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An experimental investigation of the Rossby two-slit problem[1]
ALEXIS KAMINSKI, DAMTP, University of Cambridge, JOSEPH PEDLOSKY, KARL HELFRICH, Woods Hole Oceanographic Institution — Rossby waves, which arise in response to buoyancy or winds at the sea surface, are a common feature of the oceans, and the problem of Rossby wave propagation in closed basins is a classical problem in geophysical fluid dynamics. Theoretical models of ocean circulation in basins with incomplete barriers such as ocean ridges or island chains (e.g. Pedlosky & Spall, JPO(29), 1999; Pedlosky, JPO(31), 2001) suggest that barriers extending through most of a basin are surprisingly inefficient at blocking the transmission of Rossby wave energy from one subbasin to the next. However, the existing theory neglects nonlinear effects and friction in the main basin interiors. To examine these effects, here we present the results of a series of experiments performed over a range of forcing frequencies and amplitudes, in which particle image velocimetry is used to measure the flow field. We find that while the linear theory appears to capture the large-scale structures of the flow, viscosity and nonlinearity significantly affect the flow along the boundaries and near the gaps in the barrier.

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