

Abstract Submitted  
for the DFD09 Meeting of  
The American Physical Society

**Wavelet regularization of the 2D incompressible Euler equations**

ROMAIN NGUYEN VAN YEN, MARIE FARGE, LMD-CNRS, ENS, Paris, KAI SCHNEIDER, CMI, Universite de Provence — We examine the viscosity dependence of the solutions of two-dimensional Navier-Stokes equations in periodic and wall-bounded domains, for Reynolds numbers varying from  $10^3$  to  $10^7$ . We compare the Navier-Stokes solutions to those of the regularized two-dimensional Euler equations. The regularization is performed by applying at each time step the wavelet-based CVS filter (*Farge et al., Phys. Fluids, 11, 1999*), which splits turbulent fluctuations into coherent and incoherent contributions. We find that for Reynolds  $10^5$  the dissipation of coherent enstrophy tends to become independent of Reynolds, while the dissipation of total enstrophy decays to zero logarithmically with Reynolds. In the wall-bounded case, we observe an additional production of enstrophy at the wall. As a result, coherent enstrophy diverges when Reynolds tends to infinity, but its time derivative seems to remain bounded independently of Reynolds. This indicates that a balance may have been established between coherent enstrophy dissipation and coherent enstrophy production at the wall. The Reynolds number for which the dissipation of coherent enstrophy becomes independent on the Reynolds number is proposed to define the onset of the fully-turbulent regime.

Marie Farge  
LMD-CNRS, ENS, Paris

Date submitted: 27 Aug 2009

Electronic form version 1.4