Topology of Turbulence affected by body forces

A.M Matulka (1), J.M. Redondo,(1,2) A. Carrillo (1)

(1) Dept. Fisica Aplicada Universitat Politecnica de Catalunya, Barcelona, Spain
(anna.magdalena.matulka@upc.edu) (2) DAMTP, Cambridge University, Cambridge, U.K.

It is important to measure mixing efficiency, specially when non-homogeneous turbulence is produced by one or several body forces like buoyancy [1], rotation or magnetic fields. The role of internal, inertial or Alfven and Lorentz waves seems to affect the locality of the cascade processes. Arquimedes, Coriolis or Lorenz forces produce changes in the scaling [2]. The fractal dimensions of the flows are related to the local Richardson, Ri, numbers [3] and the Rossby number Ro. A complex parametric space based on Re,Ri and 1/Ro is used to identify the dominant mixing instabilities and the changes in spectra and intermittency.

[1] Cantalapiedra, I.R. and Redondo, J.M. (1995). Mixing in zero-mean-flow turbulence. En: Mixing in Geophysical Flows. eds: J.M. Redondo, O. Metais.International Center for Numerical Methods. CIMNE 127-146.

[2] Redondo, J.M. (2003)Topological Structures in Rotating Stratified Flows. Topical Problems of Fluid Mechanics eds: J. Prihoda, K. Kozel. Prague.

[3] Redondo, J.M. and Linden, P.F.(1996) Geometrical observations of turbulent density interfaces. The mathematics of deforming surfaces. eds.D.G. Dritschel and R.J. Perkins Oxford: Clarendon Press Oxford. P. 221-248.