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Progress in Dynamic SGS Modeling for the SCALES Methodology – Part I.[1] DANIEL E. GOLDSTEIN, OLEG V. VASILYEV, University of Colorado at Boulder, NICHOLAS K.-R KEVLAHAN, McMaster University, Canada, GIULIANO DE STEFANO, Seconda Universita Napoli, Italy — This is the first of two talks, which describe ongoing Dynamic SGS model development for the Stochastic Coherent Adaptive Large Eddy Simulation (SCALES) methodology. The SCALES methodology has the potential for significant improvement over regular grid LES methodologies with its ability to resolve and dynamically track the most energetic coherent structures in a turbulent flow through dynamic grid adaptation based on wavelet threshold filtering. The effect of unresolved SGS modes is modeled using a new dynamic eddy viscosity model based on modified Germano's dynamic procedure redefined in terms of two wavelet thresholding filters. As in LES, the modified dynamic procedure, when applied locally, results in model coefficient that can be locally positive or negative, which allows for local backscatter of energy to resolved scales. In practice, it has been found that locally negative values of model coefficient cause numerical instabilities. To deal with this difficulty, two different approaches are explored. In Part I, homogeneous direction averaging is considered, while in Part II Lagrangian pathline averaging is explored. The details for both approaches are given and the results of three-dimensional SCALES simulations of isotropic turbulence using both models are presented.

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