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Experimental Study of Ocean Mixing BRUCE RODENBORN, GUENTHER EBERT, HARRY L. SWINNEY, Center for Nonlinear Dynamics, Dept. of Physics, UT Austin — Ocean circulation patterns, e.g. the Gulf Stream, depend on mixing produced by the tides and wind. These oceanic currents are critical in maintaining the earth's climate. Global ocean and climate computer models parameratize mixing because it happens at such a small scale. The current understanding of ocean mixing requires about 20% of the kinetic energy in a turbulent flow to be converted into a change in the fluid's gravitational potential energy. However, this value of mixing efficiency has never been confirmed in laboratory experiments. We study mixing in a fluid contained between two counter-rotating cylinders whose density, like the ocean, varies with height. Using sodium polytungstate salt solution, we achieve an initial vertical density variation of up to 200%, and then spin the cylinders to mix the fluid. Measurements are made for laminar (smooth) to fully turbulent flows. The flow pattern is visualized using Kalliroscope, and the characteristic vertical length scale is determined from spatial fourier transforms of images. The power input is determined by measuring the torque and rotation rate of both cylinders. The fluid's gravitational potential energy is determined by measuring density as a function of height. We find that mixing efficiency is strongly dependent both on the rotation rates of the cylinders and the total initial density variation.

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