Monitoring of land subsidence and fracturing in Iztapalapa, Mexico City

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Abstract The metropolitan area of Mexico City is one of the most populated in the world and the Iztapalapa Municipality, situated on the eastern border, presents the highest population density of the city. This area is located over the geological contact between the “Sierra de Santa Catarina” volcanic range and a lacustrine basin. Inherently, the geological materials of the subsoil are horizontally and vertically heterogeneous and deform differentially under applied loads (natural and anthropogenic). As a consequence, the Iztapalapa urban infrastructure is extremely affected by fracturing and land subsidence and it is possibly one of the places with the highest social-related vulnerability in Mexico. Since localization of fracturing and deformation during land subsidence are highly dependent on local geological, geomechanical, and hydraulic conditions of the subsoil, a multidisciplinary approach for a better understanding of the fracture triggering and propagation mechanisms was established. The methodology includes: (1) detailed geological survey, (2) high resolution geophysical prospecting, (3) stratigraphic correlation of lithological logs from water extraction wells, (4) geotechnical characterization of near surface sequences, and (5) hydrogeological analysis, including the monitoring of groundwater piezometric levels. All the obtained information is referenced and analysed using a Geographical Information System (GIS), which is directly related to a main Digital Information System (SID) available via the Internet to the Iztapalapa authorities for the support of decision making. As a result of good academic–government collaboration, the former Monitoring Centre of Ground Fracturing was transformed into the Centre of Geological Risk Evaluation (Centro de Evaluación de Riesgo Geológico, CERG) that belongs to the Coordination of Civil Protection of the Iztapalapa Municipality. The physical vulnerability of the Iztapalapa area to land subsidence, ground fracturing and other geological hazards is evaluated through the analysis of the generated information based on thematic maps, which should allow better planning of mitigation strategies, urban development, land use management, and groundwater exploitation.

Key words database management; monitoring; ground fracturing; vulnerability; geological hazards; Iztapalapa