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Mixing efficiency of buoyancy forced circulation in a rotating basin CATHERINE VREUGDENHIL, BISHAKHDATTA GAYEN, ROSS GRIFFITHS, Australian National University — We ask whether rotation influences the mixing efficiency in horizontal convection in a rectangular basin. Direct numerical simulations are reported for a rotating f-plane ocean with an applied basal temperature differential over a wide range of Ekman number $E_L = 6 \times 10^{-8} - 1 \times 10^{-5}$, with Prandtl number $Pr = 5$. Two values of the Rayleigh number are considered which, in the absence of rotation, relate to the viscous ($Ra = 7.4 \times 10^8$) and inertial ($Ra = 7.4 \times 10^{11}$) regimes. The heat flux decreases and boundary layer thickness increases with rotation rate, consistent with geostrophic scaling. At very high rotation rates and the smaller Ra a regime dominated by Ekman pumping is revealed, with strong interior stratification. For the larger Ra turbulent convective plumes in the boundary layer region form cyclonic vortices that extend through the depth, weakening the stratification. The global mixing efficiency η is consistent with the theoretical prediction $\eta = 1 - (HNu/L)^{-1}$ (where Nu is the Nusselt number, H is height and L is length of the domain) for $Nu \gg 10$. Independent of rotation, η approaches unity at large Nu, and therefore at large Ra. Laboratory experiments in the inertial regime with an applied heat flux are also considered.

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