Geophysical Research Abstracts, Vol. 9, 00594, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-00594

Geomagnetic activity response to changes of orientation of the solar wind velocity, the interplanetary magnetic field and the solar wind electric field with respect to geomagnetic moment taking into account annual and daily motion the Earth

T.V. Kuznetsova and A. I. Laptukhov
IZMIRAN, Russian Academy of Sciences, Russia
(tvkuz@izmiran.rssi.ru / +7 4953340921)

We present results of our study of dependence of planetary geomagnetic activity from mutual orientation of the solar wind velocity V, the Interplanetary Magnetic Field (IMF), electric field of the solar wind E and geomagnetic moment M. We attract for calculation of the geoeffective parameters a reconnection model elaborated by us taking into account changes of geometry of the solar wind-magnetosphere interaction during annual and diurnal motions of the Earth. Our method of calculation of geometric factors in reconnection parameters allows to separate influence of values of E and the IMF and their orientation relative to geomagnetic moment M into geomagnetic activity. We take as our data base the IMF and solar wind velocity at the Earth's orbit for the period of spaced measurements 1963-2005 and Kp, Dst indices of planetary geomagnetic activity. Firstly we demonstrate that angle between the solar wind velocity and geomagnetic dipole can explain less than 15% of observed changes of Kp. Change of orientation of the IMF relative to the dayside geomagnetic field in itself can explain 35% of observed variations of the geomagnetic indices. Besides, we detect clear increasing of geomagnetic activity for the northward interplanetary magnetic field and suggest our interpretation of this effect. We show that level of geomagnetic activity depends both from value of E and its orientation relative to the Earth's moment. Dependence of geomagnetic activity from angle between vectors E and M is described by sine wave in each range of constant values of E. Mean level of geomagnetic activity

for a given value of E is determined by component of electric field E along the geomagnetic moment M (independently from its sign) connected with magnetospheric convection. Maximal and minimal deviations from this mean level is determined by transversal to M orientation of the E vector at the plane perpendicular to the solar wind velocity. Variations of geometric factors determined by mutual orientation of the vectors E and M can explain 50% of observed variations Kp and 75% of Dst. Because each from geometric parameters is connected with underlying physical mechanism, we evaluate geoeffectness of these physical mechanisms. Well-known annual variation of geomagnetic activity with peaks at equinoxes is a good test for any mechanism of the solar wind-magnetosphere interaction. Based on our results we suggest a new explanation of this variation. Phase of the statistical annual variation of geomagnetic activity is determined by oscillations of the Earth's magnetic moment during a year at the plane perpendicular to the Sun-Earth line. Amplitude is modulated by the steady solar wind electric field component E_z perpendicular to the ecliptic plane. We discuss application of our results to the problem of interaction of CMEs with terrestrial magnetic field and to other problems.

The study was supported by the Russian Foundation for Basic Research (project no 06-05-64998).