Atmos. Meas. Tech. Discuss., 7, C2840–C2843, 2014
www.atmos-meas-tech-discuss.net/7/C2840/2014/


Atmospheric Measurement Techniques Discussions



# *Interactive comment on* "Next-generation angular distribution models for top-of-atmosphere radiative flux calculation from the CERES instruments: methodology" *by* W. Su et al.

**Anonymous Referee #1**

Received and published: 23 September 2014

The manuscript describes improved next-generation angular distribution models that provide top-of-atmosphere (TOA) fluxes from CERES radiance measurements. It covers land, ocean, and polar, clear and all-sky scene types. It documents well how the new angular distribution models are constructed. It also shows how the new models improve the flux compared with, presumably, those used in data process that currently distributed. Once published it will be used for the reference for Ed4 CERES ADMs. The manuscript is long but I understand that this length is needed to cover all surface types and shortwave and longwave. I recommend publishing with minor revision. My comments follow.

Abstract I suggest re-writing the abstract. The authors provide general description of ADM but they should focus on how the new ADMs are different from old ADMs.

Equation (4) is used to assess the improvement of fluxes. But I only see that it is used for clear-sky ocean (Fig. 2) and clear-sky land (Fig. 7). Why is it not used for other scene types and cloudy conditions? If this is the metrics used to assess the improvement, it should be used for all scene types.

Page 8825 Could you explain why aerosol models of Hess et al. are used? If the authors can use any aerosol models, isn't it beneficial to use the same aerosol model that has been used in the CERES already (e.g. OPAC, Hess et al. 1998)? If one derives aerosol direct radiative effect in two ways, an observational approach used in Loeb and Manalo-Smith (2005) or an theoretical approach that use a radiative transfer model such as used in Su et al. (2013), when the same aerosol model is used, it eliminate one ambiguity that might cause the difference.

Page 8839 I do not see how the authors obtain information of sea ice fraction under clouds. In addition, the contribution of sea ice present in the clear-sky portion to the TOA flux is larger the contribution of sea ice under clouds. Therefore, to a first order approximation, the TOA flux is a function of sea ice fraction under clear-sky condition and cloud fraction. If the under cloud sea ice fraction dependence needs to be added, it should be treated differently from the sea ice fraction in the clear sky part. For example, if the cloud fraction is 50%, the range of clear-sky sea ice fraction is from 0 to 50% and the sea ice fraction under the cloudy part is 0 to 50%. But scene types listed in Table 2 are not formed in this way. Please provide descriptions of why the authors included the sea ice fraction under clouds in the way described in Table 2 and how it contributes to improve TOA flux.

Page 8845 Could you explain why cloudy sky ADMs for permanent show, sea ice and fresh snow for longwave are constructed separately for terra and aqua?

Page 8846 The authors separate the effect of ADM improvement from the effect of



AMTD

7, C2840–C2843, 2014



cloud algorithm difference. But they should mention that, rigorously, the ADM effect is evaluated by constructing old ADMs with new cloud and applied them with new clouds. I understand that the reason for not doing in this way but it should be mentioned. In addition, it is nice if the authors can speculate how the result would be if they chose this approach.

Figure 7 Please indicate that these are for clear-sky land in the caption. I do not understand that why values are not shown over the part of Siberia in C and D but appear in A and B. I would think that valid values should appear in either C or D.

Figure 10 Could you mention the scene type in the caption?

Figure 11 How does this improvement happening over the South Pole represent other areas over the Antarctica? The South Pole is viewed from one direction but other area over the Antarctica is viewed from different viewing angles and relative azimuth angles. I would think that the South Pole case is an extreme case.

Figure 15 It would be better if contours showing populations are used instead of black dots for observed LW radiances.

Figure 18 I think that these are old minus new, but it should be defined in the caption.

Figure 19 Why do the daytime and nighttime sample number changes between Ed2SSF and Ed4SSF?

Below is a list of some minor comments that provide more information to readers who are not familiar with CERES ADMs

For the purpose for clarity to those who are not involved in CERES processing, the ADMs currently used should be called as Ed 2 and the new ADMs should be Ed 4 at the beginning of the manuscript.

Loeb et al. (2005) used for the reference of permanent snow, sea ice and fresh snow ADMs. Kato and Loeb (2005), however, present more details of these ADMs. For this



AMTD

7, C2840–C2843, 2014

reason Kato and Loeb (2005) needs to be used as a reference in addition to Loeb et al. (2005)

References

Kato, S, and N. G. Loeb, 2005: Top-of-atmosphere shortwave broadband observed radiance and estimated irradiance over polar regions from clouds and the earth's radiant energy system (CERES) instruments on Terra, JGR, doi: 10.1029/2004JD005308.

Loeb, N. G., and N. Manalo-Smith, 2005: Top-of-atmosphere direct radiative effect of aerosols over global oceans from merged CERES and MODIS observations, J Climate, 18, 3506-3526.

Su, W, N. G. Loeb, G. L. Schuster, M. Chin, and F. G. Rose, 2013: Global all-sky shortwave direct radiative forcing of anthropogenic aerosols from combined satellite observations and GOCART simulations, JGR, doi: 10.1029/2012JD018294.

---

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 8817, 2014.