Atmospheric Measurement Techniques Discussions

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Comment on amt-2021-289

Anonymous Referee #3

Referee comment on "Top-of-the-atmosphere reflected shortwave radiative fluxes from GOES-R" by Rachel T. Pinker et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-289-RC3, 2021

Review for "Top of the atmosphere reflected shortwave radiative fluxes from GOES-R" by Pinker et al.

This paper described the methodology developed to derive surface and TOA SW radiative flux from ABI onboard GOES-R. It includes the conversion of the narrowband radiance observations from ABI to broadband SW radiances that are needed, and the subsequent conversion of broadband SW radiances to broadband SW fluxes. Authors used the MODTRAN to derive the narrowband-to-broadband regression coefficients first for each of the 6 channels and then used the weighed sum for the final SW broadband reflectance. These broadband radiances were then converted to fluxes using a hybrid ADMs from CERES observations and MODTRAN simulations. Major concerns are:

- For the narrowband-to-broadband conversion, the best strategy would be to use common channels on ABI and MODIS (VIIRS) and then develop the regressions using CERES Level 2 SSF data where CERES broadband radiances and MODIS (VIIRS) narrowband radiances are collocated. Spectral band difference adjustment factors (Scarino et al., 2016) can be used to account for the SRF differences between ABI and MODIS (VIIRS). I also recommend using the multi-linear regressions instead of the two-step approach used here.
- The CERES ADMs that the authors used in the study is outdated. I believe those ADMs are based on the CERES on TRMM observations, as the justification that you used to calculate theoretical ADMs is because "CERES observations at higher latitudes are under-sample or not existent". The ADMs from Loeb et al. (2005) and Su et al. (2015) are based on Terra and Aqua observations and provide sufficient coverage over high-latitude regions. The methodology that you developed to combine the CERES and theoretical ADMs are thus not necessary.
- As authors mentioned in this paper, CERES provides TOA SW fluxes, it is not clear from the manuscript why fluxes from ABI are necessary. What are the objectives for deriving fluxes from ABI and what are the potential applications?

Specific comments:

- Line 28, "A satisfactory agreement between the fluxes…" is very vague, including biases and RMS errors will be helpful.
- CERES ADMs are scene specific, the flowchart in Fig. 2 indicates that cloud phase and cloud optical depth are used for ADM. However, the paper didn't describe how these cloud properties are derived.
- Line 116, "The difference between the two radiances were below 5%", is the difference for broadband radiances or any specific wavelength?
- 6, one should avoid using red and green color scheme.
- Line 194, wrong figure number.
- 7, it is hard to see the gray lines.
- 9 didn't separate the comparison into clear versus cloudy conditions, but authors mentioned on line 244 that "The separate-channel" coefficients work well for predominantly clear sky". I assume authors draw this conclusion based upon the flux magnitude rather than any cloud detection algorithm? Magnitude of TOA SW flux is smaller under clear-sky conditions than under cloudy-sky conditions. Absolute flux differences are not the best way to assess the performance for clear- and cloudy-sky conditions.
- Why using CERES FLASHFLUX for validation? I understand the latency issue, but the data presented in this study are from 2017. Surely higher quality CERES (i.e., SSF) are available now for 2017.
- CERES data are of much coarse resolution (~20 km) compares to that of ABI (~2 km), the spatial resolution differences will certainly contribute to the biases and RMS. Authors should consider revise the comparison method by averaging the ABI pixels within the CERES footprints weighted by the CERES point-spread function before comparing with the CERES flux.
- Line 256, what "CODC" stands for?
- Line 271, typo.
- Line 321, authors state that "both estimates of TOA fluxes do no(t) account for seasonality in the land use classification", this is not clear. Do you mean CERES ADMs do not account for land surface seasonality? If so, that is not true. CERES clear-land ADMs are constructed for each calendar month (Loeb et al. 2005, Su et al. 2015).
- Line 376, what do you mean "the order in which these transformations are executed is arbitrary"?
- Line 388-389, CERES Ed4 data were release in 2017 or so, not sure what authors mean that "CERES observations are also undergoing adjustment and recalibration". Please clarify.

Scarino et al. (2016), A Web-Based Tool for Calculating Spectral Band Difference Adjustment Factors Derived from SCIAMACHY Hyperspectral Data, IEEE Trans. Geo. Remote Sens., 54, 5, 10.1109/TGRS.2015.2502904.

Su et al. (2015), Next-generation angular distribution models for top-of- atmosphere radiative flux calculation from the CERES instruments: Methodology. Atmos. Meas. Tech., 8:611–632.

Loeb et al. (2005), Angular distribution models for top-of- atmosphere radiative flux estimation from the Clouds and the Earth's Radiant Energy System Instrument on the Terra satellite. part I: Methodology. J. Atmos. Oceanic Technol., 22:338–351.