Supporting information for

Stress loading following a Mw7.8 megathrust earthquake in the northern Ecuadorian forearc

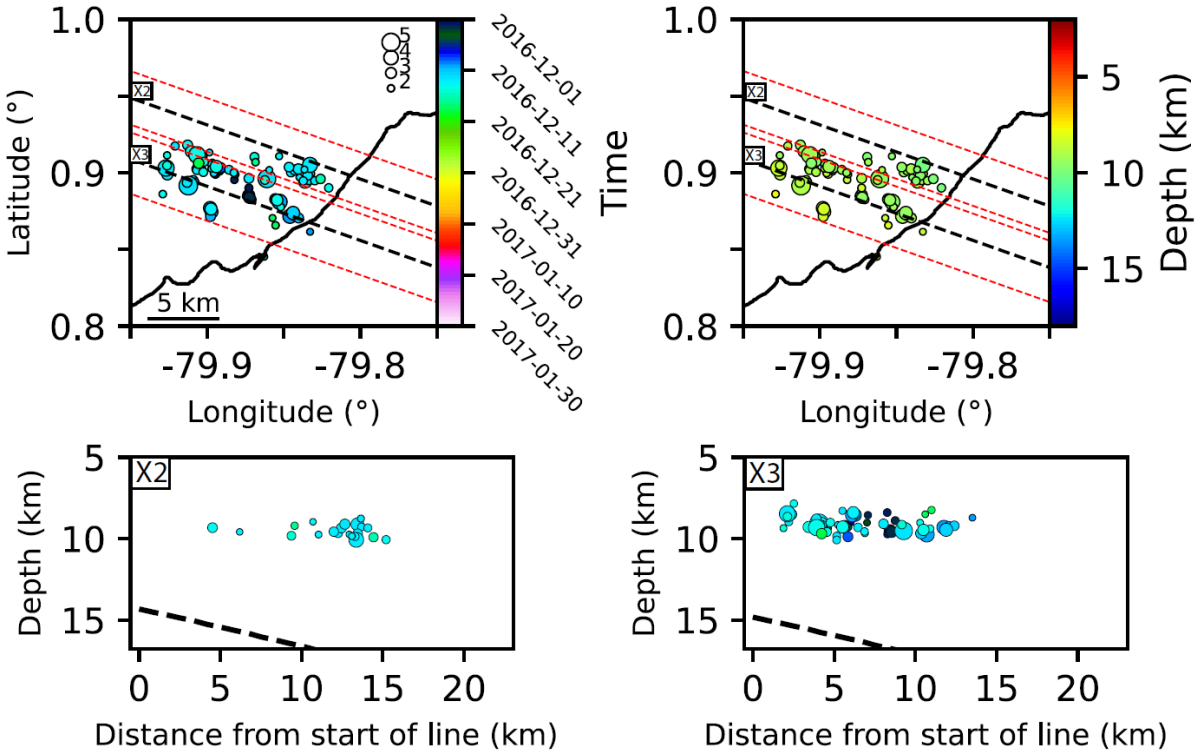

Figure S1: Spatial and temporal distribution of earthquakes of the Atacames swarm before the occurrence of the Mw5.4 event on December 19th. Left map: Seismicity color-coded with time. Right map: Seismicity color-coded with depth. Dashed black line in map view: Orientation of cross-section lines X2 and X3. The dashed red lines represent the width of the cross-sections (+/- 2 km). Events in cross-sections are color-coded with time. Dashed black line in cross-section: Plate interface model after Font *et al.* (2013).

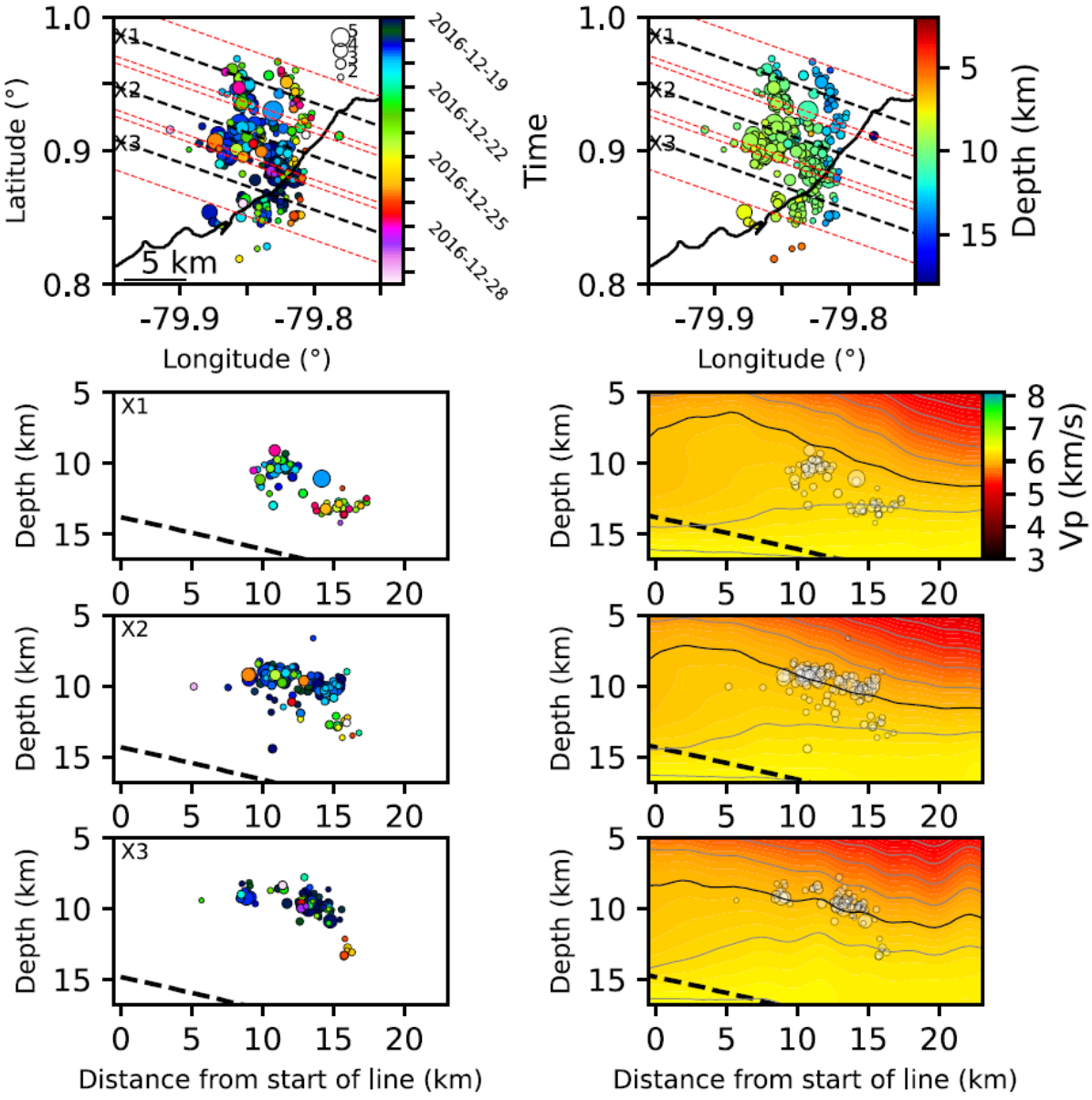

Figure S2: Spatial and temporal distribution of earthquakes of the Atacames swarm after the occurrence of the Mw5.4 event on December 19th. Left map: Seismicity color-coded with time. Right map: Seismicity color-coded with depth. Dashed black line in map view: Orientation of cross-section lines X1, X2 and X3. The dashed red lines represent the width of the cross-sections (+/- 2 km). Events on the left-hand side cross-sections are color-coded with time. Dashed black line in cross-section: Plate interface model after Font *et al.* (2013). Events on the right-hand side cross-sections are represented with a transparent marker, with the velocity model of Wickham-Piotrowski *et al.* (2025) in the background.

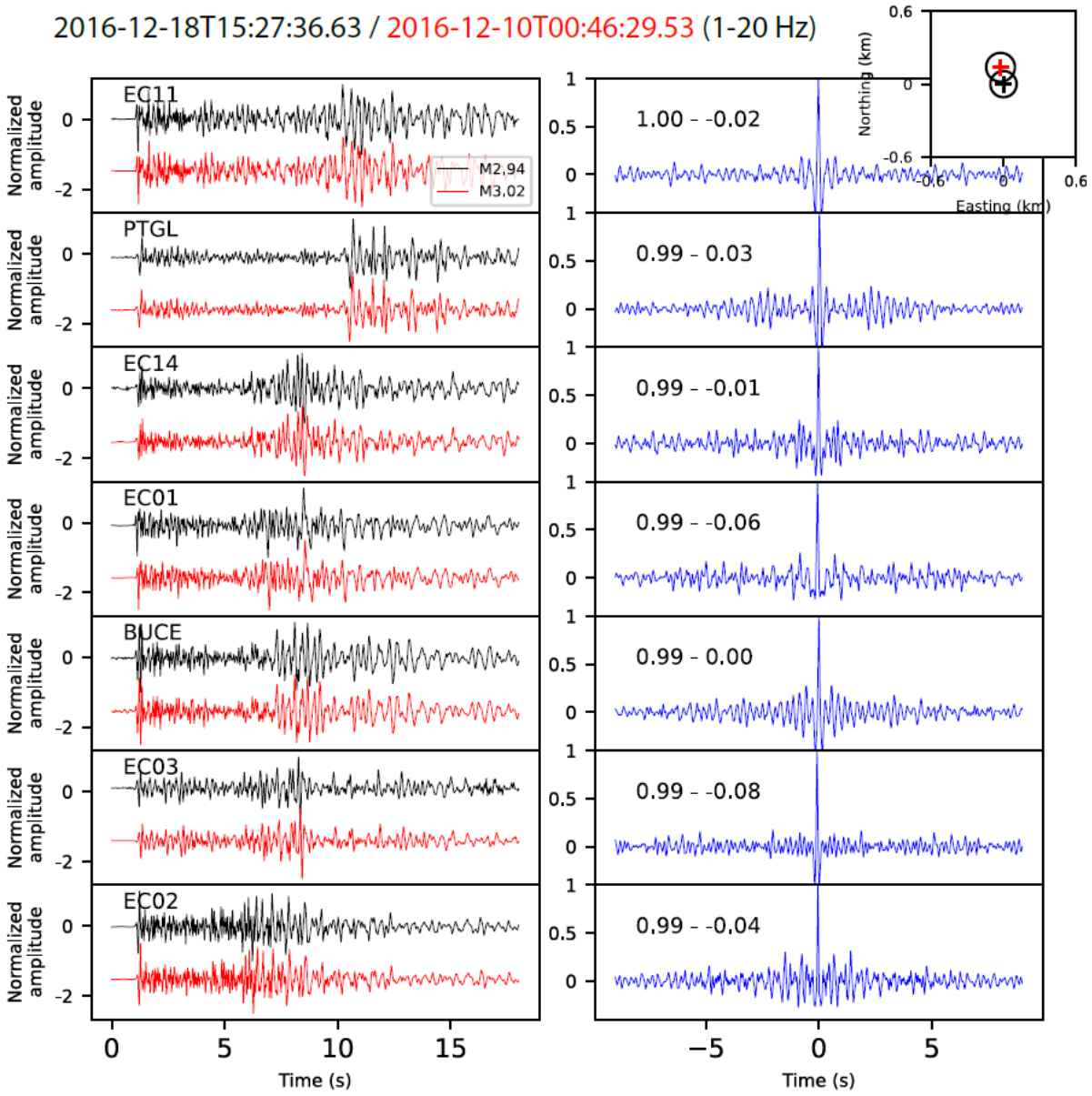

Figure S3: Waveform similarity between two earthquakes. The origin times of two events are written in black and in red at the top. The same colors are used for both the waveforms and the crosses on the map to distinguish between the two events. Left: Pairs of waveforms for different stations, band-passed filtered between 1 and 20Hz. Right: Cross-correlograms for each station with peak cross-correlation and delay values. Map inset: Relative location of both events.

