Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Inverse Cascades and Zonal Flows on a Beta Plane PHILIP MARCUS, CHUNG-HSIANG JIANG, University of CA at Berkeley — We examine the role of forward and inverse cascades in 2D turbulence in creating zonal jets on a β-plane. The magnitude of the characteristic velocity and the characteristic width of a zonal jet are set by the balance of the two cascades. The widths of the jets are strongly dependent on the value of the local Rossby deformation radius L_R. Kinetic energy is dominated by potential energy at length scales greater than $2\pi L_R$. We find that little energy inverse cascades to scales greater than $2\pi L_R$, and there is a break in the slope of the kinetic energy spectrum at that scale. Forcing at small scales produces large-scale zonal flows that resemble the widths, but not the magnitudes, of jet streams of Jupiter and Saturn. The magnitudes of the large-scale velocities of the computed zonal flows are much smaller than on Jupiter or Saturn. The transfer of energy from small scales to large scales involves many more wave number triads on an f-plane than on a β- plane, so the equilibrium energy of the large scale zonal flows is determined by only a few triads.

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Date submitted: 07 Aug 2009 Electronic form version 1.4