Special report Tehuantepec Earthquake (2017-09-07 M 8.2)
National Seismological Service, UNAM

General information

On September 7, 2017, the National Seismological Service recorded an earthquake of magnitude 8.2, in the Gulf of Tehuantepec, 133 km southeast of Pijijiapan, Chiapas. The earthquake, registered at 23:49:18 hours (04:49 UTM), was felt in the south and center of the country. The epicenter was located in 14.85 Latitude and -94.11 Longitude with a depth of 58 km (Figure 1).

Figure 1. Epicenter of the September 7, 2017 Earthquake

In Figure 2, the records from some wide band seismological stations, can be observed.

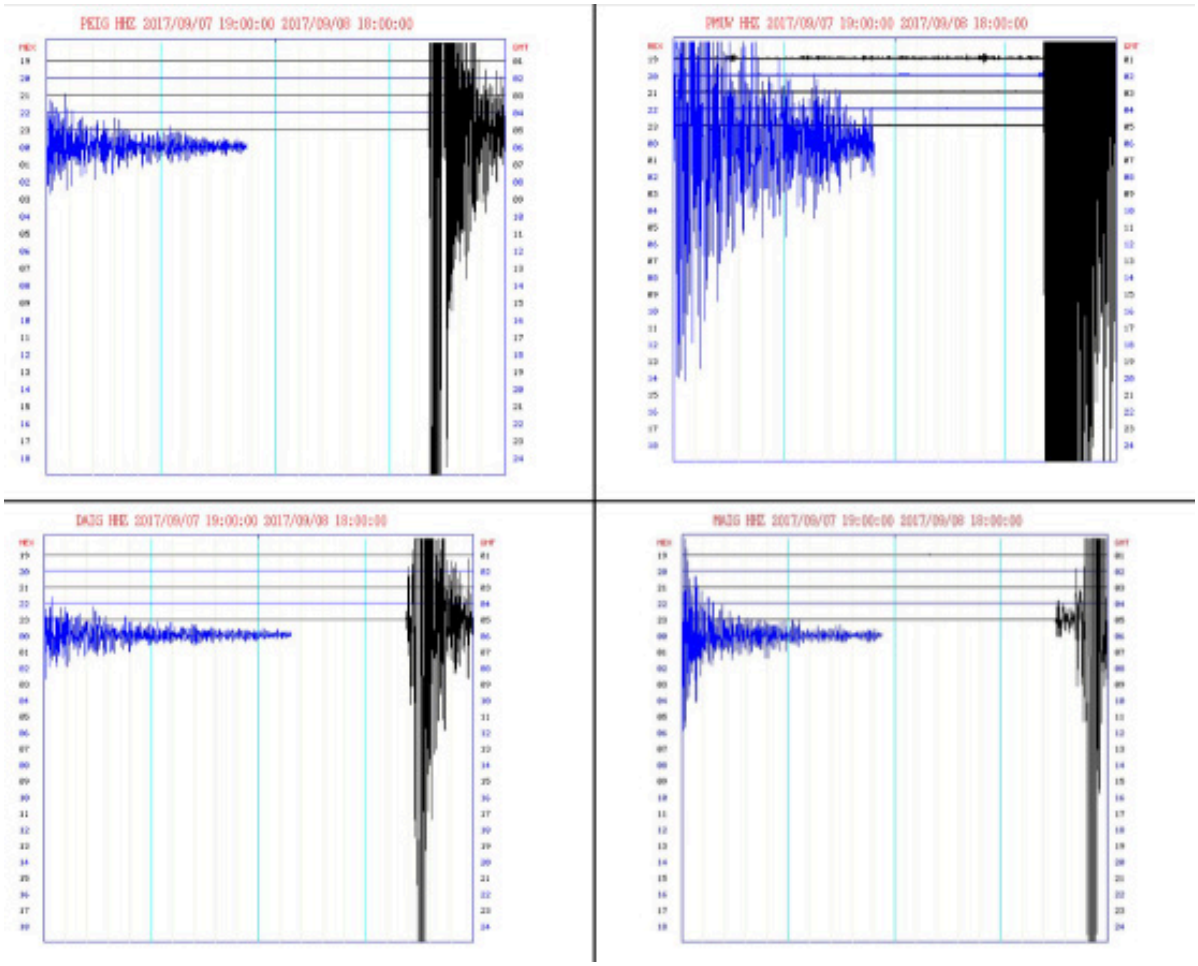


Figure 2. Seismic records in wide band stations of the National Seismological Service on September 7, 2017

