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Lahar modeling at Irazu volcano (Costa Rica)

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Irazu Volcano is a composite stratovolcano (3432 m a.s.l.) located in the Cordillera Central of Costa Rica, about 25 km E of the capital San José and 14 km NNE of the second largest city of the country, Cartago (pop. ∼140.000). The last eruption of this volcano, which occurred in 1963-65, triggered numerous lahars, the largest of which caused 20 deaths and the extensive destruction of buildings and properties in Cartago. Historic data indicate that several Vulcanian and Strombolian eruptions have occurred since 1723 and have a return period of approximately 25-30 years. It is therefore quite possible that the volcano will erupt in the near future.The principal hazards related to a reactivation of Irazu, therefore, are ash fall and the potential formation of large, destructive lahars. During the 1963-65 eruption the accumulation of ash on the slopes of the edifice triggered several tens of lahars in the drainages heading on the volcano. The destruction caused by the largest of these events led to the construction of large dikes (10-15 m high) along the channel within the city limits in order to contain the inundation area and constrain the damage from future events. However, many unauthorized buildings have since been constructed within the dikes, leading to conditions of high risk for the inhabitants. The objectives of this work are to model potential lahars within the Rio Reventado produced by future eruptions having the same magnitude of those of 1963-65. A back-analysis of the 1963 event was performed with FLO-2D in order to calibrate the model. FLO-2D is a commercially available flood routing code and uses a quadratic rheological model that represents viscous stress, yield stress, turbulence and dispersive stress terms as a function of sediment concentration. It routes a flood hydrograph over a DEM using the full dynamic wave momentum equation and a central finite difference routing scheme to distribute the flows. Several field campaigns were carried out during which data were collected with the aim of estimating parameters to be used for modelling. On the basis of the 1963 event, the characteristics of the basin and the thickness of potential ash falls, several possible scenarios were

investigated. The volumes of the four scenarios range from 1.1 x 10^6 m^3 to 2.5 x 10^6 m^3. Modelling results are in good agreement with field data.