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Atmospheric Measurement Techniques Discussions

Interactive comment on "Calibration of the DSCOVR EPIC visible and NIR channels using MODIS and EPIC lunar observations" *by* Igor V. Geogdzhayev and Alexander Marshak

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We would like to thank the Anonymous Referee #2 for their insightful comments which helped us generate what we hope is a much improved manuscript. The paragraphs with the Referee's comments below start with ">" symbol, followed by our responses

> The paper presents two methods to calibrate DSCOVR visible and NIR channels. The first method uses MODIS reflectance vs. DSCOVR digital count regression, while the second method uses MODIS reflectance vs. digital count ratio as a function of MODIS reflectance standard deviation. The paper overall is sound, but to generate the community's excitement, it needs to add the unique sciences that are already pub-

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lished, not only by the authors, but also by others. Furthermore, the text, techniques, and figures/figure captions needs to be improved to increase clarity. The paper needs to address the following concerns before it be accepted.

We agree with the questions raised by the Reviewer and we made specific changes described below to address her/his concerns.

> 0. there is little description about the scientific use of EPIC. Why do we need to calibrate EPIC in the first place? Has any interesting work done regarding the retrieval of aerosols, clouds, and surface properties? Any recent publications regarding the use of EPIC?

We agree and have significantly extended the description of the scientific applications of the EPIC data and added multiple references describing these applications in detail. The end of the first paragraph in the introduction section was modified as follows: "Thanks to its position and viewing geometry, the EPIC instrument offers an improved temporal sampling compared to instruments on the sun-synchronous orbit. It samples the entire sunlit hemisphere 10-20 times per day. Compared to other instruments on geostationary orbit, EPIC provides improved coverage in high latitudes hemispheres. It thus has the potential to augment remote sensing observations in such applications as aerosol, cloud, sulphur dioxide and ozone amounts as well as vegetation properties (Marshak et al., 2017a). EPIC data are used for the remote sensing of height and optical depth of dust plumes using oxygen A and B bands (Xu et al., 2017, Yang et al., 2013) and multi-spectral UV SO2 measurements of the sunlit Earth disk (Carn et al., 2016). EPIC measurements are applied to the estimation of leaf area index and its sunlit portion (Yang et al., 2017; Marshak and Knyazikhin, 2017) as well as measuring the ozone, cloud reflectivity and erythemal irradiance (Herman et al., 2017). EPIC measurements were used to observe the terrestrial glint from oriented ice crystals by (Marshak et al., 2017b)."

> 1. What is the radiometric resolution of MODIS vs. EPIC?

The radiometric resolution of MODIS and EPIC instruments is 12 bit per pixel. We have included this information in the first and second paragraphs in the Data section.

> 2. Do the spectral band adjustment factors consider the spectral response function difference between MODIS band and EPIC band? This is very important, as the reflectance depends on the spectral response function of each channel.

Yes they do. To clarify this we have modified the third sentence of the first paragraph; it reads as follows: “These factors in the form of linear regression coefficients were obtained from https://cloudsgate2.larc.nasa.gov/cgi-bin/site/showdoc?mnemonic=SBAF; they are based on the analysis of the SCHIAMACHY hyperspectral data for various surface targets to account for the differences in MODIS and EPIC spectral response functions (Scarino et al., 2016).”

> 3. The results show 10% difference with another independent method. There is little discussion about how to reconcile such difference? Are 10% difference small? How 10% or 3% differences may affect the level-2 products?

To put the observed difference in context we modified the end of the last paragraph to read as follows: “The difference with the ROLO coefficients is noticeably greater than the two methods reported in the previous sections and greater than the seasonal variability we observed. However, the two calibration sets are in a much better agreement in relative spectral terms. When the gains are normalized by the green channel gain, the ratios agree to about 3%. Further research is needed to account for these differences. One potential source of uncertainty is the solar spectral flux value used to convert the original ROLO radiance calibration factors to reflectance factor. Our future plans include deriving the EPIC calibration from Visibly Infrared Imaging Radiometer Suite (VIIRS) data. This work may contribute to the resolution of the systematic difference.”

We believe that widening the scope of the paper to include a discussion of the effects of calibration accuracy on the L2 EPIC-derived products would not be justified given

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a significant number and disparate nature of such products (aerosol, cloud, sulphur dioxide and ozone amounts as well as vegetation properties). In addition, each product is developed by a different science team with a better knowledge of the subject. Finally, the EPIC Level 2 products have not been yet released. We plan to analyze the effect of Level 1 data uncertainties on Level 2 products when the Level 2 products will be available (the end of 2017).

> 4. Some description about MODIS calibration and its accuracy should be discussed.

We added a reference to Toller et al. (2013) that discusses the accuracy of MODIS level 1B calibration to the last paragraph of the Data section.

> 5. The figure captions should be sufficiently to readers to understood the figure. Figure 6. what are red dots, and what are blue dots? can an example with real data be shown here?

We have extended the Figure 6 caption to read as follows: Figure 6: Schematic illustration of the effect of straylight correction. Blue dots and blue line represent a hypothetical regression fit for data without the straylight correction. Red dots and red line are for data with straylight correction. The correction decreases EPIC counts per second values for dark scenes and increases it for bright scenes, thus reducing the slope and the intercept of the fit. See the discussion in the text. It is difficult to use the real data for visualization due to the small magnitude of the changes. We think a schematic representation better illustrates the effect.

> Fig. 7. why use absolute values of regression offset?

We added the following explanation to the last paragraph of the Spectral correction section: “The closeness of the offset values to the ideal case of zero offset can be interpreted as an improvement.”

> what is the difference between gain coefficient in fig. 8 vs. calibration coefficients in Fig. 10?

They are the same quantity. For consistency we now use “calibration coefficients” in both captions

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