Relationship between Solar Wind Parameters and Geomagnetic Activity

During Magnetic Storms Driven by Different Streams

NADEZHDA S. NIKOLAEVA, YURY I. YERMOLAEV, IRINA G. LODKINA Space Research Institute RAS, Moscow, Russia, nnikolae@iki.rssi.ru

The dependence of maximal values of geomagnetic indices |Dst| and AE (intensity of ring and auroral currents) during magnetic storms on values of interplanetary electric field Ey, dynamic pressure Pd and fluctuation level σB IMF is investigated. For analysis we used Catalogue of large-scale types of solar wind streams created with help OMNI data base for period 1976 – 2000 [1]. We study separately 8 types of magnetic storms driven by different solar wind streams: corotating interaction regions CIR, interplanetary coronal mass ejection ICME, including magnetic clouds MC, and Ejecta, Sheath region both before MC and Ejecta, and uncertain type of stream.

We obtained that for all streams the value of |Dst| index is growing with increasing Ey. But only for magnetic clouds MC and, possibly, for all ICME when electric field is strong Ey>11 mV/m the value of index |Dst| reached saturation. Also it was shown that AE index was not dependent on value of electric field Ey almost for all streams with exception of magnetic clouds MC and probably of Sheath before MC. For magnetic storms driven by MC we observed linear growth of AE index when electric field was low Ey<11 mV/m, but it decreased with increasing Ey>11 mV/m. Both geomagnetic indices |Dst| and AE do not show additional dependence on Pd and σB IMF against a background of its dependence on Ey.

Our results are in agreement with similar data obtained for certain streams in other works, and supplement them with other streams. Nonlinear connection between geomagnetic indices and electric field Ey obtained for magnetic clouds MC and possibly for all ICME conforms to simulation of magnetosphere-ionosphere current system zone 1 under condition of saturation of polar cap potential.

Keywords: solar wind; geomagnetic activity; solar wind-magnetosphere interactions.

References

[1] Yu. Yermolaev et al., Cosmic Research, 47, 81 (2009).