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Atmospheric Measurement Techniques Discussions

Interactive comment on "Filling-in of far-red and near-Infrared solar lines by terrestrial and atmospheric effects: simulations and space-based observations from SCIAMACHY and GOSAT" *by* J. Joiner et al.

J. Joiner et al.

joanna.joiner@nasa.gov

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Response to Referee 2

We thank the reviewer for carefully reading the manuscript and for providing constructive comments. We address the comments below (our responses in bold).

Joiner et al., AMTD, 2012, report on a new and potentially very important data product from SCIAMACHY: They analyzed the filling-in of a strong Fraunhofer line in the 866

nm spectral region, which provides information on chlorophyll-a fluorescence. They provide a very careful analysis based on simulations and analysis of real (multi-year global) data pointing out the challenges to obtain and interpret the filling-in signals from the weak signal at 866 nm. They indicate that the new data product has the potential to provide important new information on the functional status of vegetation and that the findings are also relevant for the design of future satellite missions aiming at retrieving information on (terrestrial) vegetation fluorescence: High spectral resolution is a major cost-driver for a satellite instrument and the results shown in this manuscript indicate that the 866 nm spectral region permits fluorescence retrievals even at quite low spectral resolution. The manuscript is very well written and covers an important topic highly relevant for AMT. I therefore strongly recommend to publish this manuscript in AMT. I only have two very minor recommendations for further improvements listed below. I congratulate the authors for this excellent work and I am looking forward to seeing the final version of the manuscript published in AMT.

Thank you very much for these positive and encouraging comments.

Recommended improvements:

- Section 5.2, page 176, line 20: Please consider replacing "we assume a constant wavelength dependence" by "we assume no wavelength dependence".

  We shall do this as it sounds better.

- Section 5.3, page 177, lines 12-13: The statement is only true if the instrument line shape (ILS) function does not change. Is this a reasonable assumption taking into account that the ILS likely depends on the slit illumination, which varies depending on the (in)homogeneity of the scene observed ? I recommend to add that the statement assumes that the ILS is (sufficiently) stable.

  The authors thank the reviewer for this point. We have broken up the sentence in a revised version: "Our retrieval approach therefore does not re-

quire a reference solar spectra. In addition, it is *relatively* insensitive to errors in the instrument line shape function (ILSF), *to the extent that the ILSF is sufficiently stable.*"

Additionally, we found one small error in Fig. 3: Two of the curves (green and blue) are reversed in the legend. This will corrected in a revised version.

Since submission we have also identified a root cause of the anomalously high filling-in near coastlines. We believe this is related to the memory effect in SCIAMACHY described in Appendix A1. When SCIAMACHY observes a dark scene (e.g., clear ocean) followed by a bright scene (land), a biased filling-in signal is obtained. By additional filtering of the data, we can remove the problematic retrievals and thus mitigate this effect.

Our new filter compares a field-of-view continuum radiance with the average of the 15 previously-observed fields-of-view continuum radiances. If the previously-observed average differs from the radiance by more than 15%, that field-of-view is discarded from the sample. This new filter eliminates a significant amount of data near coastlines and thus results in somewhat noisier averages. It does, however, remove the anomalously high filling-in around coastlines shown in the discussion paper.

In addition, the new filter removes more fields-of-view that contain clouds, particularly those nearby very bright cloudy scenes. The bias in the case of observing a less cloudy scene after a more bright science is a low bias. Low bias can be caused both by cloud shielding and the memory effect. Therefore, away from coastlines, generally higher values are now obtained as a result of filtering data near clouds and greater filtering of cloudy scenes. This occurs frequently in the vicinity of deep convective clouds.

Below, we show revised figures demonstrating removal of anomalously high

filling-in near coastlines. Reflectivities are also spatially smoother as a result of more vigorous filtering of cloudy data. All figures will be updated as appropriate in a revised version. The color scale for GOSAT in the revised Fig. 8 has been optimized to better show contrast.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 163, 2012.

