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Laboratory investigation of a single mantle plume ALINE COTEL, CAROLINA LITHGOW-BERTELLONI, University of Michigan — Although many have studied the chemistry and dynamics of mantle plumes, fundamental questions remain. These can be grouped into two general issues: a) Plume structure and dynamical interaction with the surrounding mantle, b) The degree of entrainment and mixing in mantle plumes of chemically distinct material from the deep mantle. We address these fundamental questions by performing detailed fluid dynamical experiments to determine the structure, velocity, and degree of entrainment in mantle plumes. Heat is used as the driving convective mechanism to form a single mantle plume. The experiments are conducted in a Plexiglas tank (outer dimensions of $0.3\times0.3\times0.3$ m^3). A short copper cylinder, 0.03 m tall with a diameter of 0.025 m, is connected to a heater and is attached to the center of the tank bottom. By varying voltage settings we can simulate varying heat fluxes in the deep mantle. Two main techniques are employed in our experiments: shadowgraph and Particle Image Velocimetry (PIV). Penetration height and plume head size are related to the varying buoyancy flux. In addition, velocity and vorticity fields determined using Particle Image Velocimetry provide insight into the plume structure and the nature of the entrainment process.

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