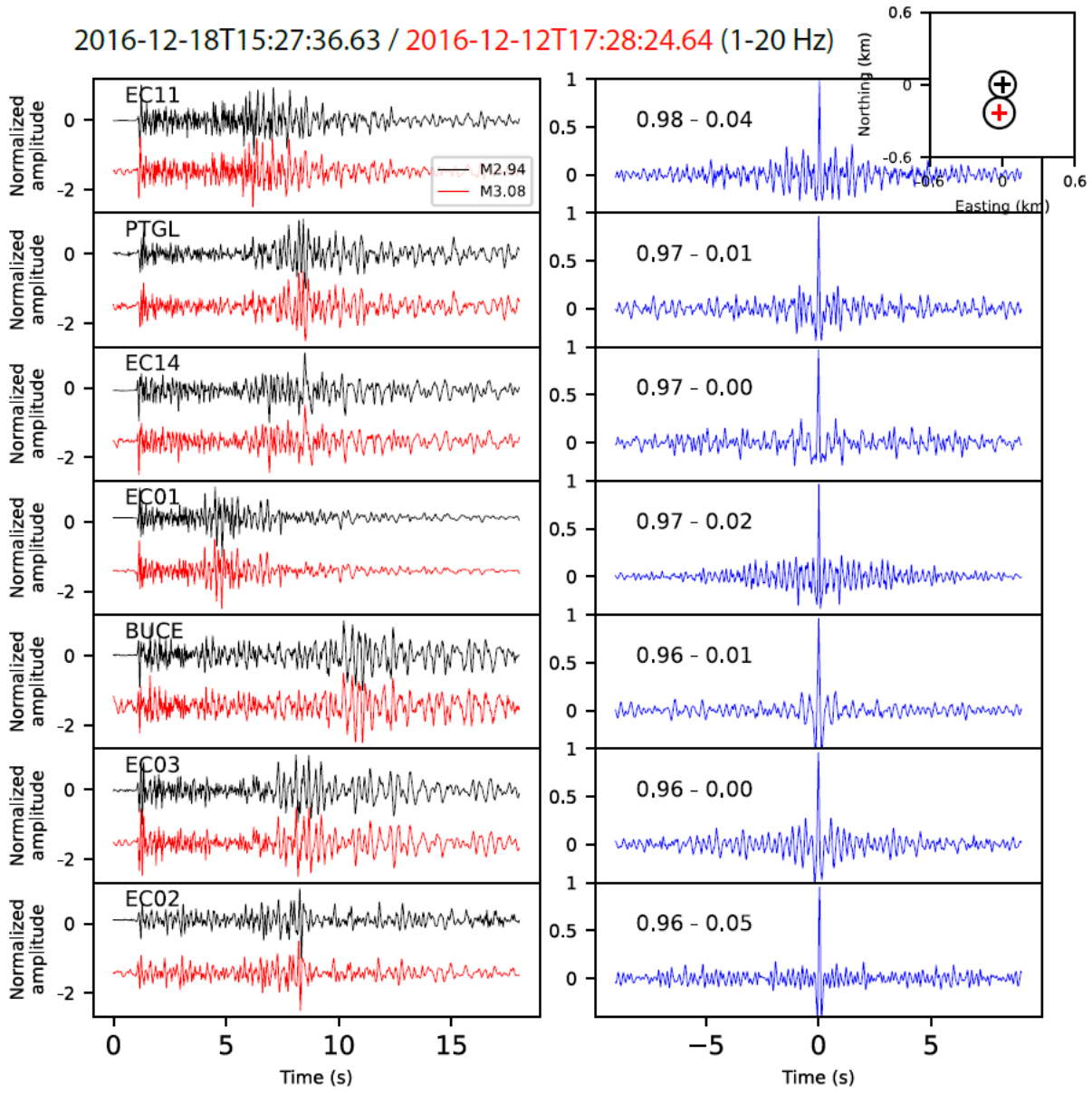

Figure S4: Continuity of Figure S3.

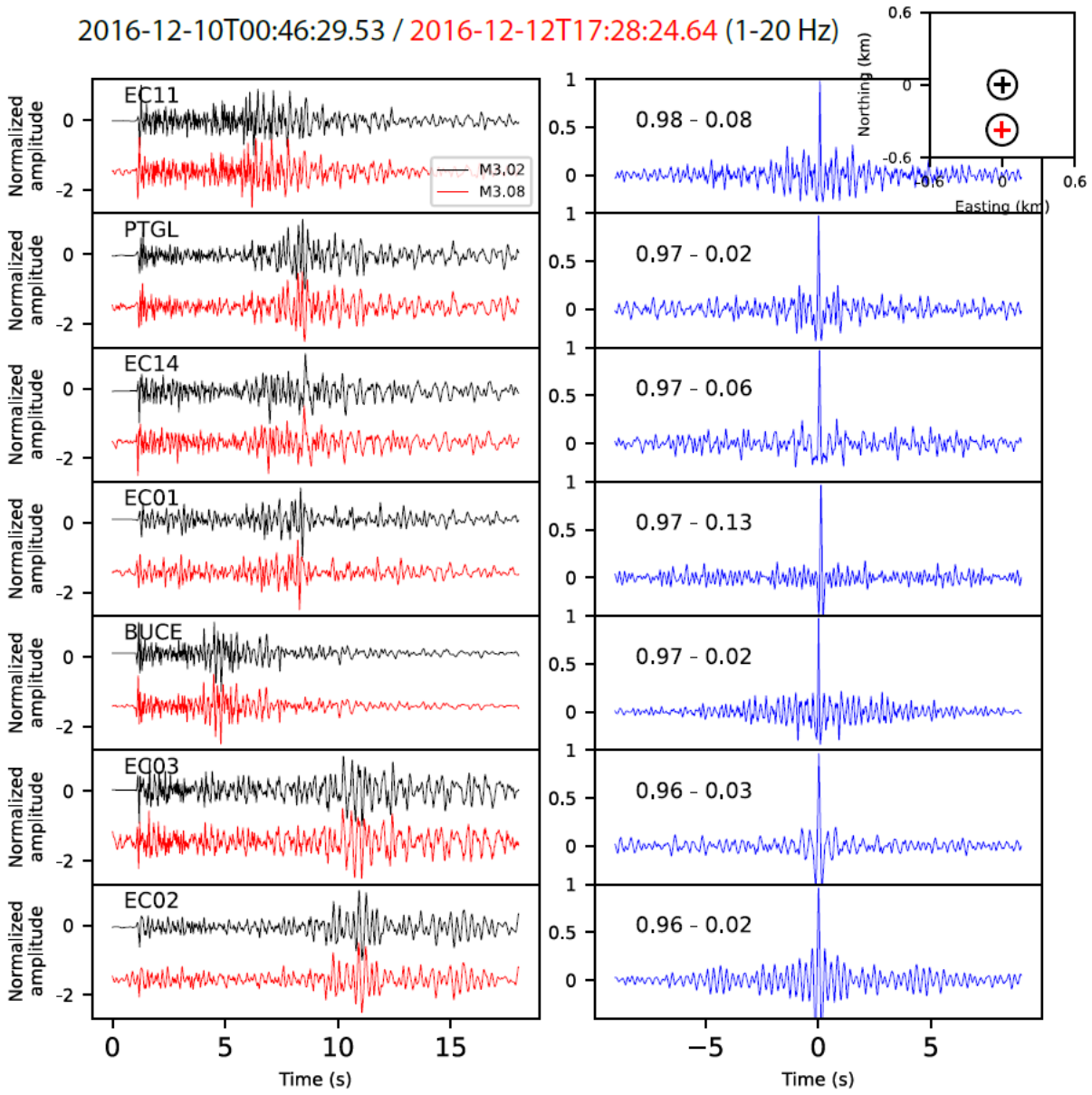

Figure S5: Continuity of Figure S3.

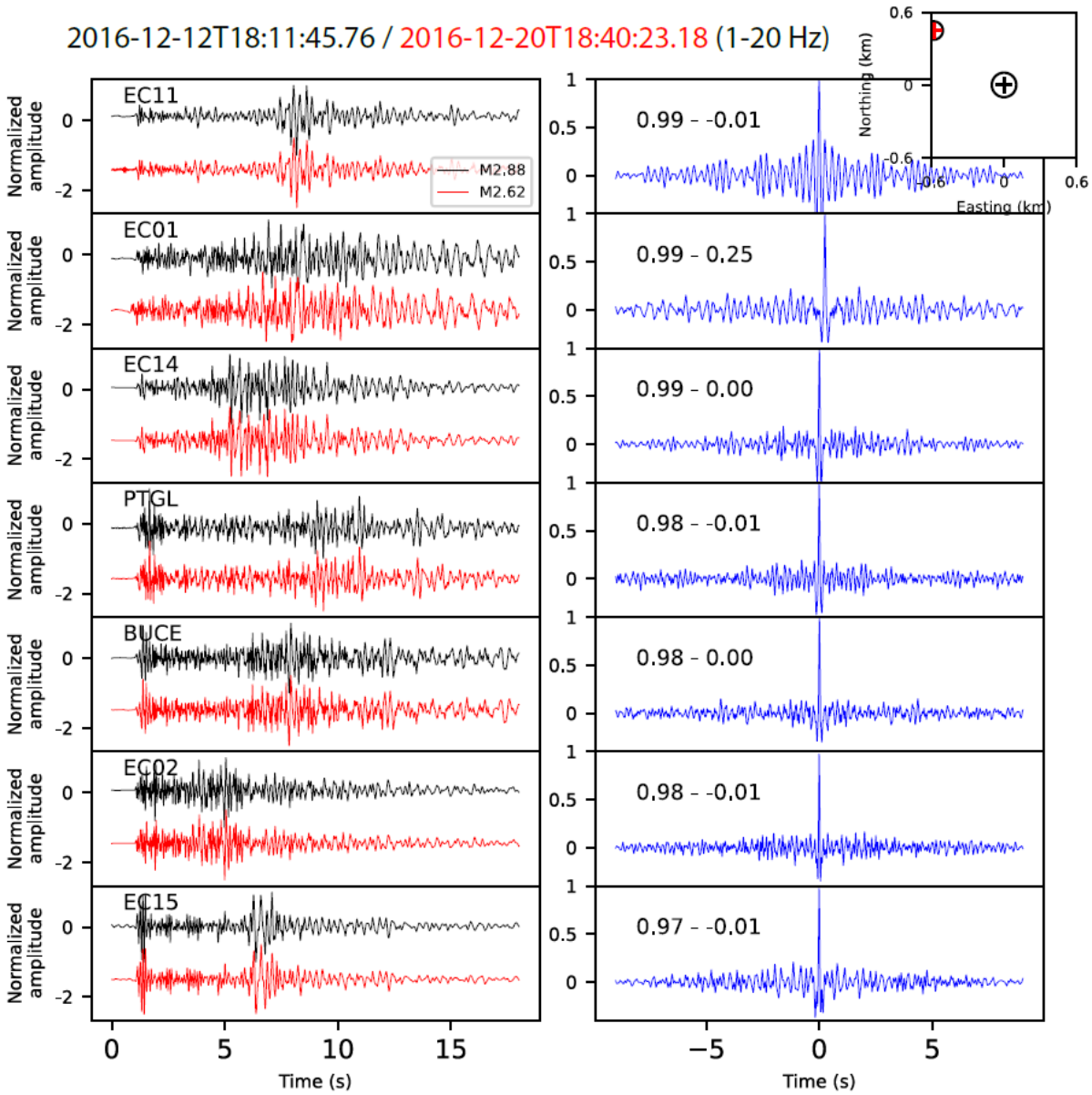

Figure S6: Continuity of Figure S3.

