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Linear Stability and Nonlinear Evolution of 3D Vortices in Rotating Stratified Flows MANI MAHDINIA, UC Berkeley, PEDRAM HASSANZADEH, Harvard, PHILIP MARCUS, UC Berkeley — Axisymmetric Gaussian vortices are widely-used to model oceanic vortices. We study their stability in rotating, stratified flows by using the full Boussinesq equations. We created a stability map as a function of the Burger and Rossby numbers of the vortices. We computed the linear growth rates of the most-unstable eigenmodes and their corresponding eigenmodes. Our map shows a significant cyclone/anti-cyclone asymmetry. The vortices are linearly unstable in most of the parameter space that we studied. However, the anticyclonic vortices, over most of the parameter space, have eigenmodes with only very weak growth rates – longer than 50 vortex turn-around times. For oceanic vortices, that time corresponds to several months, so we argue that this slow growth rate means that the oceanic anticyclones lifetimes are not determined by linear stability, but by other processes. We also use our full, nonlinear simulations to show an example of an unstable cyclone with a very fast growing linear eigenmodes. However, we show that cyclone quickly redistributes its vorticity and becomes a stable tripole with a large core that is nearly axisymmetric.

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