Re-orientations of the large-scale circulation in turbulent Rayleigh-Bénard convection

ERIC BROWN, ALEXEI NIKOLAENKO, GUENTER AHLERS, UC Santa Barbara — We present measurements of the orientation \( \theta_0(t) \) of the large-scale circulation (LSC) of turbulent Rayleigh-Bénard convection in cylindrical cells of aspect ratio 1. The orientation undergoes irregular reorientations. It contains two types of reorientation events to be called rotation and cessation. Rotation through angles \( \Delta \theta \) has a monotonically decreasing probability distribution \( p(|\Delta \theta|) \propto |\Delta \theta|^{-\gamma} \) with \( \gamma \simeq 4 \) reminiscent of heavy-tail distributions in many other systems. Cessations involve a brief vanishing of the LSC, followed by a new spontaneous re-organization of the LSC with a randomly chosen new orientation. Thus the probability distribution for cessation is uniform: \( p(|\Delta \theta|) = 1/\pi. \) Both rotations and cessations have Poissonian statistics in time.

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