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Transient buoyant convection from a discrete source in porous media[1] ALI MORADI, MORRIS FLYNN, Dept. of Mech. Eng., Univ of Alberta — The study of porous media filling box flows informs (i) the dissolution of non-aqueous phase liquids or sequestered CO_2 into potable groundwater, (ii) leakage of contaminants from waste piles, and (iii) enhanced oil recovery technologies. Here we examine the flow of a negatively buoyant, laminar plume in a box filled with a porous medium, which is connected to an infinite external ambient via upper and lower fissures. As $t \to \infty$, the box contains two uniform layers of different densities. However, the approach towards steady state is characterized by a lower (contaminated) layer that is continuously stratified and is governed by the ratios of the virtual origin correction and lower fissure depth to the box height, and the ratio, μ, of the draining timescale to the filling timescale. Whereas the presence of a continuous stratification in the contaminated layer for finite time poses analytical challenges, we show that it is possible to derive bounds on the range of possible solutions. A separate component of our study considers time-variable forcing where the plume source strength is either abruptly altered or turned on and off with fixed half-period. Throughout, comparisons are drawn against filling boxes driven by turbulent free plumes.

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