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Onset of motion at the surface of a porous granular bed by a shearing fluid flow ANYU HONG, Clark University, WPI, Northwest Agricultural and Forestry University (China), MINGJIANG TAO, WPI, ARSHAD KUDROLLI, Clark University — We will discuss an experimental investigation of the onset of particle motion by a fluid flow over an unconsolidated granular bed. This situation arises in a number of natural and industrial processes including wind blowing over sand, sediment transport in rivers, tidal flows interacting with beaches and flows in slurry pipelines and mixing tanks. The Shields criteria given by the ratio of the viscous shear and normal stresses is used to understand the onset of motion. However, reviews reveals considerable scatter while noting broad trends with Reynolds Number. We discuss an idealized model system where fluid flows with a prescribed flow rate through a horizontal rectangular pipe initially fully filled with granular beads. The granular bed height decreases and reaches a constant height when the shear stress at the boundary decreases below a critical value. We compare and contrast the values obtained assuming no-slip boundary conditions with those observed with PIV using florescent tracer particles to measure the actual fluid flow profile near the porous interface. We will also report the observed variation of the Shields criteria with particle Reynolds Number by varying particle size and fluid flow rates.

Anyu Hong
Clark University, WPI, Northwest Agricultural
and Forestry University (China)

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