The focal mechanism of the earthquake is that of a normal fault (rumbo=311, echado=84.4, displacement=-94.7), as seen in Figure 3, which is characteristic of an intra-plate earthquake, in the region of the Cocos Plate subduction under the North American plate. 928 aftershocks were registered until 11:00, September 10, distributed over the Gulf of Tehuantepec. In Figure 4, the aftershocks until 13:00 of September 8, are displayed.

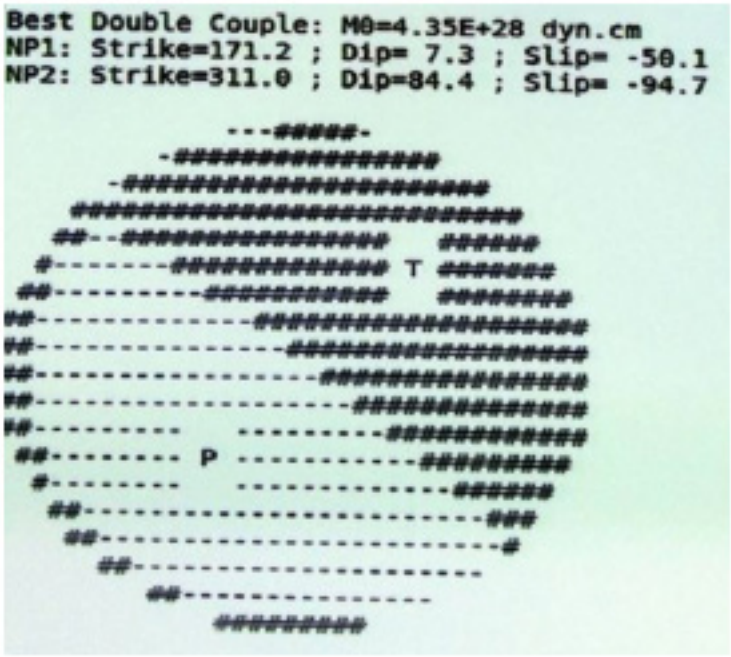


Figure 3. Focal mechanism of the earthquake

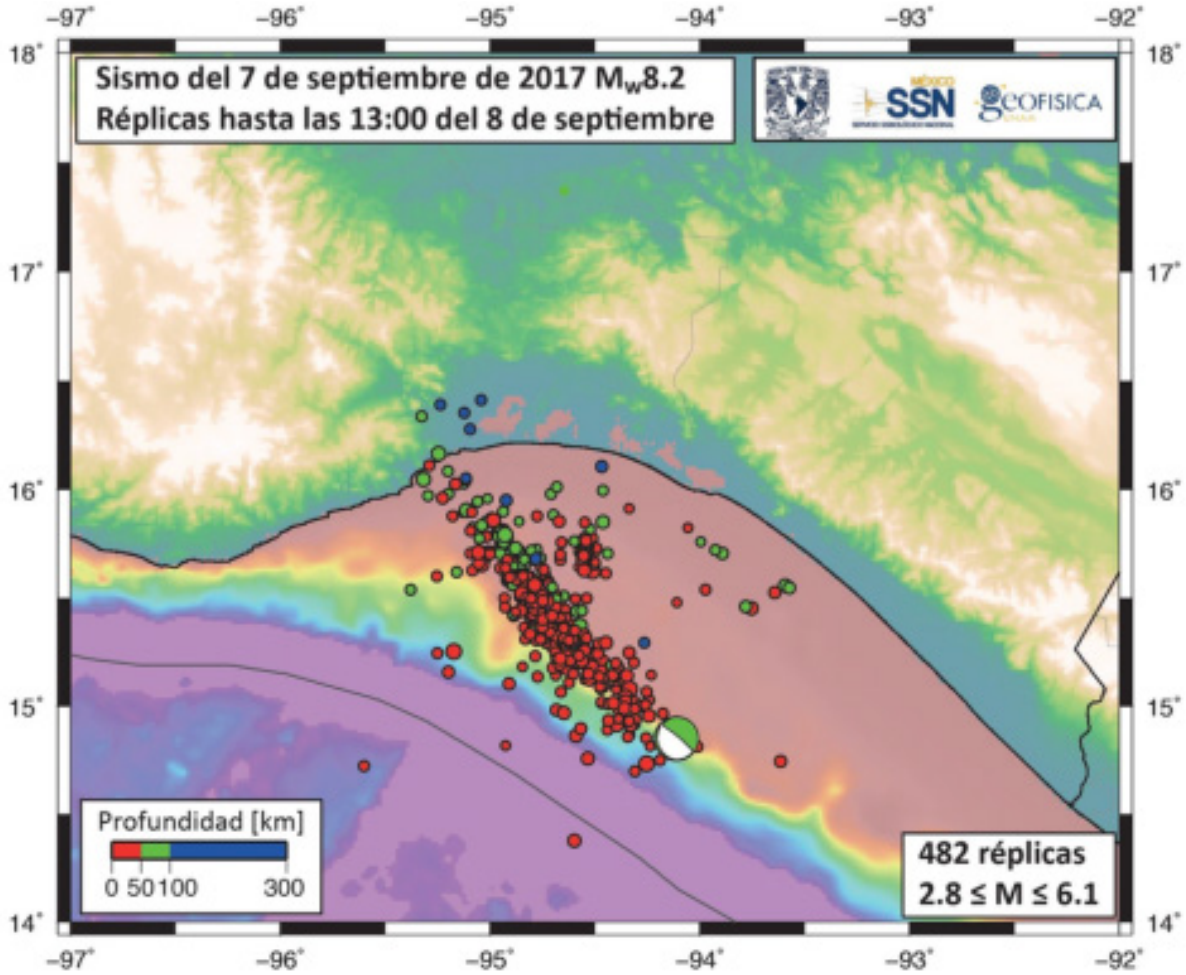


Figure 4. Aftershocks measured by the SSN. Until 13:00 of September 8, 482 aftershocks were registered, the maximum being magnitude 6.1. The shallow aftershocks are shown in red, with depths less than 50 km; depths between 50 and 100 km are displayed in green;

those with depths greater than 100 km are depicted in green. The main shock (M8.2) is denoted by its focal mechanism.

Figure 5 shows the intensity map, estimated by the Institute of Engineering, UNAM. The maximum intensities are near the Gulf of Tehuantepec, therefore the cities nearby were the most affected.

