



## Shallow Granular Flow through a Contraction

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We consider flow of dry granular matter down an inclined chute with a localized contraction. Measurements are presented for granular particles of varying diameter. Measurements and analysis show that friction and changes in particle volume fraction are important relative to inviscid granular “hydraulic” theory, especially across granular bores. This inviscid hydraulic theory is valid at leading order when the incoming chute flow is uniform and effectively frictionless upstream of the contraction. For fixed upstream conditions and depending on the nozzle width of the contraction, we observe either small oblique jumps, a reservoir with a steady jump, or a reservoir with an upstream (traveling) bore. Shallow layer theory extended to include friction and porosity changes qualitatively predicts these regimes. Implications for volcanic debris flows are discussed.

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