Lehrstuhl für Analysis und Modellierung

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Vortices in stably-stratified rapidly rotating Boussinesq convection

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Abstract: We study long time asymptotics in the Boussinesq approximation for rapidly rotating stably-stratified fluids in a three dimensional infinite layer with either stress-free or periodic boundary conditions. For initial data satisfying certain smallness criteria, we use self-similar variables to show that the baroclinic vorticity converges to an Oseen Vortex with algebraic rate while the baroclinic component decays to zero faster than any algebraic rate. In the case of periodic boundary conditions, we also find that the barotropic vertical velocity and thermal fluctuations converge to decaying Gaussians whose amplitudes oscillate with opposite phase of each other. We also use dispersive estimates and Lyapunov functional techniques to determine asymptotics in the rapid rotation limit for a broader class of initial data where we only require smallness in the quasi-geostrophic part of the baroclinic dynamics.