

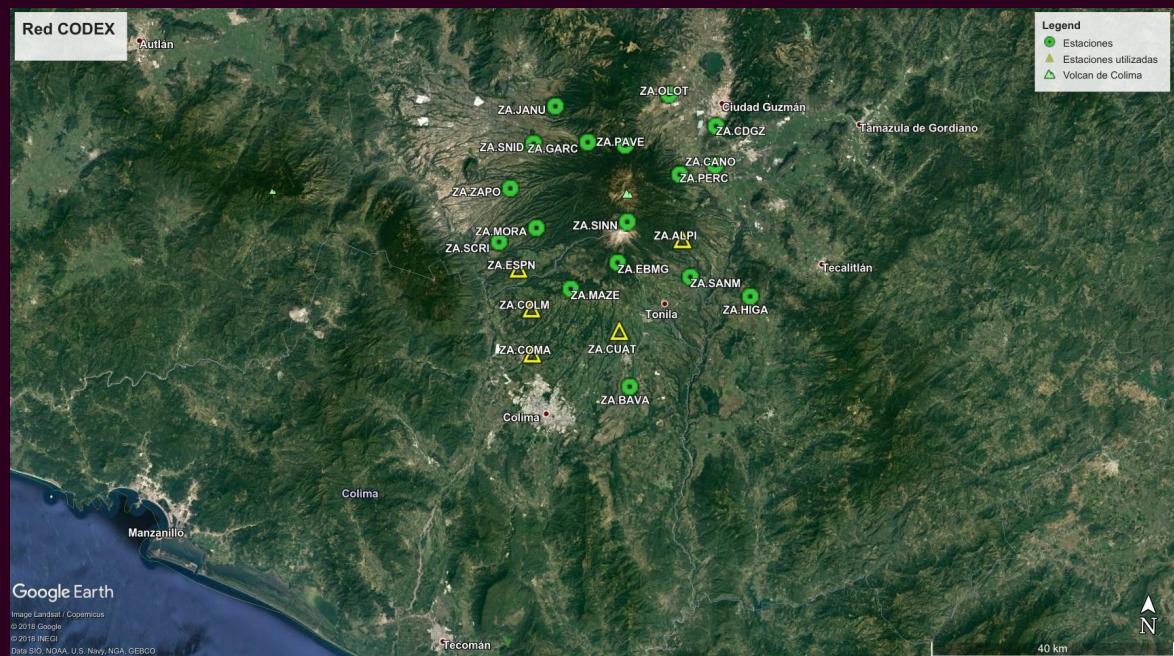


FACULTAD DE CIENCIAS
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Campus Juriquilla

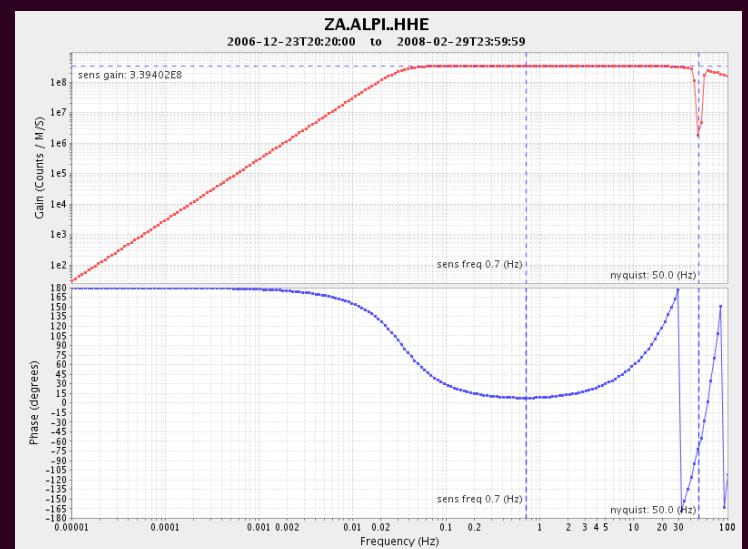
Universidad Nacional Autónoma de México
UMDI Facultad de Ciencias Juriquilla
Sismología I, 2018-2
Trabajo final
Martínez Valdés Judith Ivonne

CODEX

(Colima Volcano Deep Seismic Experiment)

