Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Forward/Inverse Energy Cascade in 2D and QG Turbulence
CHUNG-HSIANG JIANG, PHILIP S. MARCUS, University of California, Berkeley — We perform numerical simulations to study two-dimensional and quasi-geostrophic turbulence. In all runs, small scale forcing injects energy at wave number, k_f, and the inverse energy cascade is halted at large scale by linear drag. A new decomposition of spectral energy flux into aggregated transfer function cascading up and down (hereafter ATFu and ATFd) is introduced instead of Kraichnan's classical approach. Both functions are positive, monotonically increasing in spectral space and have the same power-law dependency in the energy inertial range. Amazingly, the ATFd has discontinuity at k_f and the jump equals to energy injection rate $\dot{E}_{in}$ while the ATFu is always continuous. This implies that the energy injected is transferred first to small scale and then cascade inversely but not directly to large scale. The QG turbulence resembles the 2D turbulence if β effect is too weak to create zonal flow. If zonal jets are spotted, the exponent of the power-law dependency and the magnitude of ATFs are smaller compared to that in 2D turbulence indicates that β inhibits the inverse energy cascade. The properties of ATFs are strongly dependent on $\dot{E}_{in}$ and the drag loss but not k_f.

Chung-Hsiang Jiang
University of California, Berkeley

Date submitted: 10 Aug 2009 Electronic form version 1.4