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Axisymmetric viscous gravity currents flowing over a deep porous medium MELISSA J. SPANNUTH, Yale University, JEROME A. NEUFELD, Cambridge University, J.S. WETTLAUFER, Yale University, M. GRAE WORSTER, Cambridge University — When a viscous gravity current flows over a horizontal porous medium it not only spreads laterally, but also drains vertically into the substrate. Such flows occur in many environmental and industrial settings. We have studied the axisymmetric spreading of such currents over a deep porous medium fed by a point source of fluid at the origin. For constant fluid influx we observe the existence of a steady state in which drainage exactly balances external fluid input and the current ceases spreading. The steady state is well-described by the analytical solution of the equations for a viscous gravity current spreading due to the slope of its free surface augmented by a simple drainage law. In addition, scaling laws derived from the full governing equations collapse the experimental data and a numerical solution accurately predicts the evolution of the current. Finally, non-ideal behavior demonstrated by experiments using a more complex porous medium indicate the sensitive dependence of current behavior on the properties and geometry of the underlying porous medium.

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