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Applying renormalized numerical simulation to model turbulent flow over a fractal tree canopy[1] JASON GRAHAM, CHARLES MENEVEAU, Johns Hopkins University, Baltimore, MD — Renormalized Numerical Simulation (RNS) is a down-scaling approach that uses drag forces from resolved flow fields to parameterize the drag forces due to unresolved scales (Chester et al., 2007, J. Comp. Phys.). The RNS procedure is analogous to the dynamic sub-grid scale model. In RNS a form drag model is used to parameterize the forces and the drag coefficient, c_D, is dynamically evaluated by learning from the large scale problem and recursively feeding back to the small scale problem the renormalized drag forces. In this study a suite of Large Eddy Simulations using RNS are performed to analyze boundary layer flow over a canopy of fractal trees. The fractal trees provide complex boundary-turbulence interactions while maintaining tractable characteristics that can be systematically studied. Resolved branches are represented in the LES using the immersed boundary method. Several RNS implementations are tested and compared: 1) explicit and 2) implicit time formulations, and two spatial treatments for c_D: 1) local 2) global definitions. For these set of simulations the time averaged flow field, Reynolds and dispersive stresses, and drag forces of the canopy are computed.

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