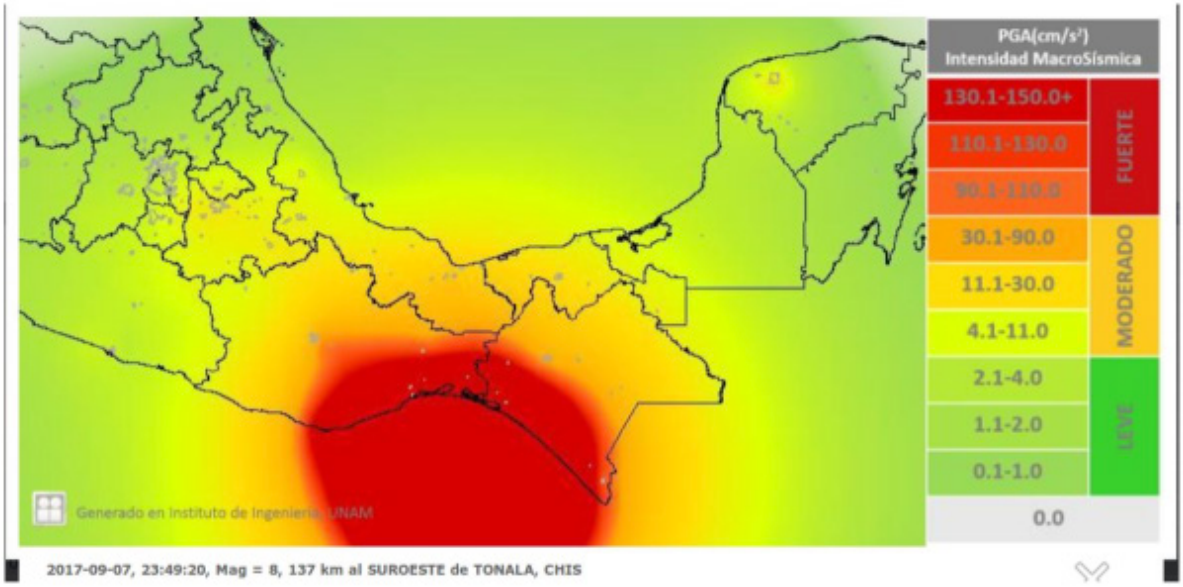
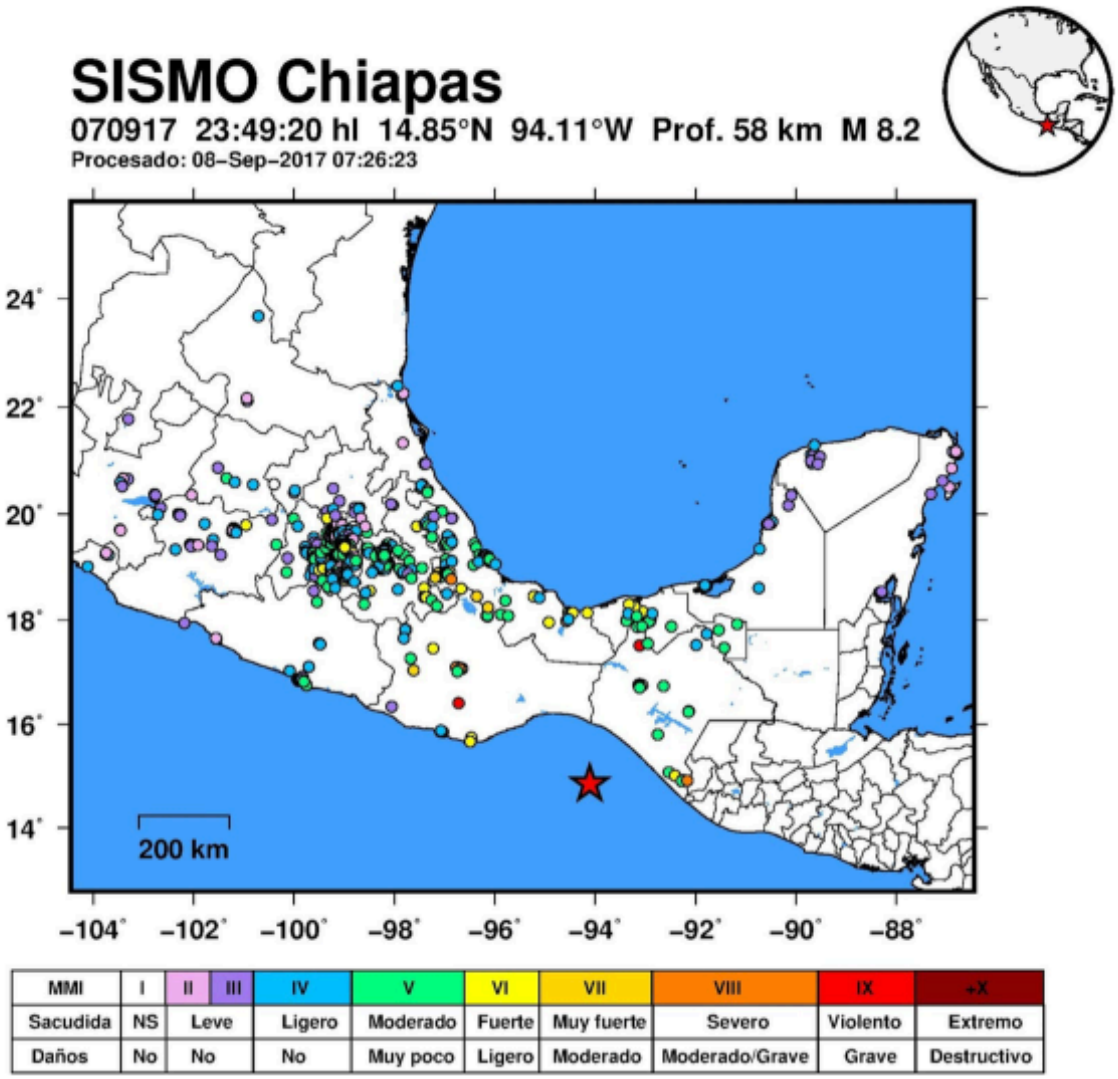


Figure 5. Intensity map of the September 7, 2017 Earthquake

Figure 6 shows the map of macro-seismic intensities, generated from the community survey distributed online (more than 3000 answers), and developed by the School of Earth Sciences of the National Autonomous University of Nueva Leon, in its website http://fct.uanl.mx/sintio-un-sismo/. The color scale represents the different intensities as felt by the population.



