

On the mechanism of the loading-unloading process in the Earth's magnetosphere

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There are two well-known empirical methods for calculating a total energy flux W supplied to the magnetosphere. These methods are based on totally different ideologies and techniques; therefore, they can be considered independent. However, both these methods yield well consisting results [Mishin V.M. et al., 1998]. Such a "cross-checking" shows that they reflect correctly the time behavior of W . Furthermore, it is found that a maximum of the input energy flux is ahead of the AE-index variation reflecting the energy losses in the ionosphere. There is such a time interval in which W already drops, and AE-index still increases. This fact received an interpretation in terms of the "loading-unloading" of energy. It is assumed that there is some energy deposit where the input energy is loaded and then unloaded through the magnetospheric-ionospheric current system.

One of these authors showed previously that the dawn-dusk current in the nightside part of the magnetosphere does work on magnetospheric plasma by compressing it when moving toward the Earth. This region was called the MHD compressor. In the region of the inner boundary of the plasma sheet where gas pressure drops along convection lines, there is a region of MHD generators. This region is connected through electric currents both with the ionosphere and with the MHD compressor. Thus the MHD compressor is fed both by an external current and by the current of the MHD generators which turned out to be "unclaimed" by the ionosphere. When during disturbances the ionospheric loading current increases, a total cross-tail current drops - there occurs a dipolization. Dipolization will also manifest itself when the external current drops. In any case, the response of the MHD generators to a change in the current through the compressor will occur with a delay. This delay is caused by the fact that the plasma tube with enhanced or decreased pressure must travel the distance with the convection velocity from the compressor to the generator where gas kinetic energy converts to electric energy. It is this phase shift in the operation of the compressor and the generator, which creates a situation when the input power already drops and the released power still grows.