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Using Lyapunov Vectors to Quantify Spatiotemporal Chaos in Rayleigh-Benard Convection MU XU, Virginia Tech, ALIREZA KARIMI, University of Notre Dame, JEFFREY TITHOF, Georgia Institute of Technology, MIRO KRAMAR, VIDIT NANDA, Rutgers University, MICHAEL SCHATZ, Georgia Institute of Technology, KONSTANTIN MISCHAIKOW, Rutgers University, MARK PAUL, Virginia Tech — Spatiotemporal chaos is a common feature of spatially-extended systems that are driven far-from-equilibrium with examples that include the dynamics of the weather and climate, fluid turbulence, and excitable media. Despite significant effort, many open questions remain regarding our physical understanding of high-dimensional chaotic systems such as these. Using recent advances in computing algorithms and available supercomputing resources it is now possible to compute the spectrum of Lyapunov exponents and orthonormal Lyapunov vectors for experimental conditions. We present large-scale parallel numerical simulations of Rayleigh-Benard convection undergoing spiral defect chaos for very long times and for laboratory conditions that we compare with experiment. We use averages of the leading order orthonormal Lyapunov vector to gain insight into the regions in space generating the most disorder which we compare with experimentally accessible quantities. We discuss the similarities and differences between characteristic and orthonormal Lyapunov vectors. Lastly, we describe our efforts to compute the characteristic Lyapunov vectors for Rayleigh-Benard convection.

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