

Contribution of geometry of interaction between interplanetary and terrestrial magnetic fields into global magnetospheric state

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Interaction between the solar wind, Interplanetary Magnetic Field (IMF) and geomagnetic field is natural laboratory for study such fundamental mechanism as magnetic reconnection. The accepted point of view is that B_z (GSM) is the most geoeffective parameter. It is not quiet so. Analysis of theoretical models shows that electric field E is not result of reconnection process, but one is introduced as independent parameter determining mainly reconnection process (reconnection rate). Besides, orientation and value of E (relative to neutral line) plays main role in the reconnection. This means that E of the solar wind should play determining role in reconnection between IMF and geomagnetic field. We present key parameters for space weather governing the magnetosphere state. Geomagnetic activity is determined in our approach by two kinds of causes: 1) time variations of the solar wind parameters, sources of which are time variations of solar activity; 2) time variations of mutual orientation of geomagnetic moment M , IMF, electric field of the solar wind E , sources of which are mainly annual and daily motions of the Earth. We stressed the geometric effect 2) in our study. We present results of our study of dependence of planetary geomagnetic activity from geoeffective parameters taking into account orientation of the magnetic moment of the Earth relative vectors of the IMF and E . Geoeffective invariant (relative to a coordinate system) parameters have clear physical sense of components of electric field of the solar wind along special directions of the M . We take as our data base (for the period 1964-2004 of space measurements at 1 a. u. at ecliptic plane) all values of K_p , Dst and A_p indexes of planetary geomagnetic activity while there was simultaneous coverage of the IMF and solar wind velocity (to calculate E). We attract for calculation of these parameters a reconnection model developed by us that describes a reconnection between terrestrial magnetic field and IMF of arbitrary orientation taking into account annual and daily rotations of the Earths dipole. Results of our analysis show that main geoeffective parameter E_{mv} (component of the E vector perpendicular both to M and the solar wind velocity V) can explain 95 % variations of geomagnetic indexes. Besides, results of our study explain well-known variations of geomagnetic activity (annual variation, in vicinity of equinoxes, and the UT variation for each season) by variations of values of geoeffective parameters (depending from astronomical season and UT). At last we evaluate direct contribution of geometric factors in the

geoeffective parameters (calculated on the basis of measurements of the IMF, V and orientation of the M vector in GSE coordinate system) on the geomagnetic activity. Variations of angle between the vectors of IMF and M can explain 30% of variations K_p . Variations of our pure geometric parameter (determined by mutual orientation of vectors E and M) can explain 50% of observed variations of the K_p (for invariable values of E in the solar wind). This means that geomagnetic activity can reach very high levels of geomagnetic activity without changing values of solar wind parameters. Geomagnetic activity can reach very high level of the geomagnetic activity $K_p=8$ ($A_p=207$ nT, $Dst=-180$ nT) for invariable values of E in the solar wind ($E>8$ mv/m) from geomagnetic active state $K_p=4$ ($A_p=27$ nT, $Dst=30$ nT) by changing only angle between E and M . Our analysis shows that daily rotation of the Earth's dipole (variations of mutual orientation of vectors of geomagnetic moment M and the solar electric field E depending from UT and season) is mainly responsible for these changes of the magnetospheric state.