Geophysical Research Abstracts
Vol. 16, EGU2014-16632, 2014
EGU General Assembly 2014

Urban structure damaged by differential land level lowering in the lacustrine plain of Queretaro City, Mexico

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The Queretaro City, Central Mexico, is placed above a variety of volcanic and sedimentary materials filling a N-S trending graben, with a geomorphologic designation of volcanic valley. The stratigraphic sequence of the filling is mainly composed by lava flows interbedded with an almost 100 m thick pyroclastic unit that was easily eroded by fluvial processes during the Tertiary time. The near surface sequence in the plain is hence composed by alluvial deposits covered by organic silty and clay lacustrine materials. Moreover, as many cities in Mexico, the main source of water supply in Queretaro is groundwater. Groundwater withdrawal caused a 1-3 m/year lowering of the piezometric level and a significant consolidation of the granular materials. Currently, the depth to groundwater table in the lacustrine plain is approximately 120 m deep. The thickness of the granular material varies significantly depending on its location with respect to the normal faults delimiting the main structure of the regional graben. The consolidation on these variably-thick deposits caused differential displacements (e.g., land subsidence) of the ground surface, generating local stress accumulation and fractures. Fracture propagation to the ground surface affected most of the urban structure in the city. We present the correlation of the outcome of a geomechanical model (Ochoa-Gonzalez et al., 2013) with the measured groundwater withdrawal and faulting maps in order to investigate the contribution of the different factors determining the generation of ground fracturing, and to evaluate the associated risk of damage to urban structure in the lacustrine part of the metropolitan area.

References

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