



## Hazard map for volcanic ballistic impacts at El Chichón volcano (Mexico)

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The 1982 eruption of El Chichón Volcano in southeastern Mexico had a strong social and environmental impact. The eruption resulted in the worst volcanic disaster in the recorded history of Mexico, causing about 2,000 casualties, displacing thousands, and producing severe economic losses. Even when some villages were relocated after the 1982 eruption, many people still live and work in the vicinities of the volcano and may be affected in the case of a new eruption. The hazard map of El Chichón volcano (Macías et al., 2008) comprises pyroclastic flows, pyroclastic surges, lahars and ash fall but not ballistic projectiles, which represent an important threat to people, infrastructure and vegetation in the case of an eruption. In fact, the fatalities reported in the first stage of the 1982 eruption were caused by roof collapse induced by ashfall and lithic ballistic projectiles. In this study, a general methodology to delimit the hazard zones for volcanic ballistic projectiles during volcanic eruptions is applied to El Chichón volcano. Different scenarios are defined based on the past activity of the volcano and parameterized by considering the maximum kinetic energy associated with ballistic projectiles ejected during previous eruptions. A ballistic model is used to reconstruct the “launching” kinetic energy of the projectiles observed in the field. The maximum ranges expected for the ballistics in the different explosive scenarios defined for El Chichón volcano are presented in a ballistic hazard map which complements the published hazard map. These maps assist the responsible authorities to plan the definition and mitigation of restricted areas during volcanic crises.