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Laboratory and numerical studies of stratified spin-up flow stability SERGEY SMIRNOV, Texas Tech Univ, RAFAEL PACHECO, Arizona State Univ — The stability of stratified rotating flows is investigated by means of laboratory experiments and numerical simulations in axisymmetric cylindrical and annular containers with both horizontal and sloping bottoms. The baroclinic current in initiated via incremental spin-up/down of a linearly stratified fluid by an abrupt change in the rotation rate of the system. The flow stability depends on the characteristic values of the Rossby number, $\varepsilon = \Delta\Omega/\Omega$, and the Burger number, $B_u = NH/fR$, where $f = 2\Omega$ is the Coriolis parameter, R is the characteristic horizontal length scale of the flow, H is the depth of the fluid layer, and N is the buoyancy frequency. Particular attention is given to the nonlinear flow regime (finite Rossby numbers). It is found that axisymmetric spin-up current loses its azimuthal symmetry when $B_u \quad < 1$, and breaks into a system of large-scale cyclonic and anticyclonic vortices with predominantly vertical axis of rotation. The eddies always develop at the density fronts formed by the corner regions adjacent to the sidewalls of the container. It is also shown that the stability of the spin-up flow is affected by the bottom slope. In the presence of the latter the bottom boundary layer experiences a qualitatively different behavior. While the density field demonstrates a smooth monotonic behavior in the case of stratified spin-up at all times, it reveals high-frequency fluctuations in the spin-down case.

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