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An examination of effects of finite resolution and sampling uncertainties in large-scale direct numerical simulations of turbulence[1] P.K YEUNG, Georgia Tech, S.B. POPE, Cornell Univ, K.R. SREENIVASAN, New York Univ — Advances in computing power have allowed turbulence simulations to be conducted using massive computational resources of such magnitudes that make rigorous examinations of numerical fidelity in the results ever more important. One common practice in checking for resolution effects is to refine the grid, then integrate over a substantial time period, and compare the results, which will however differ also for reasons of statistical sampling. Another alternative which focuses on local instead of global errors is to begin from the best-resolved simulation available, and progressively filters out high-wavenumber contributions, to identify which features remain and hence may be robust even at more modest resolution. This approach has been applied to the statistics of dissipation and enstrophy in short-time datasets at resolution $16{,}384^3$ for forced isotropic turbulence. In this manner, and using results on the cumulative distribution function, we are also able to separate deterministic errors due to the numerics from errors due to finite statistical sampling.

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PUI-KUEN YEUNG
Georgia Institute of Technology

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