Geophysical Research Abstracts
Vol. 13, EGU2011-10819, 2011
EGU General Assembly 2011

Stratification, Rotation and Dissipation Effects on Transport of Solvable and Insolvable Admixture in Periodic Flows

Yuli D. Chashechkin

A. Yu. Ishlinski Institute for Problems in Mechanics of the Russian Academy of Sciences, Laboratory of fluid mechanics, Moscow, Russian Federation (chakin@ipmnet.ru, +7-499-739-9531)

Remote sensing instruments revealed rich fine component in general structure the environment. Fine extended arms of of solvable and insolvable admixture are registered both in the atmosphere and in the ocean. Concentration of a dye in a thin extended narrow bands having irregular of even arch forms is fixed in laboratory stratified and rotating flows (different illustrating examples are presented). The goal of paper is theoretical searching of mechanisms and performing precision laboratory modeling of contragradient transport of substances. Analysis is based on the fundamental set of governing equations including equation of state, Navier-Stokes, Fourier's and/or Fick's equations describing flows of stratified or generally rotating fluids . From condition of the constituting equations compatibility the order of linearized set is defined. The hierarchy of basic models is given. Solutions of the set are searched by singular perturbation method. Both the regular perturbed solutions describing large scale flow components that are vortices and waves as well as a rich family of singular perturbed solutions describing high gradients components are found. Thickness of thin components is defined by kinetic coefficients, characteristic velocity and frequency of buoyancy or rotation. The minimal number of singular perturbed components is defined by viscosity effects and is equal two. In precise experiments were shown that energy and momentum are transported by regular perturbed components. The energy dissipation, vorticity generation and transportation are associated with singular perturbed components. Discontinuities of stratification and compact vortices are formed directly in the fluid body in domains of thin flow components convergence. Passive admixtures are accumulated on singular perturbed components and transported along their surfaces or lines of their intersections. In experiments with stratified flows accumulation of a dye was observed on interfaces past moving 2D (horizontal cylinder) and 3D (sphere) flows. In rotation fluid both solvable and unsolvable admixtures are spinning from a compact source into plane spiral arms and 3D helix filaments. Comparison of theory and experiments is given and extrapolation of data on the environment is discussed.