Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Equatorially trapped convection in a rapidly rotating spherical shell BENJAMIN MIQUEL, KEITH JULIEN, University of Colorado, Boulder, EDGAR KNOBLOCH, University of California, Berkeley — Convection plays a preponderant role in driving geophysical flows. Unfortunately, these flows are often characterized by rapid rotation (i.e. small Ekman number E) which renders the equations stiff and introduces a scale separation in the system: for example the wavelength of the marginal mode at the onset of convection in a rapidly rotating sphere scales like $E^{1/3}$ and is modulated by a $E^{1/6}$ envelope. These scalings keep the fully nonlinear dynamics of the internal convection in Earth's core ($E \sim 10^{15}$) out of reach from direct numerical simulations, analytical work and experiments on one hand, but advocate for the development of reduced models on the other hand. We present a reduced model derived in a shallow gap spherical shell geometry. As the Rayleigh number is increased, the flow is first destabilized in the equatorial region where the dynamics remains trapped. The linear stability is analyzed and the fully nonlinear dynamics is presented.

Benjamin Miquel
University of Colorado, Boulder

Date submitted: 02 Aug 2016 Electronic form version 1.4