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Biogeosciences Discussions

Interactive comment on "First observations of global and seasonal terrestrial chlorophyll fluorescence from space" *by* J. Joiner et al.

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Dear Joanna Joiner et al.,

Congratulations on your first results using real GOSAT data. I would like to point you to a paper just accepted for publication in GRL (coincidentally submitted just one day before yours) but focussing on the retrieval method and the fluorescence impact on the O2A band in general (hence, no real GOSAT fits are shown):

"Disentangling chlorophyll fluorescence from atmospheric scattering effects in O_2A-band spectra of reflected sun-light" *http://www.agu.org/journals/gl/papersinpress.shtml#id2010GL045896* We cite your work in the final version of this paper and would appreciate it if you reciprocate.

Since we are also working intensely with GOSAT data, I have a few questions/comments of more technical nature:

- In figure 2, you show the GOSAT ILS and mention that the spectral sampling is depicted. But the data points actually indicate the sampling with which the ILS is provided, not the true GOSAT sampling, which is about 0.1995cm^{-1}, i.e. only half of the FWHM. The figure suggests that the ILS is highly oversampled which is not the case (in fact, it may introduce undersampling errors if you shift the solar spectrum wrt to the radiances).

- In figure 6, you show exemplary fits in different geographical regions. The spectral sampling of GOSAT in wavelength units is about 0.01nm. This should give you about 10 data-points between 770.0 and 770.1nm. However, it appears that there are many more, do you interpolate the true GOSAT spectra to a finer grid? This might explain why your fits look smooth, not revealing the noise in individual measurements. GOSAT data are indeed quite noisy and the signal-to-noise ratio is between 100-300 in good cases. The fits you show are probably on co-added spectra and it should be mentioned how many spectra are averaged, otherwise it will give a wrong impression of the retrieval precision (which is not discussed here). It is also unclear which spectra are being used as GOSAT provides two polarization directions.

  Your fit seems to be a straight line away from the O_2 bands (far edges of the fitting window). This suggests that you truncate the ILS, otherwise you would see the side-lobes of the unapodized sinc function. This may be critical, especially since you exclude the O2 lines, which have an impact on the Fraunhofer lines as well since the ILS is not zero 0.05nm away from the center. Variations in the O_2 column may thus impact your fluorescence retrieval and lead to biases. It is unclear to me at this moment whether or not the deviations from EVI (for example) are truly a difference in the signal or still a potential bias in the retrieval.

- Figure 7: The need for an unexplained spectral structure of this magnitude is somewhat worrisome and may be related to an ILS problem, especially since the residual structure strongly resembles the ILS with somewhat stronger wiggles. Also here, the spectral sampling seems not to represent the true GOSAT sampling.
- Figure 8 and following: Is there a reason why you cut the world-map at moderately high latitudes in summer (GOSAT should provide data)? In the figures, it may also be revealing to include the frequently encountered negative values by e.g. starting from -1, not 0.
- Inversion: The forward model may be non-linear. Do you use iterations (esp. the wavelength shifts will need iterations but also the albedo and maybe fluorescence if you fit in radiance space)?

Interactive comment on Biogeosciences Discuss., 7, 8281, 2010.