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DYNAMICS OF FREE PLASMA IN THE EARTH IONOSPHERE ^{*)}

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The experiments on artificial plasma creation in the ionosphere are majoring in the following two key points. At first, these experiments allow us to verify theoretical models of free plasma, which are impossible in laboratory experiments due to wall conditions and poor vacuum. Second, these experiments allow an in situ study of magnetosphere-ionosphere electrodynamics. In the FLUXUS (140 km altitude) and NORTH STAR-I(II) (350 and 270 km altitude, respectively) experiments aluminum plasma was injected by explosive type generators ETG (max energy 6 MJ) by IDG RAS.

The results of numerical simulation for the initial phase of plasma expansion in FLUXUS and NORTH STAR-II experiments are presented in [1,2]. In the NORTH STAR-I experiment, the artificial atmosphere was created by dry air injection prior to ETG onset, thus allowing to study of the impact of the atmosphere on the environment ionization and direct compare with FLUXUS results.

Below we present the 3D numerical simulation results for the interaction of Al plasma jet with an air cloud at 350 km altitude. We use radiation gas dynamic code FRONT [3] of the Godunov family in XYZ geometry on the Eulerian grid. The temporal scenario of injected plasma parameters was determined in [2] with encouraging coincidence with available evidence.

We compare the simulation results with gas dynamic and optical evidence. The influence of an artificial atmosphere, represented by an air cloud, on the parameters of plasma formation is investigated.

References

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