Geophysical Research Abstracts
Vol. 13, EGU2011-12332, 2011
EGU General Assembly 2011


# Continuousness and discontinuousness of stochastically induced transitions in geophysical turbulence

Marianne Corvellec (1), Freddy Bouchet (1), and Eric Simonnet (2)

(1) Laboratoire de Physique, ENS de Lyon, CNRS, Université de Lyon, 46 allée d'Italie, 69364 Lyon cedex 07, France (Marianne.Corvellec@ens-lyon.fr), (2) Institut Non Linéaire de Nice, CNRS, Université de Nice Sophia-Antipolis, 1361 route des Lucioles, 06560 Valbonne, France (Eric.Simonnet@inln.cnrs.fr)

In geophysical turbulent flows, it is customary to have two or more attractors responsible for low-frequency variability. We study this phenomenon in the dynamics of two-dimensional and quasi-geostrophic turbulence. In the inertial limit, with a time scale separation (between spin-up time and inertial time), the attractors are concentrated near a set of steady states of the inviscid equations. Statistical mechanical approaches help us determine which of these steady states are eligible. Then, we can establish phase diagrams, which show states with different topologies (different flow structures), in a very general theoretical framework. Assuming that a given system is close to a phase transition, we can infer that the stochastic forcing will lead to transitions between the various attractors. This was indeed found in a numerical simulation of the two-dimensional stochastic Navier-Stokes equations, as well as in experiments in fast-rotating tanks. We describe recent results which reveal whether the qualitative changes of attractors are continuous or discontinuous, when tuning an external parameter. The long-run proportion of time spent in a given state explains most of the low-frequency variability.

References:

F. Bouchet and E. Simonnet, Random changes of flow topology in two-dimensional and geophysical turbulence, Phys. Rev. Lett. 102 (2009), no. 9, 094504-+.

F. Bouchet and M. Corvellec, Invariant measures of the 2D Euler and Vlasov equations, J. Stat. Mech. (2010) P08021

F. Bouchet and A. Venaille, Statistical mechanics of two-dimensional and geophysical flows, submitted to Physics Reports

M. Corvellec and F. Bouchet, A complete theory of low-energy phase diagrams for two-dimensional turbulence equilibria, in preparation