STUDY OF RECENT SEISMIC ACTIVITY IN THE BASINS AND TRANSFORM FAULTS OF THE GULF OF CALIFORNIA.

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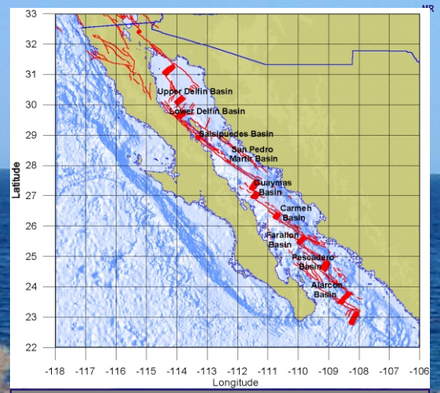

Figure 1) Tectonic setting of the Gulf of California. Faults and basins were taken from MARGINS.

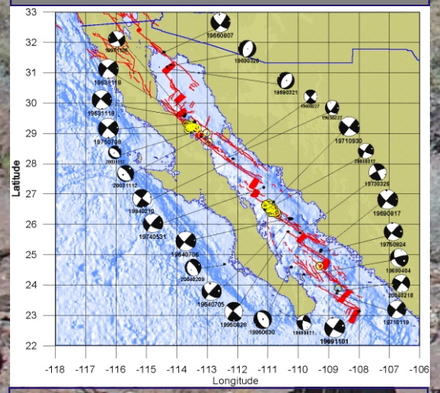

Figure 3) Published fault plane solution of events located along the transform faults and basins of the Gulf of California (see Table 1).

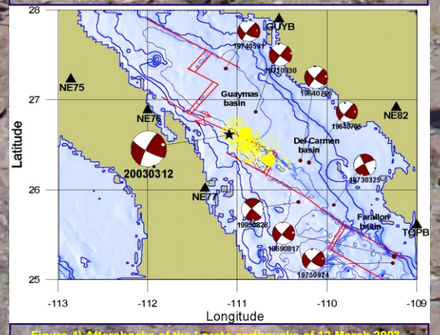

Figure 4) Aftershocks of the Loreto earthquake of 12 March 2003 magnitude 6.4 earthquake. Star is the location of the Loreto earthquake it is alsb shown its fault plane solution. Yellow empty circles are the aftershocks.

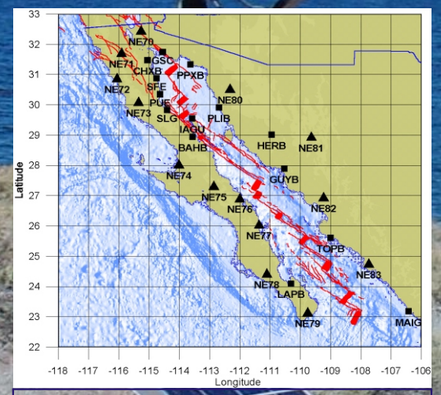

Figure 2) Broad band seismic station deployed around the Gulf of California. Full triangles are the NARS-Baja stations. Squares are the CICESE RESBAN stations.

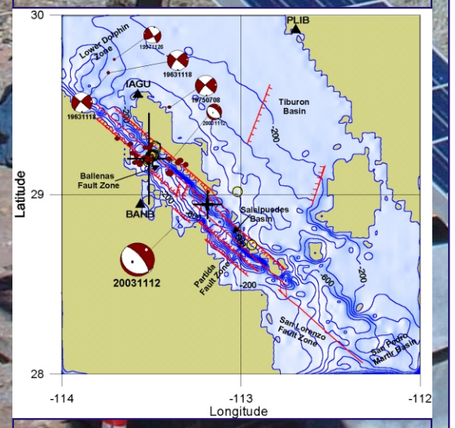

Figure 5) Aftershocks of the Bahia event of 12 November 2003 magnitude 5.7 earthquake. Triangles are the seismic stations. Red circles are aftershocks with location errors of less than 2 km. Vertical and horizontal black lines shows maximum and minimum errors locations of aftershocks depicted with empty circles. It is also shown the fault plane solution of the Bahia event as well as the fault plane solution of the foreshock of magnitude 3.3 small beach ball.

