Abstract Submitted
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Deterministic flow reversal in thermal convection DETLEF LOHSE, Twente, KAZU SUGIYAMA, Tokyo, RUI NI, Hongkong, ENRICO CALZAVARINI, Lyon, SIEGFRIED GROSSMANN, Marburg, TAK SHING CHAN, Twente, HENG DONG XI, SHENG-QI ZHOU, Hongkong, CHAO SUN, Twente, KEQING XIA, Hongkong — Two-dimensional (2D) numerical simulations of the Boussinesq equations are presented with Rayleigh numbers up to $Ra = 10^9$ and aspect ratio of about 1. They reveal a diagonal large scale convection roll ("wind of turbulence") and smaller rolls in the two remaining corners diagonally opposing each other. These corner flow rolls play a crucial role for the mechanism of large scale wind reversal: They grow in kinetic energy and thus also in size thanks to the plume detachments from the boundary layers up to the time that they take over, leading to the breakdown of the large scale convection roll and the formation of a new one, rotating in the other direction. Based on the numerical simulations and on theoretical arguments we identify the characteristic time scale for this whole process. According to present precision it seems to grow with Ra as a power law. – Employing PIV techniques the same deterministic flow reversal mechanism is shown to be at work for thermal convection in quasi 2D rectangular Rayleigh-Benard cells.

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