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Evaluation and testing of hydro-mechanical models describing slump failure and potential for liquefaction.

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An important aspect for the evaluation of the intensity and impact of slope failures is the forecast of the potential for a slide to flow transition. For this purpose a hydro-mechanical model was further developed and tested on slope failure processes observed in the field and in the laboratory. Two slump failures were studied, which developed on secondary scarps of a clay-rich slow-moving mudslide in Super Sauze (French Alps). One occurred on May 5^{th} 1999 and it completely liquefied into a flow. The second slump developed in October/November 2006. The total displacement of about 5m took place over a period of 18 days. The slumped material remained for a larger part in the source area and practically no liquefaction was observed during failure.

A number of retrogressive slump failures were generated in the Utrecht laboratory flume with displacement rates of around 0.2 cm per second. The slumping material showed liquefaction after around 70% of the displacement.

A first hydro mechanical so called *compression model* was developed, which generates excess pore pressure due to differential displacements in an elastic slumping body. Dissipation of excess pore pressure is obtained in the same time step according to Terzaghi's consolidation theory. A comparison of field and laboratory observations and model results showed that the *compression model* generated too high excess pore pressures after relative small displacements. The model was adapted in such a way that excess pore pressure is generated by a change in the stress field, which is caused by a

change in geometry of the slump during movement. This so called *stress field model* gives better results. It generates less excess pore pressures after larger displacements. It forecasts for example liquefaction of the 1999 slump and no liquefaction of the slump, which occurred in 2006.