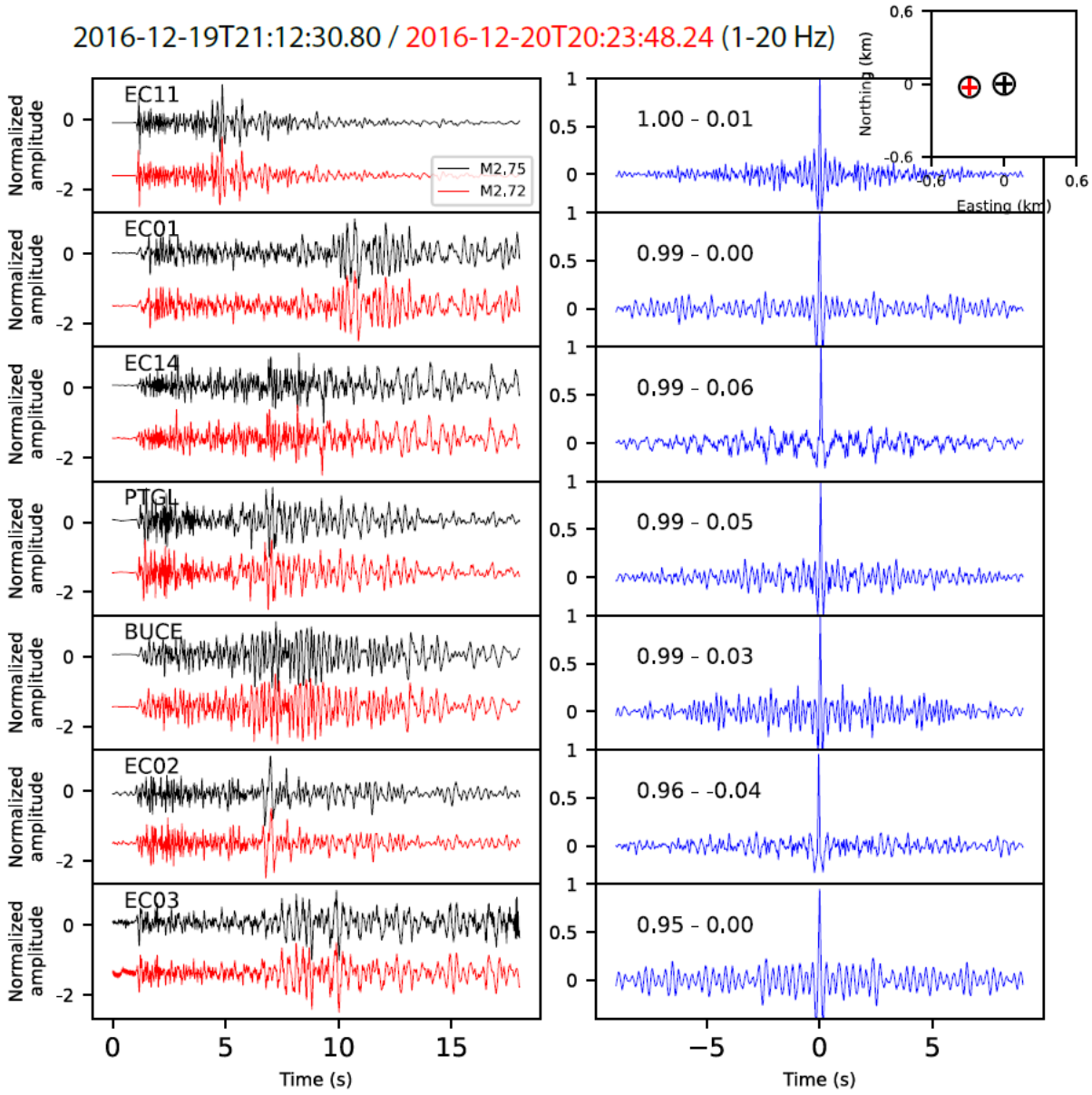

Figure S7: Continuity of Figure S3.

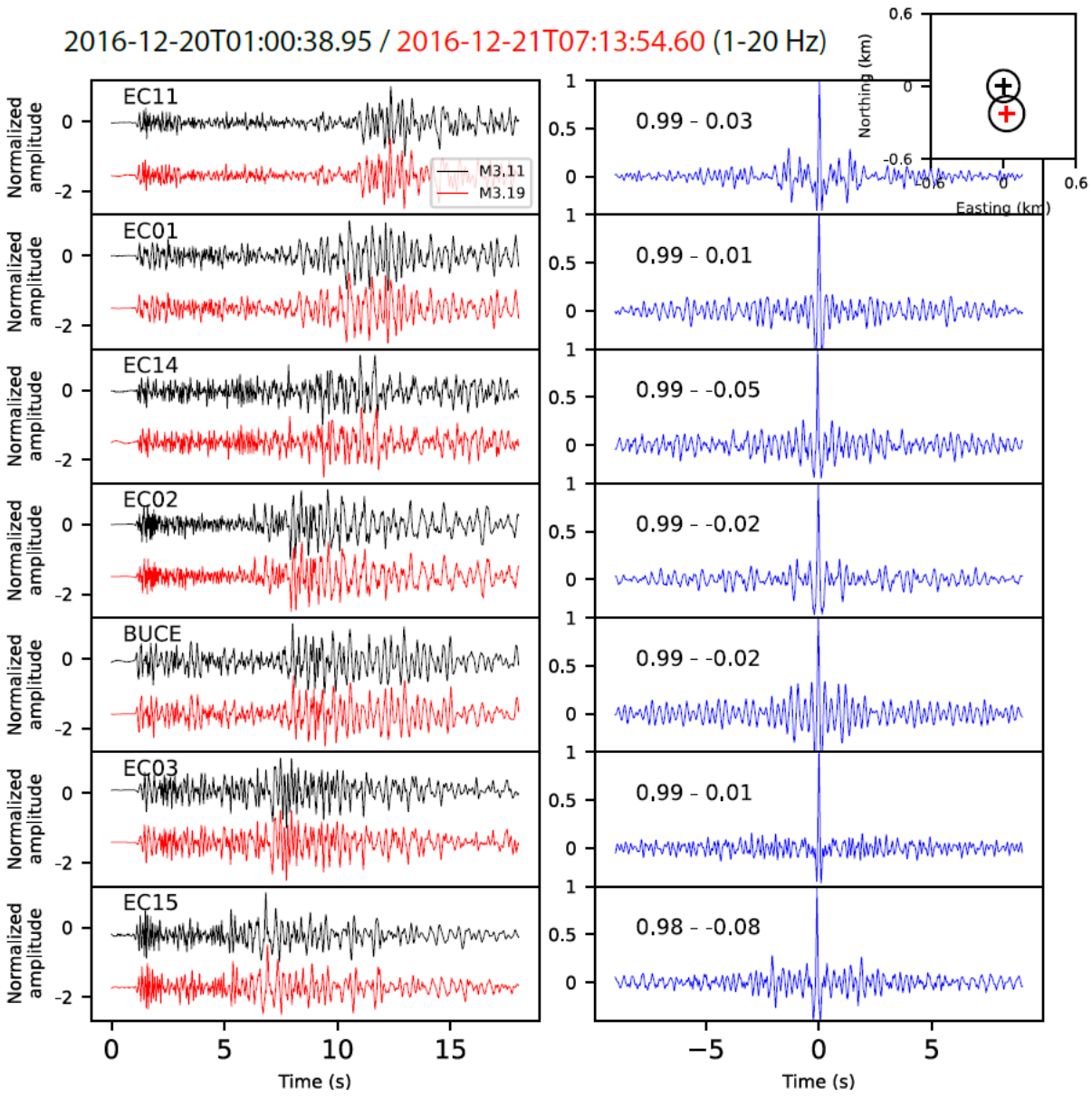

Figure S8: Continuity of Figure S3.

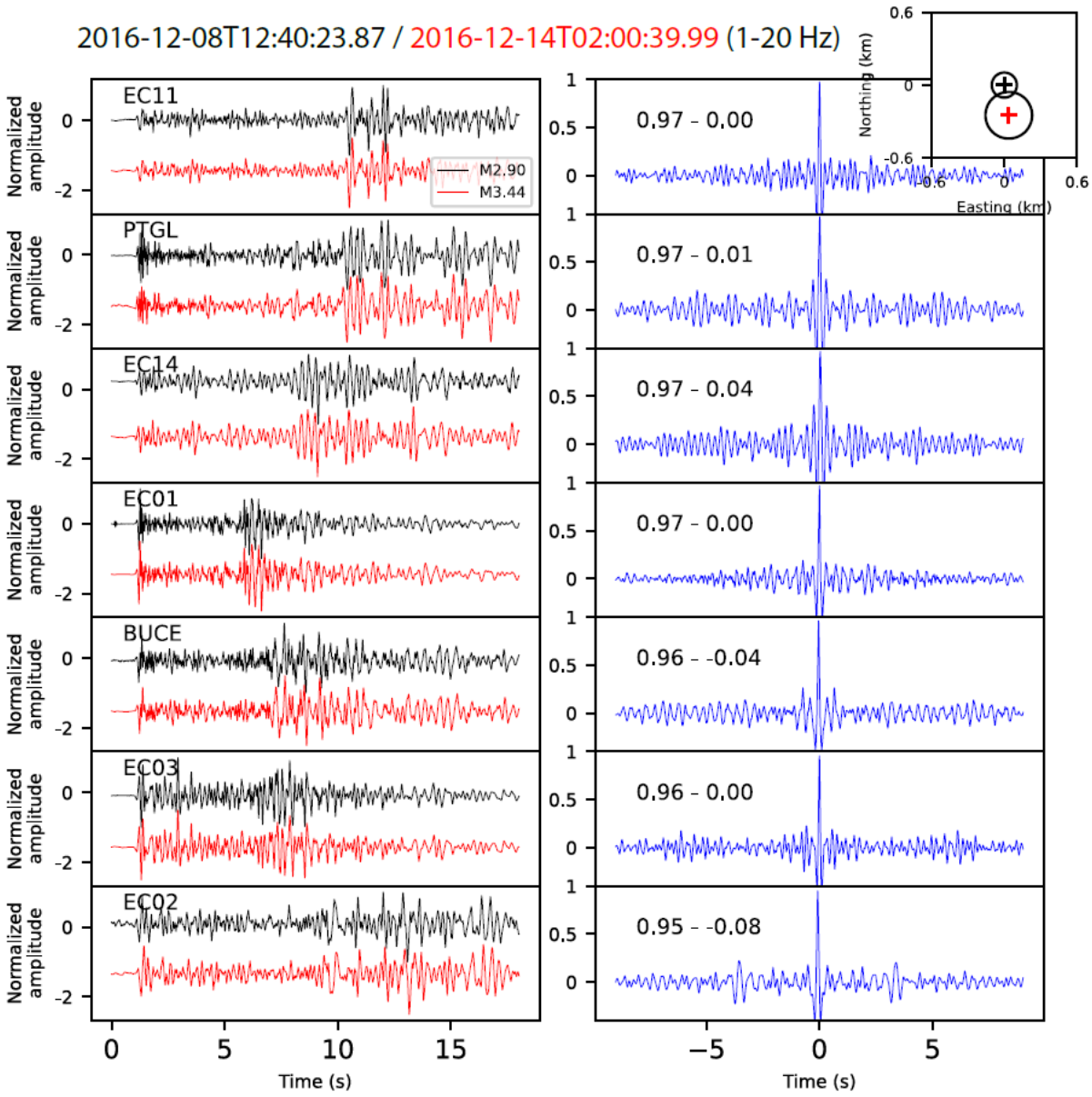

Figure S9: Continuity of Figure S3.

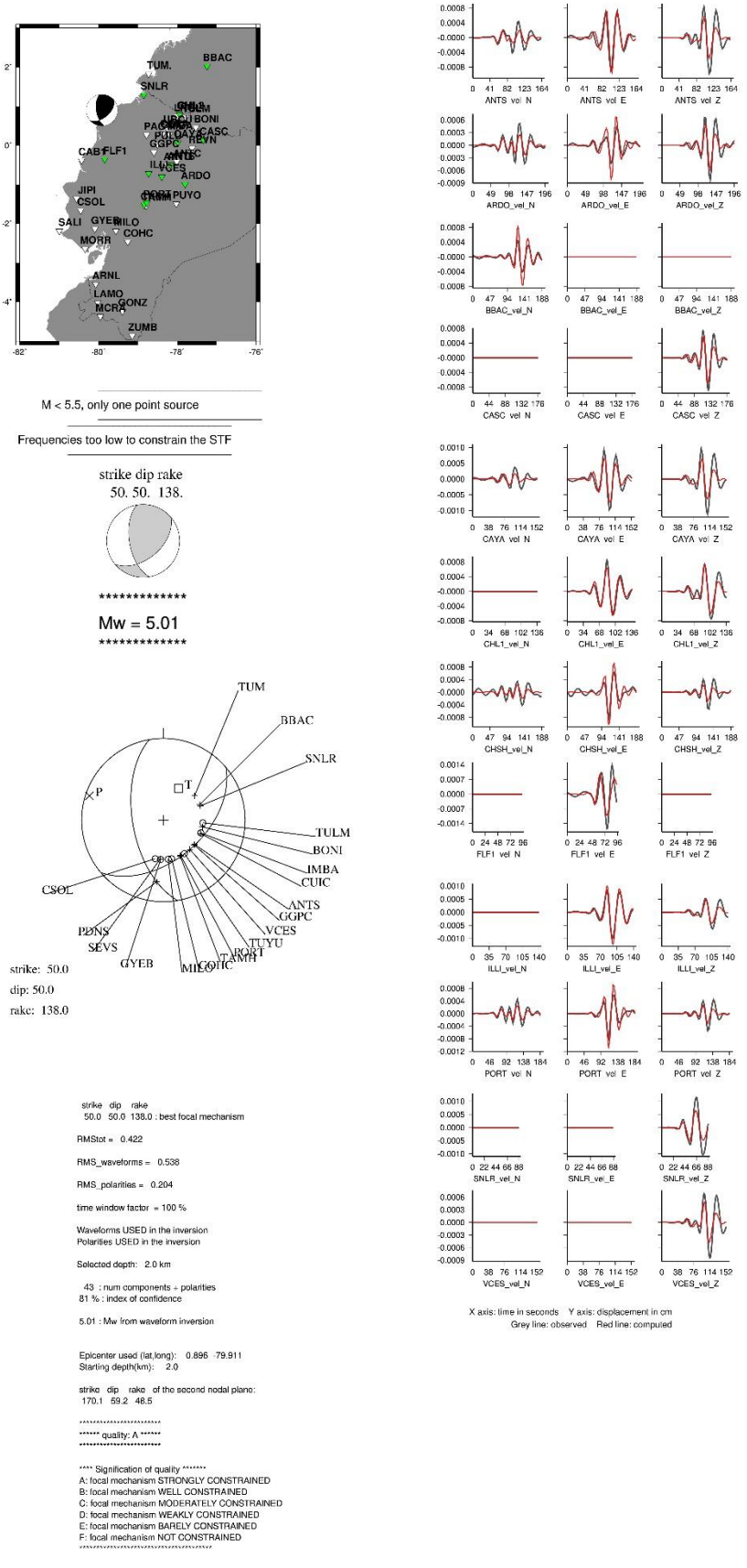

Figure S10: Focal mechanism computed with FMNEAR corresponding to the event with an origin time of 2016/12/12 15:53:54.38 and M_L5.2. Inset map represents the locations of the event with the stations used. Circles on the beach ball are compressions and crosses are dilations. Black seismograms: Waveforms. Red lines: Synthetics.

