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TROCONVEX: An extreme laboratory approach to geostrophic turbulence JONATHAN CHENG, RUDIE KUNNEN, Eindhoven Univ of Tech — Many celestial bodies contain vast fluid layers of turbulent, massively-multiscale flows, driven by buoyant instabilities and constrained by Coriolis forces. The canonical problem of rotating Rayleigh-Bénard convection (RRBC) provides a fundamental framework for understanding such flows, but even in this simplified setting, many geophysical behaviors remain inaccessible to current studies. Here we present the first results from a new 4-meter high cylindrical RRBC device, TROCONVEX, designed to characterize rotating convection in far more extreme conditions than previously possible: it can attain Ekman numbers as low as $5 \mathrm{x} 10^{-9}$ and Rayleigh numbers as high as 10^{14} in water, both nearly an order of magnitude more extreme than other RRBC experiments. We examine a suite of nonrotating and rapidly-rotating convection cases by measuring the Rayleigh, Ekman, and Nusselt numbers. Scaling trends between these parameters show the heat transfer evolution over many behavioral regimes, ranging from rotationally-constrained convective plumes to nonrotating-style turbulence. Future measurements of temperature statistics at the boundaries of the fluid layer will specify the flow morphology. In combination with future velocity measurements, these extreme laboratory results will expand our understanding of rotating convection toward geophysical settings.

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