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Physical balances in non-hydrostatic balanced quasi-geostrophic equations KEITH JULIEN, ANTONIO RUBIO, University of Colorado Boulder, IAN GROOMS, New York University — A suite of high resolution DNS for Rotating Rayleigh Benard convection using the non-hydrostatic balanced geostophic equations (NHBGE) (Julien et al 1998, 2006) over a wide range of parameter space was conducted to allow for the analysis of the term-by-term balances of the prognostic equations. These reduced equations offer greater access to the Low Rossby limit of thermal convection in comparison to the DNS of incompressible Navier-Stokes. The result has been a greater understanding of the transition between three regimes (cellular, columns, geostrophic turbulence) in terms of physical balances. Particularly, analysis reveals a dynamically unstable thermal boundary layer that can be modeled and turbulent interiors for which scalings with thermal forcing can be understood. Further insight has been gained into the scaling and breakdown of the convective Taylor columns (CTCs) (Grooms et al PRL, 2011) and the equation balances inside and outside of the CTCs in regimes where they coexist with cellular solutions.

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