【Grant-in-Aid for Scientific Research (S)】

Hyper-Temporal Terrestrial Ecosystem Observation with Third Generation Geostationary Satellites

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Project Information	Project Number : 22H05004 Keywords : Terrestrial Biosphere, Remote Sensing, Geostationary Satellite	Project Period (FY) : 2022-2026

Purpose and Background of the Research

●Outline of the Research

Terrestrial carbon cycle is one of the causes of uncertainty in future projections of climate change. The project aims to establish the international observation network of the latest geostationary meteorological satellites, such as Himawari-8, for terrestrial monitoring, and to clarify the dynamics of terrestrial ecosystems in detail through high-frequency observations (every 10 minutes). With the new datasets, the project also aims to understand terrestrial ecosystems and to detect early changes in vegetation caused by extreme climate.

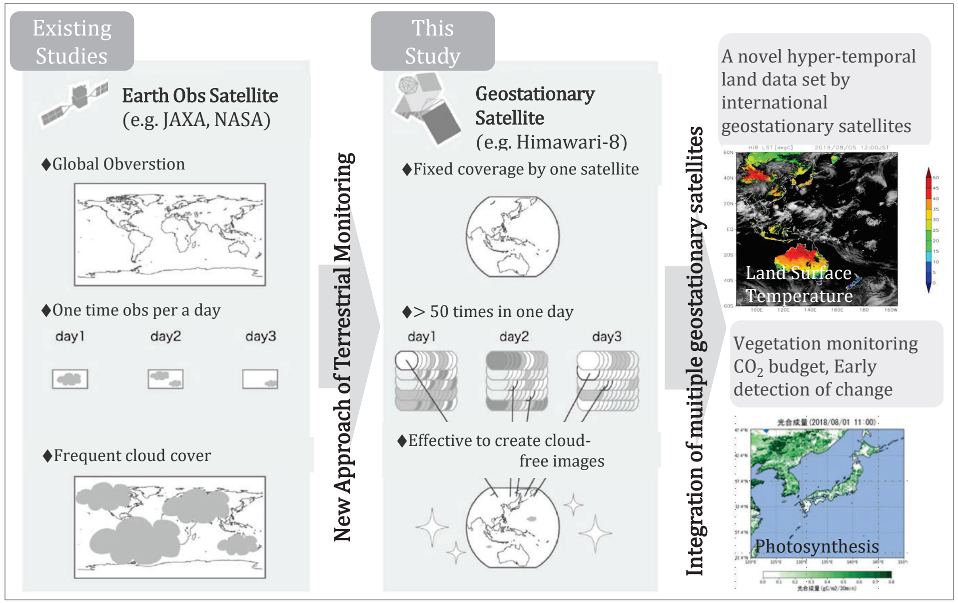

Fig. 1 Overview of this research. Earth environmental observation satellites have been used for terrestrial ecosystem monitoring, but there has been a desire to increase the frequency of observations. This study aims to construct a global data set that integrates geostationary satellites across global, and to improve the terrestrial CO2 budget estimation.

●Strengths of this research group

The Center for Environmental Remote Sensing Research, Chiba University has been processing multiple geostationary satellite data and open them to the public for more than 20 years. The center has accumulated expertise in geostationary satellites, including its own precision positioning technology.

●Advantages of geostationary satellites to monitor vegetation

The use of geostationary satellites enables the acquisition of significantly more data than conventional satellite observations (e.g. > 26 times more data), and allows finer temporal scales of seasonal changes in vegetation such as leaf flushing (Fig. 2).

●Purpose of this research

- To establish a novel global network dataset of new-generation geostationary satellites
- To provide a new estimation of regional vegetation change and carbon budget
- Reduction of uncertainty in terrestrial carbon budget and climate change projection

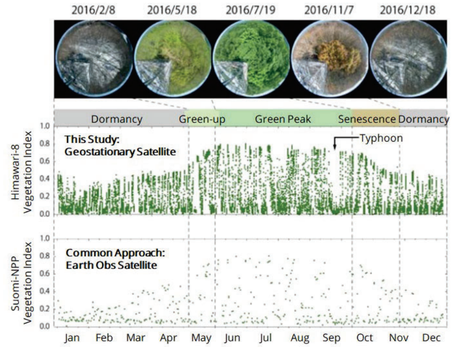

Figure 2: Example of the variation in vegetation activity from satellite observations at an alpine observation site, Takayama (Miura et al. 2019).

Expected Research Achievements

●Expected Outcome

- Development of a global-scale, hyper-temporal (e.g. 10 minutes) land surface dataset by integrating geostationary satellite data from Japan, the U.S., China, and Korea.
- Clarifying to what extent we can clarify the terrestrial ecological environment and terrestrial CO_2 budget with a new hyper-temporal geostationary satellite data.
- Examples of terrestrial vegetation applications are: (1) to determine the determinants of photosynthesis in the Amazonian-Southeast Asian-African tropical rainforest, (2) to detect early water stress conditions in vegetation growth caused by heatwave, and (3) to detect the timing of vegetation leaf flush and defoliation on a daily basis.

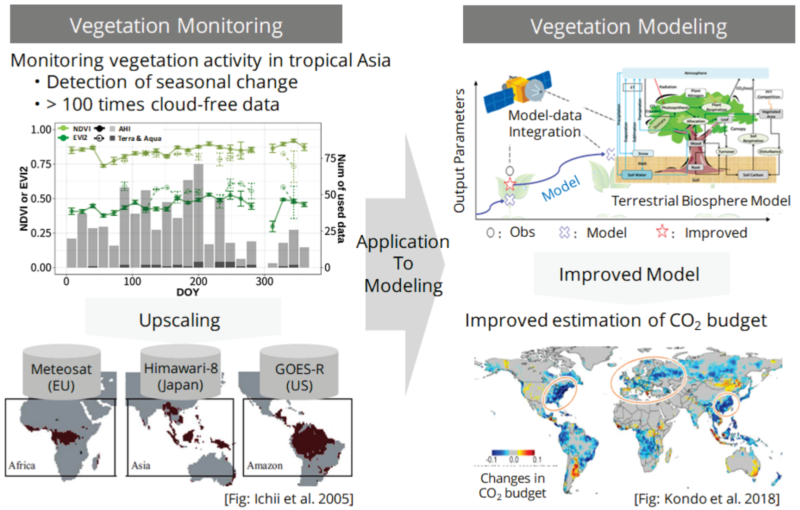

Figure 3. An example of the results we aim to achieve in this research. By applying geostationary satellites to land monitoring, a much larger amount of data can be obtained than with conventional satellite observations. These data sets will be also incorporated into numerical models to elucidate the terrestrial CO_2 budget.

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