

The Role of a Tiny Brightening in a Huge Geo-effective Solar Eruption Leading to the St Patrick's Day Storm

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The largest magnetic storm in solar cycle 24 was caused by a fast coronal mass ejection (CME) that was related to a small C9.1 flare that occurred on 15 March 2015 in solar active region (AR) NOAA 12297. The purpose of this study is to understand the onset mechanism of the geo-effective huge solar eruption. We focused on the C2.4 flare that occurred prior to the C9.1 flare of the filament eruption. The magnetic field structure in the AR was complicated: there were several filaments including the one that erupted and caused the CME. We hence carefully investigated the photospheric magnetic field, brightenings observed in the solar atmosphere, and the three-dimensional coronal magnetic field extrapolated from nonlinear force-free field modeling, using data from *Hinode* and *Solar Dynamics Observatory*. We found three intriguing points : (1) There was a compact but noticeably highly twisted magnetic field structure that is represented by a small filament in the C2.4 flaring region, where a tiny precursor brightening was observed before the C2.4 flare. (2) The C2.4 flaring region is located in the vicinity of a foot point of the closed field that prohibits the filament from erupting. (3) The filament shows a sudden eruption after the C2.4 flare and accompanying small filament eruption. From our analysis, we suggest that a small magnetic disturbance that was represented by the tiny precursor brightening at the time of the C2.4 flare is related to the trigger of the huge filament eruption.

Keywords: St Patrick's Day Storm, Solar Flares, Filament Eruption, *Hinode*, *Solar Dynamics Observatory*