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Slope stability under seismic activity and precipitations

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Processes leading to slope failures are often difficult to describe / understand since they involve complex interactions of seismic, geological and hydro-meteorological factors.
To date, we are still puzzled by the triggering of the Kainama loess earthflow in April 26 2004, in the Gulcha region (Kyrgyzstan, Central Asia), in the transitional zone between the Fergana Basin in the north and the Alai Range in the south.
Indeed, numerical simulations conducted so far and using the 2D finite difference code FLAC have shown that the Kainama slope failure is not of purely static origin and cannot be related to a high water table. In addition, the modelling of successive small magnitude earthquakes similar to the ones that struck the Kainama slope a few weeks before the triggering of the loess earthflow, has shown that small permanent deformations develop along and within the slope. The remaining question is whether a slope that suffered from repetitive but moderate seismic activity prior to groundwater level rise (spring rains and snow melting) is prone to a delayed failure.
The scope of the present study is therefore to incorporate in the modelling the effect of spring rains. Slope stability will be assessed considering various rainfall scenarios characterized by the intensity and the duration of the precipitations. Besides, we will take into account the slope geometry degradation due to previous and small extent failures caused by seismic shaking.
The implications of such a work are important to support the need for the maintain of an active protection of populations in mountainous areas hit by earthquakes since slopes that do not fail co-seismically may result in mass movements after heavy rains in mid / long term.