GEOMAGNETIC STORM WITH MAIN PHASE DURING NORTHWARD IMF AND TRANSFER OF ELECTROMAGNETIC ENERGY TO MAGNETOSPHERE

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The magnetic storm occurred on 21–22 January 2005 (minimum Dst= -105 nT, maximum Kp=8) was highly anomalous because the storm main phase developed during northward interplanetary magnetic field (IMF) and after the IMF was northward during ~7 hours. It is possibly that this storm is the first event of such type to be reported; as to our knowledge, the storm was analyzed only by Du et al (2008). We use interplanetary ACE and Cluster C1 data for determination of the solar wind parameters. Dst, Kp, AU, AL indices are used to follow development of geomagnetic activity (GA) for the storm. We attract results of our previous studies. Our study of influence of mutual orientations of the solar wind electric field E vector and the geomagnetic moment M vector on GA (Dst, Kp) obtained on basis of measurements of solar wind velocity V and IMF at ~1 AU for the period 1963-2005 showed that GA depends both from module E and angle between vectors of E and M. As result we found a new dependence of the GA rise during northward IMF for constant module of E. We showed that this increase of Kp (Dst) is driven by the Em component (the E vector along the M vector) that is important for understanding mechanisms of the storm. We show that unusual large value of the solar wind Em component (Em~15.7 mV/m) played important role in development of the anomalous storm. Based on calculations of the independent components of the solar wind E vector we show that the Dst (Kp) temporal variation during the anomalous storm follows the variation of the E components. The result points to the fact that the energy rate supplied to magnetosphere during the storm nearly equals to dissipation rate into magnetosphere (energy storage is not essential). Based on our analysis we suggest a possible mechanism for the anomalous storm main phase: reconnection of geomagnetic field with northward and azimuthal IMF in cusps and polar regions of both hemispheres (that leads to intensive convection between hemispheres).

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