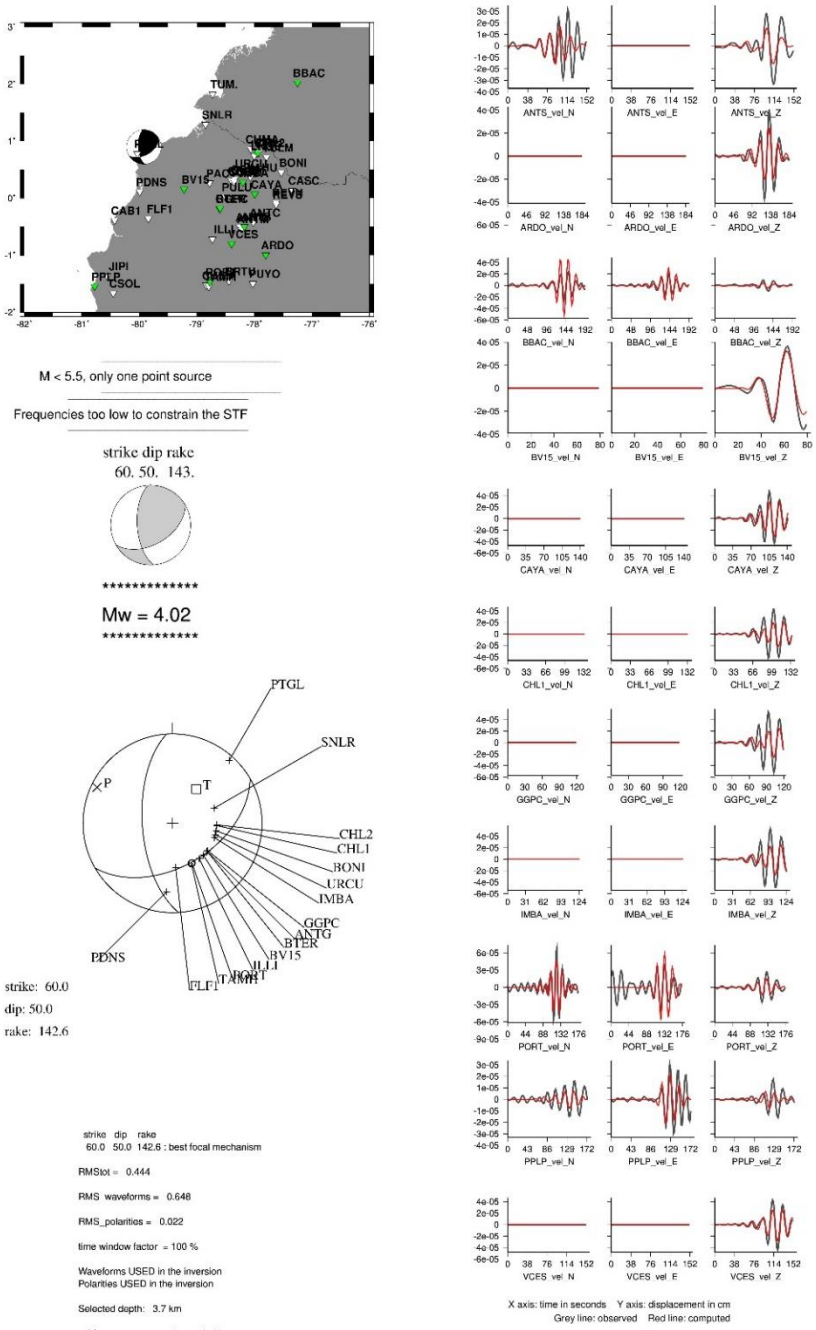

Figure S11: Focal mechanism computed with FMNEAR corresponding to the event with an origin time of 2016/12/12 19:29:08.88 and M_L4.5. Inset map represents the locations of the event with the stations used. Circles on the beach ball are compressions and crosses are dilations. Black seismograms: Waveforms. Red lines: Synthetics.

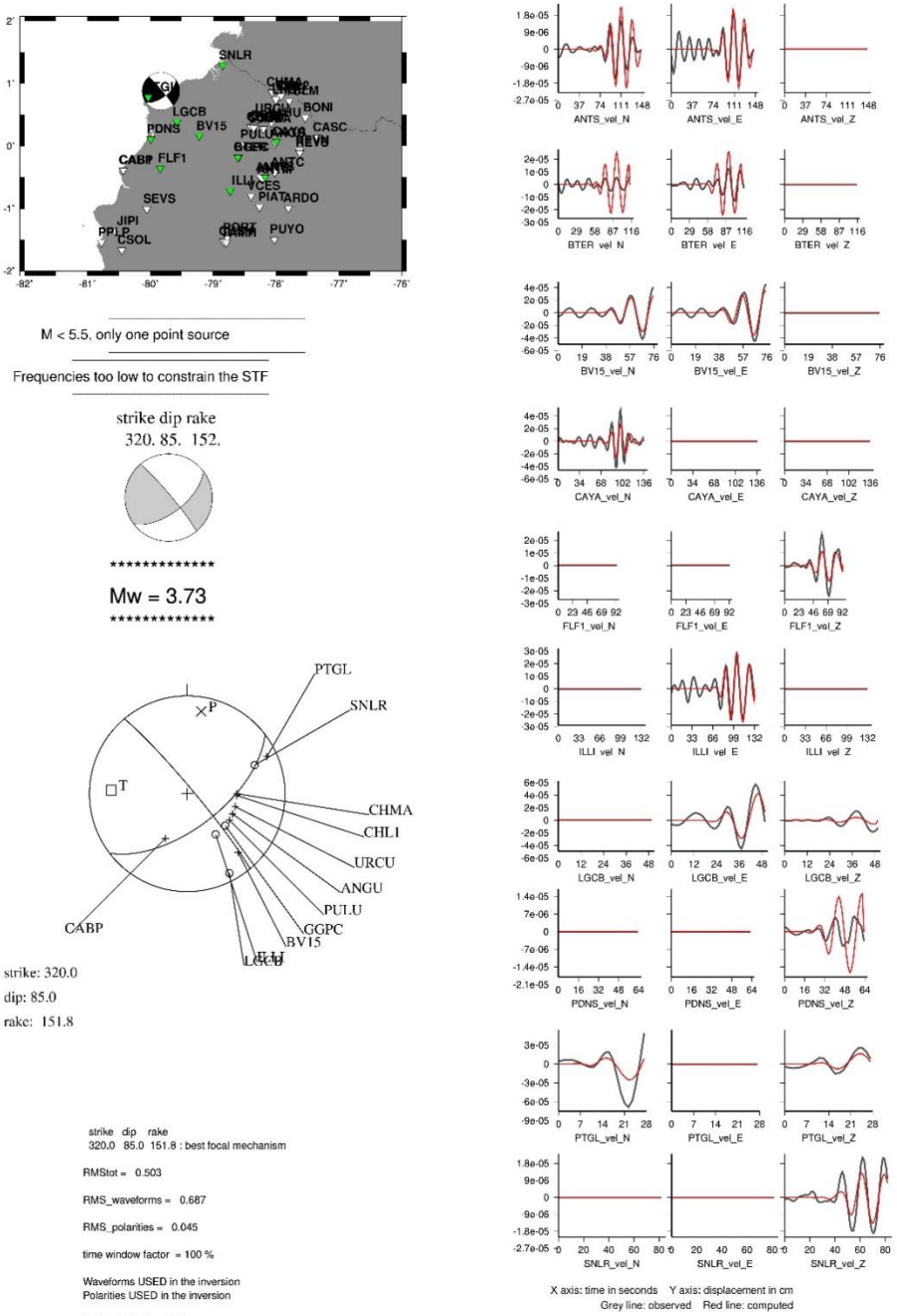

Figure S12: Focal mechanism computed with FMNEAR corresponding to the event with an origin time of 2016/12/19 08:20:04.09 and M_L4.5. Inset map represents the locations of the event with the stations used. Circles on the beach ball are compressions and crosses are dilations. Black seismograms: Waveforms. Red lines: Synthetics.

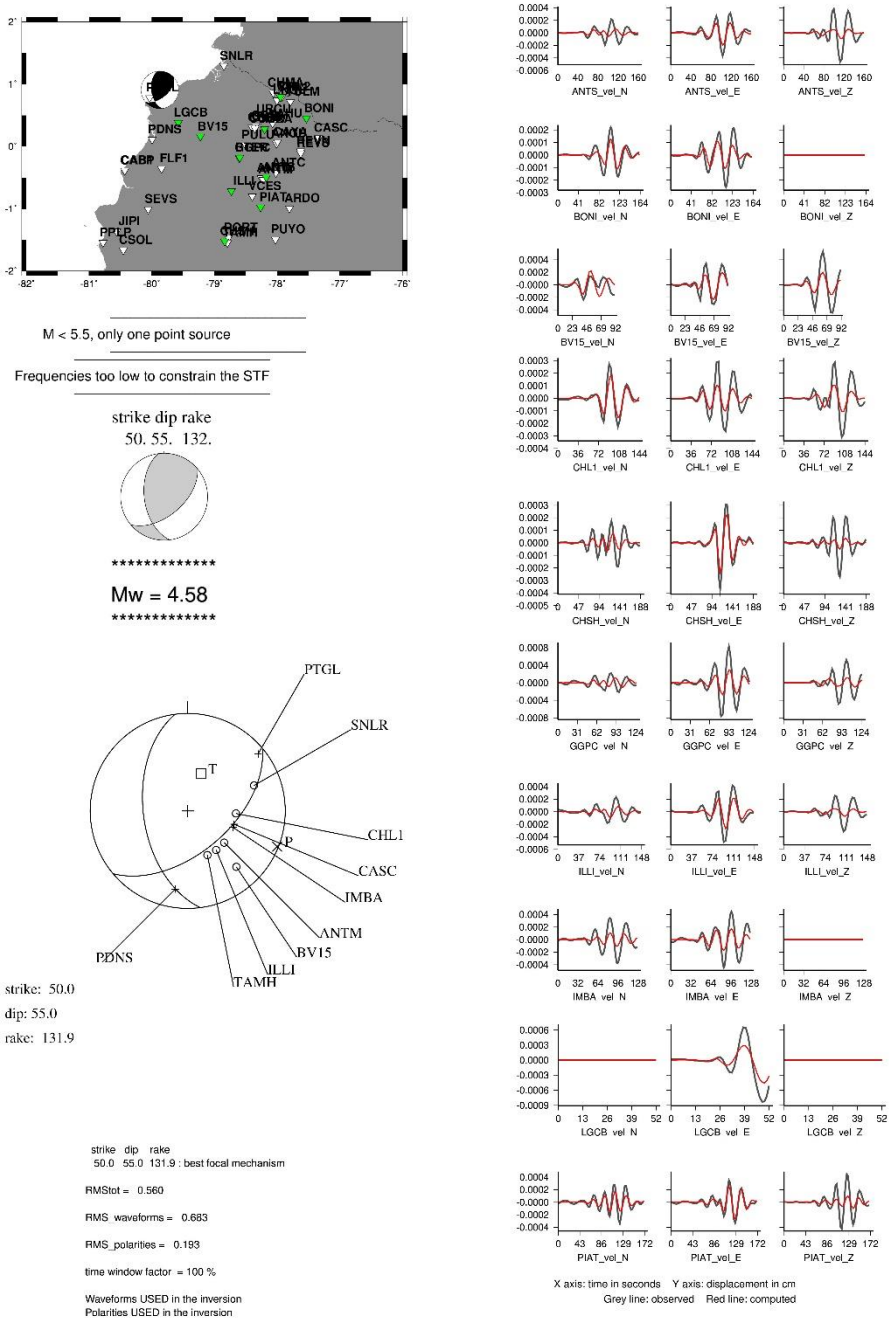

Figure S13: Focal mechanism computed with FMNEAR corresponding to the event with an origin time of 2016/12/20 12:09:38.01 and M_L4.3. Inset map represents the locations of the event with the stations used. Circles on the beach ball are compressions and crosses are dilations. Black seismograms: Waveforms. Red lines: Synthetics.

