Energetics of the magnetosphere during a quasi-substorm

L.A. Dremukhina, Y.I. Feldstein
(IZMIRAN, Troitsk, 142090, Moscow Region, Russia)

It is discussed quantitatively the problem of a possible localization of a source of magnetospheric disturbances, namely, whether the energy of the near-Earth part of the magnetospheric tail is sufficient to support the energy flux dissipating in the ionosphere and the inner magnetosphere during magnetic disturbances. For this purpose we studied the event occurred on November 24, 1986 from 1500 UT till 1900 UT when the solar wind parameters, and auroral particle precipitation boundaries data as well as data on ion composition at geocentric distances 2<L<7 are available. This event can not be considered as a single substorm but as a superposition of several substorm splashes (quasi-substorm). For our calculation we used the paraboloid model of the magnetospheric magnetic field to evaluate the energy stored in the nightside sector of the magnetosphere connected to the near-Earth part (till 20Re) of the magnetotail current system, and its dissipation rate Ut. The energy dissipation rate in the ionosphere and the inner magnetosphere Us was obtained as a total dissipation due to Joule heating in the high-latitude ionosphere, particle precipitation, and dissipation from the ring current. Obtained results has shown that magnetospheric disturbances like quasi-substorms do not occur due to expense of the energy previously stored in the near-Earth tail. During quasi-subtorms Us and the energy storage in the magnetotail (of the tail lobe magnetic flux) grow simultaneously, i.e. the process of direct energy input to the magnetosphere from the solar wind continues even during abrupt intensification of auroral electrojets. The energy dissipation from the near-Earth tail is not sufficient to support the quasi-storm generation and development. This conclusion becomes still more justified if both hemispheres are taken into account for Us determination. We conclude that during magnetospheric disturbances there are simultaneously loading-unloading and directly driven processes which are displayed as in the storage of the solar wind energy in the magnetotail and the ring current so in the energy direct dissipation in the upper atmosphere.