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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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Dear Wout,

Thanks for starting this discussion. Especially if we all manage to have it in a scientific rather than in an emotional way ;) Some comments from my side:

- Purpose of the manuscript:

As Christian has already said: by no means this paper was intended to attack FLEX at all. It only discussed (partially) the best way for Fs retrieval in the 755-775 nm window.

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Rigorous simulations have shown that this can be done better (and much easier) with the Fraunhofer lines alone than by modeling the O2-A band in addition. The reference to a former FLEX concept based on solely measuring in O2-A was obvious, but we also stated clearly that the current FLEX concept based on a wide window \sim 600-780nm is potentially much more powerful than just that 755-775 nm window because of all the useful information for vegetation characterization which can be derived from the red-edge. Therefore we also acknowledge the fact that if FLEX finally achieve to make reliable Fs retrievals using the O2 bands in the wide spectral window, the entire data set to be derived consistently from FLEX (Fs + biophysical products + spectral indices) would be of high valuable for the EO vegetation community.

- Point #3) The fixed Fs spectral shape by means of A1 and A2

Interesting point this about the sensitivity of the Fs peaks to photosystems I and II. I understand that you claim that most of the 2nd peak is due to photosystem I Fs, although there might not be yet references out to support this. I am far from an expert on this, but I have been reading this well-known reference which doesn't seem to agree with your point (Buschmann, Variability and application of the chlorophyll fluorescence emission ratio red/far-red of leaves, Photosynth Res (2007) 92:261–271). In p.263 the author states "At room temperature the Chl fluorescence in its entire spectrum is, however, emitted mainly from PS II and only a small contribution is emitted from PS I." or "The proportion of PS I-fluorescence in the long-wavelength fluorescence depends on the stage of the light-induced photosynthetic induction: it has been estimated to reach (...) about 10% at maximum Chl fluorescence FM after the application of saturating light." The many field activities carried out in the frame of FLEX in the last years have also made use of FLD-based O2-A Fs measurements and the correlation to photosynthetic activity seemed to be there.

- Point #5) Non-isotropic Fs

Also an interesting point. But I would say that the directionality of the Fs emission

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(demonstrated at the satellite scale by both Guanter et al (2012) - sorry for self-citing - and by Joiner et al AMT in press, 2012) has not interference at all with the retrieval with Fraunhofer lines, as these are not affected by any coupling with the atmosphere and the surface BRDF. The fractional depth of the Fraunhofer lines does not change with the observation/illumination angles, opposed to the O₂ bands. So the retrieved Fs will depend on the observation angle, but the retrieval is not affected by it. I then see the challenge in the posterior interpretation of the Fs product, but not in the retrieval itself, which is what is discussed in this paper.

Hope it helps a bit...

All the best

Luis

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

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