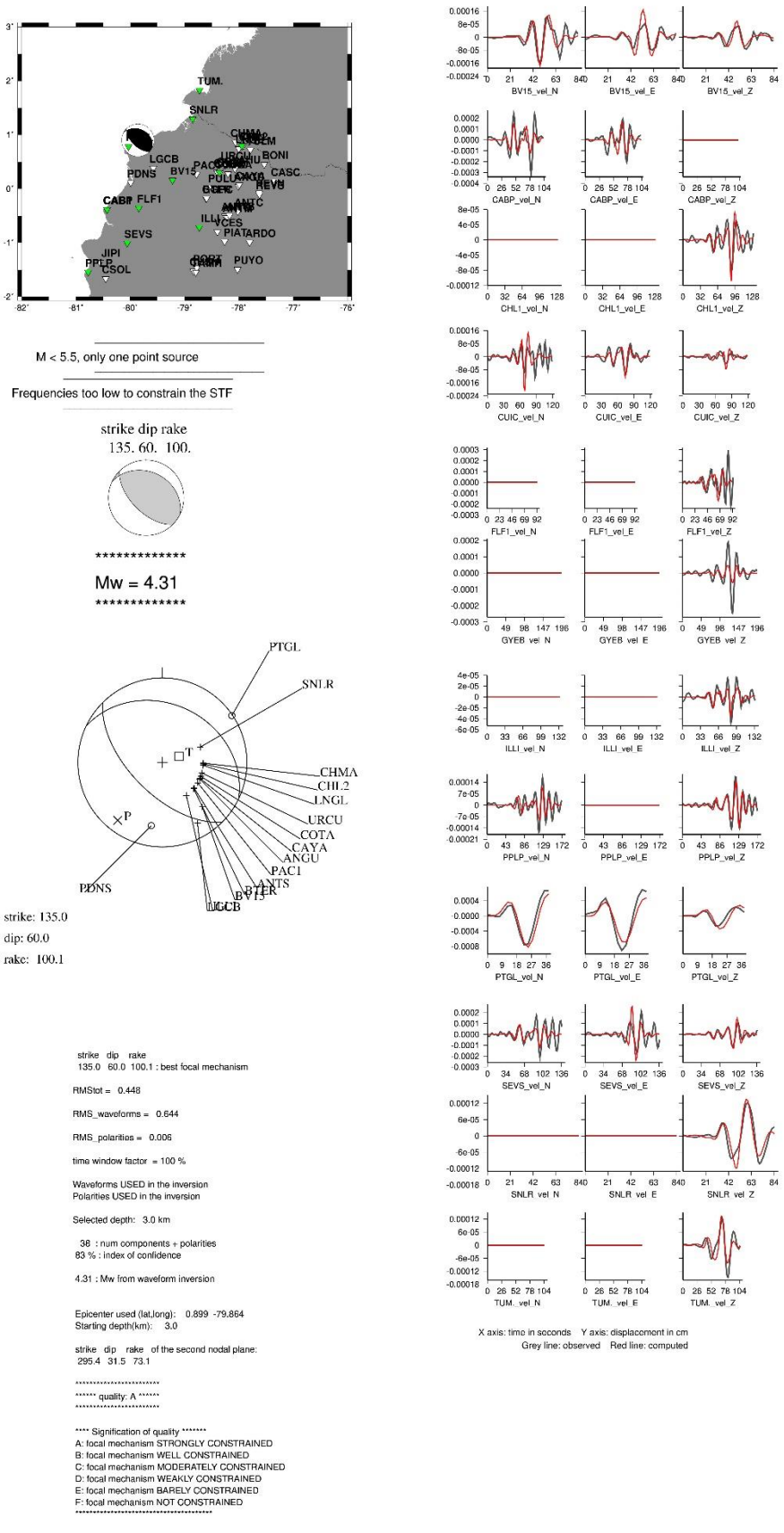

Figure S14: Focal mechanism computed with FMNEAR corresponding to the event with an origin time of 2016/12/20 15:41:31.37 and M_L4.5. Inset map represents the locations of the event with the stations used. Circles on the beach ball are compressions and crosses are dilations. Black seismograms: Waveforms. Red lines: Synthetics.

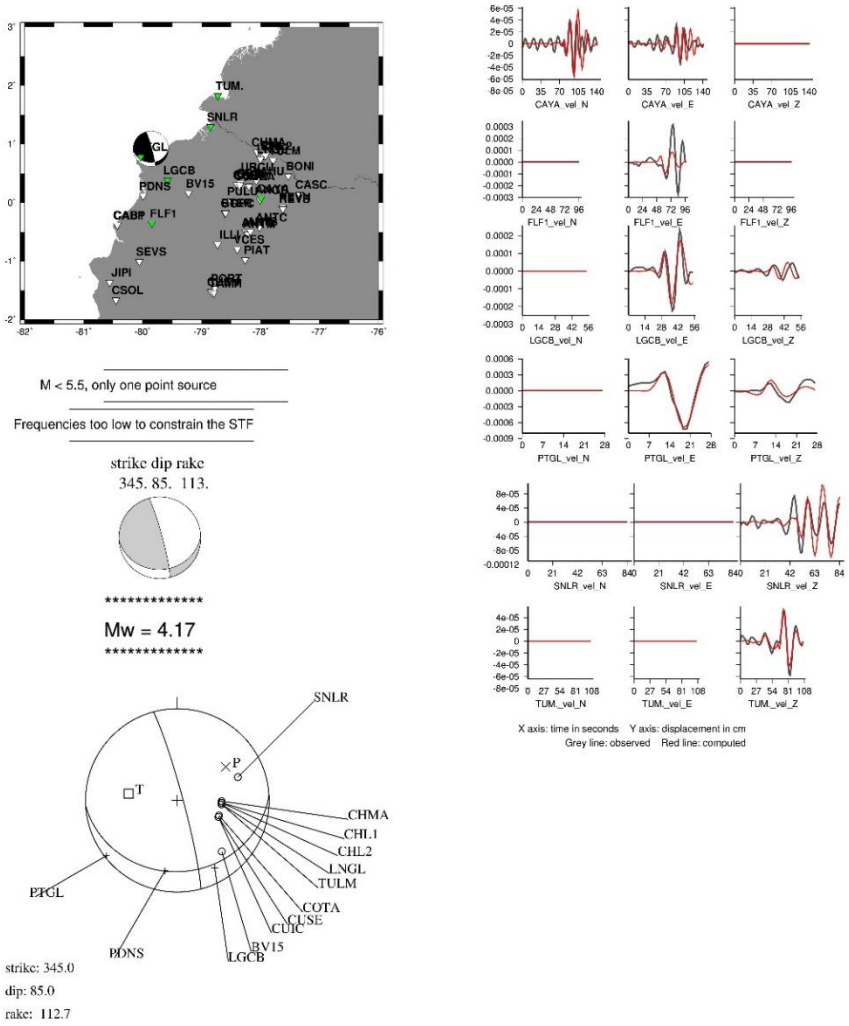

Figure S15: Focal mechanism computed with FMNEAR corresponding to the event with an origin time of 2016/12/20 17:55:13.66 and M_L4.3. Inset map represents the locations of the event with the stations used. Circles on the beach ball are compressions and crosses are dilations. Black seismograms: Waveforms. Red lines: Synthetics.

Id for figures	Method	Event Origin Time	Strike 1	Dip 1	Rake 1	Strike 2	Dip 2	Rake 2	Misfit Total / waveforms / polarities	# of channels Z / N / E	# Stations	# Components + polarities	Azimuthal Gap	Index of confidence	Quality
1	MECAVEL	2016/12/10 05:07:04.75	164	52	65	21	44	118	0.24	6 / 8 / 10	13	-	185	-	A
2	MECAVEL	2016/12/12 14:42:22.05	13	11	42	241	82	98	0.19	16 / 3 / 2	17	-	218	-	A
3	MECAVEL	2016/12/12 15:53:54.38	80	84	129	177	39	9	0.28	12 / 8 / 9	14	-	272	-	A
	FMNEAR		50	50	138	170	59	48	0.42 / 0.54/ 0.20	-	-	43	-	81 %	A
4	MECAVEL	2016/12/12 19:29:08.88	80	57	113	222	39	59	0.26	15 / 0 / 2	15	-	209	-	B
	FMNEAR		60	50	143	176	62	47	0.44 / 0.65 / 0.02	-	-	34	-	78 %	A
5	MECAVEL	2016/12/13 03:02:37.31	348	37	69	193	55	105	0.26	10 / 8 / 8	14	-	190	-	A
6	MECAVEL	2016/12/13 22:55:47.72	71	47	153	180	70	46	0.26	14 / 3 / 7	14	-	206	-	A
7	MECAVEL	2016/12/19 07:11:38.02	20	43	73	222	49	105	0.27	20 / 17 / 16	20	-	226	-	A
8	MECAVEL	2016/12/19 07:24:54.92	0	37	75	198	54	101	0.37	4 / 2 / 5	7	-	230	-	B
9	MECAVEL	2016/12/19 08:04:14.03	15	35	67	222	58	105	0.25	3 / 1 / 2	4	-	235	-	B
10	MECAVEL	2016/12/19 08:20:04.09	99	23	65	305	69	100	0.29	4 / 3 / 7	10	-	183		A
	FMNAR		320	85	152	53	62	6	0.50 / 0.69 / 0.05	-	-	27	-	74 %	B
11	MECAVEL	2016/12/19 08:57:12.63	342	54	42	224	57	135	0.23	19 / 9 / 10	19	-	182	-	A
12	MECAVEL	2016/12/19 09:59:49.17	233	60	120	3	41	49	0.27	16 / 7 / 8	16	-	180	-	A
13	MECAVEL	2016/12/20 09:25:33.66	360	33	94	175	57	87	0.29	7 / 2 / 4	8	-	179	-	A
14	MECAVEL	2016/12/20 10:49:56.51	360	40	52	225	59	117	0.23	19 / 14 / 17	19	-	201	-	A
15	MECAVEL	2016/12/20 12:09:38.01	311	60	-38	62	57	-143	0.32	14 / 6 / 6	16	-	199	-	A
	FMNEAR		50	55	132	173	53	46	0.56 / 0.68 / 0.19	-	-	36	-	72 %	B
16	MECAVEL	2016/12/20 15:41:31.37	138	30	105	300	61	81	0.25	15 / 2 / 3	15	-	193	-	A
	FMNEAR		135	60	100	295	32	73	0.45 / 0.64 / 0.01	-	-	38	-	83 %	A
17	MECAVEL	2016/12/20 17:39:21.30	360	26	59	213	67	104	0.2	21 / 8 / 8	21	-	198	-	A
18	MECAVEL	2016/12/20 17:55:13.66	285	82	74	169	17	153	0.37	2 / 2 / 4	5	-	198	-	B
	FMNEAR		345	85	113	87	23	13	0.38 / 0.61 / 0.05	-	-	22	-	82 %	A
19	MECAVEL	2016/12/21 01:04:49.82	360	31	61	212	63	106	0.32	13 /5 / 10	15	-	198	-	A
20	MECAVEL	2016/12/26 19:57:48.62	71	12	121	219	79	83	0.19	17 / 0 / 1	17	-	199	-	B

Table S1: Focal mechanism solutions computed with MECAVEL and FMNEAR (blue highlighted lines). Black bold lines highlights events for which two focal mechanism solutions are available.

