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SEISMICITY IN THE GULF OF CALIFORNIA REGION RECORDED BY THE NARS-BAJA ARRAY: PRELIMINARY RESULTS

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ABSTRACT

We report the epicentral coordinates of small to moderate size earthquakes recorded by the broadband stations of the Network of Autonomously Recording Seismographs (NARS)-Baja array between April 2002 and August 2006. The NARS-Baja array consists of 19 stations installed in Baja California and Sonora, Mexico. We initially searched for earthquakes reported by the PDE in the Gulf of California region for the period of interest and we found events with magnitudes ranging between 3.2mb and 6.7Ms. Then we relocated those events using P and S wave arrivals recorded by the NARS-Baja array and the RESBAN array (a broadband seismic array with additional stations located in Sinaloa, Sonora and Baja California, Mexico). We found that most of the seismicity is distributed in the NW-SE direction along the axis of the Gulf of California, following a linear trend that steps in the NE direction near the Guaymas and Tepoca basins. We compared the epicentral locations reported in the PDE with the locations obtained using regional arrival times and we found that earthquakes with magnitudes in the range 3.2-5.0mb differ on the average by as much as 43 km. For the magnitude range between 5 and 6.7 the discrepancy is less, differing on the average by about 25 km. To evaluate the energy released by the earthquakes analyzed, we summed the seismic energy released by individual events dividing the region in bins of two degrees wide between latitudes 23ºN and 31ºN. We found that for the time period considered, most of the seismic energy was released in the middle part of the Gulf of California between 27ºN and 29ºN.

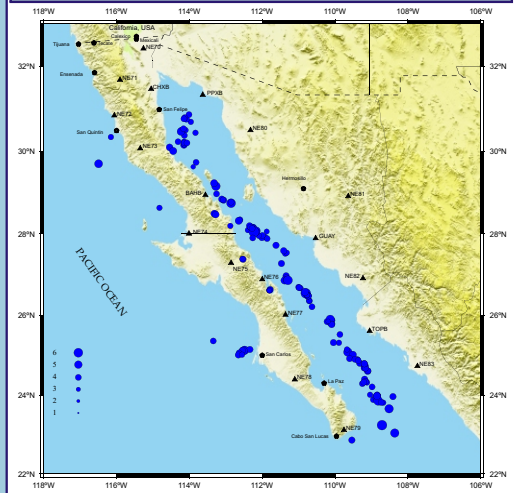

Figure 1) The map shows the distribution of the broadband stations (triangles) of the NARS-Baja array (NE70-NE83) and RESBAN array (EXCB, BAHB, PPXB, GUAY, TOPB) used to relocated earthquakes reported by PDE between April 2002 and August 2006. For events reported between 30ºN and 31ºN, we used the velocity model obtained by Nava and Brune (1982) [BSSA, 72, 1195-1206]. For events between 28ºN and 30ºN we used a velocity model based on surface wave analysis (López-Pineda et al., 2007 [JGR, 112, B04308]), and for earthquakes on the southern end, the velocity structure proposed by Fabriol et al. (1999) [J.Volc.Geotherm. Res., 93,75-92] for the Tortuga rift.

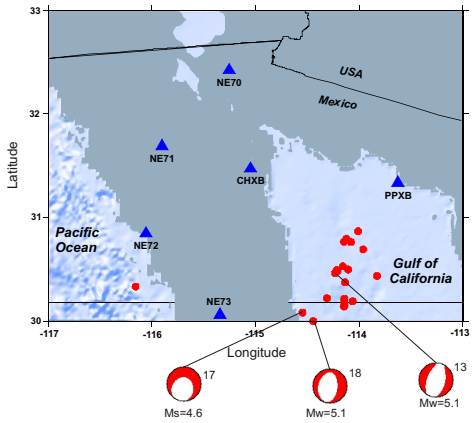

Figure 2) We calculated the seismic energy released by earthquakes located in the Gulf of California using the Gutenberg and Richter magnitude-energy relation (log E=5.8+2.4mb). Between the latitudes 29ºN and 31ºN the energy released by the earthquakes reported in the 52 months analyzed sums 3.4 X 10^{18} ergs. The magnitude of the events in this latitude bin varies between 3.2mb and 5.2Mw. Event 18 is a normal fault with a focal plane striking in the N-S direction.