Abstract

Deployment of broad-band seismic stations around the Gulf of California since 2002 have greatly improved the location of small to medium size earthquakes. This is the result of a joint project between CICESE, Utrecht University and Caltech. This network consistsof the RESBAN-CICESE network (eight broad band stations and five short period stations) and the NARS-Baja network from the Utrecht University (fourteen broad-band stations). For example, an earthquake of magnitude 5.6 occurred on November 12, 2003 and it was located east of the Bahia de los Angeles town at 29.034° Latitude North and 113.251° Longitude West, over the North Salsipuedes Basin. Fault geometry was obtained with the body waveform modeling using Herrmann (1987) reflectivity code. A preliminary fault geometry with a strike of 44°4°, a dip of 35° 5°, a slip of -40° 5° and a focal depth of 52 km was calculated. Seismic station BAHB located at about 22 km west of the epicenter showed a clear triangular source time function of 4.5 seconds. Over the southern end of the Gulf of California occurred bursts of earthquake activity on January 13 and 14, 2004 with events in the magnitude range from 3.5 to 4.4 over the Pescadero Basin at the average geographic coordinates of 24.634° 0.011° Latitude North and 109.296° 0.10° Longitude West. Again on February 9, 2004 another earthquake swarms occurred with events in the magnitude range from 4.0 to 5.3. Preliminary locations of the events indicated that the events are located in the Pescadero Basin. Focal depths of the earthquakes are uncertain. We will show the best-located events that we have been able to locate with the RESBAN-NARS-Baja network of the Gulf of California.

Gulf of California	Earthquake (Date)	Mw	Mo (N-m)	Lat	Lon	Source Time Function	Duration (sec)	Stress drop (bars)	Depth (Km)	Focal Mechanism
Northern sector:										
Wagner basin	1966/08/07[4]			31.700	-114.400					36/ 70 / -21
	1969/03/20	5.7	0.48e18	31.320	-114.180	Triangular*	6.0	5	6	23/ 43 / 273
	1969/03/21	5.6	0.33e18	31.250	-114.310	Triangular*	3.5	18	3	35/ 43 / 274
Delfin basin	1963/11/18[5]			29.700	-113.700					317/ 90 /-161
	1997/11/26	5.3	0.128e18	29.754	-113.708	Triangular[1]	3.0	37	5.0	330/ 85 / 165
Canal de ballenas	1975/07/08	6.5	5.9e18	29.490	-113.400	Triple source triangular*	12	8	1-7	132/ 93 / 170
	1963/11/18	6.4	4.6e18	29.680	-113.740	Trapezoid-triangular*	6.0	49	7.0	131/111/ 167
Salsipuedes basin	2003/11/12	5.3		29.185	-113.400	Triangular	0.3			116/ 34 /-106
	2003/11/12	5.4	1.5e17	29.017	-113.181	Parabolic	5	5	5	320/ 70 / -80
Middle sector:										
St Pedro Martir basin	1965/02/27	5.9	1.1e18	28.380	-112.270	Trapezoidal-triangular*	11	2	5	133/ 48/190
	1965/02/27			28.500	-112.100					42/ 90/ -9
Guaymas basin	1984/02/10	6.0	1.2e18	28.290	-112.140	Double source triangular*	8	5	6	127/ 96/182
	1974/05/31	6.3	3.8e18	27.360	-111.130	~Triangular*	12	5	3-5	123/ 65/169
Carmen basin	2003/03/12	6.4	4.6e18	26.615	-111.090	Triangular	6	49	5.0	117/ 79/168
	1995/08/28	6.2	3.0e18	25.800	-110.320	Complex[1]	4.4	82	14.0	222/ 78/ 0
	1971/09/30	6.5	6.7e18	26.880	-110.800	Triangular*	5	125	7.0	128/ 85/179
	1964/07/05	6.3	4.0e18	26.340	-110.210	~Trapezoidal*	12	5	--	128/ 58/175
Farallon basin	1964/07/06	6.5	7.8e18	26.320	-110.280	~Trapezoidal*	10	18	3.0	129/ 76/175
	1973/03/25	5.7	0.46e18	25.840	-109.930	Trapezoid*	4.5	12	9	153/ 94/190
South sector:										
Pescadero Basin	1975/09/24	6.0	1.6e18	25.200	-109.260	Trapezoid*	6	17	9	129/ 72/ 173
	1969/08/17	6.5	6.5e18	25.250	-109.240	Double source triangular*	10	15	10	129/ 76/ 175
La Paz	1995/06/30	6.0		24.688	-110.225[6]					327/ 39/ -92[7]
San Carlos	2004/02/09[8]	5.5		24.783	-112.421					177/ 26/ -59[8]
Tamayo Fracture Zone	1971/01/19	6.0	1.2e18	23.800	-108.730	Trapezoidal*	6	13	4	127/ 84/ 176
	2004/02/18	5.8		23.751	-108.808					306/ 82/-176
	1968/08/21			23.200	-110.600					283/ 69/-158

[1] Rebollar (2003) [3] Tanioka and Ruff (1997) *Goff et al(1987) [4]Molnar (1973) [5]NEIC. Focal mechanism is given by strike/dip/rake

Table 1) Source parameters of earthquakes located in the Gulf of California.

