Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

A Minimal Model for Precipitating Turbulent Convection[1]
LESLIE SMITH, University of Wisconsin, Madison, GERARDO HERNANDEZ-DUENAS, National University of Mexico, SAM STECHMANN, University of Wisconsin, Madison — To construct a minimal model for precipitating turbulent convection, we consider simplified bulk cloud physics assuming infinitely fast condensation, evaporation and auto-conversion from cloud to rain water. The model sacrifices all microphysics but retains important conservations principles. It is demonstrated numerically that the model is able to capture convective organization, such as squall lines. Linear analysis of a saturated base state identifies the stable, unstable and conditionally stable regions of parameter space. The two delineating parameters are established numerically in the general case of finite rainfall speed. Each parameter is also derived in an appropriate limiting scenario: the condition sufficient for instability (stability) is analytically found for the limit of zero (infinite) rainfall speed. Energy considerations further support the numerical and limiting analytical calculations.

[1]Supported by NSF CMG 1025188

Leslie Smith
University of Wisconsin, Madison

Date submitted: 31 Jul 2014 Electronic form version 1.4