

## ***Interactive comment on “Synoptic Ozone, Cloud Reflectivity, and Erythemal Irradiance from Sunrise to Sunset for the Whole Earth as viewed by the DSCOVR spacecraft from Lagrange-1” by Jay Herman et al.***

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Response to Referee #2

I have modified the abstract to reflect the reviewer's comments

EPIC (Earth Polychromatic Imaging Camera) onboard the DSCOVR (Deep Space Climate Observatory) spacecraft is the first Earth science instrument located near the Earth-Sun gravitational plus centrifugal force balance point, Lagrange-1. EPIC measures Earth reflected radiances in 10 wavelength channels ranging from 317.5 nm to

C1

779.5 nm. Of these channels, four are in the UV range 317.5, 325, 340, and 388 nm, which are used to retrieve O<sub>3</sub>, 388 nm scene reflectivity (LER Lambert Equivalent Reflectivity), SO<sub>2</sub>, and aerosol properties. Unlike low earth orbiting satellite instruments near noon values, these synoptic quantities for the entire sunlit globe from sunrise to sunset obtained every 68 minutes when it is summer or 110 minutes in winter at the receiving antenna in Wallops Island, Virginia. Depending on solar zenith angle, either 317.5 or 325 nm channels are combined with 340 and 388 nm to derive ozone amounts. As part of the ozone algorithm, the 388 nm channel is used to derive LER. The retrieved ozone amounts and LER are combined to derive the Erythemal irradiance for the entire sunlit Earth's surface, 2048x2048 points, at a nadir resolution of 18 x 18 km<sup>2</sup> using a computationally efficient approximation to a radiative transfer calculation of irradiance. Corrections are made for altitude above sea level and for the reduced transmission by clouds based on retrieved LER.

Also highlighting the value of EPIC measurements for the general public (UV index – is this passed on? Published anywhere else?) would be an interesting addition. I have given the algorithm to responsible parties at NOAA. They expressed interest, but have not indicated that they are using the new approach.

Please include explanations of abbreviations in the abstract. Done

p.4, line 11 ff: This paragraph fits better further up in the introduction.

I moved the paragraph into the introduction. The data and images of the changing synoptic cloud cover from sunrise to sunset are unique to the EPIC satellite instrument. Neither geostationary nor low earth orbiting satellites can produce these data or images. Geostationary satellites could produce something similar, but to date, none have the UV channels for ozone and LER, and geostationary satellites are limited to a range of approximately  $\pm 60^\circ$  latitude and  $\pm 60^\circ$  longitude. While low earth orbiting satellite data can be combined to produce a global representation of ozone and cloud cover, all the ozone and cloud cover are for a fixed local time (e.g., 13:30 hours for OMI) and are

C2

not representative of the atmosphere at other times of the day. 1.1 EPIC Instrument

p.5, line 187: How can errors cancel each other out? Please explain.

These are not errors. Rather to form the albedo, one takes the ratio of two quantities that both contain the solar Fraunhofer line structure. The resulting ratio does not have the Fraunhofer line structure. I modified the related sentence to read:

Because the albedo spectra AM (Eq. 1) removes the Fraunhofer line structure contained in both the solar irradiance SM and the reflected Earth radiance IM, the interpolation and convolution of AM has better accuracy than directly using IM.

p.10, line 335: Any ideas where these difference come from?

The differences arise from errors in the various satellite's calibrations.

F01: air and vacuum WL in same Figure is confusing. I chose to provide the original laboratory data (curves) done in air. I shifted the central wavelength to vacuum, since those are the values that are used in all of the science. I have added a note in the caption to clarify.

f01 Filter transmission functions (percent) for the 10 EPIC wavelengths based on laboratory measurements done in air. The central wavelength label is the shifted value used for the instrument in the vacuum of space.

F11: change red trace to grey/black or explain My error. I have fixed the figure so that all are black

p.2, line 33: orbit around

I am not sure of the reviewer's reference. The text says , "to an orbit near the Earth-Sun gravitational plus centrifugal force balance point". The orbit is a Lissajous figure about the L-1 point. At times the shape of the orbit is an ellipse with the L-1 point at a focalpoint, other times the orbit is a circle with the L-1 point at the center. The orbit goes from elliptical to a circle and back to elliptical every 5 years. However, this

C3

periodicity is altered unpredictably by in-orbit thruster corrections to account for lunar perturbations and to prevent the spacecraft from leaving the quasi-stable L-1 orbit.

The text now reads, "The DSCOVR (Deep Space Climate Observatory) spacecraft was successfully launched on 11 February 2015 to a lissajous figure orbit near the Earth-Sun gravitational plus centrifugal force balance point, Lagrange-1 (L-1), 1.5x10<sup>6</sup> km from the Earth."

p.2, line 36: optimized

The orbit was selected for earth observations, and so just turned out to be optimum for early solar storm warnings. For clarity, I changed the sentence to read, "The DSCOVR mission at L-1 is at an optimum location for early warning"

p.2, line 62: or over ice

Fresh snow over ice is correct

It turns out that the most reflective scenes are cloud-free skies with fresh snow deposited over ice. Fresh snow over land is usually not as bright because of photons lost to the absorbing ground, and scenes with only ice have a lower reflectivity because ice surfaces are usually older and darkened by pollution.

p.3, line 85: 10 wavelength Each of the 10 wavelength measurements

p.3, line 85: at slightly I do not understand the reviewer's objection. The sentence reads, "Each of the 10 wavelength measurements is obtained at slightly different times."

p.4, line 120: and are not OK (see above on page 1)

p.5, line 158: result in large OK

Section 6: several inconsistencies in use of capital "E" or not in erythema The word "erythema" is now all lower case except at beginnings of sentences or when combined

C4

with CIE ErythemaI.

p.15, line 510: ensure Careless. Now reads “ EPIC’s synoptic measurements ensure that”

p.24, line 641: their Now reads, “Normalized calibration functions referenced to their value at 4 Jan 2016”

p.24, line 644: 6 months Now reads, “p.24, line 644: “6 months apart”

Formatting does not fit yet AMT style. I need guidance here from the editor. I will read through the author instructions again.

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