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Solar-Induced Fluorescence Response to a Regional-Scale Drought Event

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Solar-Induced chlorophyll fluorescence (SIF) has been shown to respond to disturbances in the terrestrial biosphere, such as droughts or excessive precipitation. In the recent years, it was also demonstrated that SIF better describes the seasonal cycle and spring onset compared to commonly used greenness indices. As such, SIF promises to provide additional information on the state of vegetation which is not easily obtainable through reflectance-based measurements.

Retrieving SIF from space-based high-spectral resolution measurements was successfully performed using a number of instruments and platforms. Here, we use measurements from a Fourier-transform spectrometer on board JAXA's GOSAT – the first mission solely dedicated to quantify the atmospheric concentration of carbon dioxide (CO_2). With its measurements of the O_2 A-band near 760 nm, SIF can be decoupled from surface reflectance through the assessment of the in-filling of solar absorption lines.

We have retrieved SIF from GOSAT to obtain a seven-year record between April 2009 and December 2016, and applied a new bias correction method to account for time-dependent instrument biases. Using the fluorescence data, we study a large-scale drought event in North America. Not only does the SIF time series clearly reflect the response of the biosphere, but also exhibits a shift in the seasonal cycle in the year 2012. Our results complement findings by Wolf et al. (2016), who used surface measurements, and the findings by Sun et al. (2015), who employed space-based SIF measurements from another instrument (GOME-2).

References

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