MMI	I	II	III	IV	V	VI	VII	VIII	IX	+X
Sacudida	NS	Leve		Ligero	Moderado	Fuerte	Muy fuerte	Severo	Violento	Extremo
Daños	No	No		No	Muy poco	Ligero	Moderado	Moderado/Grave	Grave	Destructivo

Figure 6. Intensity map developed by the National Autonomous University of Nueva Leon, based on the survey applied online to the community.

Figure 7 displays the rupture areas of earthquakes with magnitude greater or equal to 8 that have occurred in Mexico from 1900 to 2017. The red star with the number 1, is the September 7, 2017 Earthquake, of magnitude 8.2; the area enclosed by the red line with number 2, is the M8.2 June 3rd, 1932 Earthquake. The yellow area, with number 3, represents the M8.0 September 19, 1985 Michoacan Earthquake. The white area, with number 4, stands for the M8.0 October 9, 1995 Earthquake. The number 5 represents the estimated location of the January 15, 1931 Earthquake in Oaxaca.

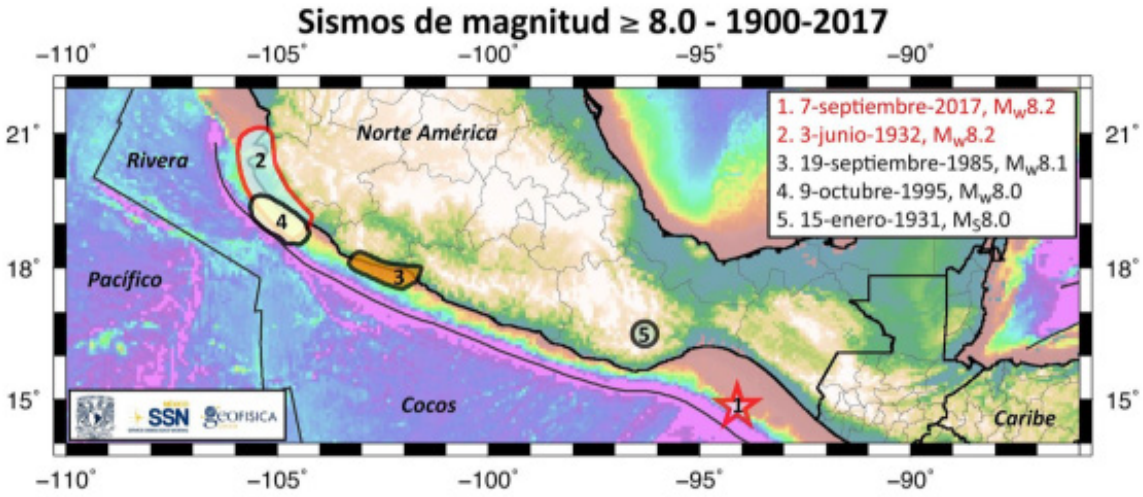


Figure 7. Earthquakes with magnitude equal or larger than 8.0 in Mexico, from 1900 to 2017.