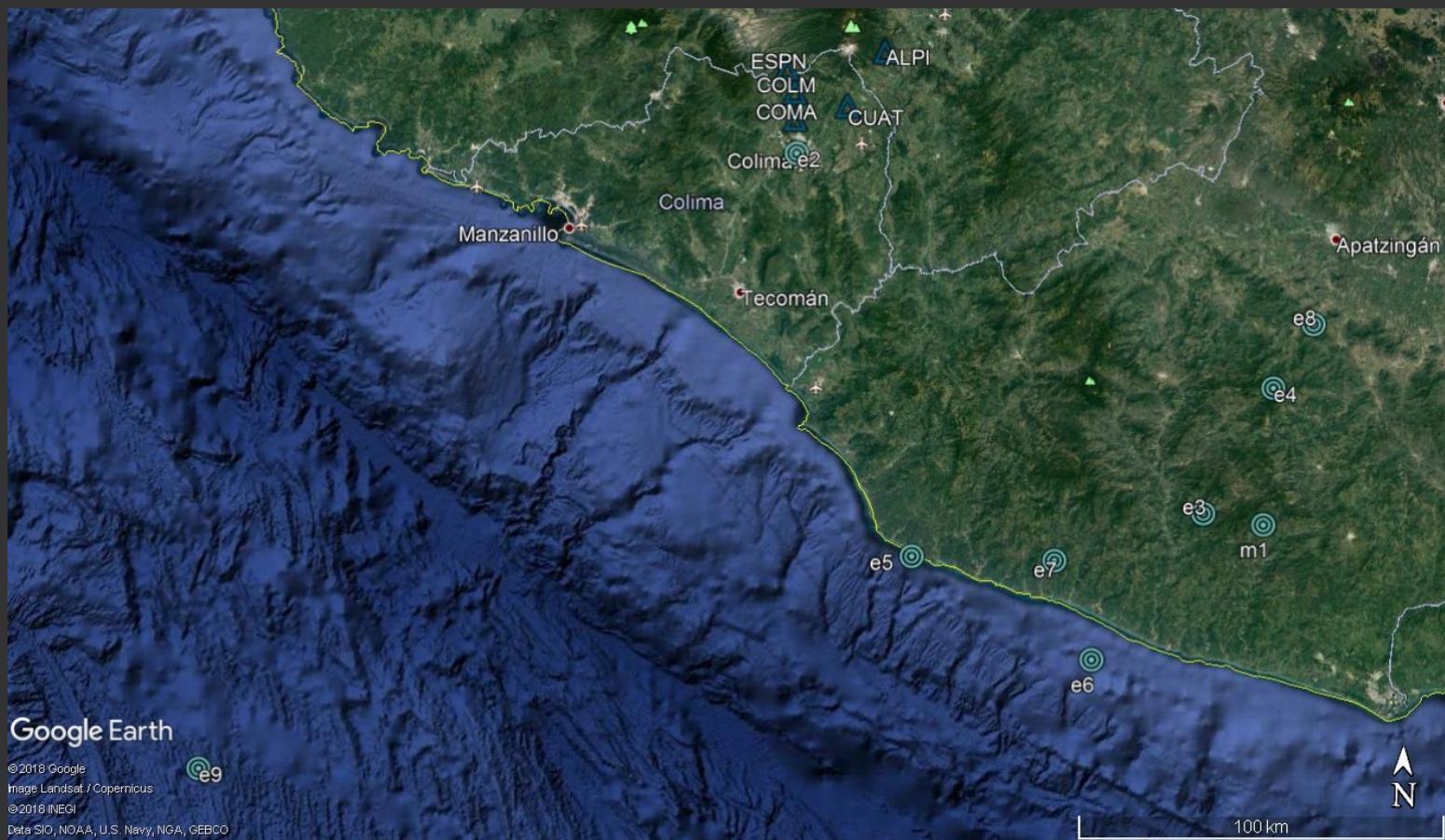


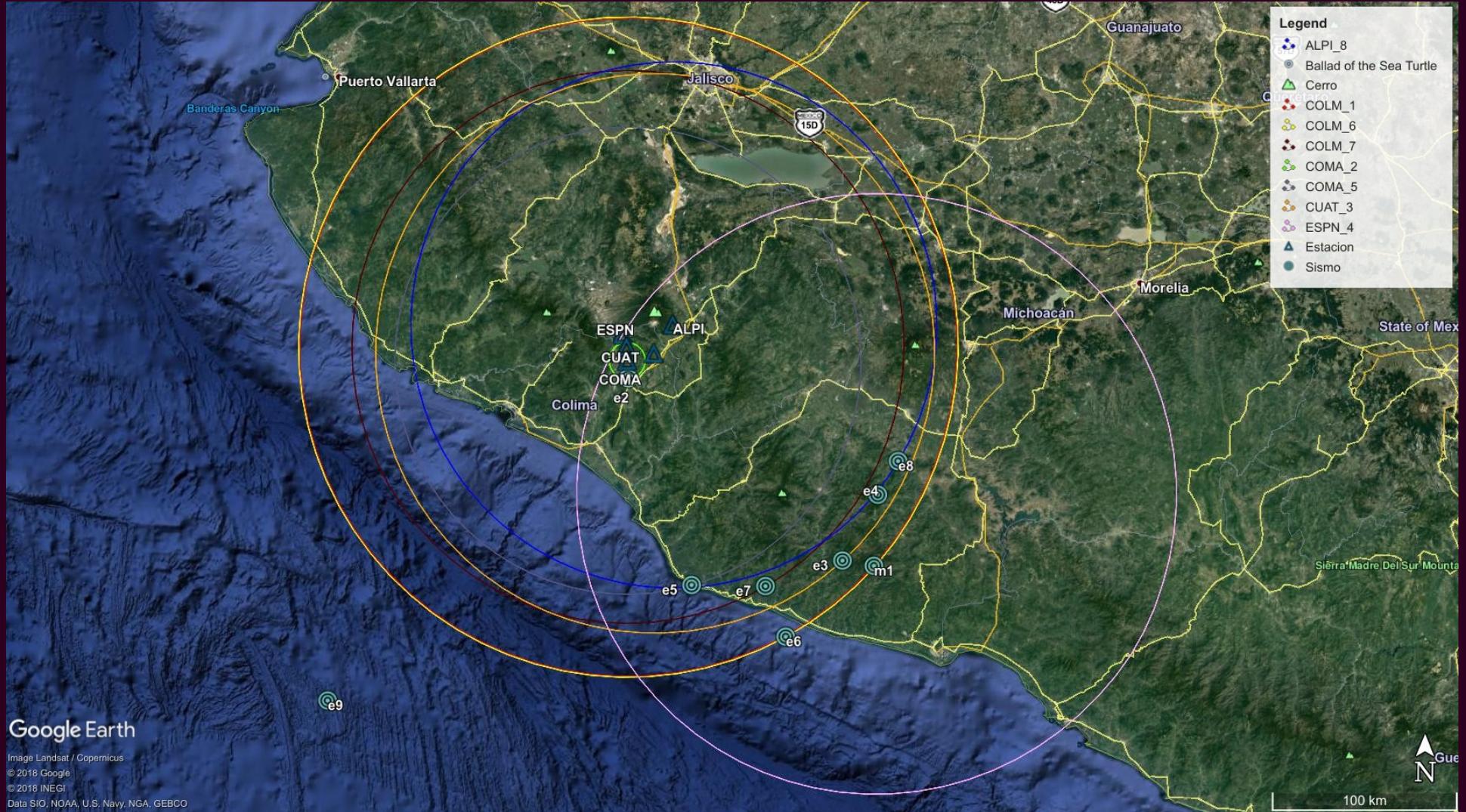
- 22 estaciones activas durante 2006-2008
- 5 utilizadas: ALPI, COLM, COMA, CUAT, ESPN
- Guralp CMG40T_30sec/Quanterra 330 Linear Phase Com



Fecha/Hora	Latitud	Longitud	Prof. (km)	Magnitud
2006/02/17,19:54	18.38	-102.51	23.74	5.3
2006/02/22,16:31	19.24	-103.74	21.36	4.5
2006/03/01,00:12	18.40	-102.67	38.1	4.5
2006/08/17,23:34	18.71	-102.50	64.45	4.9
2006/12/10,19:40	18.28	-103.41	0.49	4.9
2007/04/13,14:42	18.04	-102.95	2.24	5.8
2007/04/13,05:03	18.28	-103.05	4.25	4.5
2007/04/13,05:42	18.86	-102.40	3.64	6.3

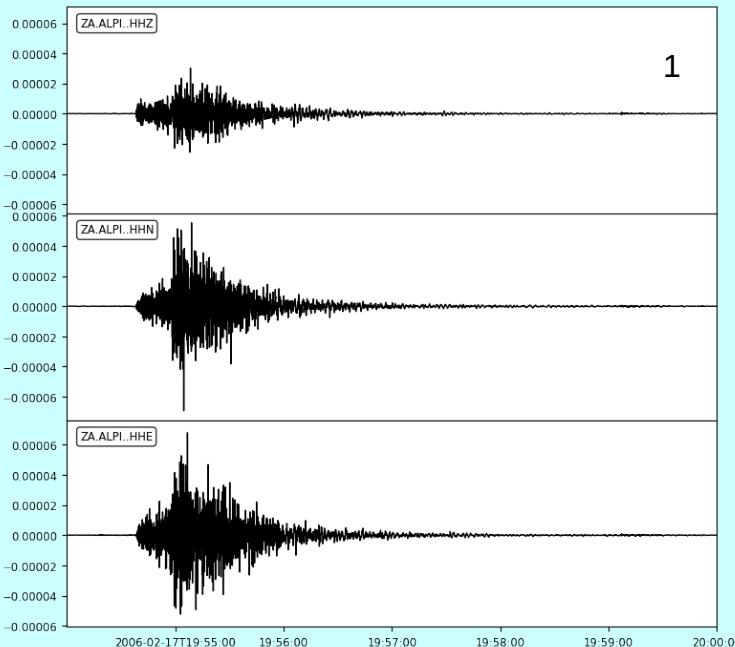
- 8 eventos en la zona SE, magnitudes >4.5





