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Free-Fall Estimates for Rapidly Rotating Heat and Momentum Transport[1] JONATHAN AURNOU, UCLA, SUSANNE HORN, Coventry University, KEITH JULIEN, CU Boulder — Dimensional analysis is employed here to provide free-fall scaling estimates for the convective heat and momentum transport in the limit of rapid rotation, and to relate these to scalings for non-rotating Rayleigh-Bénard convection (RBC) systems. Our analysis shows that the scalings for free-fall dominated heat (Nusselt number, Nu) and momentum transfer (Reynolds number, Re) of rapidly rotating convection differ from their non-rotating RBC counterparts by a factor of Ro_{ff}^2, where $Ro_{ff} = \tau_\Omega/\tau_{ff}$ is the free-fall Rossby number defined as the ratio of the characteristic rotation time τ_Ω and the buoyant free-fall time τ_{ff}. Since $Ro_{ff} \ll 1$ in the rapidly rotating limit, our predicted rapidly rotating, free-fall transport rates remain far below the associated rates in non-rotating systems.

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