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Stability of a tilted vortex in a stratified fluid NICOLAS BOULANGER, PATRICE MEUNIER, STÉPHANE LE DIZÈS, IRPHE, CNRS, Marseille, France — Intense cyclones on a slope and oceanic vortices shedded behind a coastal tip are two examples of tilted vortices in a linearly stratified fluid. The structure and the stability of such a basic flow are here analysed experimentally and theoretically when the maximum angular velocity of the vortex is larger than the buyoncy frequency. We first show by an asymptotic analysis in the limit of small tilt angles and large Reynolds numbers that tilting induces strong axial flow and density variations. These fields are found to exhibit a critical point singularity at the radius where the angular velocity of the vortex is equal to the buoyancy frequency. The axial velocity and density profiles obtained by smoothing this singularity in a viscous critical layer are compared to PIV measurements and shadowgraph visualisations and a good agreement is demonstrated. The strong axial shear generated in the critical layer is also shown to be unstable by a Kelvin-Helmholtz like instability. Shadowgraph visualizations and growth rate measurements are compared to theoretical results obtained from a linear stability analysis of the theoretical profiles.

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