Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

**Advection-condensation of water vapor with coherent stirring: a stochastic approach**[1] YUE-KIN TSANG, University of Exeter, JACQUES VANNESTE, University of Edinburgh, GEOFFREY VALLIS, University of Exeter
— The dynamics of atmospheric water is an essential ingredient of weather and climate. Water vapor, in particular, is an important greenhouse gas whose distribution has a strong impact on climate. To gain insight into the factors controlling the distribution of atmospheric moisture, we study an advection-condensation model in which water vapor is passively advected by a prescribed velocity and condensation acts as a sink that maintains the specific humidity below a prescribed, spatially dependent saturation value. The velocity consists of two parts: a single vortex representing large-scale coherent flow (e.g. the Hadley cell) and a white noise component mimicking small-scale turbulence. Steady-state is achieved in the presence of a moisture source at a boundary. We formulate this model as a set of stochastic differential equations. In the fast advection limit, analytical expression for the water vapor distribution is obtained by matched asymptotics. This allows us to make various predictions including the dependence of total precipitation on the vortex strength. These analytical results are verified by Monte Carlo simulations.

[1]This work is supported by the UK EPSRC Grant EP/I028072/1 and the Feasibility Fund from the UK EPSRC Network ReCoVER.

Yue-Kin Tsang
University of Exeter

Date submitted: 31 Jul 2015 Electronic form version 1.4