Geophysical Research Abstracts
Vol. 15, EGU2013-2452-2, 2013
EGU General Assembly 2013

Analysis of remotely-sensed global canopy scale fluorescence as a predictor for GPP

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The uncertainties of modeling terrestrial global **g**ross **p**rimary **p**roductivity (GPP) are large, partly because of a lack of direct global measurements. GPP is the amount of atmospheric carbon dioxide taken up by ecosystems via photosynthesis, which is the single largest flux of the global land carbon budget and makes plants an important component of the global climate system. The measurement of fluorescence, which is linked to photosynthesis therefore could be of vital importance for the modeling of GPP. An adequate technique to monitor the fluorescence signal on a global scale, whose maximum lies in a spectral region of 650 nm – 800 nm, is satellite remote sensing. This was made possible by the satellite mission GOSAT, which was launched in January 2009 and is able to measure the signal globally with a relatively fine spatial resolution ($\sim$ 10 km) and at narrow spectral windows around 770 nm and 759 nm. Although the link between photosynthesis and fluorescence at the leaf scale is, based on lab– and field–based experiments, relatively well known, the relationship at the canopy level and for the coarse spatial resolutions provided by space–borne instruments (of the order of 10 km – 100 km) is still uninvestigated.

The objective of this study is to explore the relationship between the retrieved fluorescence signal from GOSAT on global scale with several well investigated vegetation indices, like FAPAR and EVI, as well as meteorological parameters such as incoming radiation, soil water content or temperature potentially driving photosynthesis down-regulation. The final goal is to assess the information content of all these parameters for the statistical modelling of GPP. Fluorescence is expected to have a higher information content than the latter mentioned indices in situations where the leaves are still green, but the environmental conditions are limiting the productivity of the plants, because of its linkage to ecosystem phenology.