

St Patrick's Stormの原因となったフィラメント噴出のトリガに関する研究

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Triggering Scenario of Geo-effective Solar Eruption on 15 March 2015

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The largest magnetic storm so far, called St Patrick's Day event, in the solar cycle 24 occurred on 17 March 2015. It was caused by fast coronal mass ejection (CME) on 15 March 2015 from solar active region (AR) NOAA 12297. Surprisingly, the CME is suggested to be related to a C9.1 flare while the large CME is usually corresponding to a large flare. The propose of this study is to understand the onset mechanism of the huge solar eruption which caused big impact on a magnetic environment of the geospace. The magnetic field structure in the AR was complicated: There were several filaments including the one which erupted and caused the CME. We hence carefully investigated the photospheric magnetic field, brightenings observed in the region from the chromosphere to the corona, and the three-dimensional coronal magnetic field calculated through our nonlinear force-free field (NLFFF) model using photospheric vector magnetic field data from the Hinode/Solar Optical Telescope and the Solar Dynamics Observatory. We focused on the C2.4 flare occurred prior to the C9.1 flare and filament eruption. Through our provisional analysis covering long time span, we noticed the C2.4 flare prior to the C9.1 flare is important to understanding the dynamics of this AR system and the CME event. (1) There was a compact but noticeably highly twisted magnetic field structure. During the C2.4 flare, flux cancellation was seen on the photospheric magnetic field data. (2) The erupting filament is sustained by the coronal magnetic field prior to the flare, and C2.4 flaring site locates in the vicinity of one footpoint of them. (3) The top of the coronal loops sustaining the filament touch to a region where the torus instability would be expected. Therefore, we consider that the magnetic reconnection at the C2.4 flaring site changed the magnetic environment of the filament, destabilized the highly twisted magnetic field structure, and finally allowed the twisted magnetic field to erupt.