Tail current variation associated with SCs

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We have examined statistically the spatial and temporal variation of the tail current associated with sudden commencements (SCs), both of which are thought to be caused by impulsive pressure pulses of the solar wind passing through the geospace. The data analysis in the present study is based on hundreds of SC events indentified with the magnetometer data obtained at Kakioka (KAK), Japan during January, 1997 through January, 2007 (˜11 years). The extensive coverage of the magnetotail (X = -9 to ˜-30 Re) by the Geotail spacecraft allows us to pick up 72(49) SC events for the northward(southward) IMF condition, respectively, accompanied by the Geotail observation inside the magnetotail. Correlation between SC occurrence and increases of the total (kinetic+magnetic) pressure (Pt) observed in the magnetotail, as a proxy for the tail current intensity, is quite well. Surprisingly, however, some events show that Pt rises occur almost simultaneously or even precedes by a few minutes the corresponding SCs, although most of the events show that SCs precedes the Pt rises observed in the nightside magnetosphere. We also find that Pt increases quite coherently from 5 to nearly 30 Re down the tail with apparently no dawn-dusk asymmetry. This result implies that the enhanced tail current on SCs does not branches into the filed-aligned current connecting to the ionosphere, in contrast to that during storm main phase as reported by past studies. Interestingly, comparison with magnitude of the ground sym-H variation reveals that the Pt rise is larger during the southward IMF (SIMF) cases than the northward IMF (NIMF) cases for the same level of sym-H increase. This indicates that not only the enhanced dynamic pressure of the solar wind, but also the enhanced dayside reconnection driven by the SIMF contribute significantly to the tail current enhancement when a pressure pulse of the solar wind sweeps the magnetosphere.