Retrograde rotation of the large-scale circulation in turbulent rotating Rayleigh-Benard convection at large Rossby numbers up to 200\(^1\)

HUI-MIN LI, JIN-QIANG ZHONG, Tongji University, Shanghai, China — We examine the azimuthal rotation of the large-scale circulation (LSC) for turbulent Rayleigh-Benard convection in the presence of weak rotations about a vertical axis at angular velocities \(1.0 \times 10^{-3} \leq \Omega \leq 0.1\) (rad/s). Over the entire Rossby-number range \(1 \leq Ro \leq 200\) studied, linear retrograde rotations of the LSC circulating plane are observed. With increasing \(Ro(\sim 1/\Omega)\) the retrograde rotating velocity \(\langle \dot{\theta} \rangle\) decreases monotonically, but the ratio \(\gamma = \langle \dot{\theta} \rangle / \Omega\) experiences a transition at \(Ro^* \approx 80\) above which \(\gamma\) increases sharply. We discuss the \(Ro\)-dependence of \(\gamma\) for \(Ro > Ro^*\) and show that a maximum ratio \(\gamma_{max} = 0.36\) is observed at \(Ro = 200\), more than twice larger than other results reported before in a lower-Ro regime [1]. The experimental findings may shed new light to interpret the low precession rate under weak Coriolis force within the framework of the LSC models [2].


\(^1\)Supported by NSFC Grant 11202151.