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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.

**J. Trentmann (Referee)**

joerg.trentmann@dwd.de

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The manuscript by Alexandri et al., 2015, assesses the ability of the regional climate model RegCM4 to simulate the surface solar radiation patterns over Europe by comparison with satellite-based observations from the CM SAF. The differences found between the model results and the reference observations are further analyzed by comparison of other quantities that impact the surface solar radiation (like cloud optical thickness, cloud effective radius, aerosol properties, and others) with reference measurements

also derived from satellite. The authors find that the good agreement between the model simulations and the observations results, at least in part, as a consequence of contradicting effects in the model. The application of a radiative transfer model to assess the effect of the various parameters on the simulated surface solar radiation is innovative and insightful.

This manuscript contains a wealth of useful information, however, the main outcome / take-home message is not clearly highlighted. The manuscript would benefit from a more focused and dense presentation of the results of the analysis.

**General Comments:**

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.

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.

Recently, the CM SAF released a new surface solar radiation data set: SARAH (http://dx.doi.org/10.5676/EUM_SAF_CM/SARAH/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



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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 SARAH data set and to replace the current results. The supplement could be substantially shortened or even removed.

**Specific Comments:**

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.

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.

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.

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.

Section 2.4: Please carefully check formula (9) and make sure that the sums are cor-



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rectly calculated. Based on the right side of the formula the middle part should read:

$$\frac{1}{N} \times \sum_{i=1}^{N} \frac{RegCM_i - CMSAF_i}{CMSAF_i} \quad (1)$$

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.

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.

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 ($134 \pm 89$ and $136 \pm 83$).

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