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Ecophysiological dynamics of forest canopy photosynthesis and its optical observation

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Forest ecosystem has a crucial role in regulating the earth system as well as in supporting various ecosystem services such as primary production and biodiversity persistence. Understanding on the ecophysiological dynamics of forest canopy photosynthesis and ecosystem-scale carbon cycling is still an important theme of environmental science. In addition, the progress of satellite optical remote sensing provides us to observe the broad-scale ecosystem structure from days to years, and from plot to continental scales. In this study we aimed to reveal the functional role of leaf-level ecophysiology and forest leaf area distribution in forest canopy photosynthesis in a cool-temperate deciduous broadleaf forest at "Takayama" super-site, in central Japan. Simultaneously we made optical remote sensing of canopy structure in means of several vegetation indices (NDVI, EVI, GRVI, CI) to detect the phenological changes of canopy photosynthetic property. Our in-situ observation of leaf and canopy characteristics, which were analyzed by an ecosystem carbon cycling model, revealed that their phenological changes and summer micro-meteorology are responsible for seasonal and inter-annual variations in canopy photosynthesis. Significant correlations were found between the vegetation indices and canopy photosynthetic capacity, but the relationships changed throughout the seasons from spring to summer, and to autumn. Our next challenge goes to apply these findings to gain insights into detailed understanding on the carbon metabolism of forest ecosystem and also to assess the canopy photosynthesis at landscape - regional scales by satellite remote sensing.

Keywords: forest ecosystem, photosynthesis, ecophysiology, remote sensing