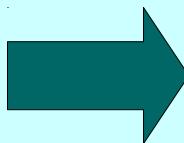
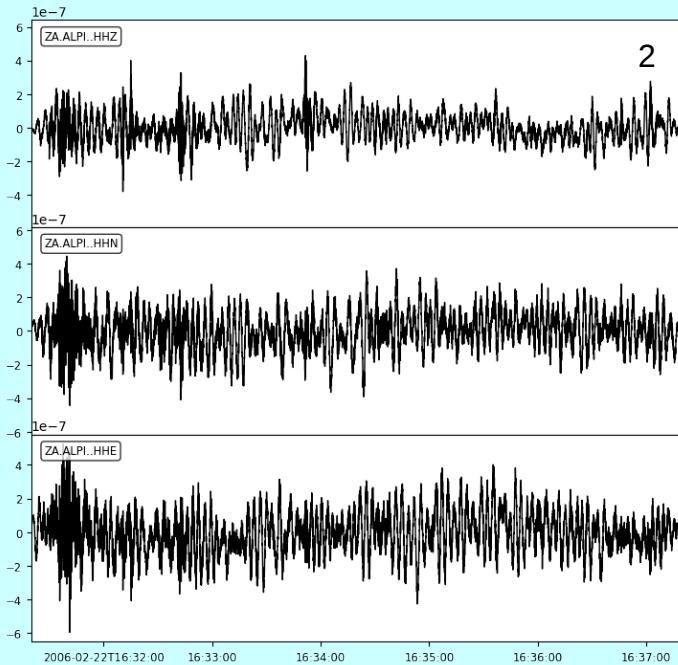
Estación	E1	d1	E2	d2	E3	d3	E4	d4	E5	d5	E6	d6	E7	d7	E8	d8
ALPI	19	152	7	56	17	136	16	128	17.5	140	20	160	-	-	18	144
COLM	21	168	3	24	18	144	17	136	15	120	21	168	18.5	148	19	152
COMA	19	152	1.2	9.6	15	120	17	136	15	120	20.5	164	17.5	140	-	-
CUAT	18	144	2.1	16.8	18	144	16.5	132	15.5	124	19	152	17	136	17	136
ESPN	20	160	2.5	20	19	152	18.5	148	16.5	132	20.5	164	19.5	156	19	152

2006-02-17T19:54:00.009998 - 2006-02-17T19:59:59.999998

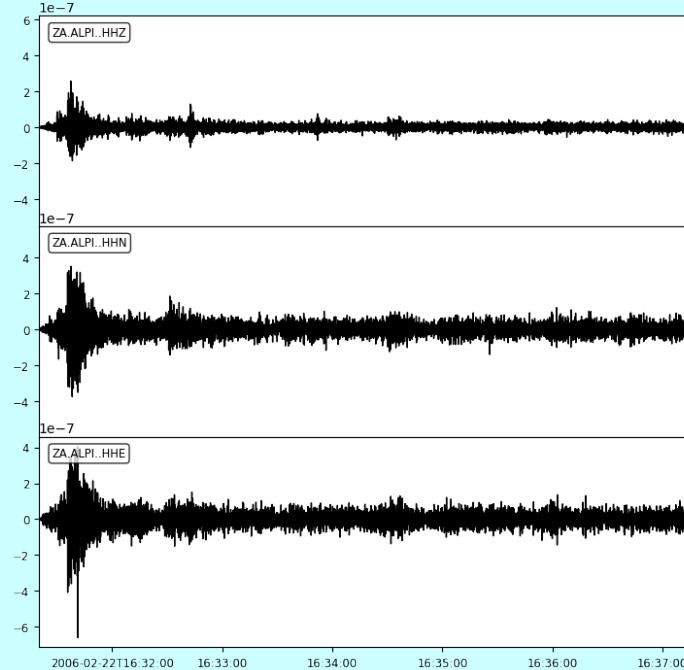


Eventos

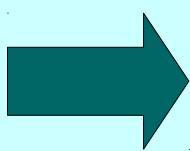
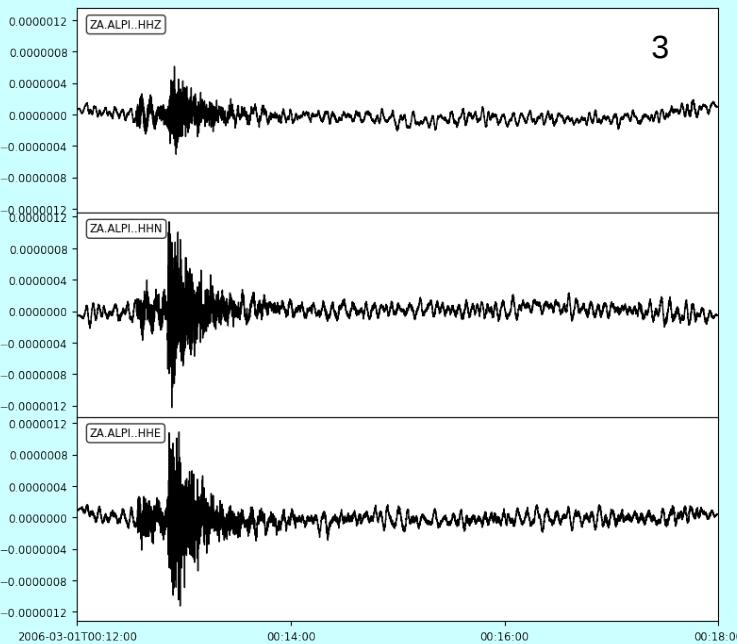
2006-02-22T16:31:20.000001 - 2006-02-22T16:37:19.990003



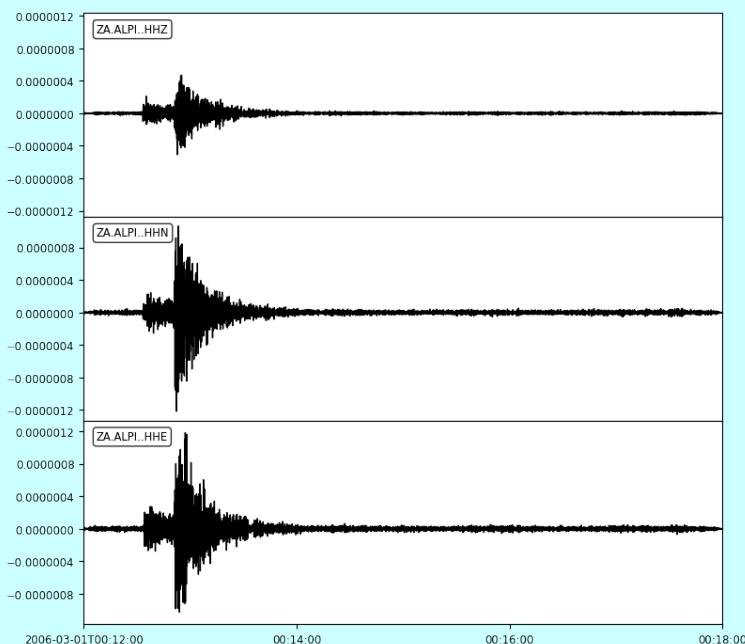
2006-02-22T16:31:20.000001 - 2006-02-22T16:37:19.990003



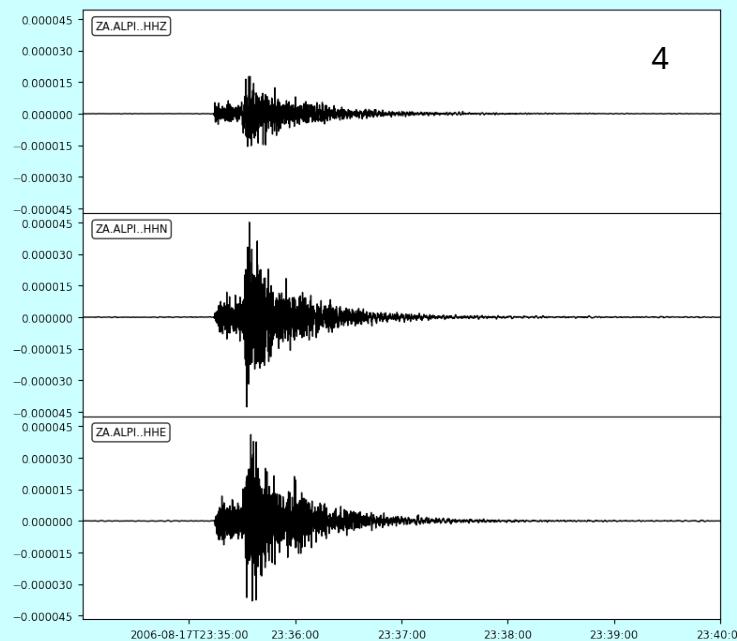
2006-03-01T00:12:00.000001 - 2006-03-01T00:18:00.000001



