Abstract for an Invited Paper
for the MAR15 Meeting of
the American Physical Society

Stochastic models for tropical convection and extreme rainfall events[1]

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In the Tropics, storms and convection occur intermittently and have a major impact on weather and climate. In recent years, tropical rainfall statistics have been shown to conform to paradigms of critical phenomena and statistical physics. To gain further insight into these statistics and extreme events, this talk presents simple stochastic models for the statistics of precipitation events and water vapor dynamics (local in space, and evolving in time). Through exact solutions and simple numerics, a suite of observed rainfall statistics is reproduced by the model, including power-law distributions and long-range correlations. The key ingredients of the model are the dynamics of column water vapor, governed by a combination of Gaussian stochastic forcing and nonlinearity provided via a threshold and/or stochastic trigger. Finally, these statistics are being explored in climate model simulations with collaborators.