Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Improving Simulations of Atmospheric Flow with an Immersed Boundary Method to Represent Complex Terrain KATHERINE LUNDQUIST, FOTINI CHOW, University of California, Berkeley, JULIE LUNDQUIST, JEFF MIROCHA, Lawrence Livermore National Laboratory — A framework is being developed for building-resolving urban flow simulations using the Weather Research and Forecasting (WRF) model. WRF is formulated as a meso-scale model which solves the compressible Navier-Stokes equations. Additionally, WRF allows for lateral boundary forcing based on synoptic data and performs two-way grid nesting at subsequent finer nested grid levels. To accommodate the complex geometries of urban scale domains, we have implemented an immersed boundary method (IBM) along with a rough surface parameterization. This IBM alleviates difficulties associated with terrain following coordinates in WRF, and allows seamless nesting of domains ranging from the synoptic to urban scale. Illustrative examples will be used to demonstrate that both Neumann and Dirichlet type boundary conditions have been implemented with the IBM. Simulations with Neumann boundary conditions include nonlinear topographic mountain waves over idealized terrain. Dirichlet boundary conditions are validated in a variety of laminar and turbulent flows. Examples include the simulation of external flows over bluff bodies and channel flow with a sinusoidal lower boundary.

Katherine Lundquist
University of California, Berkeley

Date submitted: 03 Aug 2007 Electronic form version 1.4