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Transitions of the propagation phases for non-Newtonian gravity currents MIJANUR CHOWDHURY, FIRAT TESTIK, Civil Engineering Department, Clemson University, Clemson, SC, USA — Transitions of the propagation phases for both two-dimensional and axisymmetric non-Newtonian gravity currents were investigated experimentally and theoretically. Fluid mud gravity currents, which exhibit power-law (shear thinning) rheological properties, were generated for constant-volume (in a flume) and constant-flux (in a flume and a three-dimensional tank) release configurations. Experimental observations indicated that, similar to their Newtonian counterparts (e.g. saline gravity currents), fluid mud gravity currents exhibit inertial and viscous propagation phases, preceded by either slumping (for the case of constant-volume release) or chaotic jet (for the case of constant-flux release) phase. When the currents make transitions from inertial to viscous phase, a thickening-thinning behavior was observed. Order-of-magnitude expressions for the transition time and position were derived and predictions of these expressions were compared to the experimental observations. A Moody-like diagram based upon a new friction factor and Reynolds number for power-law gravity currents is proposed to identify the transition from the inertial to viscous propagation phase.

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