Towards a simple stochastic correction of kinetic energy spectra in fluids

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Both conservative and diffusive truncations of inviscid fluid models fail to capture the correct power law scaling of the kinetic energy spectrum at small scales. This scaling is important both for downscale transport of vorticity and energy, as for small upscale `backscatter' that influences variance. In this talk we discuss progress towards a simple correction using a stochastic thermostat approach from molecular dynamics. Thermostats are used in MD to perturb dynamics such that trajectories are ergodic in the canonical Gibbs measure (constant temperature). To apply these methods to discretized fluids, several challenges must be met: (i) we perturb only the smallest scales, hence controllability must be established; (ii) we are given expectations (kinetic energy spectrum) instead of invariant measure; (iii) we have to deal with forcing at low wave numbers; (iv) experience from heat conduction problems suggests that artifacts may occur. We report recent progress on these fronts.