



Numerical simulations of flooding in Tulancingo (Mexico). Implication on flooding hazard assessment.

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The Hidalgo state in Mexico, because of its geographical location so close to the slope of the Gulf of Mexico, is one of the most vulnerable states to being affected by the influence of extreme weather phenomena that are generated both in the Atlantic Ocean and in the Gulf of Mexico.

The Tulancingo municipality (Mexico), has been affected by numerous extreme weather phenomena that caused heavy flooding events with severe damage to property and people. Most of the weather phenomena placed several dams under hydrologic risk. A factor that increases the risk of flooding in Tulancingo is the presence of the dam 'La Esperanza' located at about 5 km southeast of Tulancingo. The hurricane 'Dean', in 2007, led to the overflow of the dam. The exceedance discharge generated inundation downstream that reached water heights of 1 m in Tulancingo. At the present time, more than 60% of the total volume of the dam is filled with sediments, surpassing the designed value. Thus, the volume of water that generated the spill during the hurricane 'Dean', corresponded to half its original capacity when it started operations in 1943.

Mexico does not have a specific regulation that establishes water depth and velocity thresholds, critical to conduct flooding hazard assessment. With the aim to provide a tool for the flooding hazard assessment, we performed a numerical study of inundation waterdepths by means of the IBER software. The study is based on the construction of different inundation scenarios that are based on the hydrologic study of 'La Esperanza' dam's basin, associated to regional precipitation and different return periods. Inundation waterdepths, flow velocity, and land use were used to construct flooding hazard maps. We calculated the occurrence probability of the considered inundation events. The hazard maps presented here and the evaluation of the flooding likelihood can be a useful tool for estimating the hazard of future flooding scenarios and may represent a starting point to establish contingency plans to mitigate flood risk in Mexico.