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Multidisciplinary determination of Lahar Erosion Dynamics at the Colima Volcano (Mexico)

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Volcán de Colima (10º 30′44′′N, 103º 37′02′′ W) is currently the most active volcano in Mexico and the North American plate. Associated to its frequent volcanic activity, renovated in 1998 and later in 2010, secondary processes like lahars, triggered by rain mixing with the loose pyroclastic debris produced, are common. Colima lahars channelled through the main water drainages (ravines), and reach large distances along their path (from 7 to 15 km long) burying farmland and all kind of human infrastructures at the surrounding area.
The inner part of the ravines is greatly affected by lahars, especially by the bulking processes, so establish an appropriate method to determine its affection rate seems to be needed.
In order to analyze 1-year lahar erosion dynamics inside one of the most active ravine (Montegrande 2011-2012 period), our team proposed a multidisciplinary perspective that combines numerical modeling (ArcGeoWEPP), fieldwork recognition and free satellite imagery, in the assessment of the related hazards.
On the one hand, ArcGeoWEPP model allowed simulation of watersheds and hillslope profiles within ravines, taking into account climate parameters, land and vegetation covers. This tool was especially useful in areas where the terrain complexity prevented access. The results of this model were combined with 16 real cross-section topographies observed inside the Montegrande ravine and the floodplain delineation of lahars created from satellite imagery.
The total 1-year volume of debris at Montegrande was finally reached, but also the erosive, sedimentary and balanced areas were identified, so as the lahar and its deposit dimensions. 750,000 tons per year were eroded inside the Montegrande ravine during 2011-2012 lahars, 805,000 tons if the hillslopes of the surrounding area were considered, and 580,000 tons were deposited along the path. The flood plain area was 1,100,000 m2.
Numerical models combined with field data obtained from different sources seems to be a useful framework to reproduce lahar erosion dynamics at volcanic areas like Volcán de Colima.

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