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Dynamics of the large-scale circulation in turbulent Rayleigh-Bénard convection with modulated rotation[1] JIN-QIANG ZHONG, SEBASTIAN STERL, HUI-MIN LI, Tongji University, Shanghai, China — We present measurements of the azimuthal rotation velocity $\dot{\theta}$ and thermal amplitude δ of the large-scale circulation (LSC) in turbulent Rayleigh-Bénard convection with modulated rotation. Both $\dot{\theta}$ and δ exhibit clear oscillations at the modulation frequency ω. Fluid acceleration driven by oscillating Coriolis force plays a role in determining the LSC rotations and causes an increasing phase lag in $\dot{\theta}$ when ω increases. The applied modulation also produces oscillatory boundary layers and the resulting time-varying viscous drag modifies δ periodically. Oscillation of $\dot{\theta}$ with the maximum amplitude occurs at an intermediate $\omega^{\star}$. Such a resonance-like phenomena is interpreted as a result of the optimal coupling of δ to the sample rotation velocity. We show that an extended LSC model with a relaxation time for δ to response to modulated rotations provides predictions in close agreement with the experimental results.

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