

Preliminary comparisons in loss estimation for the September 19th earthquake

Introduction

Given the recent seismic event that caused important damage to Mexico City and the states of Puebla and Morelos, we have performed a quick compilation of some relevant information that is available so far.

Seismic Intensity

There are several sources of information on the reported seismic intensity. These include the intensity maps published by the American agency USGS, as well as Mexican information, such as maps from UNAM.

A mandatory step in calibrating the loss estimation models is the comparison of seismic intensities reported with those estimated by the models. In the following figure, intensity (ground acceleration) maps are shown. On the left, the USGS map and on the right the one produced by Instituto de Ingeniería, at UNAM.

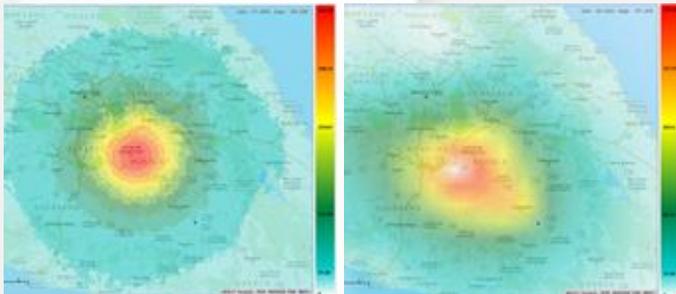


Figure 1. Ground acceleration maps. Left: USGS; Right: II-UNAM

Loss estimation models contain similar maps that are used in the evaluation of losses. On the left side of the following figure, the ground acceleration map of event 9719 of our R-Plus® system is shown. This event has a magnitude of 7.18 and is one of the more than 13,500 possible earthquakes that our R-Plus® system includes. It can be observed that the occurrence of events such as that of September 19th 2017 was already contemplated in our system.

On the right hand side of Figure 2, we present the intensity estimation that we performed once the main characteristics of the event were known. These characteristics are magnitude, hypocentral localization and orientation of the rupture plane. The figure shows that there is a substantial correspondence between the estimated and the recorded accelerations, which gives us confidence in the methods we are using to estimate ground motion.

References:

- USGS (<https://earthquake.usgs.gov/earthquakes/>)
- SSN (<http://www.ssn.unam.mx/>)
- Mapeo Colaborativo 19s (<https://www.google.com/maps>)

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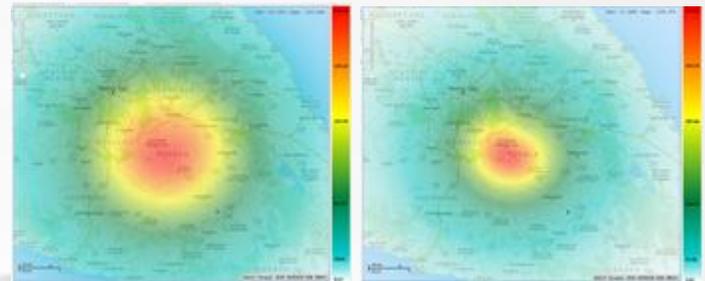


Figure 2. Ground acceleration maps. Left: event 9719 of R-Plus®; right: updated footprint, once the main event characteristics were known

From the former comparisons we can conclude that estimated intensities are similar to those recorded, with a maximum of around 300 cm/s² in the epicentral area.

Losses in Mexico City

Around 40 buildings were reported as collapsed in Mexico City. The following figure shows, on the left-hand side, the location of those buildings and on the right-hand side the buildings that, according to our R-Plus® system, should have shown considerable damage during this event. Both maps include in the background the information about ground period, which is a measure of the softness of the soil of the city, also considered in our R-Plus® system. Areas with a grey shade represent zones with periods of 0.5 to 1.0 seconds, also known as transition zones.

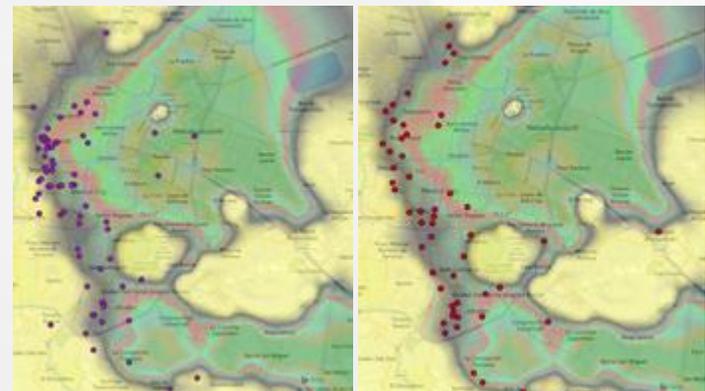


Figure 3. Maps of actual collapses (left) and estimated considerable losses (right), estimated using the R-Plus® system and a portfolio of buildings representative of that of the insurance sector.

In these maps, the coincidence between reported and modeled (estimated) damages is noteworthy, concentrated in the western side of the city, on the transition zone and the shallow portions of the lake. The first conclusion in this regard is that the characteristics of the earthquake -its peculiar frequency content- caused a high-amplitude ground motion below many of the buildings with around 5 stories in that area. The details of this behavior will surely be analyzed in the following months.