



Cities on Volcanoes 9
November 20-25, 2016
Puerto Varas, Chile

'Understanding volcanoes and society: the key for risk mitigation'



Topohazard, a methodology to improve lahar hazard maps for a better emergency and urban planning

José M. Marrero^{1 2}, Francisco Vazcones¹, Pedro Espín¹, Daniel Sierra¹, Hugo Yepes¹, Jacob Pastor², Catalina Erazo², Carlos Estrella² y Patricia Mothes²

¹Instituto Geofísico de la Escuela Politécnica Nacional. Calle Ladrón de Guevara E11-253 y Andalucía, 1701-2759, Quito

²Instituto Geográfico Militar, El Dorado, 170413, Quito, Ecuador

Keywords: emergency management, differential of topography, Cotopaxi, Ecuador

In 1979, the first hazard map for the Cotopaxi volcano was released. Prior to the recent unrest (2015-2016), the last hazard map update was conducted in 2004 using the same scale and base map. On April 2016 a new unrest was detected and the emergency response system was activated in the threatened areas, specially in those affected by lahars. However, one important difference between this unrest and the previous one (2001-2003) was the use of volcanic hazard information in a digital environment (GIS) instead of hard-copy cartography. Additionally, the hazard information revealed some incoherences when it was overlaid with a newer and much more detailed base map. This new evidence ended up in an effort intended to review and fit the lahars' limits to the base map. To help in this task, a new methodology was developed which has also proved to be very helpful in the improvement of risk assessment and uncertainty management. The methodology developed calculates the differential of topography between the bed river and the adjacent slopes and, if available, computes the same but from the lahars' limits instead. As an alternative to the differential of topography method aforementioned, a second approach allows to get arbitrary values in order to apply a color scale and smooth the visual results. Detailed hazard maps are therefore obtained, where the hazard area is shown in terms of distance and altitude showing the implication of being close to the bed river. Besides, secure areas and uncertainty limits can be delimited so that shelters or any other infrastructure are properly situated. As an example, a detailed hazard map of Latacunga city, Cotopaxi volcano's southern drainage, was designed as a tool for volcanic crisis management and emergency planning.