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Modeling realistic hazardous geophysical mass flows using a range of one and two phase models in the TITAN2D code suite

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The range of scales and the complexity of the rheology for geological materials, coupled with the mathematical problem of describing a multi-phase free surface flow, makes modeling and computing geophysical mass flows a significant challenge. Several model systems of equations have been proposed for describing such flows. These range from the early viscoplastic models of mud flows to more recent one and two phase models based on granular flow ideas. Examination of different models and testing these predictions is difficult. In recent work we have developed and implemented in a large scale computational platform a set of models ranging from simple dry granular flow to two-phase and overland flow. We will illustrate recent results from these models on tests using a set of well constrained laboratory scale flows and field observations of well documented flows at sites in San Bernardino County, California. We will address a range of questions related to the significance of different modeling assumptions and the implications of modeling assumptions on numerical computations of large scale flows. We will also briefly outline our approach to dealing with parametric uncertainty in the models and the characterization of its impact on selected output quantities.