Atmos. Chem. Phys. Discuss., 15, C5643–C5646, 2015
www.atmos-chem-phys-discuss.net/15/C5643/2015/


Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "On the ability of RegCM4 regional climate model to simulate surface solar radiation patterns over Europe: an assessment using satellite-based observations" *by* G. Alexandri et al.

**Anonymous Referee #2**

Received and published: 5 August 2015

General comments:

This manuscript is an interesting study on assessing the ability of RegCM4 to simulate surface solar radiation (SSR) over Europe. The methodology developed in this paper shows a qualitative and quantitative contribution of various known parameters that affect SSR, such as cloud fraction, cloud optical thickness, cloud effective radius and aerosol optical depth. Though there are some studies recently that have analysed the radiation scheme found in regional climate models, none to my knowledge have gone

in depth as this study to quantitatively show how various factors as listed above affect the SSR. The methods they have used are properly applied to obtain their results with sufficient analyses. The scientific content is also appropriate for the journal and the paper would make an important contribution to the topic that deals with the assessment of a regional climate model to simulate such an important radiative flux component. Though I think the paper is publishable, there are some issues that need to be taken care beforehand such as found in the comments below and those that include being more consistent in the results and better clarity in the figures.

Major or specific comments:

It would be very useful if you could draw a major conclusion as to which variable out of CFC, COT, and AOD were most important to the RegCM4-CM SAF SSR deviations over the whole of Europe and on an annual basis. This should be included in the paper and in the abstract.

Overall the data used in the analyses are presented clearly in section 2, but two of the subsections could be written more concisely dealing with the equations of Rel and Rei in section 2.1 and the CM SAF satellite data in 2.2. Please see the minor comments below for more details.

Regarding the datasets used in the study, I recommend making a table to show all the variables and its source from the datasets used and their corresponding periods and original resolutions. The reader can simply refer to this table and see at once all the variables and datasets used for the analysis. Please see the minor comments for more details.

Detailed information was given on the biases found in the variables from the literature including the cloud property variables from CM SAF satellite but none on the other data (AOD, ASY, and SSA, ALB, and WV). Please add this in your section 2.3 Other data.

As completed for the cloud fractional cover and the cloud optical thickness, additional



ACPD
15, C5643–C5646, 2015





comments should be made dealing with the spatial patterns seen in the cloud effective radius, aerosol optical properties, and other parameters (WV and ALB) compared to that of the SSR of RegCM. From a qualitative perspective, do these parameters explain the SSR patterns seen in Figure 1? Such comments should be made respectively at the end of their sections, i.e. sections 3.3.2, 3.4, and 3.5.

The conclusion section seems to be a repeat of the results. If you do this, I recommend to make a summary of the results by writing these paragraphs more concisely. Also, a few comments as a separate paragraph should be written on comparing and/or contrasting these SSR results to the ones in the references you cited in the Introduction, i.e. Jaeger et al. (2008) and Kothe et al. (2011). The new title of this section should then reflect these changes and called the Summary and Conclusions section.

Minor comments:

Regarding section 2.1 on description of the model, where it is mentioned that the emissions are monthly historical, are they also time independent or not changing in time? If so, this would affect your results of simulated SSR. Please account for this in your conclusions.

Lines 170-173: You mention the influence of CFC, Re, and cloud water path (CWP), but is there any particular reason you analysed the cloud optical thickness (COT) instead of the CWP or not analysing both?

The equations that follow line 180 through line 194 can be all taken out and referred to from the studies of Giorgi et al. (2012), Slingo (1989), and Briegleg et al. (1992) if the reader is interested.

Lines 223-229: This paragraph should be taken out and used instead in the introduction as you started in lines 82-85. Add this paragraph i.e, lines 223-229 to lines 82-85. As stated in the major revisions above, I recommend making a table at this point showing all the variables used, their data sources, periods, and original resolutions. It should



ACPD
15, C5643–C5646, 2015

also be made clear here in the text of this paragraph or somewhere in the introduction what period you will use for your main investigation. Following this in the introduction, you should also state here why you chose these data, such as its used as input for the radiative transfer model which is also used in the CM SAF SSR estimation as you pointed out in lines 377-380. It would be clearer to the reader if you pointed this out sooner as in the introduction.

Lines 251-298: The descriptions of the MagicSol-Heliosat algorithm and the MSG satellites should be written more concisely or condensed.

Lines 317-320: Is this homogeneity considered for Europe or globally?

Lines 344-347: Does this bias refer to a global bias?

It is interesting that the results in Figure 10 for eastern Europe show that AOD contributes to the SSR positively for all months of the year, but why this is not reflected in the negative change in SSR in eastern Europe in Figure 1?

Technical comments:

Line 8: Change the sentence to: “The SSR bias. . .”

The fonts of the figures in the main text of the paper should still be addressed as the fonts are still hard to read at that size.

All figures: Larger fonts should be used for all parts of the figure. The same corrections should be made for all remaining figures.

A black font or one that would be clearer to read should be used in figures 1,4, and 7. This refers to the text of different seasons on the upper left-hand corner of each panel in the map.

---

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 18487, 2015.