Long-term behavior of the magnetotail stretching and
dependence on interplanetary and geomagnetic
conditions

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It is known that the stretching of the magnetic field lines in the near-Earth magnetotail
is characterized by the latitude of the precipitation boundary, on which the energy flux
of ions with energy above 3 keV is maximum. This boundary, called b2i, is routinely
determined from low-orbiting DMSP satellite particle data by the Auroral Particles
and Imagery Group at JHU/APL. The lower b2i, the more stretched is the magnetic
field. We used b2i values, which are publicly available at the JHU/APL website, along
with interplanetary and geomagnetic activity data from the OMNI database for years
1984-2004 (the interval spanning solar cycle 22 and most of solar cycle 23) for in-
vestigation of the long-term evolution of the magnetotail stretching. It is found that
annual average of b2i has pronounced variations during the two solar cycles. Maximal
b2i values (more dipole-like magnetosphere) are found in 1987 (near the minimum of
solar cycle 22) and in 1996 (near the minimum of solar cycle 23). Minimal b2i value
(more stretched magnetosphere) is found in 1991 near the maximum of solar cycle 22,
but in 2000 (maximum of cycle 23) the b2i minimum is not distinct. In contrast to the
behavior of b2i during the declining phase of the preceding cycle, a strong decrease
of the latitude is observed in 2002-2003. Such variations of b2i are in agreement with
the behavior of interplanetary parameters which also demonstrate an “anomalous” be-
havior in 2002-2003. The best correlation of the magnetotail stretching is found with
annual average of the merging electric field. More stretched magnetotail means more
intense cross-tail current in the near-Earth region and, consequently, higher level of
geomagnetic activity. This explains a high correlation (|r|>0.8) between annual aver-
age of b2i and geomagnetic activity indices Kp, AE, and Dst. The correlation is higher
than that between the indices and interplanetary parameters. It is also found that b2i
depends on season. Monthly averaged b2i values exhibit distinct minimum in March and October. This agrees with the well known equinox increase of geomagnetic activity.