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Profound Effects of Boundaries and Weak 3D Motions on Nearly 2D Turbulence PHILIP MARCUS, CHUNG-HSIAING JIANG, University of California at Berkeley — Over the last 30 years, there have been many numerical simulations of 2D turbulent flows, most of which have used doubly-periodic spatial boundary conditions. One of the common goals of these simulations has been to reproduce and understand the inverse energy cascade to large scales. The flows are either run-down or forced (often at the small scales and dissipated at the large). Often the calculations include a beta plane (to mimic geophysical flows) which breaks symmetry and allows for the formation of large-scale zonal flows. Our interest is the understanding of the atmospheres of the large planets, which have both large, long-lived zonal flows *and* large, long- lived vortices. Flows in rotating laboratory tanks designed to simulate the atmospheres also produce vortices and zonal flows. However, 2D, forced simulations on a beta plane that are initialized with weak noise produce long-lived large zonal flows *or* long-lived, large vortices but not both simultaneously. We find that by including boundaries and/or by including weak 3D motions we can create both large, long-lived zonal flows and vortices. Here we examine why this is so and what the implications are for the modeling and simulating of real 3D flows with 2D equations of motion.

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