

Interactive comment on “Chlorophyll fluorescence remote sensing from space in scattering atmospheres: implications for its retrieval and interferences with atmospheric CO₂ retrievals” by C. Frankenberg et al.

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We thank the anonymous reviewer for her/his positive review. Please see some comments below:

Important issue of A-band zero-level offset recently discovered by the authors is also considered. Although, the numerical results of the section 4 (the estimated errors and error reduction efficiency) are rather algorithm-specific, presented trends are of

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interest for CO₂ remote sensing community.

→ It is very true that the impact is algorithm specific. Especially retrievals that decouple to A-band from the CO₂ bands (e.g. the PPDF method, using the O₂ A-band mostly for screening) would not be affected at all.

In particular, in the community there is no consensus regarding inclusion of surface pressure into state vector. To my opinion presented results seem to support exclusion of surface pressure from the state vector. Author opinion regarding this issue would be of interest (at least in the interactive comments).

→ This is just a personal opinion: I agree, in many aspects, fitting of surface pressure creates more trouble than it solves, this is a matter of constant debate. While ECMWF surface pressures are rather good (+/- 1-2 hPa), some pointing errors over regions with terrain changes can induce surface pressure biases, for instance. In most cases, however, this should not result in a large problem (or can be filtered out afterwards). Retrieved surface pressure in pure Nadir geometry is definitely affected by interfering aerosols AND fluorescence and should thus not (yet) be considered a useful product. In the future, multi-angle retrievals (see Frankenberg et al, AMTD, 2012) may enable better surface retrievals.

The authors concluded that adding fluorescence to the retrieval state vector reduces bias in XCO₂. However this algorithm modification results in additional scatter in the retrieved XCO₂. Also this approach leads to sub-optimal fit of fluorescence signal itself making Fraunhofer-lines-only approach more prospective alternative for fluorescence as primary target from GOSAT observations. It would be interesting to discuss combination of these approaches: using fluorescence retrievals from Fraunhofer-lines-only in XCO₂ retrievals (either without further fluorescence adjustment or with further adjustment under strong constraints)

→ We have already thought of this idea and it would certainly be useful to do so. Two aspects prompted us to (so far) not mention this option: a) the retrieved Fs using

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Fraunhofer lines is still highly affected by noise. A solution may be to just use the retrieved F_s as prior and its uncertainty as 1-sigma in the prior covariance. b) If we do it that way, a pre-processor will be needed, which may complicate things. Also: If we fix F_s to the one retrieved in the Fraunhofer lines, atmospheric scattering can still affect the structure of F_s at TOA (from the non-scattering case) and potentially result in similar XCO₂ errors. Hence, this potential may still require some more investigations and was so far not taken into account in this manuscript.

As was mentioned above, all minor comments (clarification of the definition and misprint corrections) relating to the previous version of the manuscript have been taken into account.

→ Thank you!

The only additional minor comment refers to the caption to Figure 2: “: : Positions of Fraunhofer lines most suitable for fluorescence retrievals in the GOSAT spectral range are indicated by green lines”. However green lines are not seen in this figure.

→ Good catch. We changed the axis range (units) of the figures and the lines got dropped. Please find the new plot attached.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 2487, 2012.

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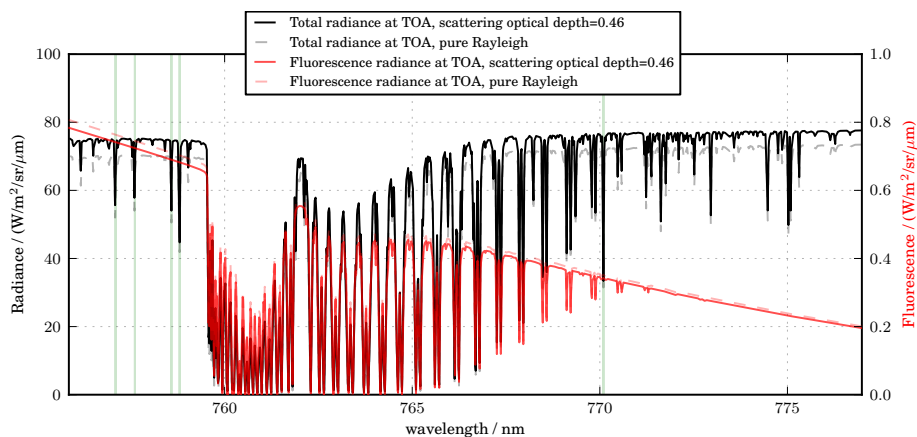


Fig. 1.

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