Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Coupling meso- and micro-scale fluid dynamics codes for wind-energy computing[1] IGNAS SATKAUSKAS, MICHAEL SPRAGUE, MATT CHURCHFIELD, National Renewable Energy Laboratory — Enabled by peta-scale supercomputing, the next generation of computer models for wind energy will simulate a vast range of scales and physics, spanning from wind-turbine structural dynamics and blade-scale turbulence to meso-scale atmospheric flow. This work focuses on new mathematical interface conditions and computational algorithms for coupling meso-scale numerical-weather-prediction codes with micro-scale turbine-vicinity fluid-dynamics codes. Here, an inherent challenge exists when the weather code is based on the compressible Euler equations while the turbine-vicinity flow is modeled by the incompressible Navier-Stokes equations. We propose several one- and two-way code-interaction approaches. These approaches are implemented in a two-dimensional testing platform composed of two in-house codes: (1) a finite-difference code that mimics the weather research and forecasting (WRF) solver and (2) an embedded-domain code based on a common finite-volume approach.

[1]Supported by the Center for Research and Education in Wind

Michael Sprague
National Renewable Energy Laboratory

Date submitted: 03 Aug 2012 Electronic form version 1.4