Development of new satellite to monitor SIF and PRI of terrestrial vegetation with high spatial and wavelength resolutions

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To deal effectively with global warming by mitigation and adaptation, it is necessary to monitor emission and sequestration of greenhouse gases with their underlying mechanisms including biogeochemical processes. The Earth-observation satellite is powerful tool to observe temporal and spatial variations in structure and function on ecosystem in regional to global scale. It has been conducted to estimate GPP (gross primary production) by using satellite-measured optical properties of vegetation canopy such as NDVI (normalized vegetation index). Those vegetation indices are related to greenness of the canopy but not reflect the photosynthetic activity, that are quite sensitive to climatic conditions. Thus, there are still large uncertainty in the estimation of GPP.
In recent years, advent of the Earth-observation satellite with high wavelength-resolution sensors enable us to observe SIF (Solar-Induced chlorophyll Fluorescence) emitted from terrestrial vegetation. Since the chlorophyll fluorescence is emitted in photochemical reaction, which is a part of photosynthetic process, SIF would be good indicator of photosynthetic activity. In the photochemical reaction, xanthophyll cycle is also play important roll to release extra energy and it is able to monitor its condition by using PRI (Photochemical Reflectance Index). In the recent study in single-leaf scale, it has been shown that simultaneously measured SIF and PRI help us to estimate accurate photosynthetic rate based on ecophysiological model (Hikosaka and Noda 2019). Similarly, simultaneous measurement of SIF and PRI with the Earth-observation satellite would be helpful to estimate GPP and understand the in regional to global scale. However, there are no satellite to measure SIF and PRI simultaneously to date. FLEX, which will be launched in 2022 is the only satellite mission to measure them.
In this talk, we will propose development of new satellite to observe SIF, PRI and other vegetation indices such as NDVI with high spatial and wavelength resolutions. This satellite would contribute accurate estimation of GPP and effective policy making against global warming.
In this talk we will suggest to develop new Earth-obsevation satellite to monitor SIF and PRI of terrestrail vegetation with high spatial and wavelength resolutions.

Keywords: vegetation remote sensing, solar-induced chlorophyll fluorescence, xanthophyll cycle

