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Coherent vortex simulation of 3D homogeneous isotropic turbulence NAOYA OKAMOTO, KATSUNORI YOSHIMATSU, Department of Computational Science and Engineering, Nagoya University, Nagoya, Japan, KAI SCHNEIDER, M2P2-CNRS & CMI, Aix-Marseille University, Marseille, France, MARIE FARGE, LMD-IPSL-CNRS, Ecole Normale Superieure, Paris, France, YUKIO KANEDA, Department of Computational Science and Engineering, Nagoya University, Nagoya, Japan — Coherent vortex simulation based on the wavelet filtered Navier-Stokes equations are presented for three-dimensional decaying isotropic turbulence. The vorticity field is decomposed into coherent vortices and an incoherent background noise using an orthogonal wavelet representation. The time evolution of the coherent vortices is then integrated deterministically, while discarding the incoherent flow contributions at each time step is shown to be sufficient to model turbulent dissipation. The wavelet filter dynamically adapts to the flow evolution and thus changes with time. A safety zone is required to track the vortices and the small scales produced by their nonlinear interaction. Different strategies for choosing the safety zone are tested and their influence on the precision and efficiency is assessed. We show that an adequate choice allows to reduce the number of degrees of freedom by a factor 6 with respect to direct numerical simulation, while preserving the high order statistics of the flow.

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