Environmental controls on anomalous variation in solar-induced fluorescence during the last 10 years

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Solar-Induced Chlorophyll Fluorescence (SIF) has been used to estimate the ecosystem photosynthesis (GPP) recently by Satellite remote sensing and by ground observations. The advantage of use of SIF is to be able to detect the photosynthetic activity on multiple scales. To examine the potential relationship in the anomalies between SIF and environmental factors including the VI, we investigated them from the currently available satellite monthly data from GOME-2 on 0.5o (Joiner et al., 2009) and other observation-based datasets including the inversion biosphere carbon uptake estimated by CarbonTracker, the ground surface CO2 concentration by GOSAT, the CRU climatology from UEA, and multiple climatic teleconnection indices (NiNO3, PDO, NAO etc.) for 10 years from 2007 to 2016.

The SIF and biosphere land carbon uptake by Carbon Tracker 2016 has a strong negative correlationship in Australia and Middle of North America, especially in summer (JJA) in grass, shrub and rangeland. High correlation between SIF and CO2 concentration showed seasonal change. This suggests that the photosynthesis in drier and less productive ecosystems showed directly positive reactions to leaf biomass change increase probably due to simple canopy structure.

Summer SIF anomaly showed relatively high correlation coefficients to the anomalies in temperature, diurnal temperature range, potential evapotranspiration, cloudiness and precipitation depending on region. SIF anomaly also responses strongly to NiNO3 and other teleconnections in Africa, Australia, East and Central Asia, and North America. Land Cover specific analysis shows that cloudiness has negative relationship to the sensitivity of anomalies in SIF to that in cloudiness and precipitation slopes except for desert. Precipitation does not show clear relationship. Temperature shows positive response to sensitivity to cloudiness and precipitation, and negative one to that to temperature.

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