Comparison of Temporal Variations of Top-of-Canopy SIF Obtained from Two Spectroradiometers at Evergreen Coniferous Forest in Japan

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Solar-induced chlorophyll fluorescence (SIF) is of growing interest as a proxy to quantify the actual photosynthesis and to monitor plant status, and as its potential to be used in remote sensing. The SIF detection from the space including airborne and satellite platform needs to be calibrated/validated using the reliable ground level data. Since the overlapping wavelength bands of chlorophyll fluorescence and Fraunhofer lines are utilized to retrieve the SIF, wavelength resolutions of the spectrometers are important for SIF monitoring. Recently, several commercially available spectroradiometers have been used for SIF measurement in the field. Cendrero-Mateo et al. (2019) pointed out that as SIF only represents a fraction of the radiance measured by the spectrometers, the erroneous estimation and interpretation of the SIF signal could be caused by the insufficient characterization of the sensor, the inadequate measurement protocols, or an incorrect implementation of the retrieval method. Also, Julitta et al. (2016) reported that the near infrared SIF (NIR SIF) could be accurately detected by using the spectroradiometers with an ultrafine resolution (less than 1 nm), while the spectroradiometers with higher spectral resolution (less than 0.5nm) could detect the red SIF. Although standard-FLD method, one of the most common methods to retrieve SIF, requires data from spectrometers with fine wavelength resolution, area-based FLD method (Nakashima et al. 2021) enables SIF retrieval even with spectrometers with rough resolution. In this study, we measured the top-of-canopy SIF (TOC SIF) using two spectroradiometers with different wavelength resolutions, PGP100 (PREDE Co., Japan) and HR4000 (Ocean Insight, USA) at an evergreen coniferous forest. The spectral range of PGP100 is 350.2~899.7 nm, while that of HR4000 is 623.8~816.8 nm. The intervals of observed wavelength for PGP100 and HR4000 are 0.42~0.43 nm and 0.04~0.06 nm, respectively. Also, the full width at half maximum is 3.6 nm for PGP100 and 0.02 nm for HR4000. The measurement was conducted at Kiryu Experimental Watershed (KEW), one of the AsiaFlux sites, in Shiga Prefecture, Japan. The forest is dominated by Japanese Cypress (*Chamaecyparis obtusa*). Both spectrometers were fixed on the canopy access tower and continuous measurement have been conducted from 2004 for PGP100 and from 2017 for HR4000. We retrieved SIF by standard FLD method for HR4000 and by area-based FLD method for PGP100 to compare their potentials to estimate the NIR SIF. We will also show the diurnal and seasonal patterns in SIF and the relationship with GPP and SIF in the cypress forest.

Keywords: Evergreen coniferous forest, HR4000, PGP100, Solar-induced chlorophyll fluorescence (SIF), Spectroradiometers, standard FLD and area-based FLD

