An optimization method for Slow-moving Landslides detection in satellite image time series

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Résumé

In this work, we develop a new method to detect slow-moving landslides from a time series of displacement maps, coming either from optical image correlation or InSAR. The developped method is based on the sparsity charcateristics of the landslide signal in space. We suggest to use the most recent techniques in optimization, such as the Monotone+Lipschitz Forward-Backward-Forward (M+L FBF) algorithm [1], using specific constraints from slow landslide, like their monotonic aspect through time. This approach leads to a mathematical formulation of the problem. The efficiency of this approach is demonstrated through comparison with a field inventory of slow landslides collected on the Colca valley in Peru. A database of about 30 landslides is thus realized over an area of 300 km2, using a time-series of displacement over 27 years (1986-2013) generated by time-series correlation of SPOT1-5/Pléiades images. The results shows that all important landslides, already known from field investigations or previous research, are detected. The detection also include more than 250 % other small and unknown landslides. We finally analyze the displacement time-series from the different landslides in terms of natural forcings.

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