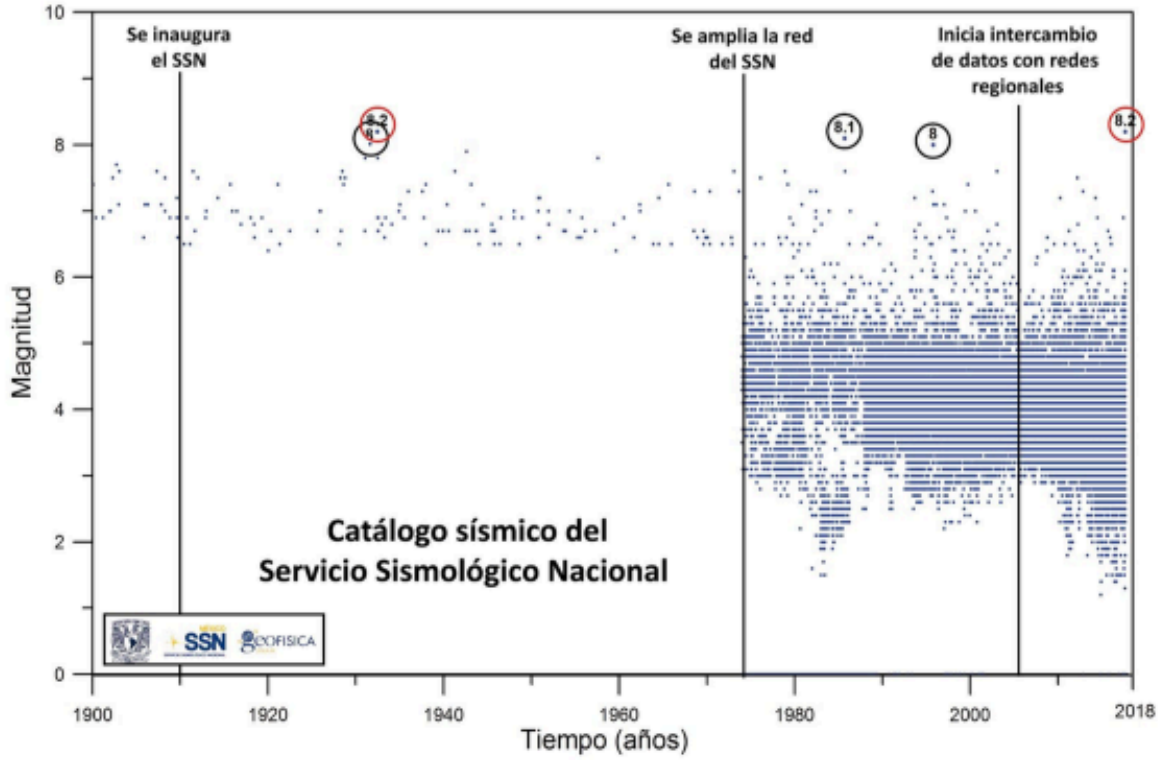


Figure 8. Earthquake catalog from 1900 to date, in Mexico

In Figure 8, the earthquake catalog from 1900 up to date can be seen. The horizontal axis shows the years and the vertical axis, the magnitude. It can be clearly seen that from the expansion of the Seismic Network of the National Seismological Service in the 70s, it was possible to detect and locate a larger number of earthquakes of magnitude 6 or less. Since the National Seismological Service started interchanging data with regional seismic networks, it was possible to detect more small earthquakes. In Figure 8, the circles represent the 5 earthquakes of magnitude greater than 8 that have been registered since seismic instrumentation was installed. These 5 earthquakes are also seen in Figure 7. Those in red, represent the earthquakes of magnitude 8.2, including the September 7, 2017.

History of Chiapas and Oaxaca seismicity

Mexico is located in a high seismicity area due to the interaction of 5 tectonic plates: North American, Cocos, Pacific, Rivera and Caribbean (Figure 9). For this reasons, the occurrence of earthquakes is very common, and the National Seismological Service reports 40 seismic movements daily in average.

Chiapas and Oaxaca are the states more seismic-prone in Mexico. The origin of this seismicity is the convergent contact between two important plates: North American and Cocos.

At the beginning of the 20th century, three shallow earthquakes of magnitude greater than 7, took place in the coast of Guatemala and Chiapas. The first (M7.5), near the border between Mexico and Guatemala occurred on April 19, 1902; the second (M7.7), occurred on September 23, 1902 in the north coast of Chiapas, and the third (M7.6), on January 14, 1903 in the south coast of Chiapas.

