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The Effects of Surface Stress on Horizontal Convection[1]
KATARZYNA E. MATUSIK, STEFAN G. LLEWELLYN SMITH, University of California, San Diego — Laboratory experiments have been designed to investigate the effects of a surface stress on horizontal convection. In the ocean, a zonal wind stress drives a meridional Ekman flow due to the effects of rotation. We explore features of horizontal convection in the presence of a surface stress that is imposed in opposition to the buoyancy-driven circulation. The buoyancy flux is achieved by injecting a plume of dense water into a fresh-water tank, while continuously maintaining a fresh-water surface boundary condition. The magnitude of the stress is varied by adjusting the flow rate of fresh water traversing along the surface; this stress is run in parallel to the north-south buoyancy gradient in order to simulate a 2D non-rotating system. We measure the steady-state density field using the synthetic schlieren technique, and the vertical and horizontal velocities are determined by PIV techniques. The boundary layer is resolved with conductivity probe measurements. The addition of a surface stress to horizontal convection may offer insight into the effects of wind on the ocean surface, namely the implications of a kinetic energy source on the overall energetics of the circulation.

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