# Relevant aspects of the seismic hazard in Colima, Mexico

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ABSTRACT

Perform probabilistic assessment of seismic hazard (PSHA) is a fundamental activity that offer valuable information to the seismic risk management of cities. In the present work some relevant aspects about a recent analysis about the seismic hazard of Colima, Mexico are mentioned.

## *A. Introduction*

The state of Colima is located aside of the Pacific Ocean and about of one third of the total perimeter of this state of Mexico is delimited by the sea. In this region the interaction of tectonic plates that are in a subduction process below the Continental Plate, produces significant earthquakes. In 2003 an important earthquake generates significant damage in the region [1]. For this reason, in the present document some relevant aspects of the preliminary results of a PSHA of Colima in development are included.

## *B. Seismicity in Colima*

The seismicity related to the subduction process that generate the major part of the earthquakes that affect to the Colima state can be considered between moderate and high. As a reference of the kind of earthquakes that affect to the Colima state, it is possible to mention some recent earthquakes: a) Colima earthquake of 31 October 2007; b) Tecomán, Mexico earthquake of 22 of January 2003 with magnitude Mw=7.4 (2003) [1]. The earthquake of October had a magnitude equal to 5.1, but it trigger a Peak Ground Acceleration (PGA) of 1368 gals in a station located to 37 km from the epicenter (Figure 1). The Tecomán earthquake generated important damage in the towns of Tecomán and Armería, and it left 21 persons dead.

Figure 2 shows some of the different results that can be obtained after a seismic record of the 2007 earthquake was processed: a) the accelerogram of the original seismic record, b) the Fourier Spectrum of the original seismic record, c) the seismic record corrected of accelerations, d) the Fourier Spectra of the seismic record corrected, e) the diagram of velocities versus time and the diagram of displacement versus time. At the same time it is possible to observe in Figure 3 the different response spectra related to the same seismic record corrected.

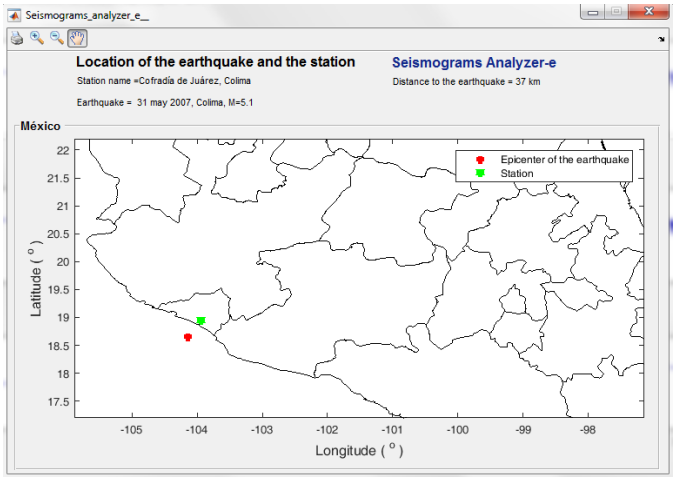


Figure 1. Location of the station Cofradía de Juárez, Colima, and the epicenter of the earthquake of magnitude 5.1 that occurred on 31 may 2007 [2].

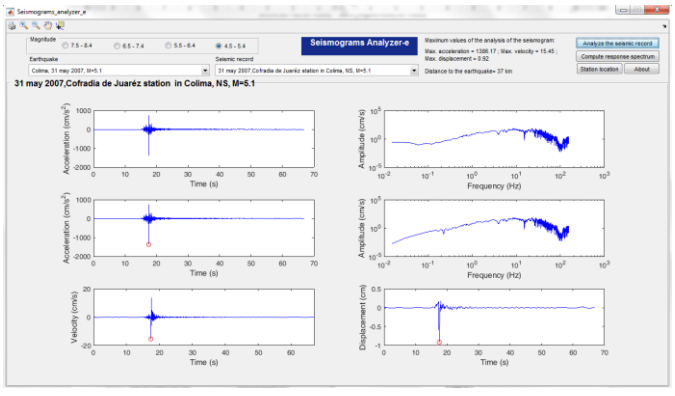


Figure 2. Graph of the original seismic record and graphs related to the corrected seismic record [2].

In the present work a PSHA has been performed in order to determine the seismic hazard of Colima. A particular contribution of the present research is the fact that the effect of local sites has been considered in the assessment of the seismic hazard.

