Remote sensing of carbon assimilation function of terrestrial ecosystem by Earth-observation satellite

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Since industrial evolution, global warming has progressed owing to increase of CO_2 emitted by human activities. To deal effectively with this issue by mitigation and adaptation, it is necessary to monitor emission and sequestration of GHGs with their underlying mechanisms including biogeochemical processes. Plant photosynthesis is one of the important factors to drive carbon cycling between atmosphere and biosphere. The terrestrial ecosystems assimilate about 30 % of anthropogenic CO_2 through photosynthesis. Since the photosynthetic process is quite sensitive to climatic conditions such as temperature, radiation and precipitation, there are still uncertainty in the estimation of photosynthetic production of regional to global scale. This uncertainty would be lager under climate change condition in near future. Thus, it is necessary to obtain the temporal dynamics of the photosynthetic production in large area.

Satellite remote sensing has been used to monitor the spatial and temporal dynamics of terrestrial ecosystems that are responsible for such photosynthetic CO₂ absorption. Such observation provides us with geographical information on the potential distribution of carbon sequestration by the aid of ecosystem models. In these years, advent of the spectroradiometer, which has high wavelength resolution, such as TANSO FTS on Greenhouse Gases Observing Satellite (GOSAT) enable us to observe solar-induced chlorophyll fluorescence (SIF) emitted from the terrestrial ecosystems. Since the chlorophyll fluorescence is emitted from photosynthetic process itself, SIF remote sensing is drawn considerable attention as a new technique to observe the photosynthetic activity of the vegetation. SIF has been measured by gas-measurement satellites, such as GOSAT, GOSAT-2, OCO-2 and GOME2 on MetOp A and B.

In this talk, we will introduce our previous and on-going studies about estimation of photosynthetic production of the terrestrial ecosystem. We also discuss about future perspective about SIF studies in GOSAT and GOSAT-2 projects.

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