Geophysical Research Abstracts
Vol. 14, EGU2012-5030, 2012
EGU General Assembly 2012

Possible ways of space weather prediction improvement

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Most popular short-term space weather prognoses are based on CME-like solar wind conditions' analysis. Short-term forecasts of severe magnetic storms using such a prognostic scheme are rather accurate, but sometimes are not actual due to too short alert time. Moreover, the number of severe storms is 10 times less than the weak magnetic storms' number. At the same time, the quality of weak and moderate magnetic storms forecast is poor for both short-term and medium-term prognoses, especially at a solar minimum.

It is found that physical origin of weak and moderate magnetic storms is much closer to substorms' than to severe magnetic storms' nature; that is why CME-condition- based prognoses fail very often for mild geomagnetic storms [1]. Case studies and statistical analysis show that a mechanism of weak and moderate magnetic storms' development could be explained by excitation and compression of the magnetosphere by the SW density sharp increase in a combination with the southward-directed IMF. Sometimes there is a time delay up to several hours between the geoeffective density increase and the negative Bz IMF component's observation [1, 2].

The role of the solar wind velocity in the stimulation of the reconnection in the magnetotail is found out to be negligible for weak or moderate magnetic storms and essential for intensive and severe geomagnetic storms. So, a consideration of high-speed SW streams and the southward IMF direction as a main cause of a geomagnetic storm is correct for storms with Dst<-100nT only.

Additionally, there are evidences that a weak increase of the SW density, as well as increased SW turbulence in the ULF diapason one-three days before a geomagnetic storm onset could be considered as a prognostic factor [1, 2].

Therefore, more deep investigation of weak (but not severe) magnetic storms' origin is a main key of future success of space weather prediction.

1. Khabarova O.V., Current Problems of Magnetic Storm Prediction and Possible Ways of Their Solving. Sun and Geosphere, http://sg.shao.az/v2n1/SG_v2_No1_2007-pp-33-38.pdf , 2(1), pp. 33-38, 2007

2. Khabarova O., Pilipenko V., Engebretson M.J., and Rudenchik E., Solar wind and interplanetary magnetic field features before magnetic storm onset. ICS-8, University of Calgary Press, Canada, 127-132, 2006, http://ics8.ca/proc_files/khabarova.pdf .