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Steady rotating density currents on a slope WOOSOK MOON, GEORGY MANUCHARYAN, Yale University, FLORIAN SEVELLEC, University of Southampton, Yale University, ANDREW WELLS, University of Oxford, JIN-QIANG ZHONG, Tongji University, JOHN WETTLAUFER, Yale University, NORDITA — We consider the dynamics of steady turbulent entraining density currents on a conical sloping surface in a rotating fluid. A theoretical plume model is developed to describe both axisymmetric flow and single stream currents of finite angular extent. An analytical solution is derived for flow dominated by the initial buoyancy flux, which serves as an attractor for solutions with alternative initial conditions where the initial fluxes of mass and momentum are non-negligible. The solutions indicate that the downslope propagation of the current halts at a critical level where there is purely azimuthal flow in geostrophic balance, and the boundary layer approximation breaks down. A set of laboratory experiments are consistent with the dynamics predicted by the model, with flow approaching a critical level. Interpretation in terms of the theory yields an entrainment coefficient proportional to the inverse of the rotation rate ($E \propto 1/\Omega$, where E is the entrainment and Ω the rotation rate). Our theoretical model provides a framework for designing and interpreting laboratory studies of turbulent entrainment in rotating dense flows on slopes.

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