

Abstract Submitted
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Reduced flow reversals in turbulent convection in the absence of corner vortices¹ HENGDONG XI, XIN CHEN, DONG-PU WANG, Northwestern Polytechnical Univ — We report a comparative experimental study of the reversal of the large-scale circulation (LSC) in turbulent Rayleigh-Bénard convection in a quasi-two dimensional (2D) corner-less cell where the corner vortices are absent and in a quasi-2D normal cell where the corner vortices are present. It is found that in the corner-less cell the reversal frequency exhibits a slow decrease followed by a fast decrease with increasing Rayleigh number Ra , separated by a transitional Ra ($Ra_{t,r}$). The transition is similar to that in the normal cell, and $Ra_{t,r}$ is almost the same for both cells. Despite the similarities, the reversal frequency is greatly reduced in the corner-less cell. The reduction of the reversal frequency is more significant, in terms of both the amplitude and the scaling exponent, in the high Ra regime. In addition, we classified the reversals into main-vortex-led (MVL) and corner-vortex-led (CVL), and found that both types exist in the normal cell while only the former exists in the corner-less cell. The frequency of MVL reversal in normal cell is found in excellent agreement with the frequency of reversals in corner-less cell. Our results reveal for the first time the quantitative role of the corner vortices in the occurrence of the reversals of the LSC.

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