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An update on turbulence simulations at high core counts[1] P.K. YEUNG, Georgia Tech, D.A. DONZIS, U. Maryland, D. PEKUROVSKY, San Diego Supercomputer Center — Advances in computing power towards the Petascale via systems comprising $O(10^4)$ processor cores (and more) are creating great opportunities as well as substantial challenges for computational science, including direct numerical simulations of turbulence covering a wide range of scales in time and space. We present performance benchmarking data and discuss future optimization strategies for a code based on a highly scalable domain decomposition that allows up to N^2 cores on an N^3 periodic domain. Very favorable performance results have been achieved on new "Track 2" systems supported by NSF, up to $N = 8192$ on 32768 cores and over a range of parameters including the choice of Cartesian processor-grid geometry for a given hardware configuration. Both strong scaling (increasing core count for fixed problem size) and weak scaling (core count varied in proportion to problem size) have been assessed in detail. The new algorithms are currently deployed in simulations at 4096^3 resolution to achieve higher Reynolds number and to resolve the small scales better as suggested by recent literature. Plans for extension to more complex geometries and for sharing both data and codes with the wider Cyber-Fluid Dynamics community will be briefly addressed.

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