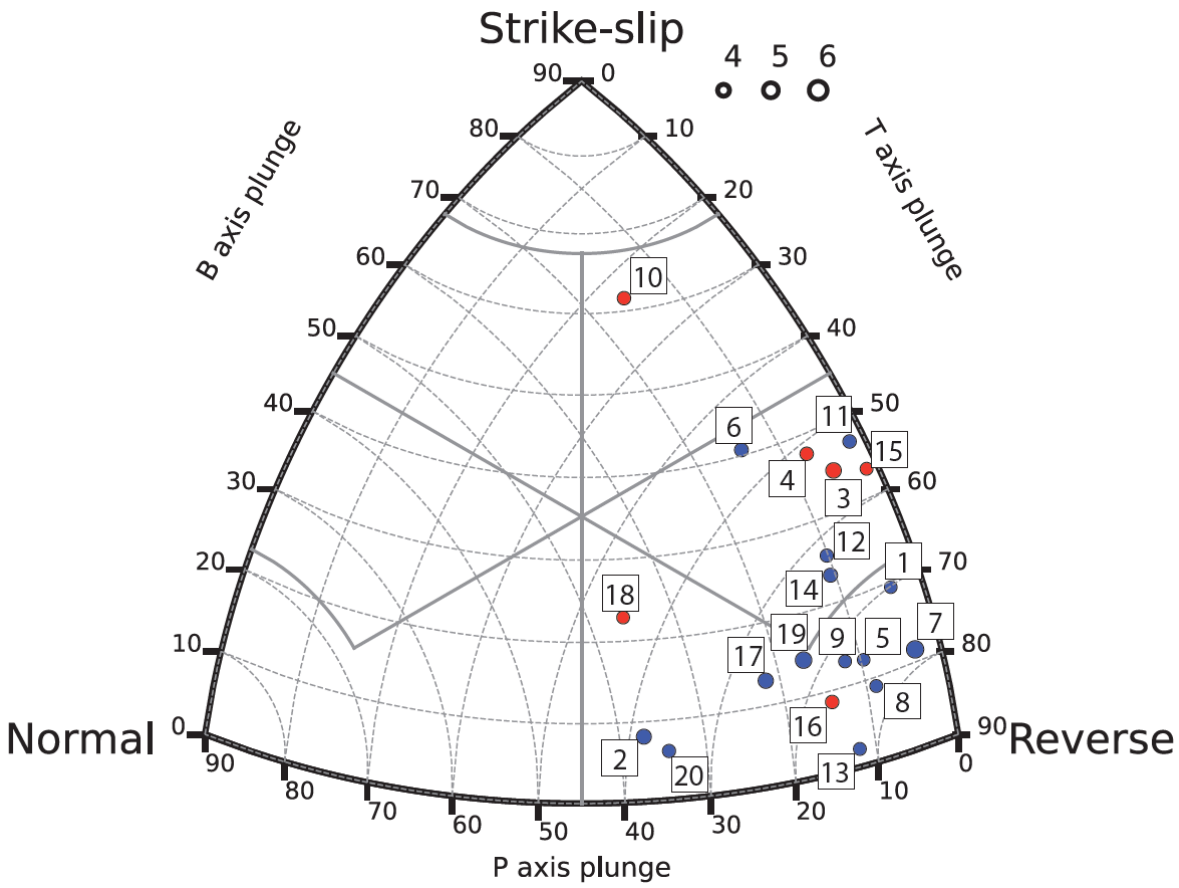

Figure S16: Kaverina diagram of the 20 focal mechanisms computed in the Atacames region. The majority are reverse, some of which have a strike slip component. Red: FMNEAR solutions. Blue: MECAVEL solutions.

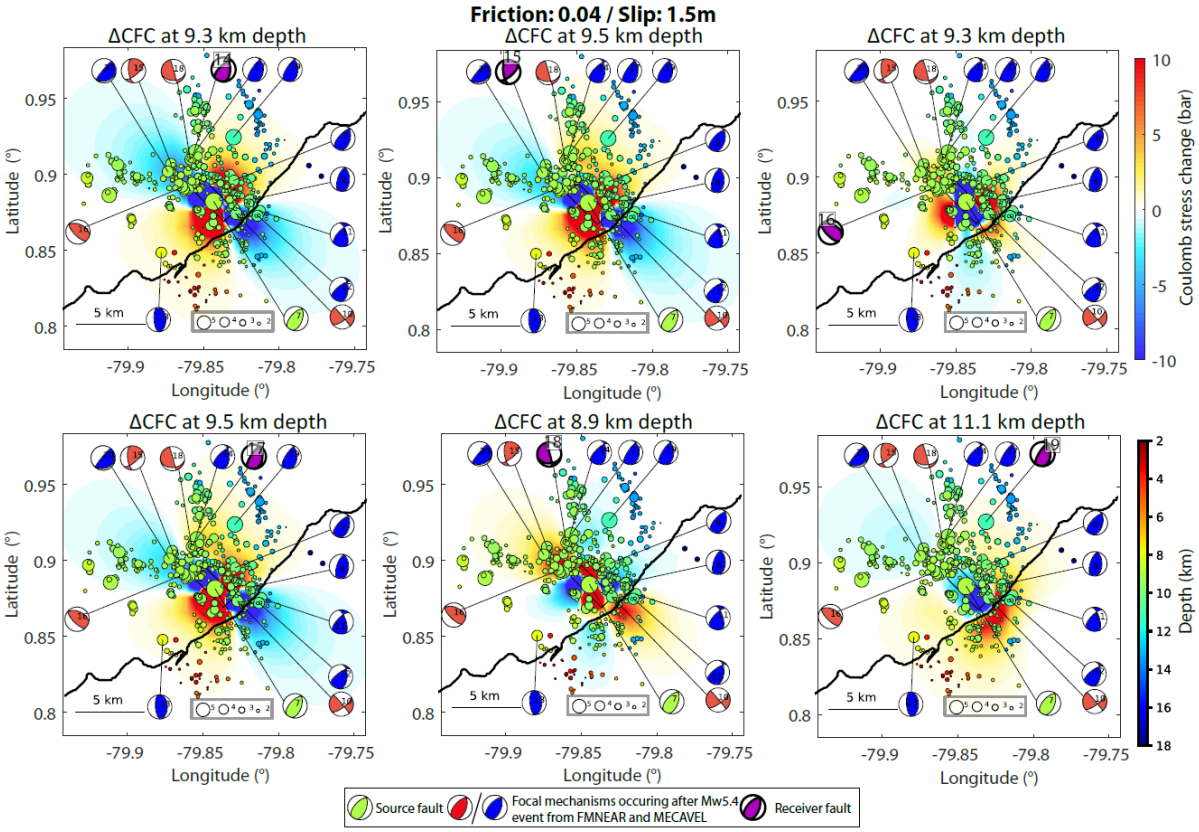

Figure S17: Coulomb stress change caused by the slip of the Mw5.4 event, using a friction coefficient of 0.04. Green focal mechanism: Mw5.4 earthquake source slip. Red and blue focal mechanism: Earthquakes occurring after Mw5.4 event computed by FMNEAR and MECAVEL respectively. Purple mechanism: Receiver fault with focal mechanism id from 14 to 19. Earthquakes are sized by magnitude and color-coded with depth. Black rectangle represents the rupture area of the Mw5.4 event. Numbers on the focal mechanisms refer to the focal mechanisms id from Table S1.

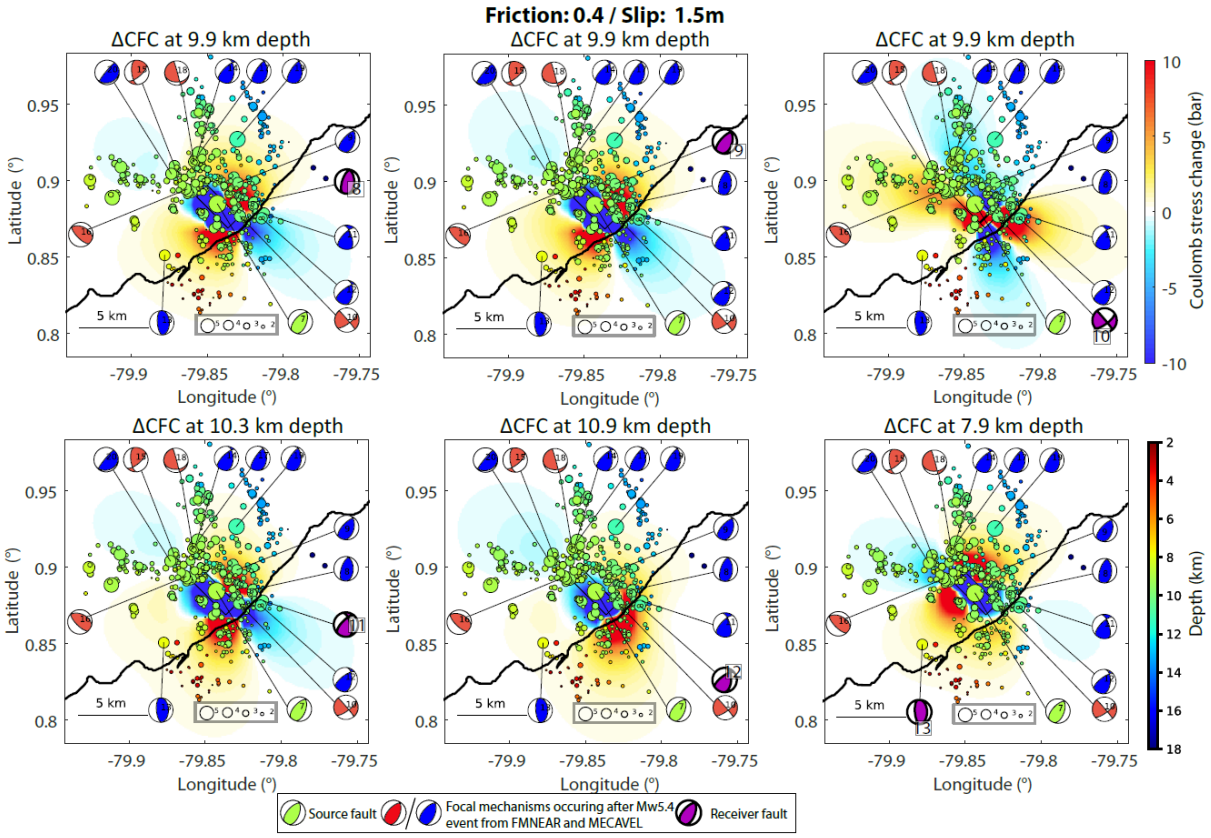

Figure S18: Coulomb stress change caused by the slip of the Mw5.4 event, using a friction coefficient of 0.4. Green focal mechanism: Mw5.4 earthquake source slip. Red and blue focal mechanism: Earthquakes occurring after Mw5.4 event computed by FMNEAR and MECAVEL respectively. Purple mechanism: Receiver fault with focal mechanism id from 8 to 13. Earthquakes are sized by magnitude and color-coded with depth. Black rectangle represents the rupture area of the Mw5.4 event. Numbers on the focal mechanisms refer to the focal mechanisms id from Table S1.

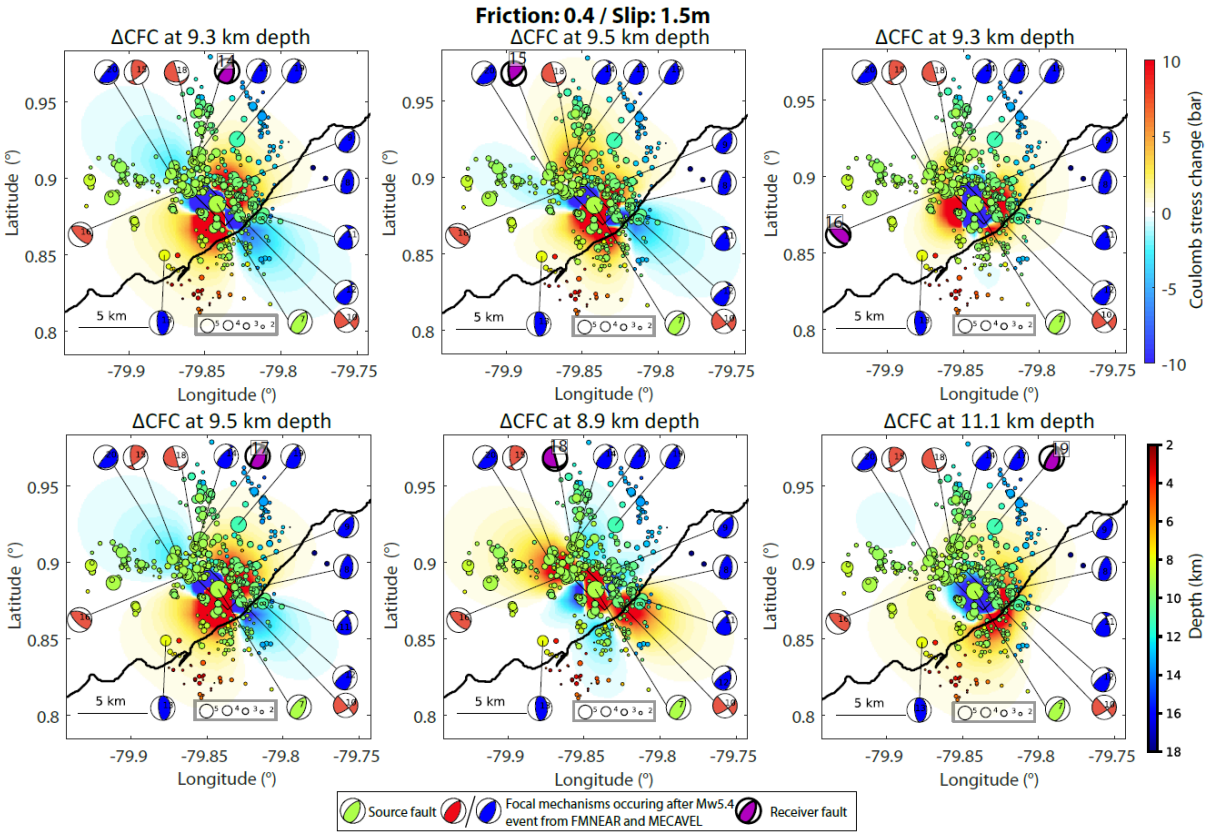

Figure S19: Coulomb stress change caused by the slip of the Mw5.4 event, using a friction coefficient of 0.4. Considering the same rupture area as in Figure 6 and Figure S10. focal mechanism: Mw5.4 earthquake source slip. Red and blue focal mechanism: Earthquakes occurring after Mw5.4 event computed by FMNEAR and MECAVEL respectively. Purple mechanism: Receiver fault with focal mechanism id from 14 to 19. Earthquakes are sized by magnitude and color-coded with depth. Black rectangle represents the rupture area of the Mw5.4 event. Numbers on the focal mechanisms refer to the focal mechanisms id from Table S1.

