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Quasigeostrophic turbulence in the ocean

A. Bracco (1), J. von Hardenberg (2), J. B. Weiss (3)

(1) The Abdus Salam International Center for Theoretical Physics, Physics of Weather and Climate Section, Trieste, IT, (2) CIMA, Universita' di Genova, IT, (3) PAOS, Colorado University, Boulder, USA (annalisa@ictp.trieste.it / Phone +39 040 2240225)

The dynamics of quasigeostrophic turbulence in presence of an ocean-like stratification is studied numerically at high horizontal and vertical resolution. Coherent vortices are found to play a fundamental role in determining both the Eulerian and Lagrangian properties of the flow.

The pycnocline is populated by a large number of vortices and kinetic energy is concentrated in the baroclinic mode for a long time.

Below the thermocline, the energy is efficiently transferred to the barotropic mode and vortices organize into tall columns.

The comparison of the Eulerian fields and of the Lagrangian transport properties with ocean observations suggest that quasigeostrophic turbulence is able to capture important features of the dynamics of the open ocean.

This work supports the relevance to mesoscale ocean dynamics of barotropic turbulent models and of parameterizations of transport and mixing developed in such a context.