On the influence of precipitating electrons on nitric oxide in the lower polar ionosphere

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A theoretical study of precipitating magnetospheric electrons contribution to the formation of the observed nitric oxide number density variations in the lower polar ionosphere has been carried out. A numerical model of the diurnal variation of odd nitrogen NO_X constituents number densities in the auroral zone at the heights of the D and E polar ionosphere layers has been developed. The model takes into account the formation of NO_X as a result of ionization and dissociation of atmospheric constituents by the UV solar radiation, as well as by precipitating magnetospheric electrons. For calculation of the odd nitrogen auroral sources an empirical model of the diurnal variation of precipitating electrons differential flux as a function of magnetic local time and geomagnetic activity has been constructed. This model is based on a large number of satellite measurements of the magnetospheric electron fluxes in the drift loss cone.

The calculations show that nitric oxide number density in the auroral ionospheric E region substantially grows as the geomagnetic activity increases. The enhancement of the NO concentration for the most intensive electron precipitation can be of an order of magnitude and can reach values over 10^8 cm^{-3} in accordance with observational data. But, on the other hand, it has turned out that for any intensity of precipitating electron flux in the ionospheric D layer there is a persistent deficit of model nitric oxide concentration as compared to measurements.