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A converging granular flow driven by fluid drag STEVEN MEIER, ExxonMobil Research and Engineering Company, DAVID YALE, ExxonMobil Upstream Research Company, ARNOLD KUSHNICK, ExxonMobil Research and Engineering Company, PAUL CHAIKIN, New York University, ERIC HERBOLZHEIMER, ExxonMobil Research and Engineering Company — The dynamics of granular flows are known to depend on applied confining stresses and the need for the material to dilate when subjected to a shearing motion, as has been shown by studies on free-surface flows driven by gravity and confined flows driven by a moving boundary. Here, we present an experimental study at the 2 meter scale of a granular flow subject to a confining stress driven by fluid drag as is encountered in some petroleum recovery and geologic processes. Before the particles start to flow, a Darcy's law pressure gradient is generated by fluid flow. The onset of flow, or failure, is history dependent. That is, it depends on both the stress state and the particle concentration as a result of the history of deformation applied to the material. The particles begin to flow when the pressure gradient exceeds the friction due to the confining stress and the gradient of stress along the flow direction. The flow also depends on the ability of the granular material to dilate. We will show that converging flow conditions allow for this required dilation. Once the particles are flowing, the pressure gradient is proportional to the confining stress on the moving sand rather than on the fluid flow rate.

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