Abstract Submitted
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Buoyant convection from a discrete source in a leaky porous medium[1] MORRIS FLYNN, MARK ROES, Univ. of Alberta, DIOGO BOLSTER, Notre Dame Univ. — The application of turbulent plume theory in describing emptying filling boxes has yielded novel strategies for the natural ventilation of buildings. Making the plume laminar and having it fall through a porous medium yields a new problem of fundamental significance, insights from which may be applied in minimizing the contamination of groundwater by chemicals leached from waste piles. We review the theory for porous media plumes then adapt to the case of an emptying filling box. The long-time solution consists of two ambient layers, each of which has a uniform density. The lower and upper layers are comprised of fluid that is respectively discharged by the plume and advected into the box through the upper opening. Our theory provides an estimate for both the height and thickness of the associated interface in terms of e.g. the source volume and buoyancy fluxes, the outlet area and permeability and the depth-averaged solute dispersion coefficient, which varies with the far-field horizontal flow speed. Complementary laboratory experiments are provided for the case of a line source plume and show very good agreement with model predictions. Our measurements also show that the permeability, k_f, of the lower opening decreases with the density of the fluid being discharged.

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