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Extensive Chaos in Rayleigh-Benard Convection MARK PAUL, MAGNUS EINARSSON, Virginia Tech — Spatiotemporal chaos is studied using large-scale numerical simulations of Rayleigh-Benard convection in cylindrical domains with experimentally realistic boundary conditions. The Lyapunov exponents and fractal dimension are calculated over a range of system sizes as given by aspect ratios of the cylindrical convection domain between 5 and 15. It is found that the chaos is extensive over this range of system size as illustrated by a linear dependence of the fractal dimension with the square of the aspect ratio. The chaos is extensive even though the convection pattern is found to transition from boundary to bulk dominated dynamics as the system size is increased. An analysis of the Lyapunov vectors is used to yield quantitative information describing the location of the largest growing perturbations. It is found that for small aspect ratios the largest perturbations are near the lateral sidewalls and as the aspect ratio increases the largest perturbations are found in the center of the convection domain. In all cases the largest perturbations are localized and correlate with defect structures in the fluid flow field.

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