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## ***Interactive comment on “Recent variability of the solar spectral irradiance and its impact on climate modelling” by I. Ermolli et al.***

**I. Ermolli et al.**

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Thank you for your comment. As far as we understand, it raises the following issues:

1) A perceived inadequate representation of the SRPM model.

To avoid misunderstanding, we stress here that Section 3 of our manuscript does not pretend to be a complete description of the available techniques to model solar irradiance variations. This section describes irradiance models that can be used in CCM simulations and only to the extent needed to provide the potential users (in particular, the climate community) with a general introduction to irradiance modelling and a description of possible sources of differences between the model output. All details that are certainly important for solar physicists but might rather be confusing for the climate

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community are far beyond the scope of this paper. Thus we would like to point out that Sect. 3.3 presents the SRPM model in exactly the same summary form as this is also done for the other four irradiance models described there. The length of the SRPM subsection (32 lines) lies within the length range for other models (28-35 lines), with the only exception of the NRLSSI model (47 lines). The longer description for the NRLSSI is due to the fact that this model uses somewhat different techniques for different spectral ranges. Note also that at the beginning of Sect. 3.3 (cf our manuscript line 6, page 24590) we write that “SRPM covers all levels of the solar atmosphere from the photosphere to the corona and takes departures from the NLTE conditions into account.” The importance of taking non-LTE effects into account is also pointed out in other parts of this section. We are not sure just how important for the potential users of the data set coming predominantly from a non-solar-physics community the fact that the model “considers full non-LTE radiative transfer in 50 species and with many levels and approx 70,000 atomic lines, plus hundreds of thousands molecular lines included”, as specified in the posted comment. We can include this sentence at your request, but we emphasise that we cannot include significantly more details for SRPM than it is done for the other models.

## 2) An inadequate reference to SRPM bibliography.

Subsection SRPM of Sect. 3.3 only describes the \*current\* (i.e. latest published) version of the SRPM-based irradiance reconstruction, in the same way as this is done for other models. This is to provide the climate community, at which this review aims, with a general insight into how the irradiance data sets that they use are built and what the main differences between them are. A general overview of the models is given at the beginning of Sect. 3.3, where also references to the earlier versions as well as some other models are given. We note that altogether 10 papers authored by you are cited in this manuscript. If you believe there are further papers that are \*directly\* related to this manuscript and its goals but are not cited, please give us the references and suggest, where they should be included.

Please note that the paper you mention in the comment (Fontenla et al. 1999, ApJ 518) is cited throughout our manuscript 6 times. Besides, the subsections describing the SATIRE-S, COSI and OAR models, all state that these models partly use different modifications of the Fontenla et al. model atmospheres.

3) A putative misrepresentation of SRPM by saying that this model is purely based on SIM results.

Sect. 3.3 starts with a general description of the evolution and main common features of the irradiance models. It states that semi-empirical atmospheric models (cf our manuscript line 21, page 24584) and radiative transfer computations (cf our manuscript lines 26 and 29, page 24583) going back to the work of Vernazza et al. (1981) are part of many models. References to Fontenla et al. (1999, 2009, 2011) models are also given. The first paper related to the RISE project is cited 6 times at different places of the manuscript. Note again that we did not mean to provide a complete list of all models ever published in the literature.

The first paragraph of the SRPM-subsection clearly says that 7 models have been used until recently and explicitly cites Fontenla et al. (2009), which is, to our knowledge, the latest published version of the models before Fontenla et al. (2011) and contains all necessarily references to the earlier modifications. It is also clearly stated that in the 2011 paper, two new models were added and 2 existing ones were modified.

In addition, we would also like to mention that the most recent \*published\* paper based on the SRPM model (Fontenla et al. 2011) states that “A few modifications to the photosphere of the plage models were carried out to assure a reasonable behaviour of the spectrally integrated radiative losses and to better match the SORCE/SIM observations of solar irradiance variations over the decay of the last solar cycle” (cf Fontenla et al. 2011 paragraph 15, page 3) and that “Further improvements were done in the models in order to better match the SORCE/SIM data shown by Harder et al. (2009) that covers more wavelengths” (cf Fontenla et al. 2011 paragraph 60 page 11). We think

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this aspect of the SRPM model must be mentioned in our manuscript, as it clarifies the possible differences in the results compared to other models (partly based on the SRPM model atmospheres as well) to the potential readers and users of the irradiance models for CCM simulations.

As the changes applied to the SRPM models are not further specified in the Fontenla et al. (2011) paper, there is no way to make our text more specific. However, in order to avoid any misinterpretation of the model, we will revise the appropriate sentences of our manuscript to make clear that the current version of SRPM is build on earlier models. We will also use only the terms employed in the original Fontenla et al. (2011) paper to describe the recent modifications. Besides, particular attention will be paid to move to the discussion subsection any statements that might appear not strictly relevant to the description of models.

With regards to the comment that the SRPM model predicted the trends measured by SORCE/SIM, we were, unfortunately, not able to find statements and figures in the published papers that could support this claim. We can only include such a statement, if you provide us with a full exact reference (article, line and page of the statement or figure number), so that this information can be added to our manuscript while revising it. We believe that we can only refer to a clear and unequivocal statement. We emphasize that we cannot include any interpretation of indirect statements.

4) Neglected discussion of some results presented either in the literature or during meetings.

The discussion of the results mentioned in the posted comment which concern variations of the photometric properties of regions observed in the solar atmosphere is irrelevant to the purpose of the manuscript, which is to present and discuss existing measurements and estimates of SSI variations and their use in the CCM simulations.

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 24557, 2012.

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