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The solar wind energy input rate to the magnetospheric ring current during the two last solar cycles

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This study presents the recent results of our calculations of the solar wind energy input rate to the magnetospheric ring current in the main phase of geomagnetic storms. Simulation of Dst index on the basis of the solar wind rate energy input to the ring current and the adjustment for the solar wind dynamic pressure with the exponential decay rate of the ring current has more than thirty year-old history. The key elements of the models were reanalyzed in numerous works and a lot of Dst-index calculations were carried out. The differences between the calculated and observed Dst values in these models may be accounted to all key elements of the models. We looked for the acceptable geomagnetic storms and intervals for calculation of the solar wind energy input rate function to the ring current during the last solar cycles. Intense solar and geomagnetic activity that had occurred on October- November 2003 and on July and November 2004 allowed us to find the acceptable intervals for the wide range of the solar wind electric field more than 30 mV/m. It should be noted that previous calculations were carried out up to 16 mV/m of the solar wind electric field values. Furthermore, there were a lot of small geomagnetic storms during these solar cycles to correct of injection function for small geomagnetic storms. These calculations show us that the relationship between rate change of the ring current and Ey-component of the solar wind remains linearly proportional for great Ey values as in the case of small storms. From this result it is evident that there is no need to use complex nonlinear models for calculation of hourly Dst index. We present the simplest algorithm for calculation the Dst-variations in order to facilitate problem of users and for the quick estimation of Dst-index from the solar wind data directly. The algorithm arises from the fact that energy input to the ring-current is proportional to the Y-component of the solar wind electric field and from our physical regularities for the ring current obtained earlier.