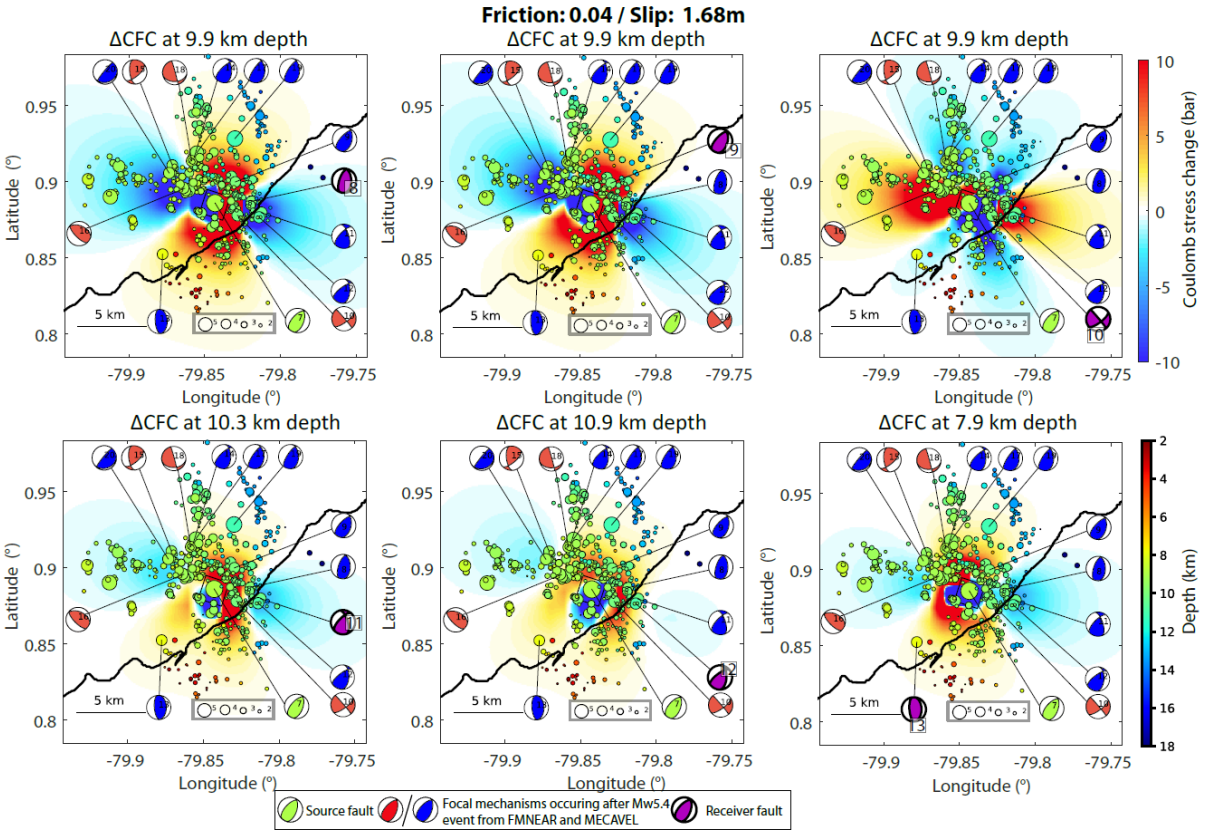

Figure S20: Coulomb stress change caused by the slip of the Mw5.4 event, using a friction coefficient of 0.04. From equation 2, we compute a slip of 1.68 m and inferred a rupture area of 3.14 km² from equation 1. Green focal mechanism: Mw5.4 earthquake source slip. Red and blue focal mechanism: Earthquakes occurring after Mw5.4 event computed by FMNEAR and MECAVEL respectively. Purple mechanism: Receiver fault with focal mechanism id from 14 to 19. Earthquakes are sized by magnitude and color-coded with depth. Black rectangle represents the rupture area of the Mw5.4 event. Numbers on the focal mechanisms refer to the focal mechanisms id from Table S1.

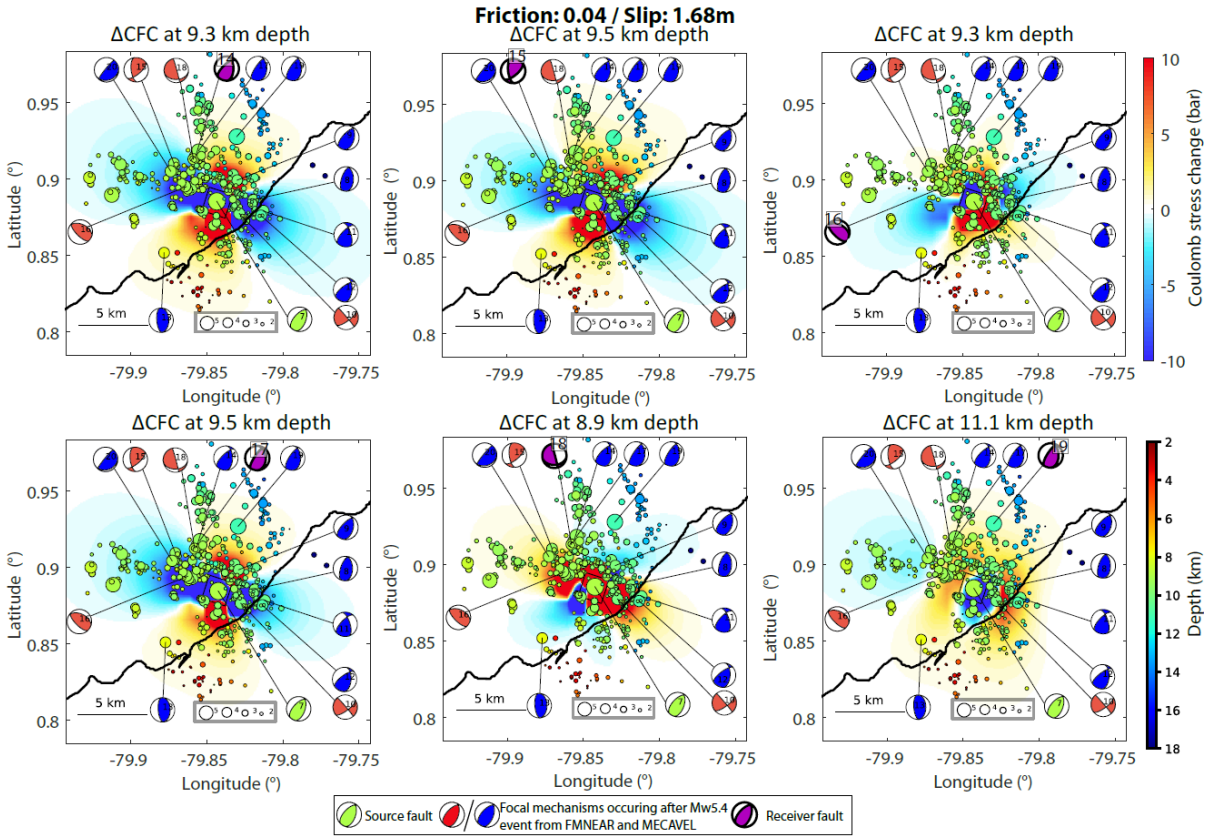

Figure S21: Coulomb stress change caused by the slip of the Mw5.4 event, using a friction coefficient of 0.04. From equation 2, we compute a slip of 1.68 m and inferred a rupture area of 3.14 km² from equation 1. Green focal mechanism: Mw5.4 earthquake source slip. Red and blue focal mechanism: Earthquakes occurring after Mw5.4 event computed by FMNEAR and MECAVEL respectively. Purple mechanism: Receiver fault with focal mechanism id from 14 to 19. Earthquakes are sized by magnitude and color-coded with depth. Black rectangle represents the rupture area of the Mw5.4 event. Numbers on the focal mechanisms refer to the focal mechanisms id from Table S1.

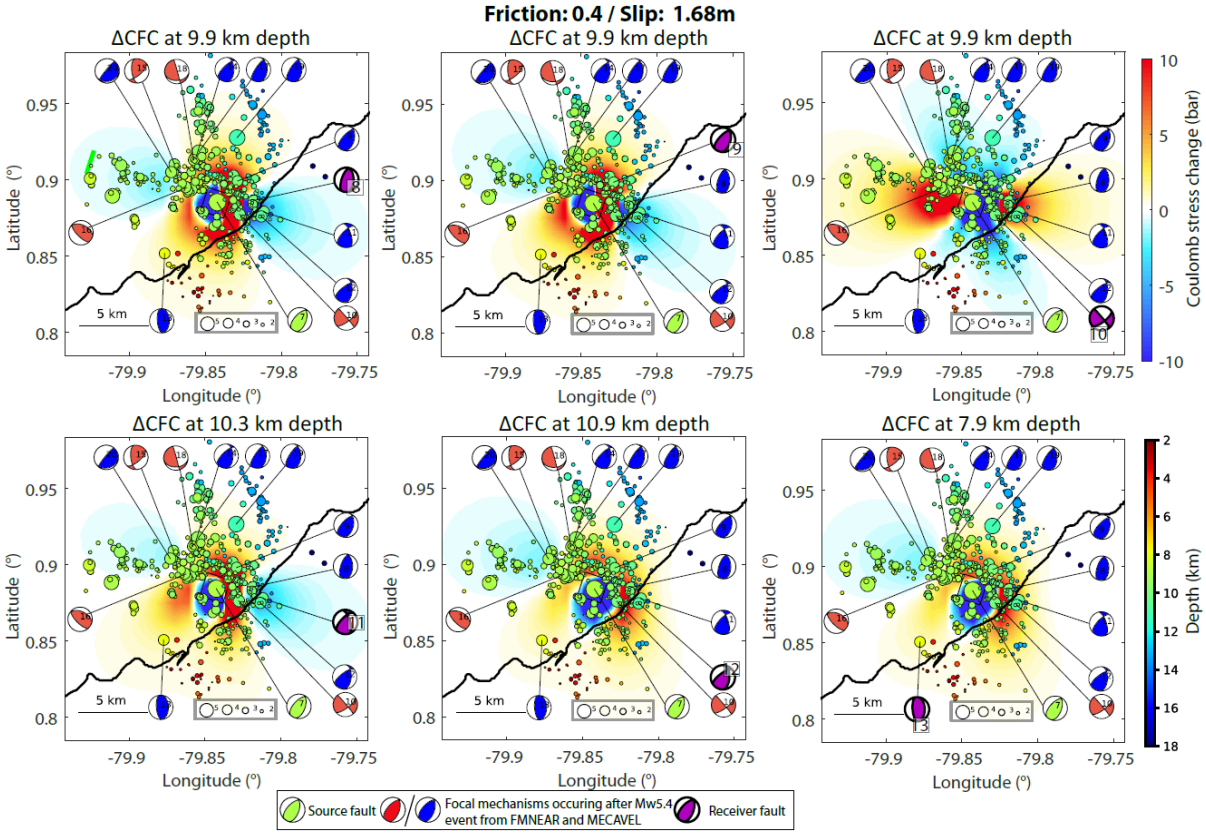

Figure S22: Coulomb stress change caused by the slip of the Mw5.4 event, using a friction coefficient of 0.4. From equation 2, we compute a slip of 1.68 m and inferred a rupture area of 3.14 km² from equation 1. Green focal mechanism: Mw5.4 earthquake source slip. Red and blue focal mechanism: Earthquakes occurring after Mw5.4event computed by FMNEAR and MECAVEL respectively. Purple mechanism: Receiver fault with focal mechanism id from 8 to 13. Earthquakes are sized by magnitude and color-coded with depth. Black rectangle represents the rupture area of the Mw5.4 event. Numbers on the focal mechanisms refer to the focal mechanisms id from Table S1.

