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Effects of Lateral Confinement on Rapidly Rotating Rayleigh-Benard Convection[1] RUDIE KUNNEN, XANDER DEWIT, ANDRES AGUIRRE GUZMAN, MATTEO MADONIA, JONATHAN CHENG, HERMAN CLERCX, Eindhoven University of Technology — The study of the so-called geostrophic regime of rotating convection has received much recent attention. Named after the dominant geostrophic balance of pressure gradient and Coriolis acceleration in rotating flows, it is the appropriate regime to describe large-scale geophysical and astrophysical flows. Current state-of-the-art experiments have grown tall but remained comparatively narrow to accommodate the requirement of extreme parameter values (high Rayleigh numbers indicating strong thermal forcing but at the same time low Ekman numbers implying strong rotational constraint) while minimizing centrifugal buoyancy. Here we compare simulations of rotating convection in a slender cylinder and in a laterally periodic domain to address the effects of lateral confinement. In the cylinder a strong wall mode recirculation develops, that precesses anticyclonically and provides a significant contribution to the overall heat transfer (Nusselt number). However, the central convection outside of the wall-mode region displays heat-transfer properties identical to those of the periodic domain. Hence the slender cylinder is a valid geometry to study laterally unbounded convection on the provision that the wall region is excluded from the analysis.

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