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Reduced Equations for Rapidly Rotating Convection in a Cylinder MICHAEL SPRAGUE, School of Natural Sciences, University of California, Merced, KEITH JULIEN, Applied Mathematics, University of Colorado at Boulder, EDGAR KNOBLOCH, Dept. of Physics, University of California, Berkeley — We discuss the derivation of a new reduced system of nonlinear PDEs for rapidly rotating Rayleigh-Benard convection (RBC) in a cylinder and examine its numerical solution. The equations are derived asymptotically in the limit of rapid rotation from the Boussinesq equations. Numerical simulation of the full Boussinesq equations for such flow is restricted due to the existence of fast-propagating inertial waves, and due to Ekman boundary layers that become increasingly thin with increased rotation rate. In the rapidly rotating limit, such boundary layers are passive, and are filtered-out in the reduced equations. Numerical simulation of a similar set of reduced equations for an unbounded layer has allowed thorough investigation of RBC in the limit of rapid rotation and for large Rayleigh numbers. Here, we limit our discussion to pattern formation at slightly critical Rayleigh numbers but under rapid rotation, for which there remain unexplained phenomena.

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