Global response of Magnetic field and Ionosonde observations to intense solar flares

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Intense X-ray fluxes during solar flares are known to cause enhanced ionization in the Earth’s ionospheric D, E and F region. This sudden change of ionospheric electron density profile is serious problem to radio wave communication and navigation system. The ground magnetograms often record the sudden change in the sunlit hemisphere during the enhanced X-ray flux, due to the sudden increase in the global ionospheric current system caused by the flare-induced enhanced ionospheric conductivity. This geomagnetic field disturbances are known as "solar flare effects" (SFEs) or geomagnetic crochets [Campbell, 2003]. The typical SFE is increase variation on the equatorial magnetic data. On Ionosonde observation during solar flare event, the High-Frequency (HF) radio wave blackout is often detected in ionogram due to the sudden disturbance in ionosphere.

We investigated the magnetic field and Ionosonde responses to two intense solar flare events occurred on 6 and 10 September 2017. We demonstrated the magnetic field variation (named as gsfe) due to the ionospheric disturbance resulting from solar flare, the delay time from the onset of X-ray solar flare and the duration of gsfe. We found that Dayside gsfe increased around the noon sector along the magnetic equator and decreased at the high latitude in the summer hemisphere in the morning sector. The delay time is short around the lower latitude and high latitude, and long at the middle latitude. The duration of gsfe at high latitude is longer than the lower latitude. There is no response in night side magnetometer data. We found HF radio wave blackout in ionogram at dayside Ionosonde stations. The duration of blackout is dependent of latitude and local time of Ionosonde stations. There is the different feature of ionogram at night side. The gsfe is shorter than the ionospheric response, possibly due to the different ionosphere layer (lower or upper) generating the effect of solar flare.