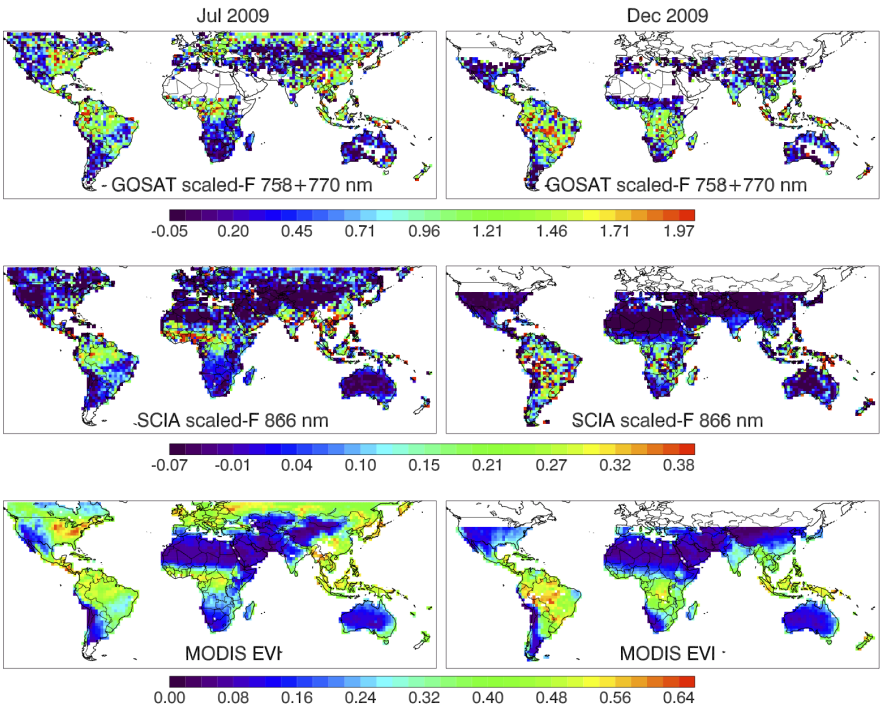

Fig. 1. revised Fig. 8

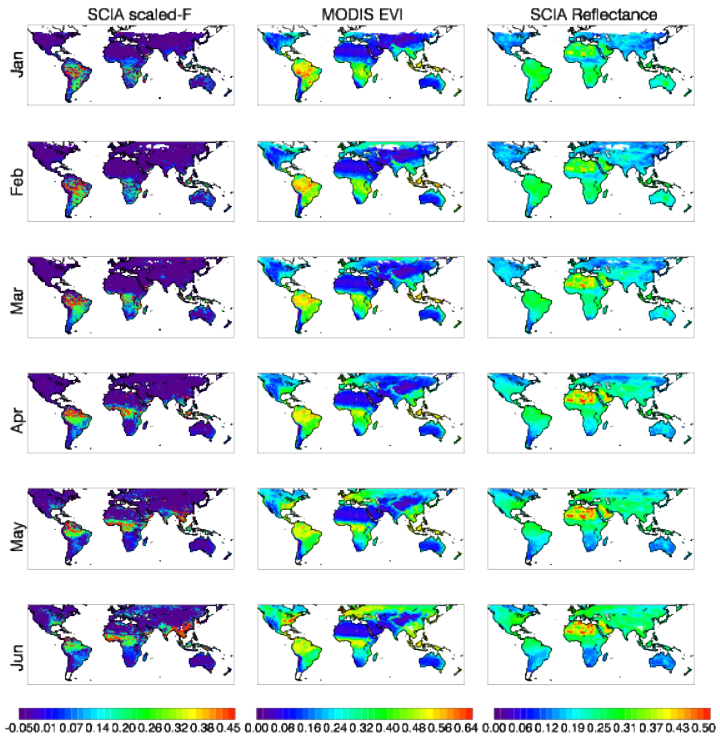

Fig. 2. revised Fig. 9

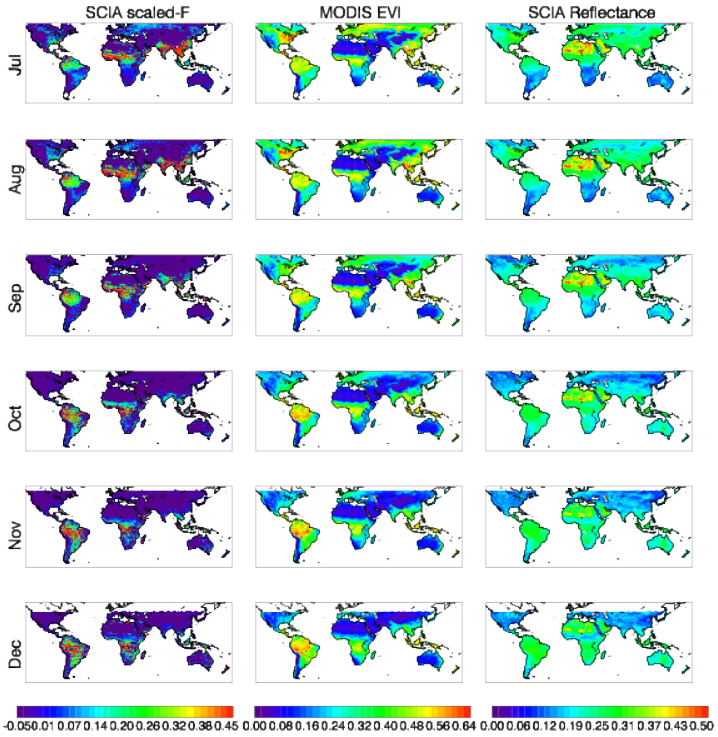

Fig. 3. revised Fig. 10