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Regular and singular components of environmental flows and their impact on transport of contaminants

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Dynamics of waves and vortices in the environment is studied rather actively; less is known mechanism of formation and motion of thin and elongated elements. Results of theoretical and experimental investigations of complete set 3D solutions of fundamental set of governing equations describing motions of a stratified and rotating environment are presented. From classification of complete set of components for linearized 3D periodic motions follows that any large- scale motion consists of regular part that is waves or vortices and several kinds of singular components. Singular elements include two different types of viscous boundary layers as well as diffusive or temperature boundary layers on contact surfaces and their analogues in a fluid interior. A high level of vorticity and energy dissipation as well as own geometrical and dynamical parameters characterizes singular elements. Constructed solutions of 2D and 3D periodic and attached waves generation problems do not contain empirical factors and fit in experimental data rather good. Non-linear interactions of the whole set of motions lead to formation interfaces and vortex dipoles directly in a stratified fluid interior. Contaminants are collected on interfaces, which are analogues of shock waves, and transported along interfaces fast. Illustrating schlieren and visualizations pf vortex and internal waves dynamics are presented. Extrapolation on environmental systems and examples are given.