Two-Fluid model in the Truncated Euler's Equations.

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It has been shown that the Spectrally Truncated Euler Equations presents a very rich behavior in its spectra [1], where a clear separation of scales can be seen. Numerical simulations show that when starting with the Taylor-Green vortex like initial condition, after a time the lowest modes follow a Kolmogorov's turbulence power law ($E(k) \sim k^{-(5/3)}$), and the energy associated to the highest modes is equi-partitioned ($E(k) \sim k^2$) and it can be considered as a quasi-equilibrium.

We have studied the statistical proprieties of this quasi-equilibrium and we found that it is effectively gaussian distributed with a non uniform temperature. We have observed that this associated temperature follows a diffusion process. In order to quantify this process we have measured the associated diffusion constant by starting with a modulated absolute equilibrium, i.e. a null mean gaussian variable with modulated variance, and watching how the temperature, defined by $T(x) = |u(x)|^2$, diffuses (Figure 1).

We have also found that an effective dissipation is produced, dumping the lowest modes. We have determined the effective viscosity by observing the flow produced by an initial condition given by pure rotation plus an absolute equilibrium.

These measurements would permit us to try to establish a Two-Fluid Model, where one of the fluids describes the large scale variations field and the other describes the highest modes's contributions to the flow which would

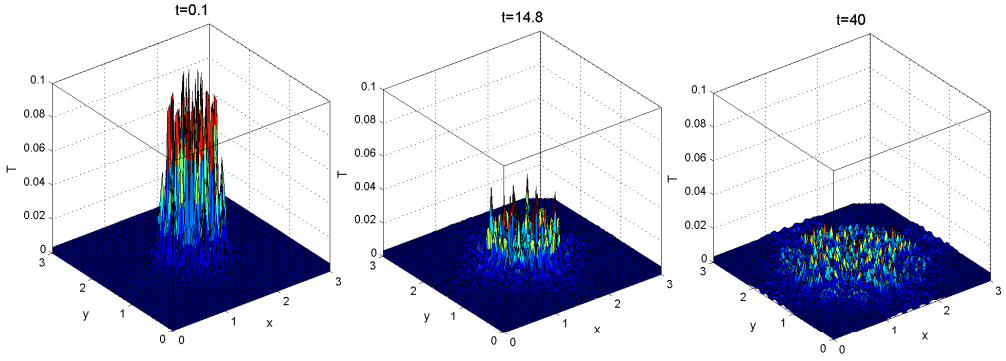

Figure 1: Cuts of the temperature in the plan $z = \frac{\pi}{2}$. We can observe the diffusion process associated to the temperature.

give an equation for the temperature and the others components of the Reynold's tensor.

References

[1] Effective Dissipation and Turbulence in Spectrally Truncated Euler Flows. C. Cichowlas, P. Bonati, F. Debbasch et M. Brachet. Phys. Rev. Lett. 95, 264502 (2005)