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Transition to the ultimate regime in two-dimensional turbulent Rayleigh-Bénard convection[1] RICHARD STEVENS, University of Twente, KAZUYASU SUGIYAMA, University of Tokyo, DETLEF LOHSE, University of Twente — The heat transfer in a RB system is determined by the Rayleigh number Ra and the Prandtl number Pr. Various natural heat transfer phenomenon involve $Ra \gtrsim 10^{20}$ and thus extrapolations to this high Ra number regime are required. Here we present results from DNS for two-dimensional RBC with $Pr = 1$ in an aspect ratio $\Gamma = D/L = 0.23$, where D and L are the width and height of the box, respectively and achieve Ra up to about 10^{13}. For $Ra < 1 \times 10^{10}$ the Nusselt number varies nearly as the $1/3$ power of Ra. However, for $Ra > 1 \times 10^{10}$ we find a sharp transition towards a regime where the Nusselt number varies nearly as the $1/2$ power of Ra. A visualization of the simulation results reveals that the transition in the Nu number scaling are caused by a break-up of the large scale structures that are observed at lower Ra numbers.

[1]DEISA Extreme Computing Initiative (DECI-6), Stichting Fundamenteel Onderzoek der Materie (FOM).

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