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Scaling of energy dissipation and enstrophy in high-resolution numerical simulations[1] DIEGO DONZIS, PUI-KUEN YEUNG, Georgia Institute of Technology, KATEPALLI SREENIVASAN, ICTP — We present results from direct numerical simulations using grid resolution up to 2048^3 with Taylor-scale Reynolds number (R_λ) up to 650 to study the scaling of energy dissipation rate ϵ and enstrophy Ω. Almost all sources of data have suggested that enstrophy is more intermittent whereas theoretical arguments suggest identical scaling. Large values of ϵ and Ω imply large velocity gradients which must be well resolved in order to study their intermittent behavior. An examination of the statistics of velocity increments shows that the usual resolution criterion of $k_{max}\eta \approx 1.5$ (where $k_{max} = \sqrt{2}N/3$ is highest resolvable wavenumber on an N^3 grid and η is Kolmogorov scale) is not sufficient for the smallest scales which contribute to high-order moments. By means of highly-resolved simulations at R_λ up to 240, we show that $k_{max}\eta \approx 3$ is sufficient for moments of ϵ and Ω up to order 4 and attempt to separate effects of Reynolds number and resolution on the observed scaling differences. A tentative conclusion is that the correlation between dissipation and enstrophy increases with R_λ while the tails of the PDFs of $\epsilon/\langle\epsilon\rangle$ and $\Omega/\langle\Omega\rangle$ approach each other. While the observed statistics of small scales are sensitive to resolution effects, results in the inertial range are less so.

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