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The drought impact on satellite solar-induced chlorophyll fluorescence in China during 2007-2015

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Drought is one of the most damaging and complicated natural hazards in the world. China is one of the countries which are most severely affected by drought. And there is a severe drought event in China every 2-3 years. From the beginning of the 1980s, some vegetation indices have been used to monitor vegetation under water stress. With the development of remote sensing technology, satellite solar-induced chlorophyll fluorescence (SIF) has emerged as a new method to monitor vegetation in recent years. Some studies have shown that compared with vegetation indices, SIF is more sensitive for vegetation functioning. However, the related studies using the satellite SIF is relatively limited in China.
The objective of this study is to investigate the impact of drought on SIF by analyzing the relationships of SIF and crucial land surface parameter under the drought condition and to assess the adaption of satellite SIF in China. The SIF data are from the Global Ozone Monitoring Experiment 2 (GOME-2). Firstly, the widely used Palmer Drought Severity Index (PDSI) was used for drought events identification from 2007 to 2015 in China. On the basis of the identification results, we chose a number of areas of interest according to different land cover types and drought intensity. Then, we analyzed the relationships of SIF and land surface variables, i.e. normalized difference vegetation index (NDVI), the fraction of absorbed photosynthetically active radiation (fPAR), root-zone soil moisture (SMC) and surface skin temperatures (Tskin). The results show that the spatial patterns of negative SIF anomalies are closely relevant to the drought intensity. The decrease of SIF is aggravated in the phase of drought occurs. Moreover we find that the GOME-2 SIF is sensitive to fPAR and fluorescence yield. And the SIF is strongly correlated with SMC, Tskin and NDVI. But the SIF decreases more rapidly during the early time of drought events than NDVI. In other words, the SIF can well capture the dynamics of vegetation functioning, which seems a large advantage for agricultural drought early warning. Therefore, all analyses indicate that the emerging satellite SIF potentially provides a new way to monitor agricultural drought.