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Buoyant convection in porous media: Two-layered separated by an inclined permeability jump[1] K. S. BHARATH, University of Alberta, C. K. SAHU, University of Cambridge, M. R. FLYNN, University of Alberta — We report upon both the early- and late-time dynamics of buoyancy driven flow leading to gravity current flow in a two-layered (upper- and lower-layer) porous media separated by an inclined permeability jump. The early-time dynamics is studied by deriving a Darcy equation-based analytical model that assumes a sharp-interface to exist between the gravity current and the ambient fluids, considering the layers are of semi-infinite thicknesses. We thereby predict the along-slope propagation of the gravity current noses all the way to runout, a state characterized by a balance between gravity current influx and outflux (due to draining). Experiments further reveal a complicated flow structure with the formation of two distinct interfaces. Herein, the nose of the flow fronts corresponding to up- and downdip gravity currents are used to quantify the transient and steady state behaviors and are further corroborated with theoretical predictions. The late-time dynamics is also study in a purely experimental context by introducing a finite lower-layer depth which allows the formation of 'secondary-gravity currents' in the lower-layer which has significant influence on the dynamics of the 'primary-gravity currents' in the upper-layer. Furthermore, the addition of vertical boundaries allows us to distinguish between two qualitatively different filling regimes, i.e. sequentially vs. simultaneously of upper- and lower-layers. Parameter combinations conducive to one or the other filling regime are identified.

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