Linear transformation of the planetary waves in ionospheric zonal flows and nonlinear analysis of satellite data

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Our goal is to gain new insight into the physics of wave dynamics in ionospheric zonal shear flows. We study the shear flow non-normality induced linear coupling of planetary scale (slow) modified Rossby waves and westward propagating fast magnetized (Khantadze) waves using an approach different from the existing one to the linear wave dynamics. The performed analysis allows us to separate from each other different physical processes, grasp their interplay, and, by this way, construct the basic physics of the linear coupling of the slow and fast waves in an ionospheric zonal flow with linear shear of mean velocity. It should be noted from the beginning that we consider incompressible flow and the classified "slow" and "fast" waves are not connected with the similarly labeled magnetosonic waves in compressible heliosphere. We show that: the modified Rossby waves generate fast magnetized waves due to the coupling for a quite wide range of ionospheric and shear flow parameters; the linear transient processes are highly anisotropic in wavenumber plane. Influence of anisotropic linear dynamics on the nonlinear processes is analysed.

Satellite data of special parameters of perturbations of magnetospheric flows and magnetic fields is studied by virtue of methods of nonlinear analysis. Recurrent diagram method is used for digital treatment of data. The fractal nature of measured signals is revealed, existence of the fractal structures is shown and their complexity is estimated.

The work is done within a framework of Shota Rustaveli National Science Foundation Grant N 31/14.