MAGNETIC LATITUDE AND LOCAL TIME DEPENDENCE OF THE AMPLITUDE OF GEOMAGNETIC SUDDEN COMMENCEMENTS

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In order to clarify magnetic latitude and local time dependence of geomagnetic sudden commencement (SC) amplitude from the subauroral latitude to equator, we analyzed the geomagnetic field data with high time resolution of 1 second provided from the Yap, Guam, Okinawa, Kakioka, Memanbetsu, St. Paratunka, Stecolny, and King Salmon stations. In the present study, we defined each SC event as a geomagnetic field variation showing a rapid increase of the SYM-H value with more than 5 nT within ten minutes. Furthermore, in order to exclude positive bays associated with the substorm onsets from the obtained SCs, we investigated Pi 2 pulsations around this period using the CPMN [Yumoto and the CPMN Group, 2001] data. From this data analysis, 3163 SCs were identified in a period from 1996 to 2008. The SC amplitudes at the above 8 stations were normalized by that in the SYM-H index with latitude correction to minimize the different contribution of the rapid change in solar wind dynamic pressure. As a result, the magnetic local time dependence of SC amplitude showed negative and positive magnetic field variations in the morning and afternoon sectors from the subauroral to middle latitudes produced by two-cell ionospheric currents (DP 2-type currents) which are driven by the dawn-to-dusk electric field accompanying a pair of field-aligned currents (FACs). The magnetic effects of the DP 2-type currents expand to the low-latitude (16.54 degree). In this region, the DL part of SC produced by the Chapman-Ferraro currents can usually be more dominant, but the DP part of SC contaminated 7 % of the DL one. At the daytime equator, the SC amplitude was considerably enhanced with a peak value of 3.24 (normalized SC amplitude) around 11 h (MLT) due to the Cowling effect. Another interesting point is that the nighttime enhancement of SC amplitude was clearly found in a region from the middle latitudes to equator. The peak value tends to increase with increasing magnetic latitude, suggesting that the origin of the nighttime enhancement exists in high latitudes. This nighttime enhancement can be interpreted as the magnetic effects of the FACs resembling the region-1 FACs associated with SCs.

geomagnetic sudden commencement, DP 2 currents, field-aligned currents

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