Average parameters of the midtail plasma sheet during SMC and two different types of the magnetospheric substorm

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We study average characteristics of plasma sheet convection in the middle tail during different magnetospheric states (Steady Magnetospheric Convection, SMC, and substorms) using simultaneous magnetotail (Geotail, 15-35 R_E downtail) and solar wind (Wind spacecraft) observations during 3.5 years. (1) Large data set allowed obtain the average values of the plasma sheet magnetic flux transfer rate (E_y) and directly compare it with the dayside transfer rate (E_{mod}) for different magnetospheric states. The results confirm the magnetic flux imbalance model suggested by Russell and McPherron (1973), namely: during SMC periods the day-to-night flux transport rate equals the global Earthward plasma sheet convection, during the substorm growth phase the plasma sheet convection is suppressed on the average by 40%, whereas during substorm expansion phase it twice exceeds the day–to-night global flux transfer rate. (2) Different types of substorms were revealed. About 1/3 of all substorms considered displayed very weak growth of the tail lobe magnetic field before the onset. For these events the plasma sheet transport was found to be in a balance with the day-to-night flux transfer, like during the SMC events. However, the lobe magnetic field value just before the onset exceed the average level of the lobe field during the SMC in these cases as well as in other substorms. Also in both groups of substorms similar configurational changes (magnetic field stretching and plasma sheet thinning) were observed before the substorm onset. (3) Superimposed epoch analysis showed that the plasma sheet during late substorm recovery phase has the characteristics similar to those found during SMC events, the SMC could be a natural magnetospheric state following the substorm.