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Scaling of Stick-Slip Instabilities in Granular Materials ERIC DAUB, Geophysics Group and Center for Nonlinear Studies, Los Alamos National Laboratory, PAUL JOHNSON, Geophysics Group, Los Alamos National Laboratory — We investigate stick-slip instabilities in sheared granular materials. This problem involves a broad range of length scales, from individual grain contacts up through larger scale frictional interfaces. Due to this range of length scales, constitutive models for deformation and fracture in granular materials must capture the essential physics at a given scale and efficiently transmit that information to larger scales. In this study, we look at the mechanisms of deformation and constraints on constitutive laws for granular materials using laboratory stick-slip data. We examine the effect of varying the applied normal stress and external shearing rate on the dynamics of stick-slip, including recurrence times, slip magnitudes, dilation and compaction of the material, and dynamic changes in the material properties. By determining the aspects of stick-slip that scale, we can develop models that are applicable to systems under a wide range of conditions at many different scales. Many engineering applications and geophysical systems require scaling from the laboratory to systems at significantly larger scales, and we explore the implications of our results for the multi-scale problem of dynamic earthquake faulting.

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