Additionally, because the FLEX mission is specifically designed to monitor the O_2 absorption bands, which are extremely affected by the pressure level, it requires precise knowledge of the surface topography during all the atmospheric correction process.
Thanks to the information provided by OLCI and SLSTR, S3 instruments, the atmospheric correction method proposed here makes possible to assess the high level of accuracy required for the proper estimation of the chlorophyll fluorescence.

Vegetation Canopy Fluorescence and Reflectance Retrieval by Model Inversion Using Optimization

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The simultaneous retrieval of a vegetation canopy's fluorescence (F) and reflectance (R) from high spectral resolution top-of-atmosphere (TOA) radiance spectra is possible thanks to the smoothness of the spectra of reflectance and fluorescent radiance. Spectral fitting methods and the Fraunhofer line detection (FLD) method exploit this spectral smoothness to retrieve F and R by modelling these as smooth mathematical functions like low degree polynomials, spline functions, et cetera. In this case the retrieval problem comes down to optimizing the fit between modelled and measured spectra of both F and R by adjusting the coefficients describing the F and R spectral functions. However, vegetation fluorescence takes place in the wide spectral range from 650 to 850 nm, and for fitting both F and R in this range with mathematical functions requires a quite a number of degrees of freedom, with an increased risk of ill-posedness of the retrieval problem. Therefore, in this contribution it was tried to model R using a light version of the SAIL model, which has only 10 variables, but yet allows modelling R over the 400 to 2400 nm spectral range. In addition, two parameters were used to describe the fluorescence spectrum with two end member spectra, which makes the total number of degrees of freedom equal to 12. Because of the wide spectral range supported by SAIL_light, the spectral data used as input for the retrieval of F and R are not limited to those provided by the FLEX mission alone, but data from the Sentinel-3 mission, expected to fly in tandem with FLEX, can be used as well to further constrain the reflectance retrieval.
In a numerical experiment a database of 31 simulated TOA spectral radiance observations by the FLORIS instrument on board FLEX and by the OLCI and SLSTR sensors on board Sentinel-3 was generated with the coupled models SCOPE and MODTRAN5. By means of SAIL_light and MODTRAN5, TOA radiance spectra were generated, and the instrument characteristics (Spectral Response Functions and noise) were applied to obtain realistically simulated observations by the three sensors FLORIS, OLCI and SLSTR. A box-constrained Levenberg-Marquardt optimization routine was applied to retrieve F and R. The retrieved F levels were compared to the ones present in the database, and statistically analyzed. The results indicate that retrievals are possible after about 11 model iterations, but systematic errors of about 10 % in F are still found. Currently, most of the computational burden is related to the propagation of ground signals through the atmosphere and simulation of the spectral sampling by the three sensors. Special techniques are required to reduce computation time in this respect.

A Linear Method for the Retrieval of Sun-Induced Chlorophyll Fluorescence from GOME-2 Data

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Global retrievals of sun-induced chlorophyll fluorescence (SIF) have been achieved in the last years by means of space-borne atmospheric chemistry sensors. In particular, a statistical SIF retrieval method for Global Ozone Monitoring Experiment (GOME-2) data was recently proposed by Joiner et al. in 2013.
GOME-2 is a medium-resolution UV-VIS spectrometer covering the spectral range of the SIF emission in approximately 650-800 nm. The first instrument in a series of three identical sensors was launched