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The effect of cell tilting on turbulent thermal convection in a rectangular cell[1] SHENG-QI ZHOU, SHUANG-XI GUO, XIAN-RONG CEN, LING QU, YUAN-ZHENG LU, South China Sea Institute of Oceanology, CAS, LIANG SUN, University of Science and Technology of China, XIAO-DONG SHANG, South China Sea Institute of Oceanology, CAS — In the study, the influence of cell tilting on flow dynamics is explored experimentally in a rectangular cell (aspect ratios $\Gamma_x = 1$ and $\Gamma_y = 0.25$). The measurements are carried out in a wide range of tilt angles ($0 \leq \beta \leq \pi/2$ rad) at Prandtl number ($Pr \simeq 6.3$) and Rayleigh number ($Ra \simeq 4.42 \times 10^9$). With the velocity measurements, the large-scale circulation (LSC) is found to be sensitive to the symmetry of the system. In the level case, the LSC is at about quarter width of the cell. As the cell is slightly tilted ($\beta \simeq 0.04$ rad), the LSC moves quickly towards the boundary. With increasing β, the LSC changes gradually from oblique ellipse-like to square-like, and to more complicated patterns. Oscillation has been found for almost all β and it is the strongest at around $\beta \simeq 0.48$ rad. With increasing β, the Reynolds number (Re) first increases till it reaches its maximum at the transition angle $\beta = 0.15$ rad, then it gradually decreases. A simple energy model is proposed to interpret the cell tilting on flow dynamics. It is predicted that the spatial distribution of the boundary layer affects the flow dynamics by varing the potential energy of system.

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