Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Multiscale Eddy Simulation for Moist Atmospheric Convection[1]
SAMUEL STECHMANN, University of Wisconsin-Madison, BJORN STEVENS, Max Planck Institute for Meteorology — A multiscale computational framework is designed for simulating atmospheric convection and clouds. In this multiscale framework, large eddy simulation (LES) is used to model the coarse scales of 100 m and larger, and a stochastic, one-dimensional turbulence (ODT) model is used to represent the fine scales of 100 m and smaller. Coupled and evolving together, these two components provide a multiscale eddy simulation (MES). Through its fine-scale turbulence and moist thermodynamics, MES allows coarse grid cells to be partially cloudy and to encompass cloud–clear air mixing on scales down to 1 m; in contrast, in typical LES such fine-scale processes are not represented or are parameterized using bulk deterministic closures. To illustrate MES and investigate its multiscale dynamics, a shallow cumulus cloud field is simulated. In comparison to LES, many statistical mean quantities are essentially the same in MES, which indicates that the bulk properties of the cloud fields are similar in LES and MES. However, MES has significantly larger turbulent kinetic energy and variance. To illustrate the fine-scale variability, an individual cloud is considered in detail, and partially cloudy grid cells are seen to be prominent near the cloud edges.

[1]Partially supported by grant NSF DMS 1209409.

Samuel Stechmann
University of Wisconsin-Madison

Date submitted: 31 Jul 2013 Electronic form version 1.4