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Mechanism of Amplification and Mutual Transformation of Eigen Modes in the Ionosphere with Inhomogeneous Zonal Wind

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The generation and further dynamics of planetary magnetized Rossby waves and inertia waves are investigated in the rotating dissipative ionosphere in the presence of a smooth inhomogeneous zonal wind (shear flow). Magnetized Rossby waves appear as a result of the interaction of the medium with the spatially inhomogeneous geomagnetic field and are an ionospheric manifestation of usual tropospheric Rossby waves. An effective linear mechanism responsible for the intensification and mutual transformation of Rossby and inertia waves is found. For shear flows, the operators of the linear problem are not self-adjoint, and therefore the eigen functions of the problem maybe nonorthogonal and can hardly be studied by the canonical modal approach. Hence it becomes necessary to use the so-called nonmodal mathematical analysis. The nonmodal approach shows that the transformation of wave disturbances in shear flows is due to the nonorthogonality of eigenfunctions of the problem in the conditions of linear dynamics. Thus there arises a new degree of freedom and a new way for the evolution of disturbances in the medium. Using numerical modeling, we illustrate the peculiar features of the interaction of waves with the background flow as well as the mutual transformation of wave disturbances in the D-, E- and F-regions of the ionosphere. It is established that the presence of a geomagnetic field, Hall and Pedersen currents in the ionospheric medium, improves the interaction and mutual energy exchange between waves and a shear flow.