Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

A low-dimensional model for large-scale coherent structures KUNLUN BAI, DANDAN JI, ERIC BROWN, Yale University — We demonstrate a methodology to predict the dynamics of the large-scale coherent structures in turbulence using a simple low dimensional stochastic model proposed by Brown and Ahlers (Phys. Fluids, 2008). The model terms are derived from the Navier-Stokes equations, including a potential term depending on the geometry of the system. The model has previously described several dynamical modes of the large-scale circulation (LSC) in turbulent Rayleigh-Bénard convection. Here we test a model prediction for the existence of a new mode where the LSC stochastically changes direction to align with different diagonals of a cubic container. The model successfully predicts the switching rate of the LSC at different tilting conditions. The success of the prediction of the switching mode demonstrates that a low-dimensional turbulent model can quantitatively predict the existence and properties of different dynamical states that result from boundary geometry.

Kunlun Bai
Yale University

Date submitted: 31 Jul 2015 Electronic form version 1.4