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The Radial Spreading of Intrusions Originating from a Plume in Stratified Fluid TAMAR RICHARDS, University of Alberta, QUENTIN AUBOURG[1], University of Grenoble, BRUCE SUTHERLAND, University of Alberta — Supervolcanoes send a plume of hot particle-laden air into the stratosphere where it eventually falls back upon itself as a fountain and then spreads laterally at its neutral buoyancy level. In order to gain insight into the initial spreading of such intrusions, we have performed laboratory experiments of fresh water injected downward through a turbulent plume nozzle into a uniformly stratified fluid. Though neglecting the influence of particles and anelastic effects, the experiment provides insight into the dynamics of radially spreading intrusions in the buoyancy-inertia regime within the Boussinesq approximation. Our theoretical and experimental results extend the prediction of Bloomfield and Kerr (JFM 1998,2000) to predict the spreading height as a function of the source momentum, buoyancy and ambient stratification for buoyancy- as well as momentum-driven sources. We find the radius of the front increases as a power law with approximately 3/4 exponent, different from self-similarity theory, which predicts a 2/3 exponent. Nonetheless, the intrusion structure adopts a self-similar shape with scaled height as a function of scaled radius having an approximate 1/2 power law from nose to tail.

[1]This research was performed while on an internship at the University of Alberta

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