# To the problem of identification of ionospheric disturbances from regular and irregular geo-heliophysical sources

**Somsikov V.M., Andreev A.B., Kapytin V.I.**

Institute of Ionosphere, Almaty, Kazakhstan

e-mail: vmsoms@rambler.ru

The identification of ionospheric disturbances from regular and irregular geo-heliophysical sources is one of the key problems of geophysics. Its relevance is due to the need to forecast catastrophic geophysical phenomena associated, for example, with earthquakes, tornadoes, etc. To solve it, both the development of theories of disturbances for various sources in the atmosphere, including the ionosphere, and the development of statistical methods for experimental data obtained by radiophysical methods.

We also propose the development of a mathematical methods for describing atmospheric perturbations from geo-heliophysical sources based on the equations of nonequilibrium thermodynamics. It is shown that to take into account evolutionary processes, the atmosphere must be considered as an open nonequilibrium dynamic system. The difficulties that arise when constructing mathematical models of the evolutionary atmosphere are discussed. In particular, the difficulties associated with the information supply of the model with the necessary data series, with the nonlinear impact of external factors on the atmosphere (such as the flows of solar energy entering the atmosphere) and the dependence of evolution processes from natural and anthropogenic factors. The ways of development of the mathematical methods for the description of open nonequilibrium dynamic systems, which, in particular, is the atmosphere, are considered. Modified equations are proposed to describe the open atmosphere. Some fundamental problems of physics, the solution of which is necessary for building an evolutionary model of the atmosphere, are considered. The possibilities of identifying specific features of atmospheric disturbances, including the ionospheric using the proposed mathematical methods, are discussed. A comparison of theoretical conclusions with the observation data of atmospheric perturbations for regular and irregular sources, in particular, for the solar terminator, a powerful tornado, and solar flares, is also performed.