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Modelling of the main phase of magnetic storms driven by different types of solar wind

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We present the results of the main phase modelling for magnetic storms with Dst<-50 nT induced by 4 types of the solar wind streams: MC (10 events), CIR (41 storms), Sheath (26 storms), Ejecta (45 events). The main phase development of magnetic storms is approximated by the linear dependence on the following solar wind parameters: integrated electric field of solar wind (sumEy), solar wind dynamic pressure (Pd), and the level of magnetic field fluctuations (sB), and the fitting coefficients are determined by technique of least squares.
As result of analysis it is shown that for all types of magnetic storms the best approximation of main phase was obtained for model with individual fitting coefficients. For magnetic storms induced by MC and Sheath the correlation coefficient between measured and modeled values of Dst indices is equal 0.99 and standard deviation is 2.6 nT and 5.6 nT, respectively. For Ejecta- and CIR- driven magnetic storms the correlation coefficient between measured and modeled values of Dst indices is equal 0.98 and 0.97 and standard deviation is 5.35 and 6.5 nT, respectively. The main phase modeling with fitting coefficients averaged over types of SW-driver is worse described the values of measured Dst index: for MC- and Sheath- driven magnetic storms the correlation coefficient between measured and modeled values of Dst indices is equal 0.65 and 0.82 and standard deviation is 21.7 and 31 nT, respectively. While for Ejecta- driven storms the correlation coefficient is 0.58 and standard deviation is 31.4 nT, and for CIR- driven storms these values are 0.67 and 25.2 nT.
The more accurate model of the main phase was obtained when we took prehistory of development of magnetic storm into account. For MC-driven magnetic storms the correlation coefficient becomes 0.83 and standard deviation is equal 15.6 nT. But for CIR- and Ejecta- driven storms the similar version of model is characterized by lower correlation coefficients 0.69 and 0.68 and higher value of standard deviation 24.2 and 29.8 nT, respectively.
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