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Intensification of the LF IG wave structures in the ionospheric plasma at interaction with non-uniform winds

Khatuna Chargazia[1], **V Yu Belashov**[2] and **Oleg Kharshiladze**[1]
[1]Javakhishvili Tbilisi State University, Georgia
[2]Kazan Federal University, Russia

This abstract presents the theoretical explanation of the generation and intensification of low frequency (LF) internal gravity waves (IGW). The method used is based on generalizing results on shear flow phenomena from the hydrodynamics community. In the 1990s, it was realized that fluctuation modes of spectrally stable nonuniform shearedflows are non-normal. That is, the linear operators of the flows modal analysis are non-normal and the corresponding eigenmodes are not orthogonal. The non-normality results in linear transient growth with bursts of the perturbations and the mode coupling, which causes the amplification of LF IG waves shear flow driven ionospheric plasma. Transient growth substantially exceeds the growth of the classical dissipative trapped-particle instability of the system. It is shown that at initial linear stage of evolution IGW effectively temporarily draws energy from the shear flow significantly increasing (by order of magnitude) own amplitude and energy. With amplitude growth, the nonlinear mechanism turns on and the process ends with self-organization of nonlinear solitary, strongly localized IGW vortex structures, which are of special interest as traveling in the ionosphere stable large-scale wave formations, caused by various reasons such as the isolated magnetic substorms, solar terminator and solar eclipse, seismo-volcanic processes, and high-power artificial explosions. The dynamics of the solitary nonlinear IGW (as well as TID excited by them at the heights of the ionosphere's F-region) for conditions close to those of the ionosphere, by omitting the physical nature of the sources, but assuming that it has the pulse character (more details about excitation of the pulse disturbances by various physical sources are given below as well as in the references listed above) is carried out. Accumulation of these vortices in the ionosphere medium can create the strongly turbulent state.

khatuna.chargazia@gmail.com