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Temperature fluctuations and thermal plume dynamics in turbulent rotating Rayleigh-Bnard convection.[1] SHAN-SHAN DING, WEN-DAN YAN, HUI-MIN LI, JIN-QIANG ZHONG, Tongji University — We present measurements of the temperature fluctuations in rotating Rayleigh-Bnard convection that are taken at fluid heights $0 \leq z \leq 20\lambda$ (λ being the thermal boundary layer thickness) above the bottom plate, with a Prandtl number Pr=6.0, varied Rayleigh numbers in the range $5.8 * 10^8 \leq Ra \leq 6.3 * 10^9$ and inversed Rossby numbers $1/Ro \leq 8.0$. The temperature variance profile exhibits a power-low dependence $\sigma(z/\lambda) = \sigma_0 (z/\lambda)^{-\beta(Ro)}$ when $z > \lambda$. For various Ra the exponents $\beta(Ro)$ follow a single curve and decrease rapidly with increasing $1/Ro$. Profiles of the temperature skewness $Sk(z/\lambda)$ and kurtosis $Ku(z/\lambda)$ are also independent on Ra, both decrease with increasing $1/Ro$. The dynamical properties of thermal plumes are analyzed using their temperature time series. Over the Ro range studied, both the plume temperature amplitude A and the time width w are in log-normal distributions. When $z > \lambda$ the means of A and the plume time fraction are dictated by power functions of z, both increase with stronger rotations. The variance of $\log(A)$, however, follows a logarithm function of z, and decreases at larger $1/Ro$. With these findings we elucidate that under the influences of rotation thermal plumes produce more pronounce and persistent thermal disturbances, leading to stronger but more symmetrically distributed temperature fluctuations in the interior fluid.

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