

Identifying Events with Time Lag between Change in Total Solar Irradiance and Sunspot Area

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The Total Solar Irradiance (TSI) of the sun is the quantity of radiant energy that the Earth receives from the Sun. Classically known as the solar constant, this value has been proved not to be constant but rather to fluctuate with solar activities and solar events. These events correspond to changes in the sunspot area as well. However, these changes are not always consistent in time with the changes in the brightness of the Sun, TSI. Fifteen cases of large solar events (change in TSI greater than 1 w/m^2) between 2010 and 2015 were identified and analyzed with Solar Radiation and Climate Experiment (SORCE) measured TSI and Solar Dynamics Observatory (SDO) measured sunspot area. Out of the 15 identified cases, five appeared to have the TSI changes leading by one or more days. To confirm this relationship, the cross-correlation coefficient was calculated for all 15 events as well. This value was found by offsetting the data of the sunspot area from five days behind to five days ahead. In addition to the sunspot area, three other values were compared to TSI. These variables were Helioseismic and Magnetic Imager (HMI) Active Region Patch (HARP) regions, umbra and penumbra magnetic area, and HMI median intensity in the visible continuum. Out of the four variables, the sunspot area and HMI intensity were the most consistent with the changes in TSI, while both cases of magnetic area had a wider spread of correlation coefficients. Further work will be needed to be done to expand the data set of large solar events and to explain why some large events have this lag and others do not.