

Role of the ionosphere in the stimulated precipitations of the auroral electrons

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The role of the ionosphere in the stimulated precipitations of the auroral electrons, i.e. the electrons with energies of 1-10 keV, is analyzed. At periods of intense magnetospheric storms and substorms such precipitations can be related to processes in the equatorial plane of the magnetosphere. One more important and well-known reason of the stimulated precipitations of the auroral electrons is related to the chain of the processes at the relatively low altitudes (0.5-1.0 RE) along the geomagnetic field over the auroral region, i.e. outside the plasmasphere. At that altitudes the conditions can exist when the drift velocity of the electrons which is related to the field-aligned current in the ionosphere-magnetosphere system is greater than the threshold value for formation of plasma instabilities and primarily the electrostatic ion cyclotron (EIC) instability. Increase of amplitude of the EIC-waves can result in EIC-turbulence, formation of abnormal resistance and the field-aligned electric field. The accelerated down in that field superthermal electrons provide the electrons stimulated precipitation. The typical average conditions in the night-time auroral ionosphere are such that parameters of the field-aligned current are close to the threshold conditions for formation of plasma instabilities at the heights of 0.5-1.0 RE. Therefore even a weak disturbance of the field-aligned current is enough for generation of the electrons stimulated precipitations. The field-aligned currents of Alfvén wave generated at the heights of the ionospheric dynamo-region, including the artificial action to the ionosphere, can play role of such additional disturbances. The efficiencies of the above mentioned processes depend substantially on the background parameters of the ionosphere including the conductivity of the ionospheric dynamo-region and the height distributions of the electron density, ion composition and the electron and ion temperatures. These parameters depend on helio-geophysical conditions, therefore the efficiency of the electrons stimulated precipitation depends on helio-geophysical conditions too. The dependences that are most important are described in this presentation. It is shown, in particular, that the occurrence of the self-supporting regime of the auroral electrons stimulated precipitation is most probable in the winter auroral region at pre-midnight and near-midnight hours. This mechanism of the auroral electrons stimulated precipitation leads to winter/summer asymmetry in the fluxes of the accelerated electrons and in the electron density at the heights of the ionospheric dynamo-region, thus supporting the important role of the ionosphere in the precipitations of the accelerated electrons.