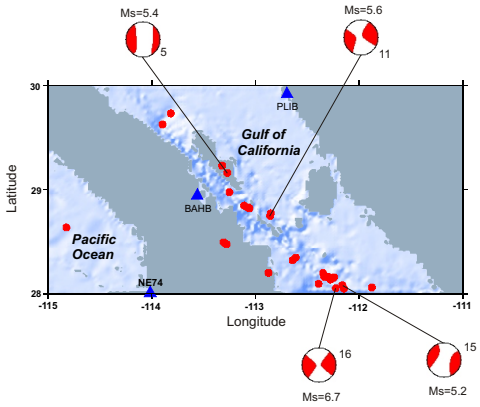

Figure 3) Near Bahia de los Angeles, where the station BAHB is located, the seismicity is confined on the western side of the Gulf. The events located between 27ºN and 29ºN have magnitudes between 3.4mb and 6.7Ms and the energy release sums 7.7 X 10^{21} ergs. Event 16(Ms6.7) is the biggest earthquakes recorded during the time period considered. Strike-slip earthquakes (event 11 and 16) have a fault plane oriented in NW-SE direction.

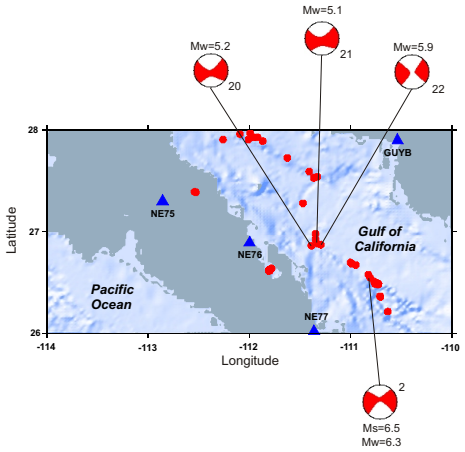

Figure 4) South of Guaymas basin, between 25ºN and 27ºN the events reported have magnitudes between 3.3mb and 6.5Ms and the seismic energy released by all the earthquakes in the bin sums 2.6 X 10^{21} ergs. It is also worth noticing that in general the epicenters correlate well with the main bathymetric features and the focal mechanism of the bigger events are strike-slip type. Event 2, for instance, have a fault plane in the NW-SE direction (φ=311) and dips 81.

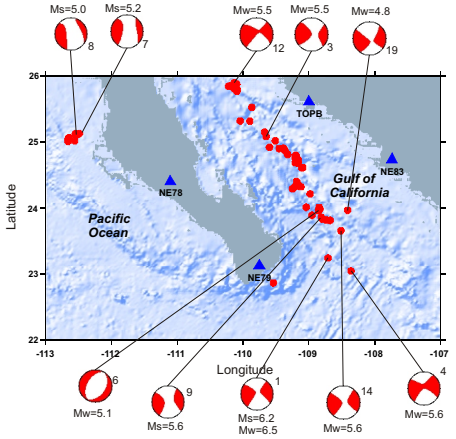

Figure 5) In the southern end of the Gulf, near Alarcón basin, the seismicity increases. Between 23ºN and 25ºN the events have magnitudes between 3.5mb and 6.5Mw and the energy release sums 2.6 X 10^{21} ergs. As in the other regions, most epicenters tend to align in the NW-SE direction and the bigger earthquakes (events 1, 4, 14, 12 with Mw magnitudes 6.5, 5.6, 5.6 and 5.5, respectively) tend to have strike-slip mechanisms. Event 1, the biggest, has a focal plane almost vertical (δ=79) and strike 306 degrees.

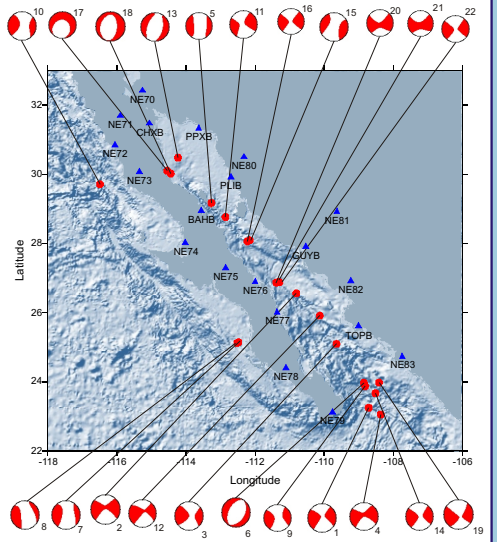

Figure 6) The map shows the bigger earthquakes of the sample (4.8-6.6 Mw). The focal mechanisms were taken from the Global CMT Catalog. Notice that most of these events are located near Guaymas and Alarcon basins.

SUMMARY

We used regional arrival times of P and S waves recorded at stations of the NARS-Baja and RESBAN arrays to relocate earthquakes that occurred in the Gulf of California, Mexico between April, 2002 and August 2006. The epicentral locations obtained with the regional arrays differ from those reported by PDE by as much as 40 km for events with mb< 5.0 and as much as 25 km for bigger events (5.1-6.5Mw). We also found that the seismicity tends to increase towards the south of the Gulf and that most of the seismic energy released in the analyzed period of 52 months occurred near the Guaymas basin, between 27ºN and 29ºN. The focal mechanisms of the bigger events, as reported by the Global CMT catalog are mostly strike-slip type.

ACKNOWLEDMENTS

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