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Rotating convection: the influence of centrifugal buoyancy FRANCISCO MARQUES, Univ. Politecnica de Catalunya, JUAN LOPEZ, Arizona State University, ORIOL BATISTE, ISABEL MERCADER, Univ. Politecnica de Catalunya — Rotating convection is analyzed in a cylinder of aspect ratio one. Traditionally, density variation was only incorporated in the gravitational and not in the centrifugal buoyancy term. In this limit the governing equations admit a trivial conduction solution. The presence of centrifugal buoyancy changes the problem in a fundamental manner. The buoyancy force has a radial component that destroys the horizontal translation invariance assumed in the unbounded theoretical treatments of the problem and the Z_2 reflection symmetry about the cylinder mid-height. The centrifugal buoyancy drives a large scale circulation in which the cool denser fluid is centrifuged radially outward and the hot less dense fluid is centrifuged radially inward, and so there is no trivial conduction state when centrifugal buoyancy is incorporated. For small Froude numbers the transition to 3D flow happens around $Ra \approx 7,500$. For Froude numbers larger than 3, the centrifugal buoyancy delays transition to $Ra \approx 50,000$. At intermediate Fr the transition to 3D flow happens via four different Hopf bifurcations, resulting in different coexisting branches of 3D solutions with complex interactions. How the centrifugal and the gravitational buoyancies compete, and the transition to 3D flow is different along each branch. The main conclusion is that centrifugal buoyancy changes quantitatively and qualitatively the flow dynamics.

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