

Interactive comment on “Reduction in Earth Reflected Radiance during the Eclipse of 21 August 2017” by Jay Herman et al.

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Anonymous Referee #1

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The paper has considerably improved. Most of the my comments and recommendations have been already mentioned by reviewer #1. From my point of view the Maignan et al., 2004 study has to be reported in the introduction sections and the "differences" observed with this study have to be reported in more detail in the section that currently this work is mentioned.

I think this is an interesting and unique work that should be published in AMT.

My co-authors and I have made minor revisions (spelling, punctuation, and slightly improved wording). I added a reference for the gamma correction, corrected the reference list and figure caption list, interchanged the order between figure 10 and 11, removed a duplicate definition of $R_{EN}(\lambda)$, fixed the caption of Fig. 6a, changed the symbol for percent difference PD to PDF to avoid confusion with “Probability Distribution”, corrected the caption of Fig. 8a, 8b, and 8c to (A+D), corrected a date on page 21 from 19 to 20, Fig 11A albedo was miscalculated by a factor of π while Fig. 11B is unchanged, the references to equations on page 23 was changed from 1 and 2 to 2 and 3, and brackets were introduced for $\langle R_{Casper} \rangle$ and $\langle R_{Columbia} \rangle$ for eqns. 2 and 3.

I have added a new figure and text describing the comparison between POLDER and EPIC related to the Maignan et al. 2004 paper. I have also added a mention of the Maignan et al. paper in the introduction.

Measured backscattered radiances of the entire sunlit Earth were obtained during the 21 August 2017 eclipse from EPIC (Earth Polychromatic Imaging Camera) on the DSCOVR (Deep Space Climate Observatory) satellite. EPIC obtains synoptic observations of the Earth from an orbit around the L_1 point (Lagrange 1) 1.5 million km from Earth (Herman et al., 2018). EPIC top of the atmosphere TOA albedo measurements, made at a backscatter angle of 172° , are in the enhanced reflectivity regime (hotspot angles). EPIC non-eclipse day TOA albedos are compared to the satellite instrument POLDER (POLarization and Directionality of the Earth's Reflectances) surface reflectivity measurements at 8° (Maignan et al., 2004).

3.3 Comparison of EPIC albedo with POLDER reflectance

The TOA albedo measurements made by EPIC can be compared with reflectance measurements made by the POLDER satellite instrument near the hotspot backscatter direction (172°) for the incident solar irradiance over nearly cloud-free scenes (Maignan et al., 2004). EPIC C/s can be converted to albedo using the calibration constants $K(\lambda)$, which already contains the factor π (Fig. 11A). The average TOA albedo from EPIC was almost the same on 20 Aug. as on 23 Aug. For EPIC albedo data over grassland common to Casper, Wyoming compared to the POLDER measurements, the C/s data for each wavelength (see Fig.5 for 443 nm) can be converted to TOA albedo.

Measurements from the POLDER satellite over Khingan Range, China (117.55°E to 131.56°E , 45.68°N to 53.56°N) show that the backscatter amount from the land surface increases with increasing wavelength (Maignan et al., 2004). The Khingan range is mainly covered by deciduous broadleaf and a mix of deciduous and evergreen needle leaf forest with a small amount of grassland, while the area around Casper is mainly short grass prairie land with few trees. Over Casper, WY (Fig. 11B), the wavelength dependence of the EPIC TOA albedo (551, 680, and 780 nm) at 172° backscatter angle is similar to POLDER surface reflectance at 8° . The shape and magnitude differences are partially caused by the atmospheric component of the albedo that includes some light cloud cover, whereas the POLDER reflectance has atmospheric effects subtracted. The effect of increasing Rayleigh scattering is seen for shorter wavelengths measured by EPIC.

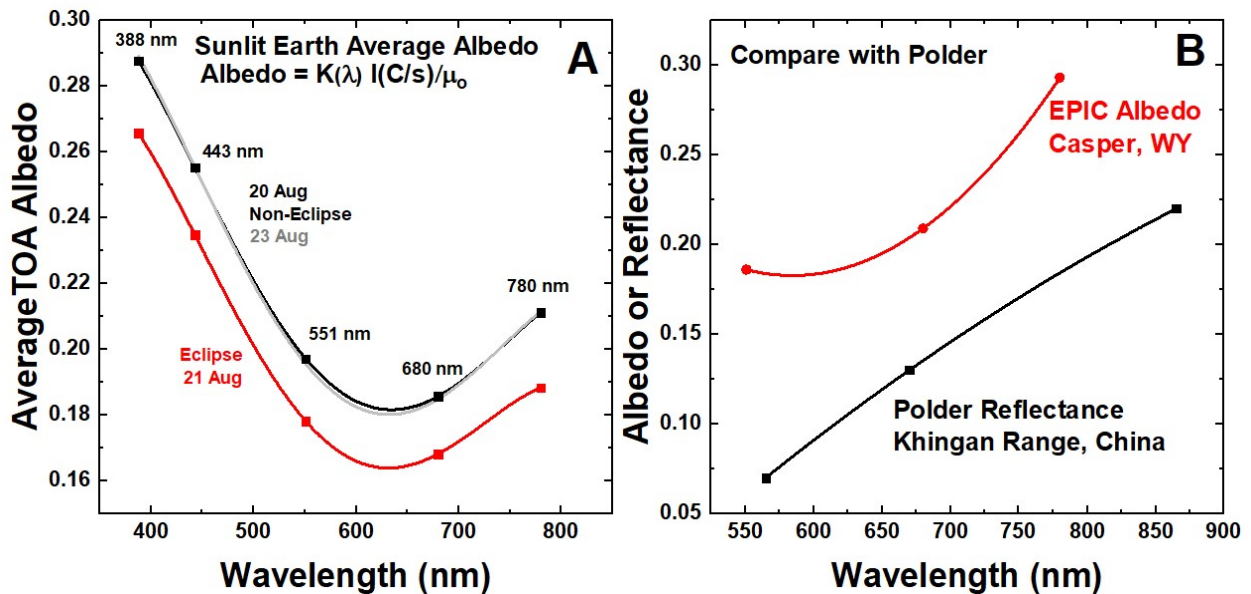


Fig. 11 A. The measured albedo at Casper Wyoming on 20 Aug (black curve) and 23 Aug (grey curve) compared to B the POLDER measured surface reflectance in the Khingan Range, China (Maignan et al., 2004) corresponding to 8° from overhead sun.