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Probing the dynamics of Rayleigh-Bénard convection using numerical simulations for the conditions of experiment MU XU, Virginia Tech, JEFFREY TITHOF, Georgia Institute of Technology, MIRO KRAMAR, Rutgers University, BALACHANDRA SURI, Georgia Institute of Technology, VIDIT NANDA, Rutgers University, MICHAEL SCHATZ, Georgia Institute of Technology, KONSTANTIN MISCHAIKOW, Rutgers University, MARK PAUL, Virginia Tech
— We present results from large-scale parallel numerical simulations of Rayleigh-Bénard convection for the precise conditions of experiment. We are interested in cylindrical convection domains of moderate aspect ratio with a Prandtl number of order 1. We compute the leading order Lyapunov vector and Lyapunov exponent and use these to quantify the dynamics. We explore time periodic dynamics and also the breakdown of patterns with prescribed initial conditions toward weakly chaotic dynamics. We directly compare our results from numerical simulation with experimental measurements where possible. The numerics yield physical insights into the spatiotemporal dynamics of convection that we can use to connect with ideas from topology such as persistence diagrams.

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