## Nonlinear dynamics of the ionospheric Alfven resonator

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A novel mechanism of the Alfven waves interaction with convective motions in the ionospheric Alfven resonator (IAR) is proposed. The model is based on parametric excitation of convective cells by the finite amplitude Alfven waves. A set of the coupled equations describing the nonlinear interaction of Alfven waves and electrostatic convective mode is derived. Our equations are then Fourier transformed to obtain a nonlinear dispersion relation, which admits the excitation of electrostatic convective cells. The generation of such cells is due to the Reynolds stresses of short-scale Alfven waves which are nonzero only when the Alfven perpendicular wavelengths are of the order of collisionless electron skin depth or shorter. Contrary to the previous studies it is shown that classical shear Alfven waves, when dispersion effects are neglected, are not capable to generate the electrostatic convective perturbations. It is found that the wave vector of the convective mode is perpendicular to that of the pump Alfven wave. The instability growth rate for the most growing mode is obtained. A comparison with the earlier obtained results is given. The results of the theory are applied to the recent satellite observations of the inertial Alfven waves in the auroral ionosphere. It is shown that convective cells produced by the parametric instability can form the fine structure of the turbulent Alfven boundary layer and may play an important role in the ionospheric plasma turbulence.
Our model provides an essential nonlinear mechanism for the transfer of energy from the short-scale Alfven waves to the long-scale enhanced convective motions which may result in the observable damping of the IAR eigenmodes. Alfven wave driven convective cells in the ionosphere can interact with the background medium and develop two-dimensional nonlinear motions in the form of Kelvin-Stuart vortex street. Such vortices can form the fine structure of the turbulent Alfven boundary layer and may constitute a dynamical paradigm for intermittency in the IAR turbulence containing nonlinearly coupled Alfven waves and convective motions.

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