Risk back-analysis of the landslides produced by the August 2005 rainfall event in Switzerland

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Switzerland was affected in August 2005 by an extreme rainfall event. It resulted in major floods, debris flows and landslides. These events caused 3 billion Swiss francs (€ 2.5 billion) of damage costs and killed 6 persons across the country. Floods were the far most important damage cause, but a huge number of landslides occurred too. Indeed, more than 5'000 landslides were reported, causing damage costs around 18 million Swiss francs. Most of them were concentrated in central Switzerland and the maximum value of 30 landslides per square kilometer was reached.

The landslide distribution shows a strong correlation with the precipitation intensity. Indeed, if the total precipitation from 18 to 23 August is correlated with the number of landslides per square kilometer, we can observe that the probability of overpassing a certain amount of landslides per square kilometer always increases with the precipitation intensity, whereas the distribution curves for each class of precipitation show a similar trend. Nevertheless, this correlation can be even stronger by choosing a better time interval for the precipitations. The aim of this work is to produce a predictive relation between the precipitation intensity and the quantity of landslide. In order to assess the amount of damage, the intersection probability of landslide and houses is estimated in each cell using stochastic geometry, taking into account an expected size and shape for the landslides and using the actual houses shapes and distribution. By applying the intersection probability to the actual landslide distribution of the 2005 event, we obtain 429.2 expected intersections, implying a damage cost of around CHF 42'000 per impacted house.

By combining these two probabilistic approaches, namely the landslide distribution and the intersection probability, we obtain an expected number of intersections between landslides and houses for any meteorological event at Switzerland scale. Using the estimated damage costs per house described above, we can estimate quickly the expected global cost of the event