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Solar-Induced Plant Fluorescence as seen from space-borne instruments

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Solar induced chlorophyll fluorescence (SIF) retrieval can be linked to vegetation correspondence to global carbon cycle, and could be useful for terrestrial carbon budget assessment as well as agricultural and environmental purposes. There have been several investigations using space-borne SIF retrieval due to its good spatial coverage and time efficiency. These methods are mainly based on the fact that plant leaves absorb sunlight mainly within the visible spectral range and use it either for photosynthesis and/or release it as heat or fluorescence (in red and Near Infra Red, NIR, spectral region) back to the atmosphere. As a result, SIF can be considered an additive signal on top of the ground reflectance reaching TOA (Top Of the Atmosphere). Chlorophyll fluorescence is mainly emitted in the spectral range of red to the near-infrared with a pronounced peak at 690 and another at 740 nm. Although it is a very weak signal and two orders of magnitude smaller than the received radiance at TOA, it is feasible to retrieve it within spectral wavelength windows in the NIR.

We developed a novel SIF retrieval method based on a modeled assumption of the emitted fluorescence spectrum at canopy level as it would be seen at TOA. The application of it to 10 years of SCIAMACHY (Scanning Imaging Absorption Spectrometer for Atmospheric CHartographY) data showed promising results. Comparing our SIF retrieval with results from other studies showed that SIF values of our retrieval are in a general agreement with them.

With some variations. As there is no validated SIF retrieval, it is difficult to judge the retrieval quality. Our approach is of generic nature and therefore, could be applied to other data sets as well. Hence, the method is being applied on GOME-2 level 1 data, as the instrument has a better spatial resolution (in the wavelength range needed) and a better global coverage.