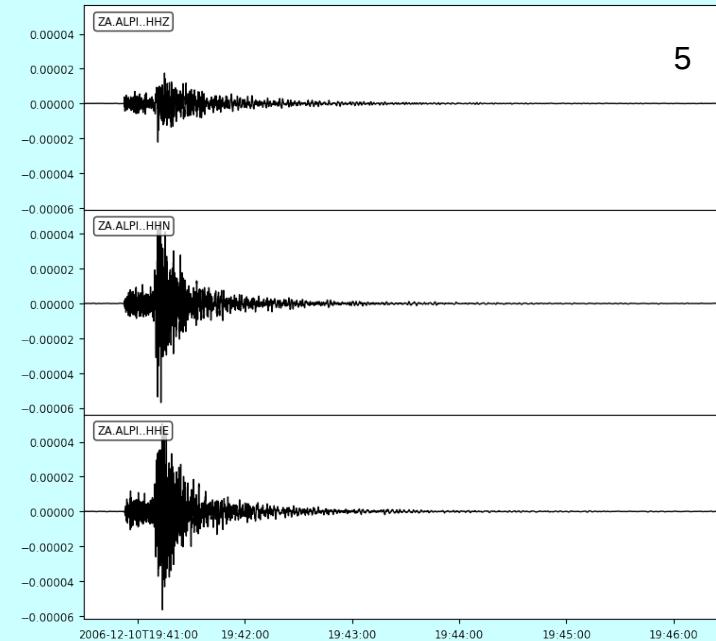
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2006-08-17T23:34:00.009995 - 2006-08-17T23:39:59.999995

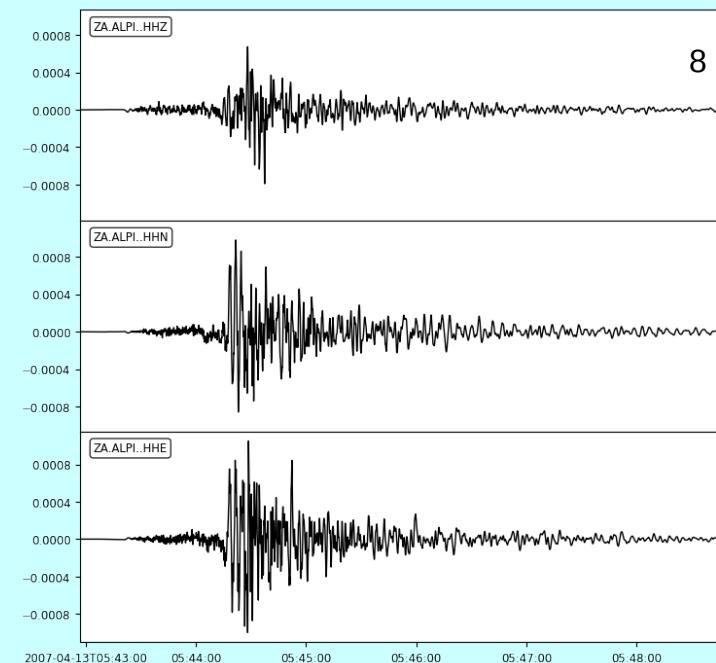
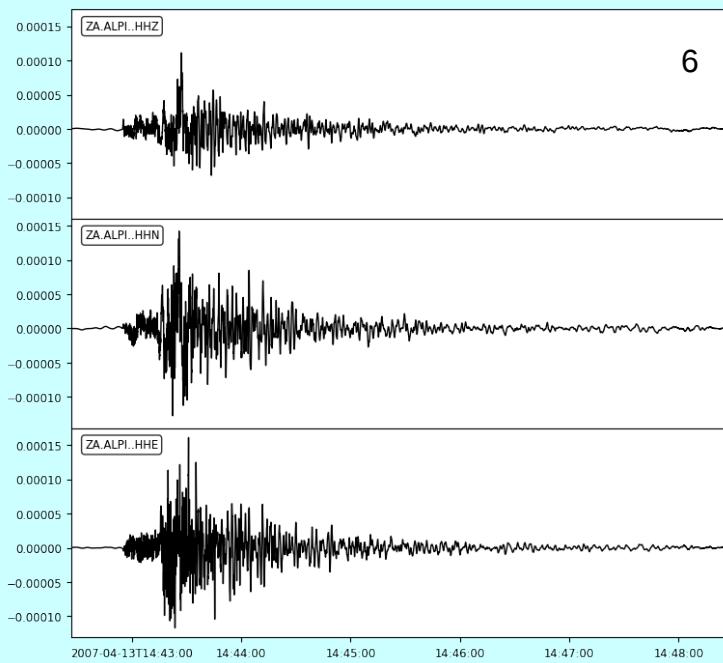


2006-12-10T19:40:30.009996 - 2006-12-10T19:46:29.999996



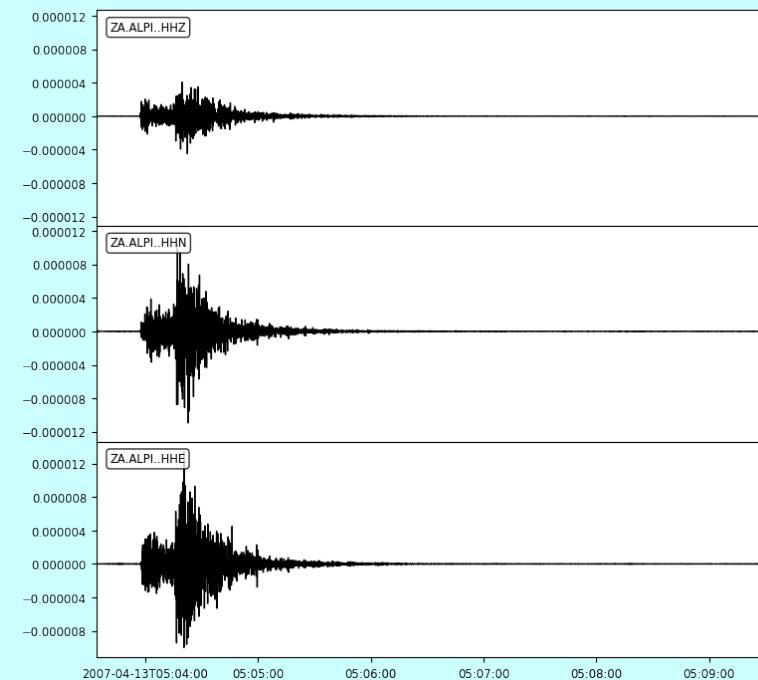
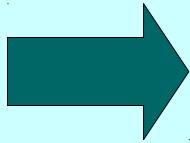
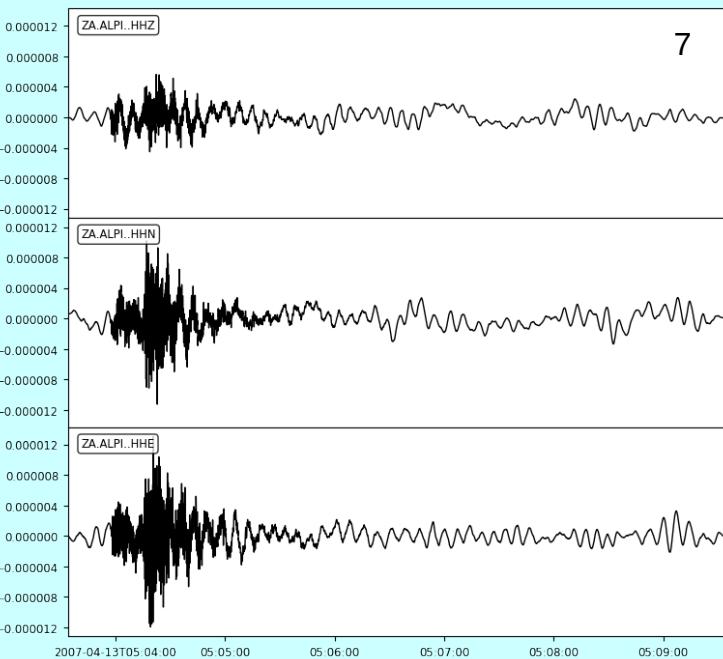
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2007-04-13T05:42:57.009998 - 2007-04-13T05:48:56.999998

