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Observation Summary of the 2006 December 13 Flare

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To make clear the mechanisms of active phenomena seen on the solar surface is crucially important for the space weather research, since they are the sources of the interplanetary disturbances. The intense solar flare (X3.4 on the GOES scale) that occurred on 2006 December 13 in the NOAA active region 10930 is one of the largest flares observed with Hinode, and therefore, has been extensively studied. In this paper, we overview the observational features of the flare and the active region.

NOAA 10930 was the so-called delta-type sunspot and showed very complicated magnetic field structure, since the southern negative sunspot rotated counter-clockwise moving eastward and in addition several magnetic pairs emerged between the main sunspots. These caused current sheets all over the magnetic inversion regions, accompanied by small energy releases observed as chromospheric brightenings in Ca II and in H-alpha.

The flare showed typical two-ribbon structure, and was associated with a faint arc-shaped ejection. The arc-shaped ejection is thought to be an MHD fast-mode shock wave, seen in the soft X-ray images taken with the X-Ray Telescope (XRT) and EUV Imaging Spectrometer on board Hinode, just at the start of the impulsive phase of the flare. Even in the preflare and/or flare onset phases, we observed many active phenomena, such as an S-shaped X-ray brightening (sigmoid), a faint X-ray eruption that could be the driver of the MHD shock, and so on. This flare was also associated with a halo-type coronal mass ejection, which affected the interplanetary space and the terrestrial environment.

Keywords: flare, corona, magnetic field, MHD shock, plasmoid ejection, CME