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



Lahar hazard quantitative risk analysis using probabilistic hazard assessment.

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Quantitative risk analysis provide decision makers with a useful tool, which allows them to have a number represented either as a fraction of the probability or the expected cost within a return period. Risk analysis mainly needs a probabilistic hazard assessment for different levels of hazard, and at least an approach to the quantification of the expected level of damage related to different levels of hazard intensity. Total probabilistic hazard (Pt) of a lahar impacting a place of interest depends on both, the probability of the occurrence of the event (Po), times the probability that the lahar reach the interest point (Pr). In order to be on the side of security, in this paper we assume $Po=100\%$, and estimate just Pr. Thus, Pt becomes a conditional probabilistic hazard. Based on previous semi-quantitative vulnerability analysis we developed damage-intensity curves due to lahar hazard for structures. The vulnerability is evaluated house by house. Finally, the risk is obtained using GRASS-GIS tools to multiply layers of hazard levels times layers of vulnerability levels defined in each grid of the DEM. We apply these ideas using the program TITAN2F, which was developed to model lahars. It allows the knowledge of the fields of velocity, particle solid concentration, dynamic pressure and the flow depth. The intensity of this hazard is represented here by the dynamic pressure, which let us know the probability of the total structural destruction and to identify the places where the level of the lahar impact becomes dangerous for human life. We apply this methodology to assess the risk in the NE flank of Popocatepetl volcano, and two small towns near Chiles volcano at the border Colombia-Ecuador, and a city located 13 km away from Chiles volcano, nevertheless threaten by secondary lahars from it, and a neighborhood in Pasto, Colombia.