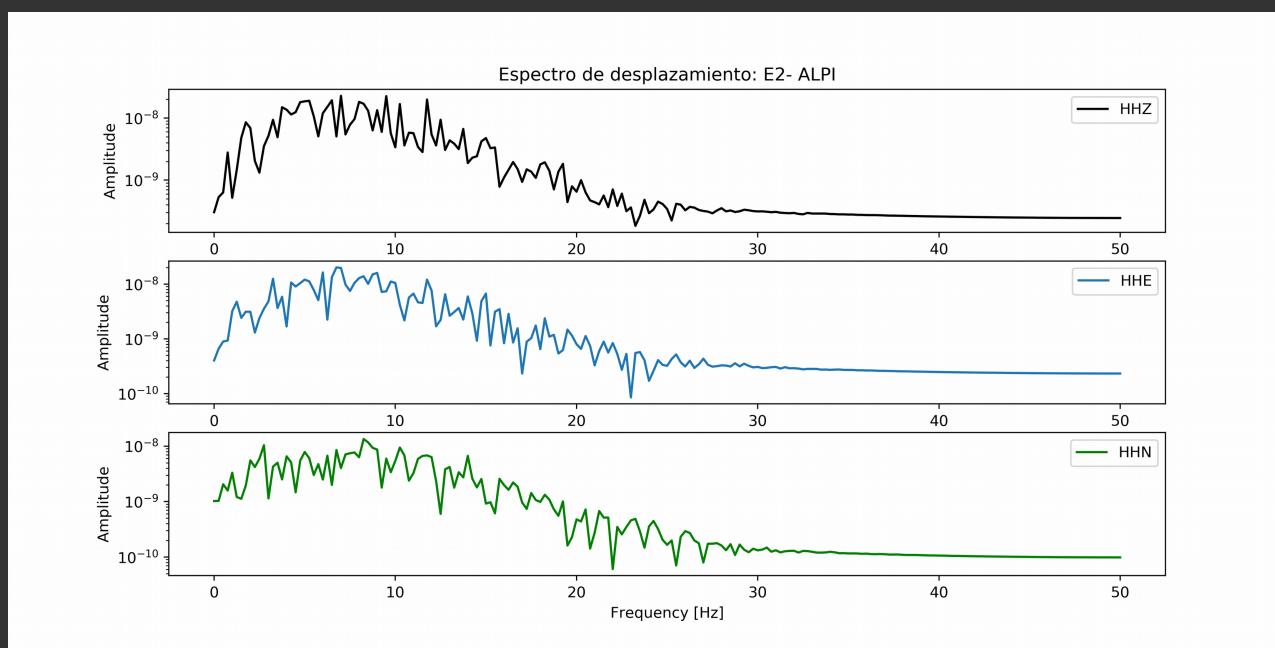
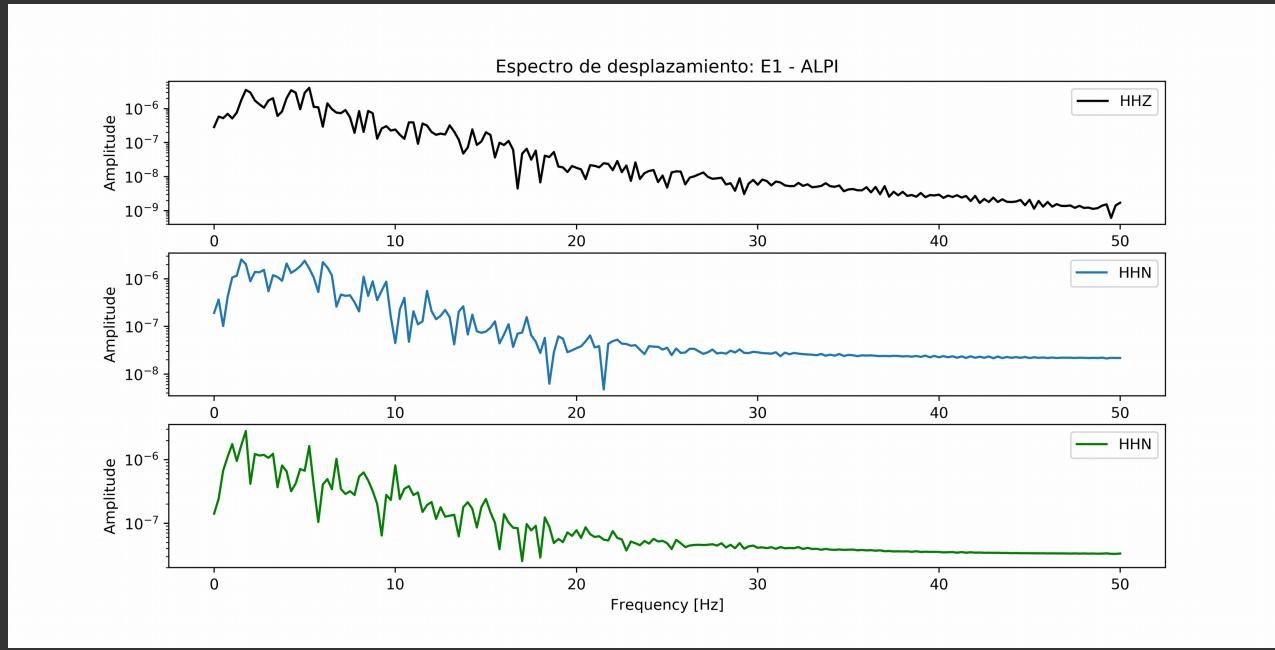