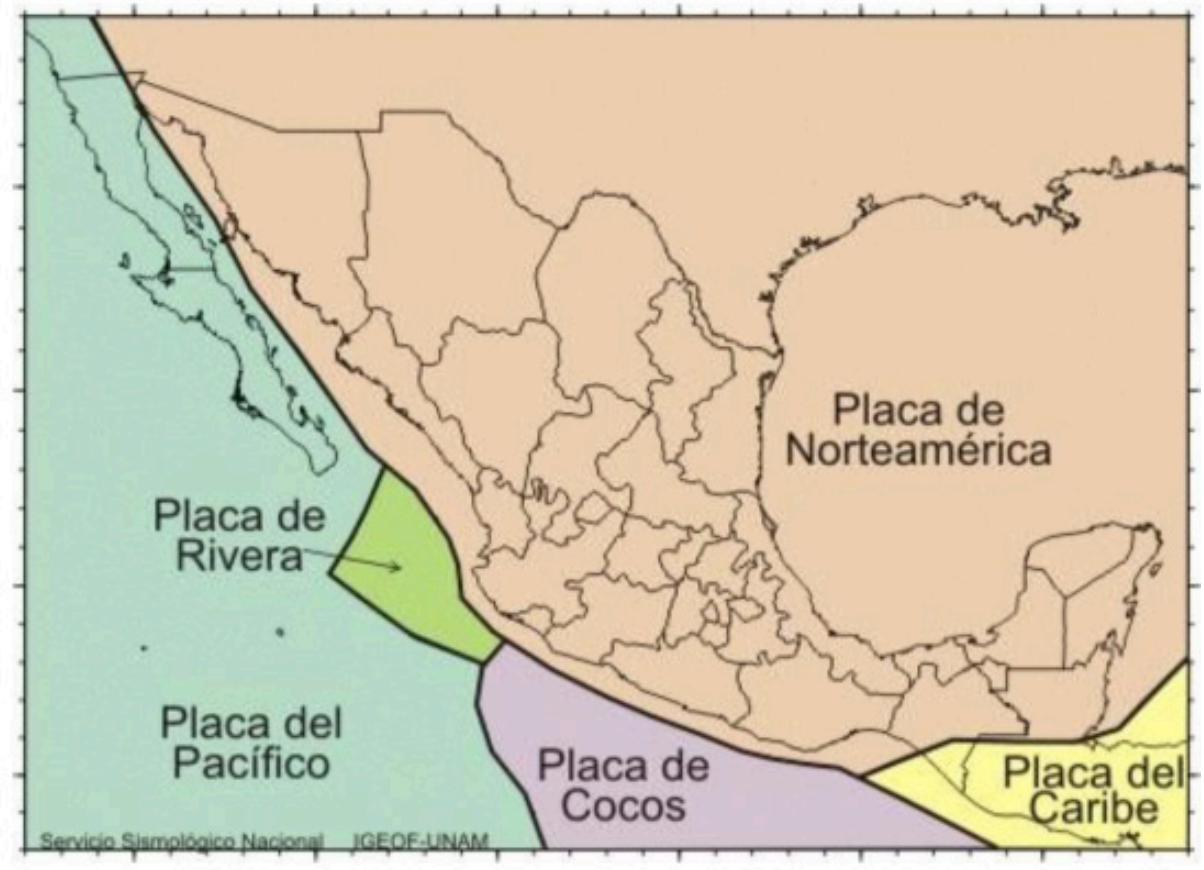


Figure 9. Tectonic plates in the Mexican Republic

Since then, three large earthquakes have happened, on April 29, 1970 (M7.3), on September 10, 1993 (M7.2) and November 7, 2012 (M7.3). All of them in the south of Chiapas. In Oaxaca, a M8.0 occurred on January 14, 1931.

Aftershocks

When there is a high intensity main shock, the rocks near the rupture zone undergo a rearrangement that generates a series of smaller shocks in the area, called aftershocks. The number of aftershocks can vary from a few to hundreds of events in the days or weeks following the main shock. The occurrence of earthquakes in Chiapas and Oaxaca is very common. So far, there are no scientific techniques in any part of the world to predict an

earthquake nor its magnitude. It is important to be aware of these natural phenomena to mitigate the seismic risk in case of a big earthquake.

NOTE: The information in this report has been generated by the National Seismological Service on September 10, 2017. It should not be considered as definite. The National Seismological Service continues receiving information and seismic data, to adjust, renew and improve the precision of the seismic parameters, such as magnitude, epicenter and depth.