

Study on the Solar Flare Effect (SFE*) of equatorial electrojet around local noon

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X-rays and ultraviolet rays associated with solar flares reach the Earth and stimulate an ionization of neutral particles in the daytime ionosphere, which changes the ionospheric current in a very short time, and this effect can be observed as drastically changing geomagnetic field perturbations [Campbell, 2003]. There are two types of magnetic field perturbations: positive SFE, in which the magnetic field becomes stronger than just before a solar flare, and negative SFE*, in which the magnetic field becomes weaker [Yamazaki et al., 2009].

Rastogi et al. (1996) stated that the positive variation of the magnetic field (SFE) through the equatorial region is a result of the enhanced equatorial electrojet (EEJ), while the negative variation (SFE*) the morning and evening side of dip-equator is a result of the enhanced counter electrojet (CEJ).

However, generation of SFE* around local noon dip equator is also reported [Rastogi et al., 2003; Yamazaki et al., 2009; Rastogi et al., 2013]. Yamazaki et al. (2009) reported two unique SFE* events. They suggested that this phenomenon may be caused by an increase in electrical conductivity in the lower part of the E layer due to X-class flares and the penetration of a westward electric field into the magnetic equatorial region due to the northward turning of the interplanetary magnetic field (IMF) Bz. On the other hand, Rastogi et al. (2013) examined the same event and proposed that this type of SFE* was enhanced partial CEJ by solar flares. However, reports on SFE* to date are limited, and it remains an open question what kind of ionospheric environment causes SFE*.

To clarify the generation mechanism of the unique SFE*, it is indispensable to understand the detailed structure of the ionospheric current system. The purpose of this study is to understand the generation mechanism of unique SFE* around noon time by developing a methodology that can quantitatively analyze the geomagnetic variations during solar flares times.

As a first step of this study, we visualize the ionospheric currents using the equivalent current method on MAGDAS/CPMN (Global Observation Network) geomagnetic data. Furthermore, by verifying the correlation between the Z-component and the fluctuation of the vector field of the Sq equivalent current system, we expect to understand the structure and development process of the current system before and after the SFE* occurrence. In this presentation, we will report the initial results of our analysis.

Keywords: Solar flare effect(SFE*), Equatorial Electrojet, Sq current

