Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

The effect of sudden permeability changes in porous media filling box flows[1] MORRIS FLYNN, U. Alberta, Dept. of Mech. Eng. — We report on investigations of filling box flows in non-uniform porous media characterized by a sudden change in permeability. The medium consists of two layers separated by a horizontal permeability jump and is initially filled with light ambient fluid. A line source supplies dense contaminated fluid that falls toward the bottom of the domain. Two configurations are studied, i.e., a low-permeability layer on top of a high-permeability layer and vice-versa. In the former scenario, the flow dynamics are qualitatively similar to the case of a uniform porous medium. In the latter scenario, the flow dynamics are significantly different from those of the uniform porous medium case; after reaching the permeability jump, some fraction of the dense plume propagates horizontally as a pair of interfacial gravity currents. Meanwhile, the remaining fraction of the plume flows downward into the lower layer. Depending on the permeability ratio of the upper and lower layers and the source conditions, the gravity currents may become temporarily arrested after traveling some finite horizontal length. Predictions of the filling box time are made and compared against laboratory measurements. Positive agreement is typically found, especially when the lower-permeability layer is located on top.

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Date submitted: 01 Aug 2017 Electronic form version 1.4