Landslides triggered by the Pisco earthquake (Peru, Mw8.0, 2007) : automatic detection of landslides in SPOT5 panchromatic images, and analysis of the distribution patterns.

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The Pisco earthquake (Mw 8.0) struck the coast of Peru in August 2007, causing 519 casualties and heavy damages to the infrastructures. In the mean time, numerous landslides and rockfalls were triggered. A field survey conducted in the 2 months following the event, shows that the erosion associated with this earthquake is dominated by large landslides. However, the few number of landslides identified by the field inventory shows also that it is highly incomplete. Main goals of this study are therefore (1) to extensively detect the coseismic landslides using remote sensing data and (2) to analyze the landslide distribution for a better understanding of the earthquake-induced-landslide processes.

For a better representativeness of the spatial distribution of landslides, we revisited the detection of landslides using satellite images covering a wide area. We acquire coseismic couples of SPOT5 panchromatic optical images (pixel size of 5m) covering 27000km2, that is most of the area visited by the field survey.
The detection is challenging for different reasons : (1) the area affected by landsliding is wide, (2) most of the area is very arid, which prevents the use of classical methods of automatic detection, developed for vegetative areas (3) few landslide detection methods are available for panchromatic images, (4) no precise digital elevation model are available on the whole area.

Because of the specificities of our dataset, we develop a new automatic procedure of detection based on the thresholding of the difference of 2 coseismic orthorectified images. False alarms are removed using a combination of the correlation of the 2 images and topographical slope analysis. Object shapes and shadow analysis is then used to isolate the landslides. The output of this method is compared with the field inventory and a manual inventory on the satellite images. The method allows detecting the major landslides, with 74% of the landslides detected and 20% of false alarms.

The method is then used over the entire images. A first analysis of this database is conducted in terms of number and size of landslides. The spatial distribution is also analyzed in relation with the topography, the surface geology, and the seismic wave field generated by the earthquake.