Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

The sensitivity of rotating Rayleigh-Bénard convection to the Ekman number MEREDITH PLUMLEY, KEITH JULIEN, PHILIPPE MARTI, University of Colorado Boulder, STEPHAN STELLMACH, Institut für Geophysik, Westfälische Wilhelms-Universität, Münster, JONATHAN AURNOU, EMILY HAWKINS, University of California, Los Angeles — Many geophysical and astrophysical applications of rotating Rayleigh-Bénard convection require no-slip boundaries. These boundaries lead to Ekman pumping, which has a dominant impact on the heat transport and affects the transfer of energy within the system. Here I present the 2D surface of the Nusselt number as a function of the Rayleigh number (Ra) and the Ekman number (E) for no-slip boundaries, generated through a combination of results from experiments, DNS, rescaled DNS, and asymptotic simulations. The Ra–E space is mapped from the transition of the weakly-rotating into the rotation-dominated regime ($E \approx 10^{-7}$) to lower E in the rapidly-rotating regime ($E \approx 10^{-11}$). This exploration provides insight into the sensitivity of the flow to the Ekman number, specifically the effect of the boundaries on the types and ranges of flow structures and the difference between stress-free and no-slip boundaries at low E, a regime of interest for modeling planetary interiors.

Meredith Plumley
University of Colorado Boulder

Date submitted: 01 Aug 2016 Electronic form version 1.4