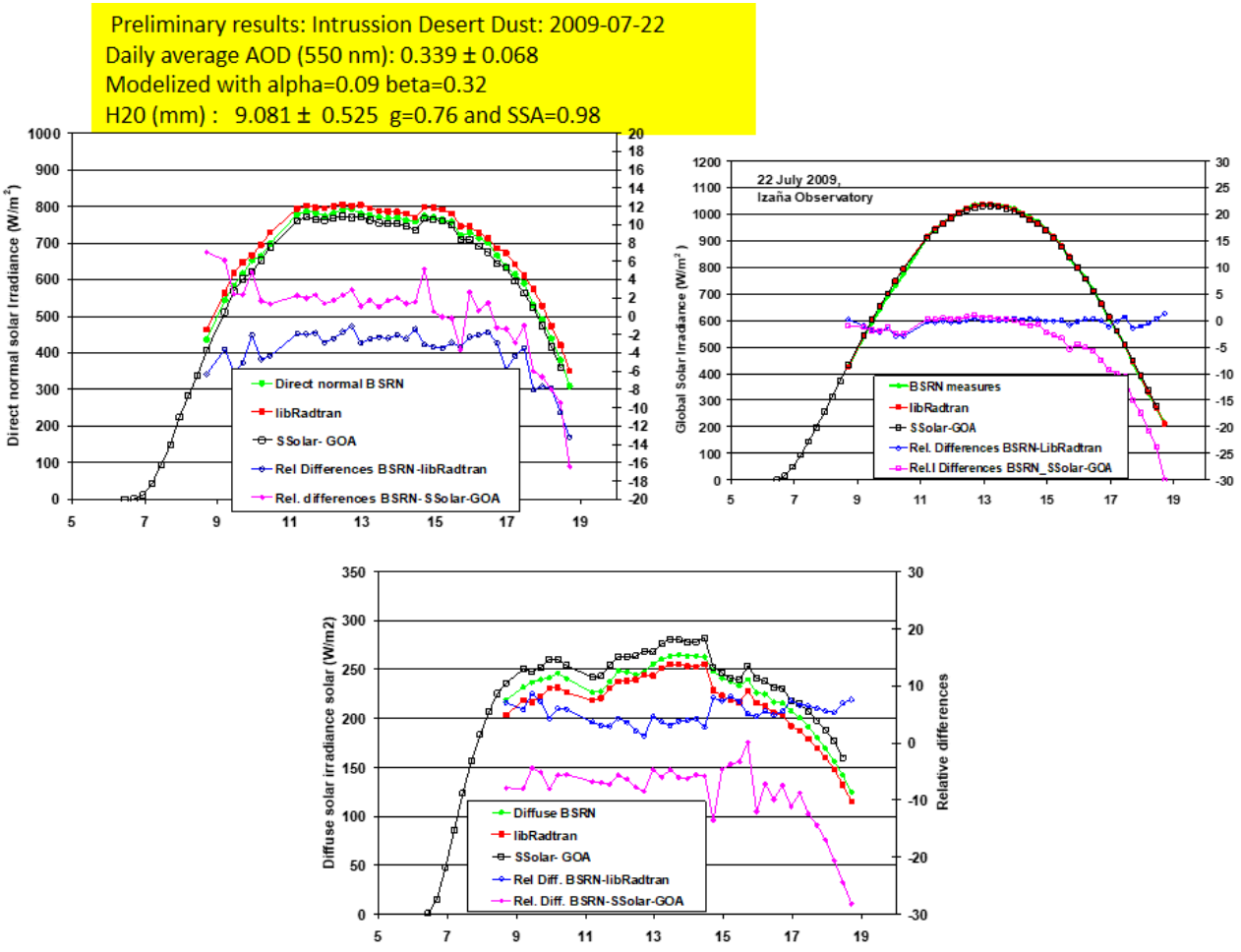
Specific Comments:

***Answer to point 1*.** This point was discussed above. We mentioned that future versions of the SSolar-GOA radiation model can include a cloud layer, but the transformation of the first version of the model, proposed in this paper, in a multiple layer model distorts the main objective of this work. As we mentioned, potential

uses of the SSOLAR-GOA model are suitable for educational and solar energy applications, which do not need really the inclusion of cloud effect. We thanks the reviewer about the recommendation on the application of the method by Callahan et al. (1994) in future versions of the model. We agree this could be the physical bases if a cloud-layer is included in our model.

Answer to point 2. We agree with the reviewer, but the differences between our model and libRadtran model are not only due to vertical structure and multiple layers. The way to obtain the diffuse components of the two models (libRadtran and SSolar-GOA) is completely different and the limitations are already explained in the text of the manuscript.

In this context we have applied our model under strong aerosol conditions: a desert dust intrusion in the Canary Islands. The predicted by SSsolar-GOA and libRadtran and measured surface irradiances are shown in the next Figure (in this case with integrated values). As can be seen for global and direct irradiance components the comparison is very good: relative error below 5% despite considering constant values for alpha and beta along the day. The variations of these parameters were weak and the estimated irradiances match the experimental values. However, we are working about this subject to improve these results.



Answer to point 3. Corrected. We have updated the reference based on your suggestions.

Answer to point 4. Corrected the typo about Rayleigh optical depth of line 254.

Answer to point 5. The other two files of extraterrestrial irradiance have been added to Zenodo and they are available for calculations in SSolar-GOA model. Also as recommended one file of direct normal and global irradiances have added to ZENODO to enable reproducibility.

Answer to point 6. Thanks for the suggestion, this will be take into account in the future version of the model when added clouds. Partially cloudy cases are difficult to simulate by 1D models, but we are going to investigate about this topic for further versions of the model.

Answer to point 7. All the units have been corrected throughout the manuscript according GMD policy units.
Answer to point 8. Four labels about the SZA values have been added to Figure 6 as required.

Answer to points 9-14, about Technical corrections: typing and language errors.

Based on the reviewer's good suggestions, the minor grammar corrections have been done, as RTE for ETR, those for the uniformity of libRadtran and SSolar-GOA names, etc..