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A FIRST EARTHQUAKE HAZARD TO RISK ASSESSMENT IN LEBANON: THE EMME PROJECT.

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Lebanon is located over a major tectonic plate boundary, the Dead Sea Transform or Levant Fault System that separates the Arabian Plate to the East and the African/Nubian Plate to the West. This active, left-lateral, strike slip boundary with a slip rate of 3-6 mm/yr splays into three major branches in Lebanon where unabated and repeated ruptures produced a number of disastrous earthquakes in the past, reported in the historical texts and also found in archeological sites. The earthquakes of AD 551, 1202, 1759 and 1837 were all $M > 7$ events and devastated the country. Given the small size of the country and the location of the major cities less than 30km away from at least one of the three major fault branches, these earthquakes have severely affected the entire population of Lebanon. The need for earthquake hazard and risk assessment is more essential than ever before especially with the recent urban, social and economic development in Lebanon.

The seismic hazard of Lebanon conducted between 2010 and 2013 as part of the EMME regional project was the first country-scale exercise including hazard and risk components. Databases of active faults and seismicity were produced and combined with population distribution and building typologies distribution that were associated to intensity based vulnerability curves. Classification of the building stock was done using available statistics and GIS information at the country-scale. Moreover a detailed exhaustive survey of most buildings within one major city was conducted for the purpose of obtaining precise, representative statistics on building typology and vulnerability classes. These can also serve as a close approximation to building typology for the country as well.

In the absence of modern instrumental strong motion data, analysis of macroseismic data from compiled historical catalogs suggests high PGA values (often $> 80\%$) in most major cities during large magnitude earthquakes. Preliminary results from an earthquake scenario similar to the AD 1202, $M_w \sim 7.6$ event on the Yammouneh Fault show that 2 – 24% of buildings will suffer from damage beyond repair, in addition to 8 to 25 % of moderately damaged buildings. Results also show that the damage from such an event will not be restricted to certain areas but will be distributed over the entire urban zones of the country.

The EMME project in Lebanon was a first experiment that resulted in a better estimation of the earthquake risk in the country, and identified major gaps that need to be addressed at the country level in order to improve its resilience to such hazards.

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