Geophysical Research Abstracts,
Vol. 11, EGU2009-13244, 2009
EGU General Assembly 2009

Internal and vorticity waves in decaying stratified flows

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Most predictive models fail when forcing at the Rossby deformation Radius is important and a large range of scales have to be taken into account. When mixing of reactants or pollutants has to be accounted, the range of scales spans from hundreds of Kilometers to the Bachelor or Kolmogorov sub milimiter scales.
We present some theoretical arguments to describe the flow in terms of the three dimensional vorticity equations, using a lengthscale related to the vorticity (or enstrophy) transport.
Effect of intermittent eddies and non-homogeneity of diffusion are also key issues in the environment because both stratification and rotation body forces are important and cause anisotropy/non-homogeneity. These problems need further theoretical, numerical and observational work and one approach is to try to maximize the relevant geometrical information in order to understand and therefore predict these complex environmental dispersive flows. The importance of the study of turbulence structure and its relevance in diffusion of contaminants in environmental flows is clear when we see the effect of environmental disasters such as the Prestige oil spill or the Chernobil radioactive cloud spread in the atmosphere. A series of Experiments have been performed on a strongly stratified two layer fluid consisting of Brine in the bottom and freshwater above in a 1 square meter tank. The evolution of the vortices after the passage of a grid is video recorded and Particle tracking is applied on small pliolite particles floating at the interface. The combination of internal waves and vertical vorticity produces two separate time scales that may produce resonances. The vorticity is seen to oscilate in a complex way, where the frecuency decreases with time.