

Spatiotemporal variation of vegetation index and sun-induced fluorescence depending on temperature conditions in the Korean peninsula.

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Current anomalous climate by climate change could cause critical problems in ecology and society. Drought by water deficit and heatwave has been occurred frequently in the Korean peninsula over recent years. Under those abnormal conditions, crop and forest suffered from water and heat stress and they will lead to the decline of crop yield and the weakened ecosystem service. The satellite remote sensing has been applied to monitor the change of vegetation health according to drought event using vegetation indices such as the normalized difference vegetation index (NDVI). Sun-induced fluorescence (SIF) as well as vegetation indices also could indicate the degree of vegetation stress. In this study, the aim is to evaluate the spatiotemporal variations of NDVI and SIF depending on temperature conditions using satellite data in the Korean peninsula. The NDVI from Aqua/Moderate Resolution Imaging Spectroradiometer (MODIS) and the SIF from Meteorological Operational Satellite-A (MetOp-A)/Global Ozone Monitoring Experiment-2 (GOME-2) were used from 2007 to 2016 that these periods include severe drought years. In addition, the MODIS land surface temperature (LST) was used to represent the temperature condition. The seasonal variations of NDVI and SIF were changed according to the degree of drought events, particularly SIF in spring. Also, the value of SIF on August 2016 was dropped comparing the other years due to the critical physiological stress by the worst recorded heat wave. In addition, the increased patterns of SIF or NDVI to LST was clearly shown under the condition less than about 29°C, and both SIF and NDVI were decreased at higher temperature condition. However, the sensitivities of NDVI or SIF to LST was higher in crop than forest. Further, depending on the regions, South and North Korea, the patterns of NDVI or SIF to LST was different: The forest in North Korea were more sensitively responded than South Korea. Our results represented that NDVI and SIF were useful indicators to detect the heat stress on vegetation and to understand effect of climate.

Keywords: Vegetation index, Sun-induced fluorescence, Temperature, Korean peninsula