The reversible 3D turbulent cascade[1] ALBERTO VELA-MARTÍN, JAVIER JIMÉNEZ, Universidad Politécnica de Madrid — It has been known for some time that the dynamic Smagorinsky LES model is reversible. If the sign of the velocities in an isotropic turbulence simulation is inverted after it has decayed for some time, it evolves back to its original state, recovering its energy and other turbulent quantities. We use this reverse evolution, during which the cascade transfers energy from the small to the large scales, to gain new insights into the behavior and reversible features of the inertial energy range. The dynamics in the plane of the Q-R topological invariants are studied for the forward and backward evolutions, as well as the structure of the Lyapunov exponents in both regimes. Considerable differences are found. In particular, the Q-R pdf of the inverse evolution is reversed, with a stable Vieillefosse tail along negative R, and a main lobe in which vortex compression predominates. The contribution of the different terms in the equation is computed for both cases, both with and without an LES model.

Javier Jiménez
Universidad Politécnica de Madrid

Date submitted: 28 Jul 2014   Electronic form version 1.4