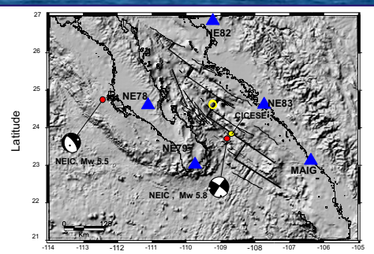

Figure 10) Map that show the tectonic features of the mouth of the Gulf of California. Empty yellow circles are our locations of the events of the earthquake swarm that occurred 13 January 2004. The largest event had a magnitude 4.5. Full yellow circle is our location of the event that occurred 18 February 2004 magnitude 5.8. Its fault plane solution was taken from NEIC. Red circle is the NEIC location. We also included the NEIC location and the fault plane solution of the 9 February 2004 magnitude 5.5 event that occurred in San Carlos.

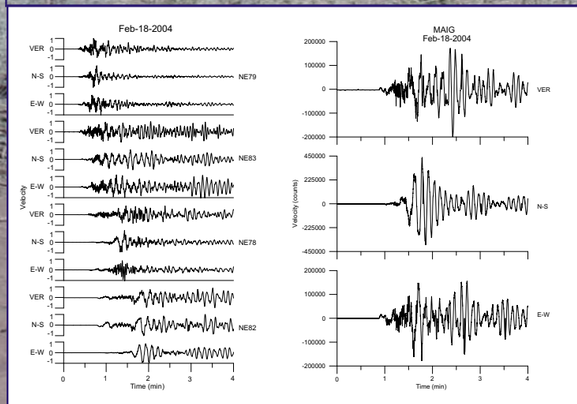

Figure 11) Velocity seismic records of the 18 February 2004 magnitude 5.8 recorded in NARS stations.

Figure 12) Velocity seismic records of the 18 February 2004 magnitude 5.8 recorded in the Mazatlan broad band station (MAIG).

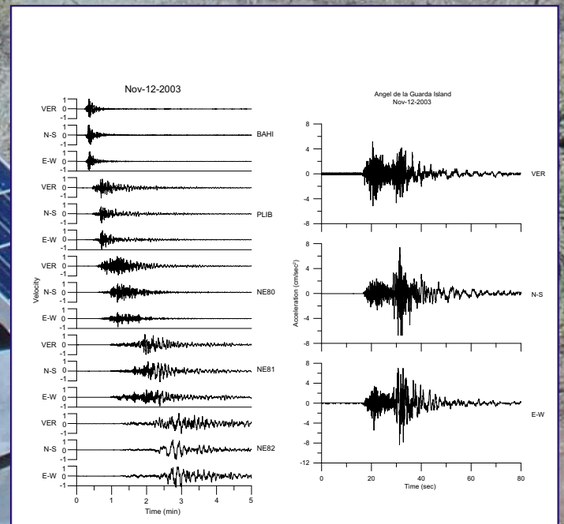

Figure 6) Velocity seismic records the closest stations (BAHI, PLIB, NE80, NE81 and NE82) of the Bahia event of 12 November 2003 magnitude 5.7 earthquake.

Figure 7) Accelerogram of 12 November 2003 magnitude 5.7 earthquake Bahia event recorded in the accelerograph of Bahia de los Angeles Isle (IAGU).

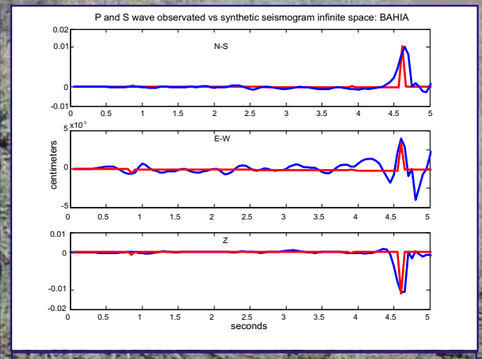

Figure 8) Synthetic (red) and observed (blue) displacement records of the magnitude 3.3 foreshock recorded in the BAHI broad-band station. It clearly shows a triangular source time function of 0.3 seconds.

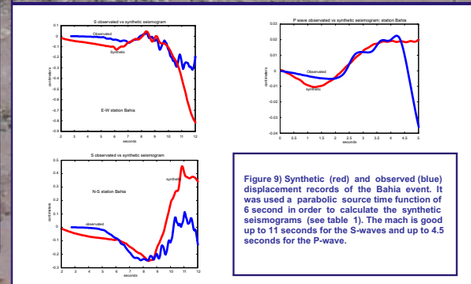

Figure 9) Synthetic (red) and observed (blue) displacement records of the Bahia event. It was used a parabolic source time function of 6 second in order to calculate the synthetic seismograms (see table 1). The mach is good up to 11 seconds for the S-waves and up to 4.5 seconds for the P-wave.