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Rotating convection: Eckhaus-Benjamin-Feir instability JUAN LOPEZ, Arizona State University, FRANCISCO MARQUES, ISABEL MERCADER, ORIOL BATISTE — A numerical study of the onset of thermal convection in a rotating circular cylinder of depth-to-radius ratio equal to 4 is considered in a regime dominated by the Coriolis force where the onset is to wall modes. The wall modes consist of hot and cold pairs of thermal plumes rising and decending in the cylinder wall boundary layer, forming an essentially one-dimensional pattern characterized by the number of hot/cold plume pairs, m. In the limit of zero centrifugal force, this onset of convection at a critical temperature difference across the depth of the cylinder is via a symmetry-breaking supercritical Hopf bifurcation which leads to retrograde precession of the pattern with respect to the rotation of the cylinder. For temperature differences greater than critical, a number of distinct wall modes, distinguished by m, coexist and are stable. Their dyanmics are controlled by an Eckhaus-Benjamin-Feir instability, the most basic features of which are captured by a complex Ginsburg-Landau equation model. This instability in rotating convection has been analyzed for the first time using direct numerical simulations of the Navier-Stokes equations in the Boussinesq approximation. Several properties of the wall modes have been computed, extending the results to far beyond the onset of convection. Extensive favorable comparisons between our numerical results and previous experimental observations and complex Ginsburg-Landau model results of Liu and Ecke (PRL 1997, JFM 1999) are made.

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