University of Colorado - Center for Research and Education in Wind (CREW)

Cooperative Research and Development Final Report

CRADA Number: CRD-11-446

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In accordance with Requirements set forth in Article XI. Reports and Abstracts A.(3), of the CRADA agreement, this document is the final CRADA report, including a list of Subject Inventions, to be forwarded to the Office of Science and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

Parties to the Agreement: University of Colorado - Center for Research and Education in Wind (CREW)

CRADA Number: CRD-11-446

CRADA Title: Center for Research and Education in Wind (CREW), a Center of the Colorado Collaboratory

Joint Work Statement Funding Table Showing DOE Commitment:

Estimated Costs	NREL Shared Resources
TOTAL	$0.00

Abstract of CRADA Work:

Enabled by petascale supercomputing, the next generation of computer models for wind energy will simulate a vast range of scales and physics, spanning from turbine structural dynamics and blade-scale turbulence to mesoscale atmospheric flow. A single model covering all scales and physics is not feasible. Thus, these simulations will require the coupling of different models/codes, each for different physics, interacting at their domain boundaries.

Summary of Research Results:

Accomplishments under this CREW grant are summarized as follows:

We created two stand-alone two-dimensional CFD codes; one solves the compressible Euler equations (mesoscale) in a manner that mimics WRF, and a manner that mimics OpenFOAM.

Two coupling schemes have been devised: partial-boundary coupling and projection coupling. Each of these can be used in one- and two-way coupling. The core of the projection-coupling approach lies in mathematical projection of the mesoscale velocity field (which is not divergence free) onto a divergence-free (incompressible) velocity field. The projection operation involves a Poisson-type solve on the microscale CFD grid. Microscale-CFD boundary conditions are extracted from this solution, which allows for a time update of the solution

The one-way coupling schemes have been evaluated with numerical experiments with matching spatial and temporal grids.

The two-way coupling schemes have been evaluated with numerical experiments with matching spatial and temporal grids

CREW funds were used in part to support a PhD-student researcher from the Department of Applied Mathematics at CU Boulder.

Subject Inventions Listing:

None

Report Date:

17 October 2016

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