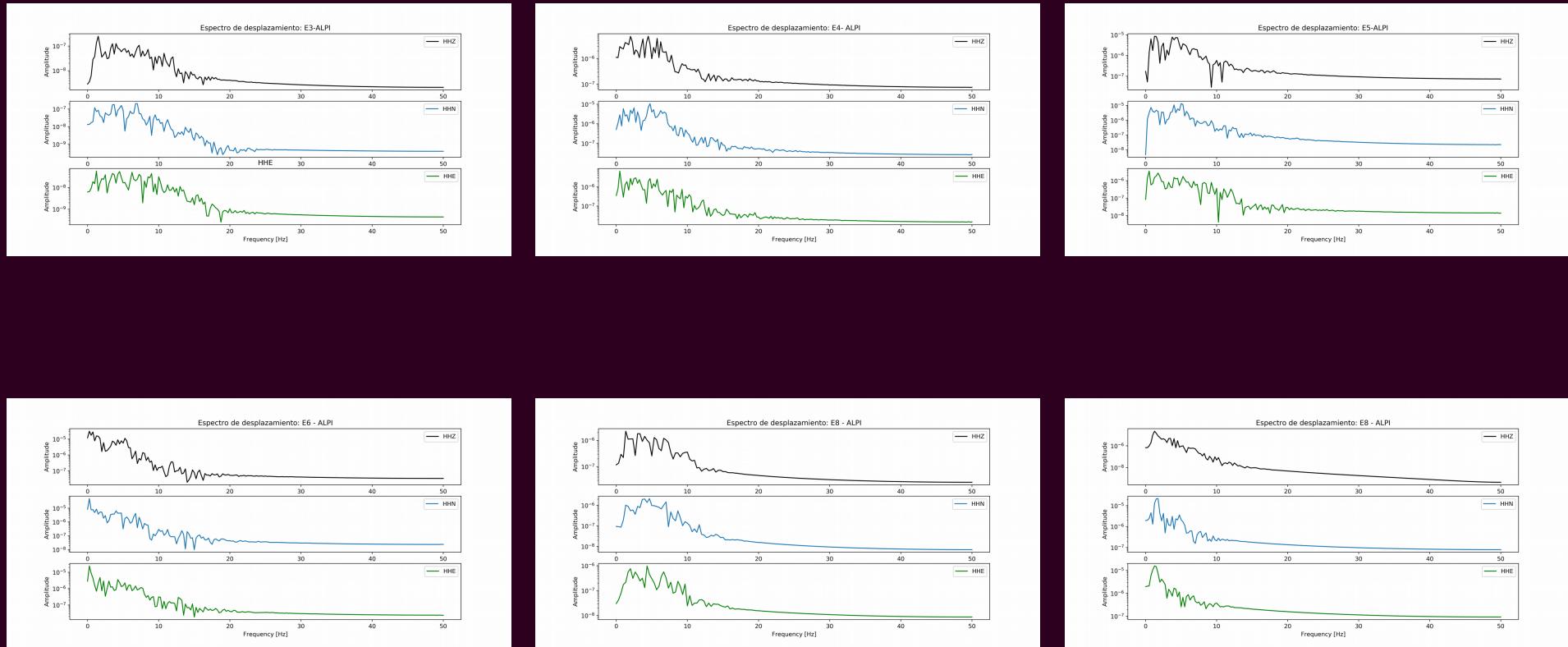
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2007-04-13T05:03:34.009998 - 2007-04-13T05:09:33.999998

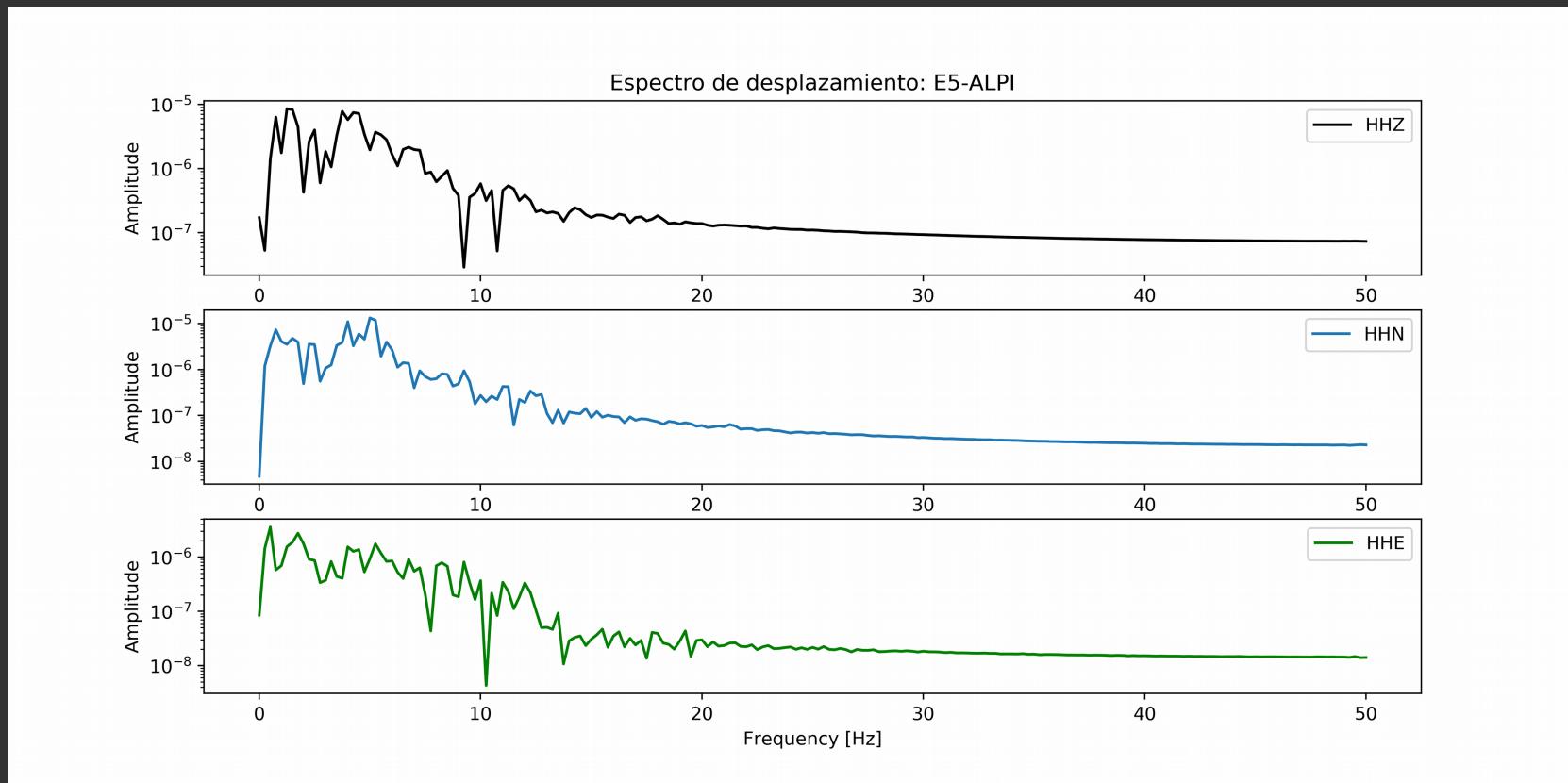
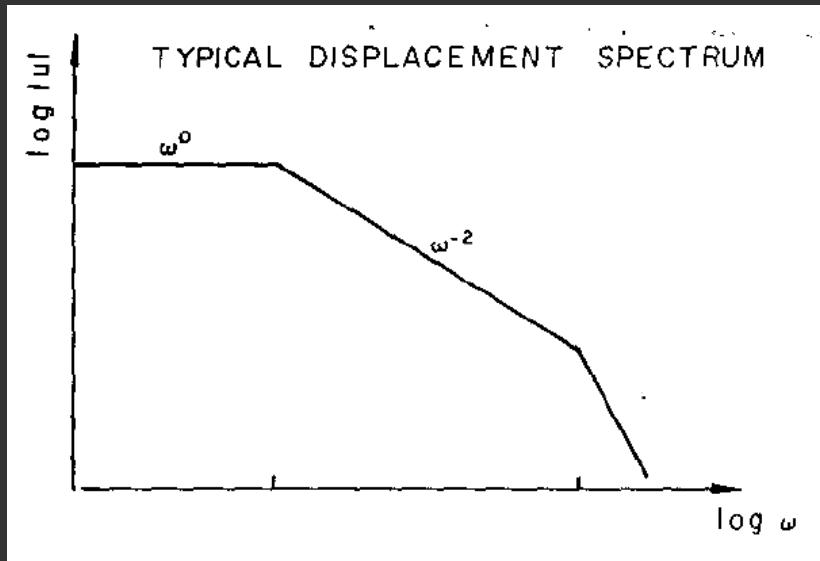


