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Atmospheric Measurement Techniques Discussions

Interactive comment on "Determining the Daytime Earth Radiative Flux from National Institute of Standards and Technology Advanced Radiometer (NISTAR) Measurements" *by* Wenying Su et al.

Anonymous Referee #4

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Review of "Determining the Daytime Earth Radiative Flux from National Institute of Standards and Technology Advanced Radiometer (NISTAR) Measurements" by Su et al. 2018

General comments:

This manuscript derives sunlit side of the Earth's radiation budget (SW and LW) from a single pixel measurement of NISTAR instrument on board the DSCOVR mission and compares with the radiation fluxes derived from the CERES measurements. This is a very interesting and important work as the Earth's radiation budget has been so far solely measured by the ERBE/CERES project and there are very little independent

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and direct measurements of these important quantities. This work builds upon many previous works the team has been working on for many years including narrowband-broadband conversion, ADM, GEO/LEO composite cloud products etc. The paper is well written and structured. I do have some questions and suggestions regarding the derivation of global ADM and evaluation of each components of the fluxes.

Specific comments:

Line 98: What is the uncertainty level of NISTAR L1B radiance? What kind of calibration procedures have been used to produce the L1B radiance? You have discussed some of the issues later in the paper but it's worthwhile to have a paragraph to discuss the NISTAR at the beginning of the paper. NISTAR provides a completely different methodology of estimating the earth's radiation budget and independent check of Earth's radiation budget created from CERES measurements, the difference found in this article is very serious and should be adequately explained. NISTAR's absolute calibration and uncertainty is of fundamental importance, otherwise the readers would question the well-established CERES products.

Line 147. The conversion from filtered to unfiltered radiances used the ratio derived from model simulation data using eq 5 and 6. Why not using the regression (3) and (4)? The regression indicates the ratio could not be constant because it's a quadratic function and has an offset. It's justified to use a constant ratio between the two if the ratio varies little as for the SW band, but a constant ratio for NIR would introduce an unnecessary source of error (1$\sim$2%) for the NIR and I don't see why you should abandon the regression.

Line 152: Did you use NIR in this work? If not, could you explain why NISTAR takes the NIR measurement?

Line 187: EPIC images have 8x8 km2 resolution at nadir and are 1/cos(vza) larger at larger view zenith angles. The EPIC cloud products are retrieved at its native resolution with (2014x2014) pixels in a granule. Some channels have degraded into 1024x1024

for downlink but reversed to 2014x2014 afterwards.

Equation (9) and (11), Ij and Fj seem to refer to radiance and flux in each EPIC composite pixel. Do you actually use those in the mean ADM calculations? If yes, did you use the EPIC measured narrowband radiances to compute the broadband radiance and flux for each pixel? Why did you grid the fluxes into 1x1 grid boxes and not the radiances? The global mean flux is computed from Eq. 11 to take care of different sizes of grids in each latitude. If you grid the radiance, then you would compute the mean radiance the same fashion as the flux. Otherwise, if you average the radiance from each pixel directly, then you would also have to consider the pixel size differences and the radiance average has to be a pixel-size weighted average.

If my understanding is correct, then the global ADM not only rely on composite product's scene identification, CERES ADM for each pixel, but also on EPIC's radiances measurements (which rely on CERES-MODIS collocation and narrowband to broadband conversion) to derive the global mean ADM. The EPIC-based sunlit global SW flux (Su et al. 2018) has used EPIC radiances and CERES ADMs and does not really need global ADM and thus global ADM is essentially untested. From EPIC radiance to flux, it relies on CERES derived narrowband-broadband conversion and CERES ADM, therefore the EPIC global flux provides some consistent check but not absolute validation in my opinion.

Eq. 13 and 14. From these equations, we know that the NISTAR flux depends on unfiltered radiances from NISTAR and the global ADM derived from EPIC (which itself depend on many other instruments and procedures). I would strongly suggest the authors examine the global ADM and NISTAR's radiance measurements separately to understand the variability and trends from each of these components. The computation of global ADM can be refined as mean radiance could be computed with pixel-size weighted average. The NISTAR total radiance and NIR radiance are also worth looking at especially when LW is derived from total subtract the SW.

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