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Time-Dependent Turbulent Scouring AMANDA POOLE, PINAKI CHAKRABORTY, G. GIOIA, University of Illinois at Urbana-Champaign, FABIAN BOMBARDELLI, University of California at Davis — When a water jet plunges into the free surface of a body of water of uniform depth, a turbulent cauldron is established in the body of water under the point of entrance of the jet. If the body of water lies on a granular bed, the turbulent cauldron starts to scour the bed to form a pothole. Under a sustained action of the jet, the pothole deepens until a state of dynamic equilibrium is attained between the granular bed and the turbulent cauldron. We propose a theoretical model to predict the depth of the pothole as a function of time. This model is an extension of a model proposed previously to predict the final, equilibrium depth of the pothole as a function of the power of the jet, the depth of the pool of water, and the size of the grains of the granular bed. Our model yields a first-order, nonlinear ordinary differential equation for the depth of the pothole as a function of the time. At the onset of scouring, where our model can be solved analytically, the depth of the pothole is a power law of the time. As the time tends to infinity, the depth of the pothole tends asymptotically to the same equilibrium depth predicted by the earlier model. For intermediate times, we solve the model computationally and compare the results with a number of experimental data sets.

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