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Geometry-dependence of dynamics of the large-scale circulation in turbulent Rayleigh-Benard convection ERIC BROWN, RUSSELL HAWKINS, University of California, Merced — We present a simple model for the geometry-dependence of dynamics of the large-scale circulation (LSC) in turbulent Rayleigh-Benard convection. This extends a previous model of stochastic ordinary differential equations (ODEs) developed to describe LSC dynamics in an aspect ratio 1 upright cylinder. The large-scale circulation exhibits behavior such as spontaneous meandering of the orientation, cessations of the flow, and various oscillation modes, which can change with the geometry of the container. Specifically, in experiments with a sideways cylinder the LSC orientation is found to align with the longer diameters, and new oscillation modes around and between these longest diagonals were found. These changes in dynamics with geometry can be accounted for with the addition of a shape-dependent potential term to the stochastic ODE model that represents the pressure forcing from the sidewall. For the sideways cylinder, the potential is analogous to a Duffing oscillator. The agreement between model predictions and observations suggests the possibility of describing LSC flows in arbitrary geometries with a relatively simple stochastic ODE model.

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