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Forecasting Flows from Target Pattern Instability in Rayleigh-Benard Convection BALACHANDRA SURI, ADAM PERKINS, MICHAEL SCHATZ, Center for Nonlinear Science and School of Physics, Georgia Institute of Technology — Using lab experiments combined with numerical simulations, we study systematically how the initial instability of an ordered pattern gradually evolves to a state of spatio-temporal complexity. The experiments begin from a reference pattern of axisymmetric convection rolls (a target pattern) that is reproducibly imposed using an optical technique for actuating fluid flow. For sufficiently large Rayleigh numbers, the axisymmetric pattern loses stability to patterns where the target's bull's-eye shifts off- center. We analyze an experimental ensemble of unstable patterns with nearby initial conditions to extract the spatial structure of the dominant modes and corresponding growth rates. We then test the extent to which a Boussinesq numerical model, in combination with a state estimation algorithm (Local Ensemble Transform Kalman Filter (LETKF)), can be used to predict the subsequent evolution of the experimentally observed patterns.

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