

# *The RAL Seminar Series*



**NCAR**

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## **A Coupled Immersed-boundary Land-surface Model for Resolving Atmospheric Flows Over Complex Terrain**

by

**Katie Lundquist**

University of California, Berkeley

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*Foothills Lab, Building 2, Room 1001*

*9:00 a.m.*

Mesoscale models, such as the Weather Research and Forecasting (WRF) model, are increasingly used for high resolution simulations, particularly in complex terrain, but errors associated with terrain-following coordinates degrade the accuracy of the solution. This loss of fidelity is demonstrated using a test case of a scalar cloud advecting over highly variable topography. Use of an alternative gridding technique, known as an immersed boundary method, alleviates coordinate transformation errors and eliminates restrictions on terrain slope which currently limit mesoscale models to slowly varying terrain. Simulations are presented for canonical cases with shallow terrain slopes, and comparisons between simulations with the native terrain-following coordinates and those using the immersed boundary method show excellent agreement. Additionally, surface fluxes of heat and moisture complicate treatment of the immersed boundary. Realistic surface forcing can be included at the immersed boundary by atmospheric physics parameterizations, which are modified to include the effects of the immersed terrain. Using the immersed boundary method, WRF is capable of simulating highly complex terrain, as demonstrated by a simulation of flow over an urban skyline.