Monitoring seasonal variations in vegetation activities over Southeast Asia using Himawari-8

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Tropical forests distributed widely in Southeast Asia play an essential role in maintaining rich ecosystems, energy and water cycles, and flood control. In Southeast Asia, the spatial and temporal distributions of land cover, plant phenology, and biomass are changing rapidly due to human activities and climate change. For example, areas of tropical forests are still decreasing due to human activities. The resulting carbon emissions are one of the significant contributors to atmospheric CO2 increase and climate change. Besides, the magnitude and frequency of environmental fluctuation by anomalous climate are increasing. Especially in tropical regions, droughts occur due to prolonged periods without rainfall, and floods occur due to extreme increases in rainfall. As a result, large-scale forest fires and severe water stress occur, and forest degradation is progressing.

Therefore, monitoring changes in terrestrial ecosystems in Southeast Asia is indispensable and also provides useful information for the conservation of rich ecosystems and the capability of flood control. In particular, it is essential to conduct extensive and continuous monitoring without any defect using satellite data.

However, in Southeast Asia, severe cloud covers exist throughout the year. Moreover, in the rainy season, it is covered with clouds over a broader area and more continuously. Therefore, it is often impossible to obtain the cloud-free data even once a month when using sensor data mounted on medium spatial resolution polar-orbiting satellites such as MODIS, AVHRR, and SGLI.

New geostationary satellites, such as Himawari-8/AHI (H8-AHI), are expected to observe land surface better due to its high observation frequency (every 10 minutes). In this study, we quantified how much more cloud-free observations can be obtained, and how detailed can we understand rainforest phenology using H8-AHI data in Southeast Asia, compared to polar-orbiting satellite data, Terra and Aqua / MODIS. First, we confirmed that the cloud detection rate is similar between H8-AHI and MODIS cloud masks. Then, we found that H8-AHI observation substantially increased cloud-free observation compared with those of MODIS on a monthly scale. Finally, we compared resulting cloud-free vegetation index time-series between AHI and MODIS, and only H8-AHI successfully tracks seasonal plant phenology over tropical forests.

Keywords: Himawari-8, cloud mask, tropical forest, MODIS

