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Transient diffusive boundary layers in porous media: optimal perturbations DON DANIEL, NILS TILTON, AMIR RIAZ, University of Maryland, College Park — We study the linear stability of gravitationally unstable, transient, diffusive boundary layers in porous media using nonmodal stability theory. We perform a classical optimization procedure to obtain perturbations with maximum subsequent amplification. Due to the transient base-state, optimal perturbations depend on the initial perturbation time. At small times, optimal perturbations extend beyond the boundary layer producing unphysical initial conditions. To reciprocate experimental conditions, we propose a modified optimization procedure using an adjoint-based optimization formulation that constrains the initial perturbation within the boundary layer. Interestingly, dominant wavenumbers obtained using resultant perturbations exhibit different temporal behavior in comparison to the classical scheme. We validate our results using nonlinear direct numerical simulations.

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