S5-11

Monitoring spatial and temporal characteristic of greenhouse gas in East Asia using satellite data

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In recent years, the frequency and severity of natural disasters such as droughts, floods, and typhoons have been increased due to climate change. The Intergovernmental Panel on Climate Change (IPCC) reported that global surface temperatures from 2011 to 2020 increased by 1.09°C compared to pre-industrial (1850-1890), primarily due to man-made greenhouse gas. Furthermore, they reported that if global temperatures increase 2°C by 2100, approximately 18% of global flora and fauna would face extinction. In response, the international community is actively working to establish climate change response systems and make sustained efforts to reduce greenhouse gas emissions. To achieve carbon net zero through greenhouse gas reduction, it is crucial to understand not only anthropogenic factors but also the mechanisms of greenhouse absorption in natural ecosystems. The National Meteorological Satellite Center, Korea Meteorological Administration (NMSC/KMA) has monitored greenhouse gases to analyze climate change through remote sensing data.

In this study, we conducted an analysis to understand the impact of vegetation on carbon absorption. Specifically, we examined the correlation between carbon dioxide (CO2) concentrations derived from the Orbiting Carbon Observatory-2 (OCO-2) satellite and Solar-Induced Fluorescence (SIF), a photosynthetic response index. Our analysis covered the period from 2015 to 2022. In the East Asia region, the average CO2 concentration, as observed from OCO-2 satellite data, exhibited a seasonal variation, increasing trend

from autumn to spring and decreasing during the summer and annual increasing approximately 2 ppmv per year. Solar-Induced Fluorescence showed its maximum values during the summer and minimum values during the winter, demonstrating a negative correlation with CO2 concentration. Furthermore, we examined the correlation between CO2 concentration and SIF based on land use and land cover (LULC) data in five East Asian countries, including Korea, China, Japan, Mongolia, and Taiwan.

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