Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

A single mode study of a quasi-geostrophic convection-driven dynamo model MEREDITH PLUMLEY, MICHAEL CALKINS, KEITH JULIEN, University of Colorado Boulder, STEVEN TOBIAS, University of Leeds — Planetary magnetic fields are thought to be the product of hydromagnetic dynamo action. For Earth, this process occurs within the convecting, turbulent and rapidly rotating outer core, where the dynamics are characterized by low Rossby, low magnetic Prandtl and high Rayleigh numbers. Progress in studying dynamos has been limited by current computing capabilities and the difficulties in replicating the extreme values that define this setting. Asymptotic models that embrace these extreme parameter values and enforce the dominant balance of geostrophy provide an option for the study of convective flows with actual relevance to geophysics. The quasi-geostrophic dynamo model (QGDM) is a multiscale, fully-nonlinear Cartesian dynamo model that is valid in the asymptotic limit of low Rossby number. We investigate the QGDM using a simplified class of solutions that consist of a single horizontal wavenumber which enforces a horizontal structure on the solutions. This single mode study is used to explore multiscale time stepping techniques and analyze the influence of the magnetic field on convection.

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Date submitted: 26 Jul 2017 Electronic form version 1.4