

Controlling the kinetic energy spectrum

Keith W. Myerscough

January 30, 2014

Abstract

Small scale dissipation plays a vital role in establishing an equilibrium energy spectrum in 2D (atmospheric) turbulence. Because Global Circulation Models cannot represent these dissipative scales they require other methods to ensure dissipation at the smallest resolved scales. Such methods commonly involve the artificial dissipation of energy from these scales, not only resulting in a perturbed kinetic energy spectrum, but also prohibiting the growth of small scale instabilities.

We propose attributing higher priority to known equilibrium statistical properties of fluid flow, at the expense of strict adherence to the model equations. In particular we augment the simulation of a 2D turbulent flow in a periodic box with a control such that the average kinetic energy spectrum is maintained when the resolution of the numerical method is insufficient to resolve the dissipative scales. The chosen target kinetic energy spectrum may be taken from data, from a high fidelity simulation or from theoretical predictions (Kolmogorov, KLB).