Spatio-temporal structures in the aurora oval: modeling approaches

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The interaction of the magnetospheric-ionospheric (MI) system surrounding the Earth with the environment (solar wind) occurs in the form of a series of transient processes at different scales. The largest of them, magnetic storms, are apparently triggered by disturbances in the solar wind. The role of the internal dynamics of the MI system, caused to a large extent by the nonlinearity and temporal delays in the processes of energy and particle inflow and outflow from the solar wind into the magnetosphere (load-unload processes), becomes more significant at smaller scales (substorms, pseudobreakups, injections, activations) [1]. A typical dynamic state of an MI system is described as self-organized criticality [2] or turbulence [3, 5], which are characterized by statistical scale invariance (scaling) in the distributions of fluctuations of many characteristics [7–9]. The dynamics of the MI system is projected into the region of the auroral oval, the very existence of which is due to this dynamics. The spatiotemporal structure of auroral disturbances largely reflects the structure of processes in MI plasma [10]. The description of this structure [4] is important both for studying the fundamental study of plasma processes [6] and for many topical applied issues related to the passage of radio waves in the ionosphere and vital activity at high latitudes. The report discusses approaches to the development of a model of the spatiotemporal structure of the auroral oval based on fractal and multifractal characteristics [4].

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