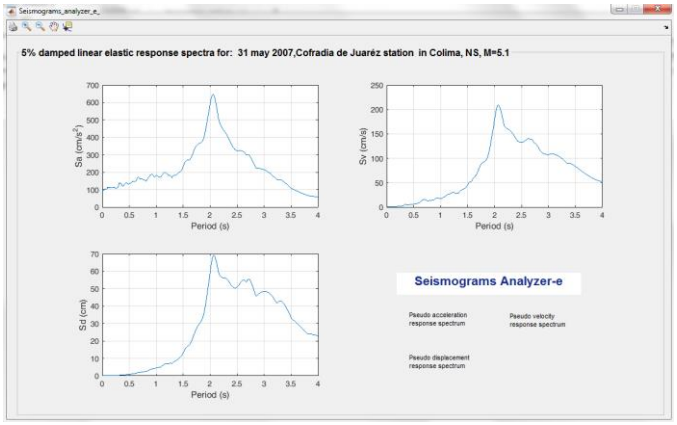


Figure 3. Response spectra related to the seismic record of the component North-South obtained in the Cofradía de Juárez Colima station, during the earthquake of magnitude 5.1 occurred on 31 may 2007 [2].

### *C. Probabilistic seismic hazard assessment in Colima*

In order to perform the PSHA for Colima the computer code CRISIS2015 was applied [3, 4]. Originally, 43 seismic sources were considered to analyze the seismic hazard in Colima. According to the results only 14 seismic sources have a contribution to the seismic hazard of the city of Colima (Fig. 4).

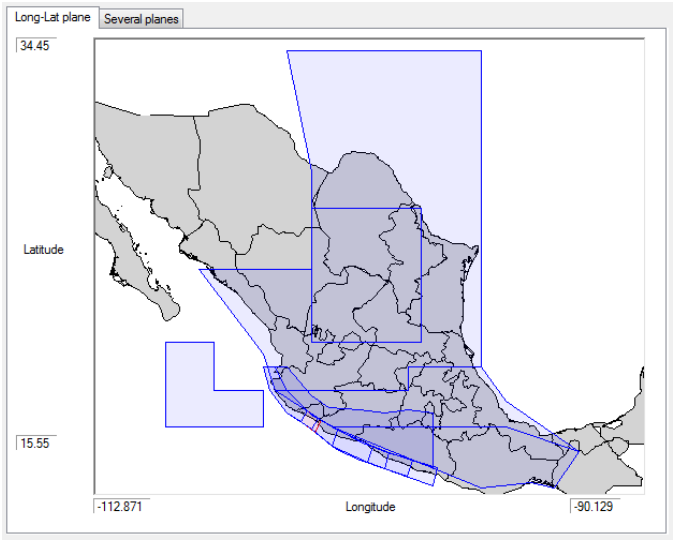


Fig. 4. Fourteen seismic sources that contribute to the seismic hazard of Colima (image of a screen of CRISIS2015 where the seismic hazard of Colima has been computed).

Figure 5 shows the seismic hazard curve of the city of Colima for a rock site. According to this curve, in a rock site of the city of Colima the intensity of 292 gals has a return period of 475 years.

On the other hand, exist evidence that confirm the importance of consider the site response effects as a part of a seismic hazard assessment. In the case of Colima recent studies have been oriented to determine the importance of site response effects in significant cities of Colima [5]. Therefore, with the purpose of consider local site effect in the assessment of the seismic hazard of the city of Colima amplification factors were considered in the present work. According to Gutierrez and colleagues [6], it is possible to expect amplification factors until 6 in some regions of the city of Colima. Therefore, this value was considered in the assessment of the seismic hazard of the city of Colima applying CRISIS2015. Fig. 5 shows the seismic hazard curve for a soil site of the city of Colima. According to this curve, in a soil site in the city of Colima with important levels of amplification the intensity that has a return period of 475 years can reach a value of 385 gals.

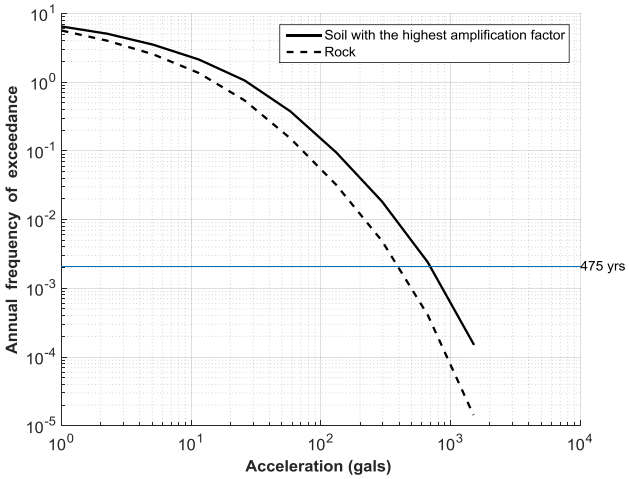


Fig. 5. Seismic hazard curves of the city of Colima, for a rock site and for a soil with important local site effects, computed by CRISIS2015.

### *D. Conclusion and Future Enhancement*

As a preliminary conclusion it is possible to highlight that according to the preliminary results, it is very important to take into account the local site effects in the assessment of the seismic hazard of the city of Colima. At the same time has been programed to continue with the analysis of the seismic hazard of the city Colima, considering additional data and different computation to the considered until now.

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