Geophysical Research Abstracts
Vol. 16, EGU2014-13978, 2014
EGU General Assembly 2014

Using field data and HSR imagery to downscale vulnerability assessment of buildings and local infrastructure facing hazards from floods and hyperconcentrated flows

Susanne Ettinger, Nélida Victoria Manrique Llerena, and Jean-Claude Thouret

PRES Clermont, Université Blaise Pascal, Laboratoire Magmas et Volcans (LMV), CNRS UMR6524 et IRD R163, 5 rue Kessler, 63038 Clermont-Ferrand Cedex, France (s.ettinger@opgc.univ-bpclermont.fr)

The focus of this study is the analysis of post-flood conditions along the Venezuela channel in the large city of Arequipa, south Peru, in order to identify the parameters determining vulnerability of buildings and infrastructure. Two tributaries draining a c. 11.9 km^2 large catchment feed the Venezuela channel. Before joining the main Rio Chili valley to the West, it crosses the city from NE to SW. Over a total length of 5.2 km, channel depth ranges from 1.3 to 6.3 m and c. 40% of the channel sections do not exceed 5 m in width. On 8 February 2013, 123 mm of rainfall within 3 hours (monthly mean: 29.3 mm) triggered a flashflood inundating at least 0.4 km^2 of urban settlements along the channel. The flood damaged 14 buildings, 23 among 53 bridges, and led to the partial collapse of main road sections paralyzing central parts of the city for at least one week. This research relies on (1) analyzing post-flood conditions and assessing damage types caused by the 8 February 2013 flood; (2) mapping of the channel characteristics (slope, wetted section, sinuosity, type of river banks, bed roughness, etc.) and buildings, bridges, and contention walls potentially exposed to inundation. Data collection and analysis have been based on high spatial resolution (HSR) images (SPOT5 2007, Google Earth Pro and BINGMAP 2012, PLEIADES 2012-2013). Field measurements (GPS, laser and geomorphologic mapping) were used to ground truth channel width, depth, as well as building outlines, contention walls and bridge characteristics (construction material, opening size, etc.). An inventory of 25 city blocks (1500 to 20000 m^2; 6 to 157 houses per block) has been created in a GIS database in order to estimate their physical vulnerability. As many as 717 buildings have been surveyed along the affected drainage and classified according to four building types based on their structural characteristics. Output vulnerability maps show that the varying channel characteristics, i.e. bank type, bed roughness, and the variable width-depth ratio of rectangular or trapezoidal channel sections determine in great part site-specific vulnerability. The sub-metric spatial resolution and GIS data analysis using PLEIADES imagery has enabled vulnerability assessment of individual features of few meters in size. However, this study shows that fieldwork remains essential for (1) completing measurements in areas where channel is < 5 m in width or partially hidden by 2-5-storey buildings; (2) assessing the type and construction material of contention walls and thus their susceptibility to fail after they are scoured; and (3) determining the opening height of bridges potentially obstructing flow and leading to inundation as a consequence of overspill.