Espectros de desplazamiento





$$f_0 \sim 4-6 \text{ Hz}$$



Parámetros de fuente

- Momento

$$M_0 = \frac{4\pi\rho\beta^3}{R_\theta} R \Omega_0$$

- Caída de esfuerzos

$$\Delta\sigma = \frac{7M_0}{16R^3}$$

$$\begin{aligned}\rho &= 2.8 \text{ g/cm}^3 \\ \beta &= 3.5 \times 10^5 \text{ cm/s} \\ R_\theta &= \sqrt{2/5}\end{aligned}$$

Magnitud momento

$$M_w = \frac{2}{3} \log(M_0) - 10.73$$

	Valores de amplitud en metros				HHN				HHE				HHZ			
Estac.	s1N	s1E	s1Z	s1N[cm]	R1[cm]	Mo	Mw	σ	s1E[cm]	Mo	Mw	σ	s1Z[cm]	Mo	Mw	σ
ALPI	0.00002	0.00003	0.00001	0.002	152000000	7.2513E+23	5.17694466	1.11E+48	0.003	1.0877E+24	5.2943388375	1.67116E+48	0.001	3.62566E+23	4.9762580011	5.57052E+47
COLM	0.000005	0.000005	0.00003	0.0005	168000000	2.0037E+23	4.80454847	4.16E+47	0.0005	2.00365E+23	4.8045484665	4.15651E+47	0.0003	1.20219E+23	4.6566493001	2.4939E+47
COMA	0.000017	0.000045	0.00001	0.0017	152000000	6.1636E+23	5.12989062	9.47E+47	0.0045	1.63155E+24	5.4117330103	2.50673E+48	0.001	3.62566E+23	4.9762580011	5.57052E+47
CUAT	0.000028	0.00003	0.00001	0.0028	144000000	9.6175E+23	5.25870929	1.26E+48	0.003	1.03045E+24	5.2786847736	1.34615E+48	0.001	3.43484E+23	4.9606039372	4.48716E+47
ESPN	0.000018	0.000028	0.000012	0.0018	160000000	6.8697E+23	5.1612906	1.23E+48	0.0028	1.06862E+24	5.2892142851	1.91496E+48	0.0012	4.57978E+23	5.0438964282	8.20697E+47
Prom.	0.0000176	0.0000276	0.000045	0.00176	155200000	6.5155E+23	5.1459652	1.07E+48	0.00276	1.02175E+24	5.2762294751	1.67108E+48	0.0045	1.6659E+24	5.4177650962	2.72459E+48
	s2N	s2E	s2Z	s2N(cm)	R2[cm]				s2E[cm]				s2Z[cm]			
ALPI	1.00E-07	1.00E-07	1.00E-07	1.00E-05	56000000	1.3358E+21	3.35382096	1.03E+44	0.00001	1.33577E+21	3.3538209604	1.0263E+44	0.00001	1.33577E+21	3.3538209604	1.0263E+44
COLM	8.00E-08	1.80E-07	4.00E-08	8.00E-06	24000000	4.5798E+20	3.04389643	2.77E+42	0.000018	1.03045E+21	3.2786847736	6.23216E+42	0.000004	2.28989E+20	2.8432097645	1.38493E+42
COMA	1.20E-07	1.00E-07	9.00E-08	1.20E-05	9600000	2.7479E+20	2.89599726	1.06E+41	0.00001	2.28989E+20	2.8432097645	8.86352E+40	0.000009	2.0609E+20	2.8127047708	7.97717E+40
CUAT	8.00E-08	2.00E-07	5.00E-08	8.00E-06	16800000	3.2058E+20	2.94062845	6.65E+41	0.00002	8.01462E+20	3.205921794	1.6626E+42	0.000005	2.00365E+20	2.8045484665	4.15651E+41
ESPN	1.20E-07	1.20E-07	8.00E-08	1.20E-05	20000000	5.7247E+20	3.1085031	2E+42	0.000012	5.72473E+20	3.1085031036	2.00365E+42	0.000008	3.81648E+20	2.9911089309	1.33577E+42
Prom.	0.0000001	0.00000014	7.2E-08	1.00E-05	25280000	6.03E+20	3.12354699	4.26E+42	0.000014	8.44206E+20	3.2209656793	5.96702E+42	0.0000072	4.34163E+20	3.0284353198	3.06876E+42
	s3N	s3E	s3Z	s3N(cm)	R3				s3E[cm]				s3Z[cm]			
ALPI	0.0000004	0.0000006	0.00000015	0.00004	136000000	1.2976E+22	4.01209488	1.43E+46	0.00006	1.94641E+22	4.1294890483	2.14204E+46	0.000015	4.86602E+21	3.7281157207	5.35511E+45
COLM	1.30E-07	1.20E-07	7.00E-08	1.3E-05	144000000	4.4653E+21	3.70323284	5.83E+45	0.000012	4.1218E+21	3.6800581012	5.38459E+45	0.000007	2.40438E+21	3.5240026305	3.14101E+45
COMA	6.00E-08	7.50E-08	8.00E-08	6E-06	120000000	1.7174E+21	3.42658394	1.3E+45	0.0000075	2.14677E+21	3.4911906154	1.62296E+45	0.000008	2.28989E+21	3.5098764311	1.73116E+45
CUAT	7.00E-08	7.50E-08	5.00E-08	7E-06	144000000	2.4044E+21	3.52400263	3.14E+45	0.0000075	2.57613E+21	3.5439781128	3.36537E+45	0.000005	1.71742E+21	3.4265839401	2.24358E+45
ESPN	4.00E-08	7.00E-08	2.00E-08	4E-06	152000000	1.4503E+21	3.37763133	2.23E+45	0.000007	2.53796E+21	3.5396566944	3.89936E+45	0.000002	7.25132E+20	3.1769446648	1.1141E+45
Prom.	0.00000014	1.88E-07	7.4E-08	1.4E-05	139200000	4.6485E+21	3.71487379	5.49E+45	0.0000188	6.24224E+21	3.8002269988	7.36608E+45	0.0000074	2.45705E+21	3.5302762458	2.89941E+45
	s4N	s4E	s4Z	s4N(cm)	R4				s4E[cm]				s4Z[cm]			
ALPI	0.000022	0.000016	0.0000075	0.0022	128000000	6.717E+23	5.15478404	6.16E+47	0.0016	4.8851E+23	5.062582244	4.4821E+47	0.000075	2.28989E+23	4.8432097645	2.10098E+47
COLM	0.000003	0.000003	0.000002	0.0003	136000000	9.732E+22	4.59546905	1.07E+47	0.0003	9.73203E+22	4.5954690512	1.07102E+47	0.0002	6.48802E+22	4.4780748785	7.14015E+46
COMA	0.000006	0.000002	0.000001	0.0006	136000000	1.9464E+23	4.79615571	2.14E+47	0.0002	6.48802E+22	4.4780748785	7.14015E+46	0.0001	3.24401E+22	4.2773882147	3.57007E+46
CUAT	0.000006	0.000007	0.0000035	0.0006	132000000	1.8892E+23	4.7875124	1.9E+47	0.0007	2.20402E+23	4.8321435899	2.21776E+47	0.00035	1.10201E+23	4.6314569261	1.10888E+47
ESPN	0.000005	0.000003	0.000002	0.0005	148000000	1.7651E+23	4.76785009	2.5E+47	0.0003	1.05907E+23	4.6199509225	1.50207E+47	0.0002	7.06049E+22	4.5025567498	1.00138E+47
Prom.	0.0000084	0.000031	0.0000032	0.00084	136000000	2.725E+23	4.89357441	3E+47	0.00062	2.01129E+23	4.805649341	2.21345E+47	0.00032	1.03808E+23	4.6141548669	1.14242E+47
	s5N	s5E	s5Z	s5N(cm)	R5				s5E[cm]				s5Z[cm]			
ALPI	0.000025	0.000018	0.000005	0.0025	140000000	8.3486E+23	5.21774097	1E+48	0.0018	6.01096E+23	5.122629303	7.21616E+47	0.00005	1.66971E+23	4.7517609691	2.00449E+47
COLM	0.00002	0.000005	0.000003	0.002	120000000	5.7247E+23	5.1085031	4.33E+47	0.0005	1.43118E+23	4.707129776	1.08197E+47	0.0003	8.58709E+22	4.5592306096	6.49184E+46
COMA	0.000015	0.000008	0.000002	0.0015	120000000	4.2935E+23	5.02521061	3.25E+47	0.0008	2.28989E+23	4.8432097645	1.73116E+47	0.0002	5.72473E+22	4.4418364369	4.32789E+46
CUAT	0.000012	0.000006	0.000003	0.0012	124000000	3.5493E+23	4.97009756	2.96E+47	0.0006	1.77466E+23	4.7694108995	1.48033E+47	0.0003	8.87332E+22	4.5687242357	7.40167E+46
ESPN	0.000016	0.000007	0.000002	0.0016	132000000	5.0378E+23	5.07149155	5.07E+47	0.0007	2.20402E+23	4.8321435899	2.21776E+47	0.0002	6.2972E+22	4.4694315604	6.33647E+46
Prom.	0.000088	0.0000088	0.000003	0.0088	127200000	2.67E+24	5.55434213	2.4E+48	0.00088	2.67001E+23	4.8876754647	2.4041E+47	0.0003	9.10231E+22	4.5761011865	8.1958E+46
	s6N	s6E	s6Z	s6N(cm)	R6				s6E[cm]				s6Z[cm]			
ALPI	0.000035	0.00006	0.00015	0.0035	160000000	1.3358E+24	5.35382096	2.39E+48	0.006	2.28989E+24	5.5098764311	4.10348E+48	0.015	5.72473E+24	5.7751697702	1.02587E+49
COLM	0.00008	0.00007	0.00004	0.008	168000000	3.2058E+24	5.60729512	6.65E+48	0.007	2.80512E+24	5.5686338236	5.81911E+48	0.004	1.60292E+24	5.4066084578	3.32521E+48
COMA	0.00007	0.0001	0.00003	0.007	164000000	2.7383E+24	5.56165687	5.28E+48	0.01	3.9119E+24	5.66494248411	7.54913E+48	0.003	1.17357E+24	5.3163390109	2.26474E+48
CUAT	0.000075	0.00006	0.000025	0.0075	152000000	2.7192E+24	5.55963218	4.18E+48	0.006	2.1754E+24	5.4950255013	3.34231E+48	0.0025	9.06415E+23	5.2415513402	1.39263E+48
ESPN	0.00009	0.00007	0.00003	0.009	162000000	3.4778E+24	5.63086729	6.47E+48	0.007	2.70493E+24	5.55581043121	5.03129E+48	0.003	1.15926E+24	5.3127864553	2.15627E+48
Prom.	0.00007	0.000072	0.000055	0.007	161200000	2.6916E+24	5.55667099	4.93E+48	0.0072	2.76848E+24	5.5648272984	5.07358E+48	0.0055	2.11481E+24	5.486847271	3.87565E+48
	s7N	s7E	s7Z	s7N(cm)	R7				s7E[cm]				s7Z[cm]			
ALPI	-	-	-	-	148000000	6.0014E+23	5.12216937	8.51E+47	0.0013	4.58932E+23	5.0444989876	6.50896E+47	0.0005	1.76512E+23	4.7678500889	2.50345E+47
COLM	0.000017	0.000013	0.000005	0.0017	140000000	3.3394E+22	4.28578097	4.01E+46	0.00012	4.00731E+22	4.3385684636	4.81077E+46	0.00005	1.66971E+22	4.0850943024	2.00449E+46
COMA	0.000001	0.0000012	0.000005	0.0001	136000000	8.11E+22	4.54268155	8.93E+46	0.0002	6.48802E+22	4.4780748785	7.14015E+46	0.00013	4.21721E+22	4.3533504496	4.64109E+46
CUAT	0.000025	0.000002	0.000013	0.00025	156000000	3.7211E+22	4.31711201	6.18E+46	0.00006	2.23264E+22	4.1692128416	3.70827E+46	0.00002	7.44214E+21	3.8511320051	1.23609E+46
ESPN	0.000001	0.000006	0.000002	0.0001	580000000	5.9489E+23	5.11962658	5.08E+49	0.00042	5.8106E+23	5.1128137984	4.96001E+49	0.00014	1.93687E+23	4.7947329619	1.65334E+49
	s8N	s8E	s8Z	s8N(cm)	R8				s8E[cm]				s8Z[cm]			
ALPI	0.000045	0.00004	0.00002	0.0045	144000000	1.5457E+24	5.39607895	2.02E+48	0.004	1.37393E+24	5.3619772647	1.79486E+48	0.002	6.86967E+23	5.1612906009	8.97432E+47
COLM	0.0001	0.00017	0.00005	0.01	152000000	3.6257E+24										

