Towards better forecasts of slab avalanches

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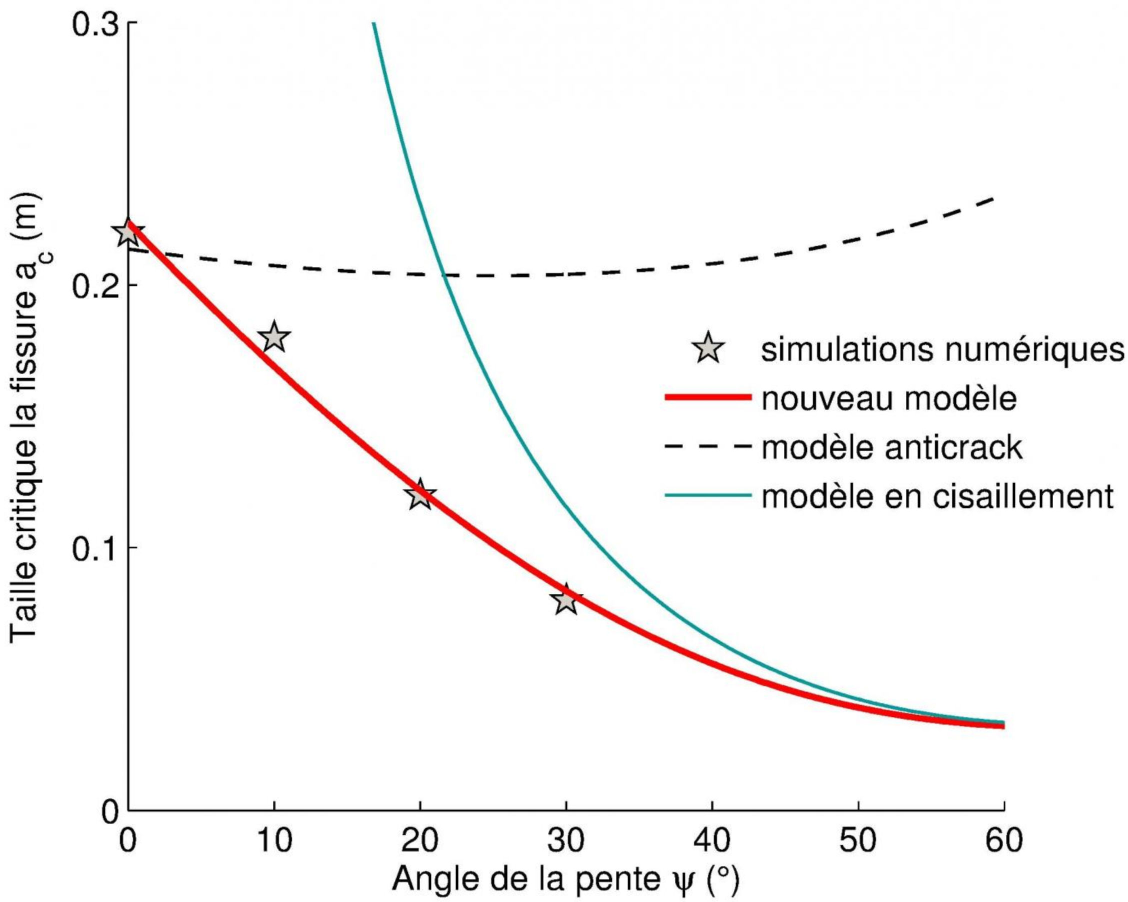
EPFL researchers have developed a new model that will improve the prediction of plaque avalanche risk. Credit: EPFL

A team of researchers from EPFL and the SLF has developed a new model that describes how slab avalanches release. In the long run, it will allow improving avalanche forecasting.

Slab avalanches are of particular interest since they are the most destructive, threatening both humans and infrastructure, and are very hard to forecast. Ranging in size from just a few meters to several kilometers, they are triggered when a weak snow layer buried underneath a cohesive snow slab fails. The initial crack spreads beneath the snow cover comparable to a domino effect, leading to the release of the slab avalanche.

Merging the best of previous models

Within the scientific community, the release of slab avalanches has been described by two opposing models: The original model (from 1979) describes a shear fracture in the direction of the slope. The other one, called anticrack, accounts for the collapse of the weak snow layer and reproduces observed cases of remote triggering of avalanches from distant flat terrain. "We don't consider one model to be superior to the other, but from a theoretical standpoint, it's simply too difficult to consider all of the physical ingredients," says Johan Gaume from the Cryos Laboratory at EFPL and first author of the new model that was just published in the journal *The Cryosphere*.



Credit: Ecole Polytechnique Federale de Lausanne

A distinguishing feature of the new model, which Gaume developed while with the Institute for Snow and Avalanche Research SLF in Davos and in collaboration with the Université Grenoble Alpes (Irstea) in France, is that it reconciles the previous approaches. "The anticrack model works well on flat terrain, but for steep slopes, above 30°, the original shear model tends to perform better. In that way, they are complementary," says Gaume. The new model accounts for this discrepancy. It was developed on the basis of computer simulations and considers the propagation of cracks within the snowpack – including the complex mechanical behavior of the weak layer – as well as shear stresses induced by slab deformation after the collapse of the weak layer.

Improving stability evaluation

The researcher's results were implemented in the numerical snow cover model SNOWPACK, used by the Swiss avalanche warning service. Although it is still awaiting validation, the new model opens a promising prospect for improving avalanche forecasting by combining traditional stability indices with a new index that quantifies the likelihood for cracks to propagate.

Provided by Ecole Polytechnique Federale de Lausanne