Interactive comment on “Reduction in Earth

Reflected Radiance during the Eclipse of 21

August 2017” by Jay Herman et al.

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.

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^O, are in the enhanced reflectivity regime (hotspot angles). EPIC non-eclipse day TOA albedos are compared to POLDER surface reflectivity measurements at 8^O (Maignan et al., 2004). This study focuses on data from two selected locations during the 21 August

The TOA eclipse measurements made by EPIC are near the hotspot backscatter direction (172^{O}) for the incident solar irradiance over nearly cloud-free scenes. For land surfaces, such as the observations made at Casper and Columbia, measurements from the POLDER satellite over Khingan Range, China (117.55°E to131.56°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). For EPIC albedo data over grassland that are comparable to the POLDER measurements, the C/s data in Fig. 9 can be converted to TOA albedo. When this is done (Fig. 10), the wavelength dependence of the EPIC TOA albedo (551, 680, and 780 nm) is similar to POLDER surface reflectance at 8^{O} even though there is no EPIC atmospheric correction and there is some light cloud cover. The average TOA albedo from EPIC was almost the same on 20 Aug. as on 23 Aug. (Fig.10A).

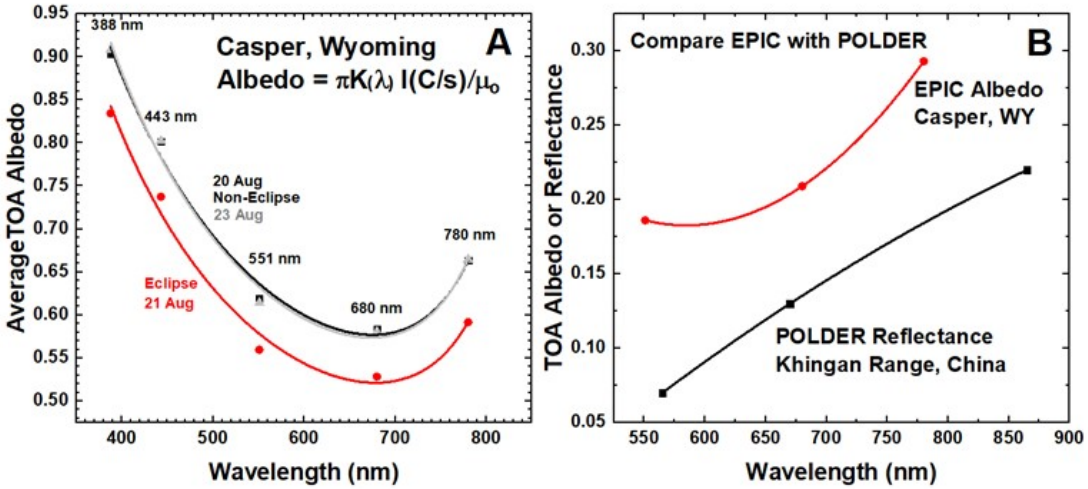

Fig. 10 A. The measured albedo at Casper Wyoming on 20 Aug (black curve) and 23 Aug (grey curve) compared to B the POLDER measured surface reflectance in the Khingan Range, China (Maignan et al., 2004) corresponding to 8^{O} from overhead sun.

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. 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.