ABSTRACT

INFLUENCES OF INTERPLANETARY MAGNETIC FIELD ON THE VARIABILITY OF THE AEROSPACE MEDIA

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The Interplanetary Magnetic Field (IMF) has a controlling effect on the Magnetosphere and Ionosphere. The objective in this work is to investigate the probable effects of IMF on Ionospheric and Geomagnetic response. To fulfill the objective the concept of an event has been created based on the polarity reversals and rate of change of the interplanetary magnetic field components, B_z and B_y. Superposed Epoch Method (SPE) was employed with the three event definitions, which are based on IMF B_z southward turnings ranging from 6 to 11 nT in order to quantify the effects of IMF B_y and B_z. For the first event only IMF B_z turnings were taken into account while for the remaining, positive and negative polarity for IMF B_y were added. Results showed that the increase in the magnitude of IMF B_z turnings increased the drop of F layer critical frequency, f_0F2. The drop was almost linear with the increase in magnitude of polarity reversals. Reversals with a positive IMF B_y has resulted in the continuation of geomagnetic activity more than 4 days, that is to say, the energy, that has penetrated as a consequence of reversal with a positive B_y polarity, was stored in outer Magnetosphere,whereas, with a negative IMF B_y the energy was consumed in a small time scale.

At the second step of the work, although conclusions about geomagnetic activity could be done, as a consequence of data gaps for f_0F2 in addition to having low numbers of events,

characterization of f_0F2 due to constant IMF B_y polarity could not be accomplished. Thus, a modeling attempt for the characterization of the response due to polarity reversals of IMF components with the Genetic Programming was carried out. Four models were constructed for different polarity reversal cases and they were used as the components of one general unique model. The model is designed in such a way that given 3 consecutive value of f_0F2, IMF B_y and IMF B_z, the model can forecast one hour ahead value of f_0F2. The overall model, GETY-IYON was successful at a normalized error of 7.3%.

Keywords: Magnetosphere, Ionosphere, Interplanetary Magnetic Field, Modeling, Genetic Programming