

We would like to thank Dr J. Trentmann for his comments that helped us to improve the quality of our paper. The changes proposed by the referee are marked in the revised version of our manuscript with a red color.

Major or specific comments:

1) “The manuscript itself already provides a lot of tables with detailed information on the regional differences; in addition a 34-page supplement is accompanying the manuscript. Overall, by the huge amount of numbers, tables, and figures in the manuscript the main message of the manuscript sometimes is not clearly highlighted. Some of the tables and figures, in particular in the supplement, are not referred to in the manuscript. I suggest that the authors consider to remove some of the tables, in particular those without references in the text, and to focus the attention of the reader on the main results of the analysis, which are highly relevant. Please find more specific comments for the streamlining of the manuscript below.”

Answer: Since our main target is this paper to serve as a textbook study for the evaluation of the ability of climate models to reproduce the SSR levels, we would prefer to keep the electronic supplement in its current form. The reader will be able to find all the details about the various parameters utilized in this paper which would be very helpful for future follow-up studies with the same or other climate models.

2) “The differences between the model and the observations are provided with two digits. This accuracy does not seem to be appropriate considering the high spatial variability and the overall uncertainty. It would be sufficient, from my point of view, to provide most values in the text and in the table with one digit, sometimes even integer values would be appropriate.”

Answer: We agree with the referee, the values appearing in the text are given with one digit.

3) “Recently, the CM SAF released a new surface solar radiation data set: SARA (http://dx.doi.org/10.5676/EUM_SAF_CM/SARA/V001), which provides consistent data from 1983 to 2013. Likely, this data set has not been available during the research documented in this manuscript. However, the results of this manuscript will be much more robust and the manuscript will be much easier to follow if this new data set would be used for the assessment, since no differentiation would be required for the time periods prior and after 2005. If time and resources allow I recommend to redo the analysis using the SARA data set and to replace the current results. The supplement could be substantially shortened or even removed.”

Answer: We agree with the referee that a future repetition of this work using the new CM SAF SARA product and possibly various model set-ups would be very important. It is indeed in our plans to proceed to such a research in the near future. Taking into account the time and resources especially as far the radiative transfer calculations are concerned we prefer to keep the original products in this manuscript.

However, we mention in the conclusions section of the revised paper that an update of this work using the new CM SAF SARA product would be very interesting.

Specific comments:

1) “Page 18493, lines 12 ff: Please add a brief statement of the treatment of cloud ice and convective cloud coverage in the radiation scheme in RegCM4. Also add a brief statement on the aerosol scheme and their radiative treatment.”

Answer: We addressed this by adding a few lines in the two paragraphs prior to the one referred in the comment.

2) “Formulas (1) to (7): The diagnostic calculations of the different cloud parameters might not need to be explicitly stated here, a reference to the model describing paper would be sufficient.”

Answer: As discussed above, our main target is this paper to serve as a textbook study constituting a bridge between the modelling and satellite community. Hence, we believe that details about the calculations done by the model and details about the satellite retrievals would be very helpful for members from both the communities to fully understand this research.

3) “Section 2.2: The section on the CM SAF satellite data could be substantially shortened; details of the retrieval algorithm could be left out here with references to the corresponding articles.”

Answer: The same as in specific comment 2.

4) “Section 2.2: Please state clearly, which data set of the surface solar radiation has been used for the assessment. Two different data sets have been used, one for the time period prior to 2006 and one for the years 2006 to 2009. If possible, please provide the digital object identifiers for those data sets. I suspect that the MVIRI data set (DOI:10.5676/EUM_SAF_CM/RAD_MVIRI/V001) has been used for the years 2000 to 2005, and the surface radiation data set from the CM SAF CLAAS data set (DOI:10.5676/EUM_SAF_CM/CLAAS/V001) has been used for the years 2006 to 2009.”

Answer: We address this in the revised version of the manuscript, the digital object identifiers of the two datasets utilized in this paper mentioning the periods of MFG (2000-2005) and MSG (2006-2009) in the introduction and in the main body of the manuscript.

5) “Section 2.4: ...Please carefully check formula (9) and make sure that the sums are correctly calculated. Based on the right side of the formula the middle part should read:...”

Answer: We made sure that the formula is correct.

6) “Page 18500, line9 ff: The other statistical metrics are only mentioned here, but there is no clear definition; the values are listed in several Tables in the Appendix, but they are referred to at all in the text; I suggest to remove these tables.”

Answer: We agree with the referee that the other metrics should be defined prior to their use. So, in the revised manuscript we write “...other statistical metrics (correlation coefficient R , normalized standard deviation NSD , modified normalized mean bias $MNMB$, root mean square error $RMSE$) are also defined, calculated and presented in the electronic supplement of this manuscript...”

7) “Page 18503, lines 7ff, Figure 1: The strong positive bias observed in the Northern Europe during winter is likely due to the satellite data set; no such bias is observed for the period 2000 to 2005 (Fig. S3) when the other satellite data is used as reference.”

Answer: We thank the referee for giving us the opportunity to comment on this. Indeed, the strong positive bias appearing over Northern Europe is likely due to the MSG satellite data since no such bias is observed for the MFG data. We have to highlight that the SSR levels over the region are very low in winter (less than 20 W/m^2). Therefore, retrieval or model uncertainties of few Watts/m^2 would appear as a very large percent bias in the maps. This is the reason why we do not further comment on the strong winter bias over Northern Europe and we also did not proceed to radiative transfer calculations over this region.

8) “Tables 1 and 2: Please order the regions according to Figure 3: start with EU, LA, OC, and then go North – South: NE, CE, EE, IP, CM, EM, NA. Please check the significance of the bias; to me it appears that small NMBs like -1.16 might not be significant considering the high variability of the original data (134 ± 89 and 136 ± 83).”

Answer: The regions have been rearranged in the tables of the revised manuscript. Also, we checked again the significance results using equation (10) and we found that our results are correct. It has to be mentioned here that the values and the standard deviations appearing in the tables come from the whole timeseries of all the grid-cells that fall within each region and not from monthly spatial averages.