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Equilibration of symmetric instability and inertial oscillations at an idealised submesoscale front AARON WIENKERS, DAMTP, University of Cambridge, LEIF THOMAS, Stanford University, JOHN TAYLOR, DAMTP, University of Cambridge — Submesoscale fronts with large lateral buoyancy gradients and O(1) Rossby numbers are common in the upper ocean. These fronts are associated with large vertical transport and are hotspots for biological activity. Submesoscale fronts are susceptible to symmetric instability (SI) — a form of stratified inertial instability which can occur when the potential vorticity is of the opposite sign to the Coriolis parameter. Growing SI modes eventually break down through a secondary shear instability, leading to 3D turbulence and vertically mixing the geostrophic momentum. Once out of thermal wind balance, the front undergoes inertial oscillations which can drive further small-scale turbulence.
Here, we consider the idealised problem of a balanced front with uniform horizontal buoyancy gradient and bounded by flat no-stress horizontal surfaces. We study the equilibration of this unstable front using a linear stability analysis and 3D numerical simulations. We find drastically different behavior emerging at late times. While weak fronts develop frontlets and excite subinertial oscillations, stronger fronts produce bore-like gravity currents. We describe the details of these energy pathways as the front evolves toward the final adjusted state in terms of the dimensionless front strength.

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