Evento	Componente	Mw calculada	M reportada
E1	N	5.1	5.3
E1	E	5.2	5.3
E1	Z	5.4	5.3
E2	N	3.1	4.5
E2	E	3.2	4.5
E2	Z	3.0	4.5
E3	N	3.7	4.5
E3	E	3.8	4.5
E3	Z	3.5	4.5
E4	N	4.8	4.9
E4	E	4.8	4.9
E4	Z	4.6	4.9
E5	N	5.5	4.9
E5	E	4.8	4.9
E5	Z	4.5	4.9
E6	N	5.5	5.8
E6	E	5.5	5.8
E6	Z	5.4	5.8
E7	N	5.1	4.5
E7	E	5.1	4.5
E7	Z	4.7	4.5
E8	N	5.5	6.3
E8	E	5.6	6.3
E8	Z	5.0	6.3

- Localización: error $\pm 12\text{km}$
- E2, E3 y E7 filtrados (banda 1-15Hz): eventos de menor magnitud reportada, mayor error en la Mw calculada.
- Componente E: mejor aproximación de Mw.
- Componente Z: mayor error de cálculo.
- Rangos amplios de M_0 y sigma: $10E20-10E24$ y $10E40-10E48$.
- $f_0 \sim 4\text{-}6 \text{ Hz}$, f_0 para eventos de menor magnitud $\sim 8\text{-}12\text{Hz}$

<https://github.com/ivemv/Seismology/blob/master/Ivonne/clases/final/final.ipynb>

Gracias

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