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Intrusive gravity currents and the solitary wave lifecycle in a cylindrical geometry JUSTINE MCMILLAN, BRUCE SUTHERLAND, University of Alberta — An "intrusive gravity current" or "intrusion" arises when a fluid of one density propagates at an intermediate depth within a stratified ambient. Numerous experimental and theoretical studies have examined the propagation of these currents in a rectilinear geometry, however, the dynamics of radially spreading axisymmetric intrusions is less well established. By way of full-depth lock release experiments and numerical simulations, we examine the propagation of vertically symmetric intrusions in a two-layer ambient in a cylindrical geometry. We show that the strong stratification at the interface supports the formation of a mode-2 solitary wave that surrounds the intrusion head and carries it outwards at a constant speed beyond 6 lock radii. The wave and intrusion propagate faster than a linear long wave; therefore, there is strong evidence to support that the wave is indeed nonlinear. By extending rectilinear KdV theory to allow the wave amplitude to decay as r^{-p} with $p \approx \frac{1}{2}$, we show that from a single measurement of wave amplitude, the theory can be used to accurately predict the amplitude, speed and spread of the wave during its nonlinear evolution phase.

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