

Numerical study of jumps formed in free-surface flows down an incline : influence of the fluid rheology

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The discontinuities in height and velocity, namely jumps, formed in free-surface flows are important processes in geophysics, for instance when they are formed during the interaction of avalanche-flows with protection structures. The present study investigates steady state jumps formed in free-surface flows with the help of numerical simulations based on depth-averaged equations. A control constant mass discharge is supplied to an incline. By imposing a difference in basal friction between a upper part of the chute bottom and a lower part of the chute bottom, a supercritical flow is produced upstream while a subcritical flow appears downstream. The transition between both gives birth to a jump located at the transition between the two portions of the chute with different basal friction. Different constitutive equations are tested (laminar, turbulent, local granular rheology, Voellmy, Herschel Bulkley), thus allowing us to quantify the influence of the fluid rheology on the jump properties : position, geometry and size.