Abstract Submitted
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What are the origins of -5/3 spectra and related dissipation scalings? SYLVAIN LAIZET, J. CHRISTOS VASSILICOS, Imperial College London — In this numerical work we present results concerning the spatial development of energy spectra and their associated integral and Taylor scales in conjunction with the spatial developments of vorticity, strain and production rates of vorticity and strain obtained from Direct Numerical Simulations of spatially developing grid-generated turbulence. We use a fractal square grid and a single mesh grid where the mesh is similar to the largest square on the fractal square grid. We find two adjacent but physically different regions in these flows relatively close to the grid: one where the Q-R diagram has not yet formed its well-known, presumed universal, tear-drop shape but where the energy spectra are not too far from a -5/3 shape over a decade of a frequency range which is set by inlet conditions rather than Kolmogorov scalings: and one where the Q-R diagram immediately adopts the well-known tear-drop shape but where the energy spectra are just about proportional to -5/3 over nearly a decade of frequencies. In the present fractal grid simulation, the first region gives rise, as one moves downstream, to the non-equilibrium behaviour $C\varepsilon \approx 1/Re\lambda$ (see Valente & Vassilicos, PRL, 2012 and Gomes-Fernandes et al., JFM, 2012) whilst the second region leads to $C\varepsilon \approx$ Const.

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