How lenses of varying permeability affect gravity fingered flow in unsaturated porous media

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Abstract
Experimental studies on fingered flow have typically examined fingering characteristics through homogeneous porous media, which does not take into account the heterogeneous subsurface more commonly found in nature. This study uses a steady flow of a dyed water-glycerol solution into an unsaturated glass bead pack to replicate light rainfall into dry sandy soil. Thirteen experiments were performed focusing on the effect of low and high permeability lenses on unstable flow. Fingers pond above high permeability lenses and within low permeability lenses, before continuing to flow downwards. Beneath lenses, fingers tend to have a predictable distribution, with distinct shadow areas where no fingers form. The behaviour can be explained in terms of the different capillary pressures encountered in the lenses. This has important environmental and agricultural consequences, as lenses in soil could slow the transport of contaminants to groundwater, and support plant growth by increasing wetted soil volume, although leaving larger dry areas below.

Bio
After growing up in Bahrain I moved to London in 2012 to begin studying for an MSci Geophysics degree at Imperial College. I am now in my 4th and final year. After taking Martin Blunt's Hydrogeology and Fluid Flow courses in my 3rd year of study, I developed an interest in this field. Last summer (2015) I was given the exciting opportunity to spend 2 months undertaking a summer research project in the Department of Civil and
Environmental Engineering at MIT. In September I began my 3 month MSci research project with Martin Blunt as my supervisor, focused on the study of fluid flow in porous media.