Characteristics of Large Amplitude Geomagnetic Sudden Commencement

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We studied global waveform distribution of large amplitude SC events which occurred in the 1990's ([1]July 8, 1991 [2]May 9, 1992 [3]June 10, 1991). Assuming that the DL-field is given by the increase of the H-component at Guam (4.6 MLAT) at night, we subtracted it from magnetic perturbations of each station. We found that in the event of [2] the same bipolar impulse appeared in the latitude range from 40 to 60 MLAT around noon where an opposite bipolar impulse is usually observed, and in the events of [1] and [3] only the succeeding negative impulse appeared from 40 to 50 MLAT around noon. These characteristics are quite different from those predicted by the SC model proposed by Araki[1994]. We consider contribution of the field-aligned currents.

Geomagnetic Sudden Commencement (SC) shows complex waveform distribution depending on the geomagnetic latitude and local time. The waveform of the H-component is dominated by a stepwise increase (DL) at low latitudes and by two successive pulses with opposite senses (DP) at high latitudes. The first pulse of DP is composed of a preliminary positive impulse (PPI) and a preliminary negative impulse (PRI) in the morning and afternoon, respectively. It is considered that the DL is produced by the magnetopause current and the DP is by field-aligned currents and twin vortex type ionospheric currents.

We studied global waveform distribution of large amplitude SC events which occurred in the 1990's ([1]July 8, 1991 [2]May 9, 1992 [3]June 10, 1991). The three SCs are the largest since IGY(1959) except the SC on March 24,1991. The H-component amplitudes of them at Kakioka were 146nT, 101nT, and 85nT, respectively.

Assuming that the DL-field is given by the increase of the H-component at Guam (geomagnetic latitude 4.6 degrees (4.6 MLAT)) at night and has a cosine variation with geomagnetic latitude, we subtracted it from magnetic perturbations of each station. We found that (a) a first positive impulse and a succeeding negative impulse appeared around 60 MLAT at from 9 LT to 10 LT and from 10 LT to 11 LT in the events of [1] and [3] respectively, (b) in the event of [2] the same bipolar impulse appeared in the latitude range from 40 to 60 MLAT around noon where an opposite bipolar impulse is usually observed, and (c) in the events of [1] and [3] only the succeeding negative impulse appeared from 40 to 50 MLAT around noon. The amplitudes of the positive pulse of the event of [2] were about 200nT and 50nT around 60 MLAT and 40 MLAT, respectively. Those of the second negative pulse of the event of [2] were about -300nT and -150nT at each latitude region.

The characteristics, (b) and (c), are quite different from those predicted by the SC model proposed by Araki[1994]. We consider contribution of the field-aligned currents that flow into the afternoon sector and out from the morning sector at first and vice versa afterward.