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Interactive comment on "Determination of circumsolar radiation from Meteosat Second Generation" *by* B. Reinhardt et al.

Anonymous Referee #3

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Review of "Determination of circumsolar radiation from Meteosat Second Generation" by B. Reinhardt et al.

General comments: The authors present a new method to determine circumsolar radiation from measurements of the geostationary satellites of the Meteosat Second Generation family, SEVIRI. To achieve this, they integrate several pretty complex procedures into one retrieval flow. The authors capitalize on the SEVIRI cloud detection and retrieval algorithms, COCS and APICS, respectively, and make an attempt to improve the latter to reduce retrieval uncertainties. Also, they present a new approach of LUT derivation to translate retrieved cirrus cloud properties into CSR values. To do that, they extend the capabilities of the Monte Carlo radiative transfer model MYSTIC to include a sun disk instead of a point source such that it can simulate the circumsolar

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region with high accuracy. In general, this approach is new and seems to be a useful contribution to the global derivation of CSR values, and hence, the work in the paper deserves publication in AMT. Nevertheless, there are some points in the manuscript that need to be addressed, especially the uncertainty estimation of the APICS algorithm, which serves as an anchor for the whole retrieval chain. Also, the manuscript would benefit from a native English speaker professional that can serve as a language editor. Overall, I think this manuscript will be an important contribution, but suggest implementing English editing and some minor additions, corrections and elaborations throughout the text, as detailed below.

Minor comments and suggestions:

1. In page 5841, lines 22 and 25; please consider changing flat to smooth.

2. Line 6, page 5838: Please rephrase the sentence to be more accurate: cirrus clouds can have (and usually have) COT above 2.0, but the optimal range for CST applications is 0.1-2.0? or just state that the cirrus type relevant for this analysis are thin cirrus clouds (COT$\sim$<3.0) . Also, please note that many of the polar orbiting satellite platforms encounter difficulties in detecting thin cirrus of below COT of 2.0 (e.g. Zhang et al., 2009 for MODIS and POLDER; see reference below).

3. Since the suggested method capitalizes heavily on the retrieved cirrus properties by the APICS algorithm, there is a need for some additional details about the validation and uncertainty of the APICS method itself. So far it seems that the Bugliaro et al. 2011 manuscript is only partially validating the algorithm, especially for thin cirrus clouds. Maybe some details from the present work by Bugliaro et al. [2013, in preparation] should be given. Also, how does the strong forward scattering due to ice particles is treated with the APICS algorithm? And does the algorithm was tested at all with the new ice particle habit that are used in the present work? (the former validation work for APICS seem to be using the Yang ice particle dataset).

4. Page 5841: line 10-12: “This in turn influences the modeling of the circumsolar

radiation as well as the cloud property retrieval, which in the end is also based on radiative transfer modeling". Isn't it the other way around? First the cirrus properties are determined by the APICS algorithm and then they are used as input to derive CSR? The end of the sentence:", which to modeling" seems un-necessary. Also, modeling is spelled with one "l".

5. Page 5841: line 13: "we use a range of cloud bulk optical properties for modeling the circumsolar radiation". The ice particle optical properties used are from various datasets and do not represent a range that is usually attributed to continues variable. Please rephrase.

6. Page 5842, line 21-22: "it is especially important in the context of this study that optically thin cirrus clouds are retrieved as well as possible", sentence not clear; please correct English.

7. Page 5846: line 21: "was assess" change to "was assessed".

8. In Table 1, please state the wavelength at which the k values were calculated. Also, clearly state that in the text corresponding the table on page 5849, line 17.

9. In figures 6 and 7, please color-code the different ice crystal habits for better clarity so that the effect of a specific ice particle habit can be better assessed. Also, please keep x-axis and y-axis similar for both figures, to make the comparison easier for the reader. If possible, please elaborate or suggest explanation for the differences between these figures. It seems that after constraining the total irradiance values (to be above 200) the differences when using different ice particle models are higher (but maybe because clear sky instances were included in figure 7 as well?).

10. In the discussion on Figure 9, the authors can relate their results to the particle mixture habit of the Baum 3.5 set, where bullet rosettes, solid columns and aggregates are the major components in the distribution.

11. In section 3.2, some additional elucidation on the differences between the CSR

values obtained by the two different datasets can add to the understanding of what are the main drivers that affect this difference; the fact that the two datasets represent smooth versus roughened particles? Or their different ice particle habit mixtures? What was the trend for the specific models? (e.g. does the solid columns were closer in result to the Baum 3.5 version than the bullet rosettes?).

12. It would be insightful to see how the same distribution in Figure 12 looks likes with the manual cumuli filter (although number of data points will be reduced), which claimed to produce better agreement. Maybe the authors would consider this as Figure 12b? or at least comment on this in the text.

Zhang Z., P. Yang, G. Kattawar, J. Riedi, L. C. Labonnote, B. A. Baum, S. Platnick, and H.-L. Huang (2009), Influence of ice particle model on satellite ice cloud retrieval: Lessons learned from MODIS and POLDER cloud product comparison, Atmos. Chem. Phys., 9, 7115–7129, www. atmos-chem-phys.net/9/7115/2009

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