Low-altitude satellite observations of sudden commencements (SCs) in the inner magnetosphere

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Geomagnetic storm sudden commencements (SCs) have been extensively studied with the magnetic field measurements from the ground and spacecrafts for many years. The SC waveform on the ground surface is rather complex with a strong dependence on latitude and local time (LT). Based on a large number of observational results and former studies, Araki [1994] developed a physical model of SC. According to his model, the source of the SC in the interplanetary space is a simple step-function like increase of the solar wind dynamic pressure. The increase of the dynamic pressure causes a stepwise compression of the magnetic field in the magnetosphere and propagates earthward in the dayside magnetosphere with a relevant HM wave velocity. The SCs observed on the ground can be decomposed into two parts as DL (disturbance dominant at low latitudes) and DP (disturbance originating at polar region). The DP is further decomposed into two parts corresponding to the preliminary sharp impulse (PI) and the following main impulse (MI). In this model, the ionospheric currents play a vital important role in each part of the SC disturbance. In order to clearly identify the effects of the ionospheric currents associated with SCs, simultaneous observations of the magnetic field above and below the ionosphere are extremely valuable. However observation of the SCs by low-altitude spacecraft are rather scarce. In this study, using the vector magnetic field measurements from the Oersted spacecraft, we identified more than 30 clear SCs at different local times. Especially, for the first time, we detected several clear PI impulses of the SC in the dayside low-latitude inner magnetosphere. The unique properties of SCs reflected by those events have never been reported before. We believe that the characteristics of those SCs observed by Oersted are significant complimentary to our empirical knowledge of the SCs in the inner magnetosphere.