

Interactive comment on “Potential of the TROPOspheric Monitoring Instrument (TROPOMI) onboard the Sentinel-5 Precursor for the monitoring of terrestrial chlorophyll fluorescence” by L. Guanter et al.

Anonymous Referee #1

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The paper by Guanter et al. reports on the prospective performance of the Sentinel-5 Precursor (S5P) in retrieving plant fluorescence. An ensemble of simulated soundings is subject to an approximate retrieval method similar to the one in operation for real data e.g. from GOME-2. As such, the assessed error budget includes contributions from simulated noise errors and from the approximate nature of the retrieval e.g. with respect to the treatment of aerosols and clouds. The paper aims at estimating what errors to expect from S5P on the global scale in comparison to the existing GOME-2 records.

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The paper is very well written. It is a relevant contribution to the atmospheric sciences. So, I recommend publication in AMT.

In my opinion, the paper could put more emphasis on S5P specific challenges. The employed retrieval method works well for other satellites for very similar spectral ranges; S5P's instrument properties are improved compared to previous satellites; so, what else to expect than a better fluorescence retrieval? Then, the simulated noise is pessimistic (p12556,l26) i.e. the estimated performance does tell that S5P will be better than GOME-2 but, does not tell by how much really. In particular, it would be interesting to assess how much spatiotemporal averaging will actually be necessary to make S5P's fluorescence a useful product. Further, S5P's wide swath implies large viewing zenith angles. How accurate is the assumption that fluorescence is isotropic and that there are no angle dependent instrument effects? Will averaging inner and outer swath pixels work through via statistical error reduction? Could there be seasonal and regional biases e.g. due to changing canopy structure? As far as I understand the paper shortly touches on that aspect but does not go into depth (p12567,l3).

Specific comments

section 2.2: It is unclear to me where the convolution of the monochromatic radiance-at-sensor by the instrument function enters the forward model?

p12554,l15: $\nu_{2-n} \rightarrow \nu_j$

p12554,l21: The whole paragraph reads confusing. Signal-to-noise is defined at the continuum radiance level and scales with the square root of radiance. Thus, for bright surfaces, radiance at the continuum is large and the fluorescence contribution is relatively small implying that while signal-to-noise at the continuum increases the fluorescence retrieval error might actually increase. Is that the main point discussed here?

p12556,eq 5: The noise model depends on the square root of radiance alone. Typically, there is radiance independent contributions e.g. from dark current noise, read-out

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noise. In that sense, the noise model is optimistic for dark surfaces. The denominator lacks radiance units.

p12564, Discussion: The discussion is quite speculative on what S5P can deliver beyond SIF, but does not cover a critical assessment of the shortcomings of the presented SIF assessment. A few aspects that come to mind: pessimistic and simplistic noise model, fluorescence assumed isotropic, S5P instrument issues such as angle-dependent spectral features of a mirror.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 12545, 2014.