Seasonal dependence of diurnal variations of SC amplitude from middle to low latitudes

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In order to confirm seasonal dependence of diurnal variations of SC amplitude on the ground from middle latitudes to equator during the main impulse (MI) of SCs, we analyzed a large number of SC events identified by the long-term observation data with high time resolution of 1 second provided from the 6 stations: Yap (geomagnetic latitude, MLAT0.38 degree), Guam (MLAT=5.22 degree), Okinawa (MLAT =16.54 degree), Kakioka (MLAT =27.18 degree), Memanbetsu (MLAT =35.16 degree), and St. Paratunka (MLAT =45.58 degree). The SC events in the present analysis have been defined as a rapid increase of the SYM-H value with more than 5 nT and time variation of 1.5 nT min^{-1} within ten minutes in the SYM-H index. Then, we identified 7556 events of SCs in a period from January 1981 to March 2008. In the present analysis, the SC amplitude obtained at the above 6 stations has been normalized by that in the SYM-H index with latitude correction in order to minimize the different contribution of the rapid change in solar wind dynamic pressure. We also used solar wind data obtained from the IMP-8, Geotail, Wind and ACE satellites within the same period. The results showed that the peak-to-peak amplitude of magnetic field disturbances in the morning (8:00, MLT) and afternoon (16:00, MLT) sectors due to two-cell ionospheric currents (DP 2-type currents) connected to a pair of field-aligned currents (FACs) resembling the region-1 (R-1) type of FACs tends to be more enhanced in summer than in winter in the middle latitudes (PTK and MMB). Furthermore, the nighttime enhancement of SC amplitude in the regions also tends to become large in summer. These signatures indicate that the DP 2-type currents tend to become larger under the ionospheric condition of the high conductivity in summer. From the above seasonal dependence, we can conclude that the MI currents system is the voltage generator with strong dependence of the current intensity on the ionospheric conductivity. In the low latitudes (KAK and OKI), seasonal dependence of SC amplitude in the daytime sector is very small, compared to that in the middle latitudes, while the SC amplitude in the nighttime sector indicates the seasonal effects of the FACs intensity as well as in the middle latitudes.