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Preliminary Volcanic Hazard Maps of Nevado de Toluca Volcano (Mexico)

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Nevado the Toluca volcano is a quiescent active volcano, located 80 km southwest from Mexico City. During the past 50 ka, the volcano has been characterised by explosive activity predominantly, with plinian and sub-plinian eruptions as well as merapi-type dome collapses. Several sector collapses have been recognized during the eruptive history of the volcano, associated with voluminous cohesive debris flow and debris avalanche deposits and strongly controlled by structural setting. During periods of volcano quiescence, erosive processes caused the emplacement of lahars (no-cohesive and hyperconcentrated flow deposits).

Its present state of activity and its eruptive record pointed the need to evaluate the volcanic hazards associated to Nevado de Toluca volcano.

Hazard zonation was based on stratigraphical and geological studies of the Nevado de Toluca, coupled with geomorphological characterization of the edifice and surrounding areas. First we have realised a geological map of the entire Nevado de Toluca volcano at 1:25,000 scale, based on a detailed stratigraphic reconstruction and on lithostratigraphic units (Bellotti et al., 2004). The geological data collected allowed the definition of all volcano-related hazardous phenomena, including recurrence times, volumes emplaced and affected areas.

Software designed to simulate gravitational flows, such as FLOW3D (Kover e Sheridan, 1995), TITAN2D (Patra et al., 2004) and LAHARZ (Iverson et al., 1998), have been validates in comparison with past eruptions and let to verify flow volumes and

mobility.

Four different maps have been compiled for each volcanic hazard recognized: 1- tephra fall, 2- pyroclastic flow, 3- debris flow and 4- debris avalanche.

Tephra fall hazard zonation was based on deposit distribution and mean wind direction, which is mostly toward E-NE.

Debris avalanche and pyroclastic flow hazard zonation was based on the extension of past affected areas coupled with process-based models, like FLOW3D and TITAN2D.

Debris-flow hazard zonation was based on the distribution of lahars deposits and the geomorphologic analysis of the area. LAHARZ was used to improve hazard-zone delineation.

Furthermore, all the compiled hazard maps were weighted for recurrence time and combined to obtain a map showing probability estimation for total destruction due to flows from the volcanic edifice.

The final product is a preliminary volcanic hazard map for the Nevado de Toluca area. This map has been edited considering the needs of final users, as government and civil protection; the aim is to distribute a useful instrument for land planning and emergencies management.