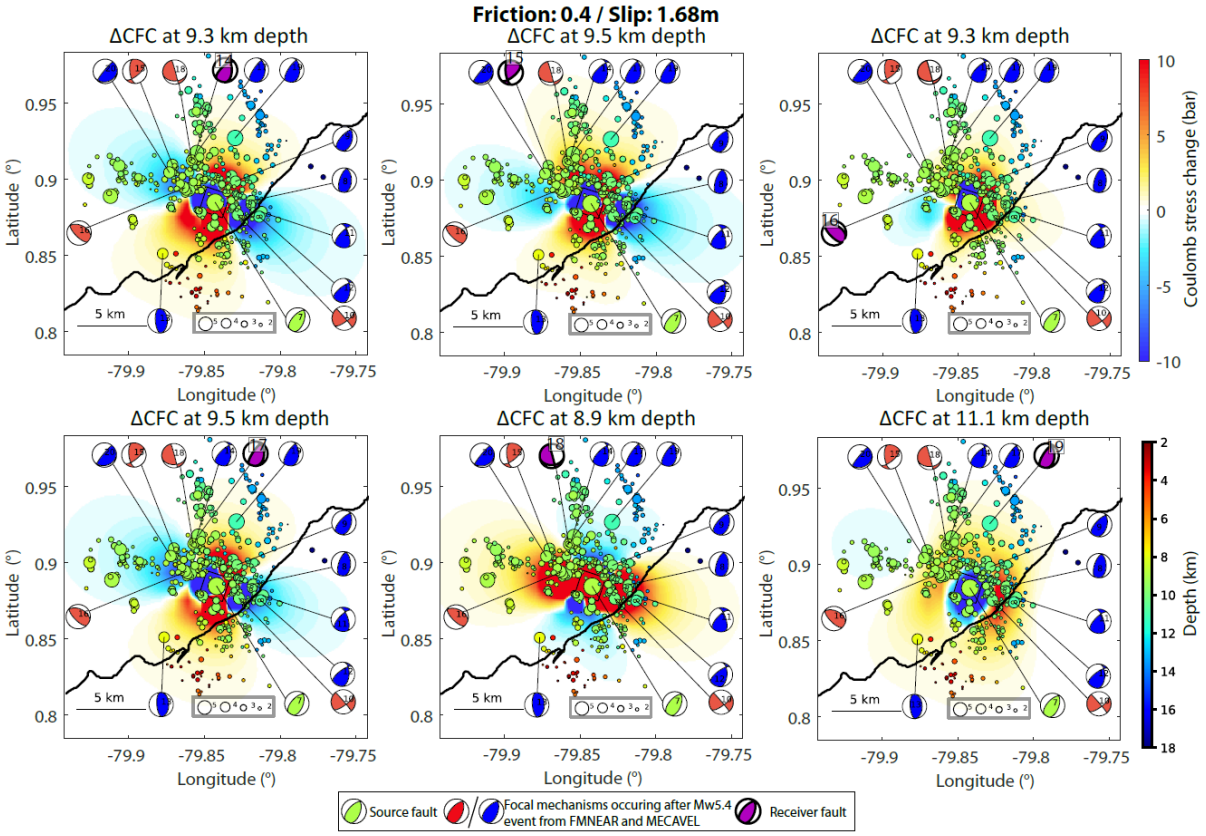

Figure S23: Coulomb stress change caused by the slip of the Mw5.4 event, using a friction coefficient of 0.4. From equation 2, we compute a slip of 1.68 m and inferred a rupture area of 3.14 km² from equation 1. Green focal mechanism: Mw5.4 earthquake source slip. Red and blue focal mechanism: Earthquakes occurring after Mw5.4 event computed by FMNEAR and MECAVEL respectively. Purple mechanism: Receiver fault with focal mechanism id from 14 to 19. Earthquakes are sized by magnitude and color-coded with depth. Black rectangle represents the rupture area of the Mw5.4 event. Numbers on the focal mechanisms refer to the focal mechanisms id from Table S1.

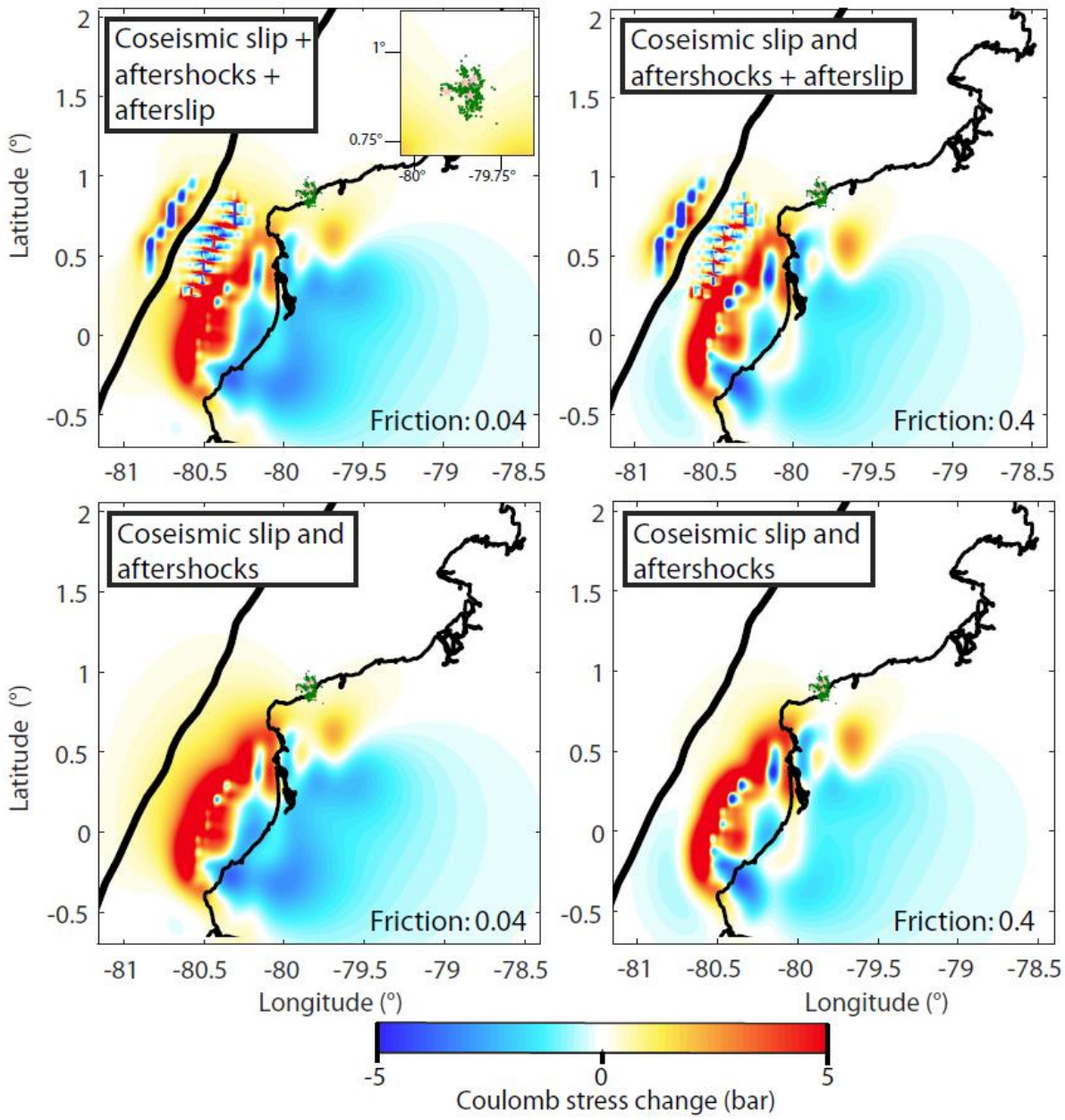

Figure S24: Coulomb stress change at 8.9 km depth caused by a combination of coseismic slip from the Pedernales earthquake, afterslip and aftershocks following the Mw7.8 earthquake. The values of the coefficients of friction tested are 0.04 and 0.4. The receiver fault is the focal has the attributes of the mechanism of the largest earthquake of the Atacames swarm, the Mw5.4 earthquake, with a strike, dip and rake of 20°, 43° and 73° respectively. Green dots represent earthquakes from the Atacames swarm and pink star, the events with magnitudes larger than 5.

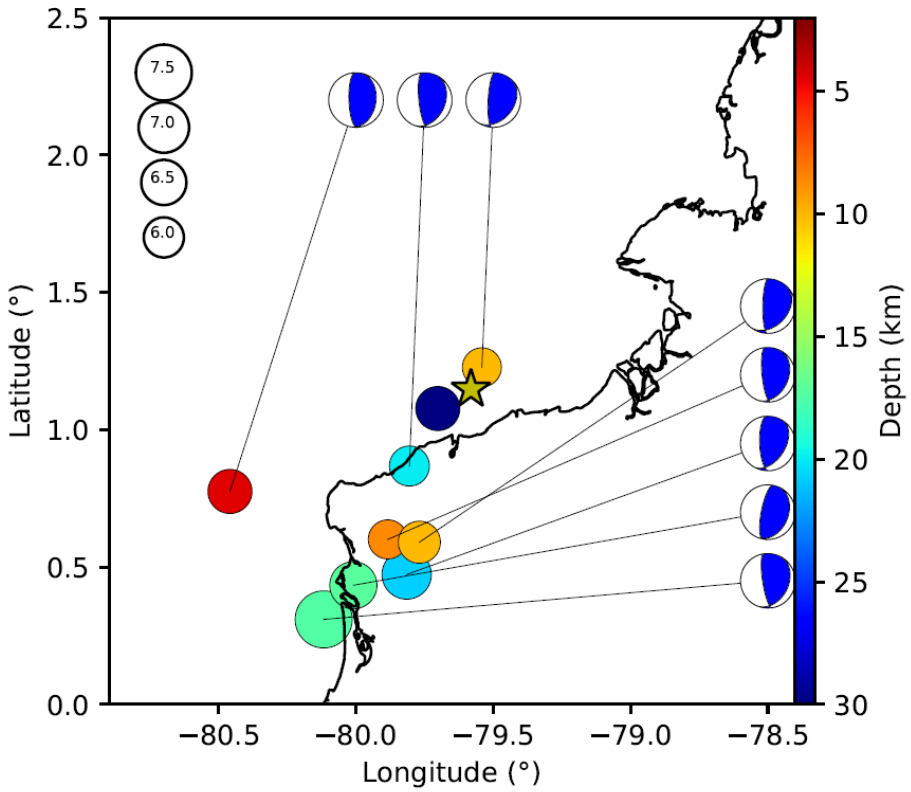

Figure S25: Location of Mw5.9+ events between 2015 and 2025 located by IG-EPN (see Table S2) with their associated focal mechanisms. Events are color-coded with depth and sized by magnitude. The yellow star represents the epicenter of the 1958 Mw7.7 earthquake (Swenson and Beck, 1996).

Origin time (Year-Month-Day hour:minute:seconds)	Latitude (°)	Longitude (°)	Depth (km)	Magnitude (Mw)
2015-05-30 06:26:06.000	1.227043	-79.541428	10.00	5.90
2016-04-20 08:33:43.000	0.775296	-80.459084	4.31	6.40
2016-05-18 07:57:00.000	0.433877	-80.009613	17.19	6.70
2016-05-18 16:46:42.000	0.473013	-79.815453	20.76	6.90
2016-07-11 02:01:08.000	0.600839	-79.884155	8.67	5.90
2016-07-11 02:11:04.000	0.590491	-79.769196	10.08	6.20
2022-03-27 04:28:10.000	0.867790	-79.805550	20.00	6.00
2025-04-25 11:44:49.000	1.077168	-79.702151	30.14	6.40

Table S2: List of Mw5.9+ earthquakes between 2015 and 2025 used to compute the Coulomb stress changes of Figure 26.

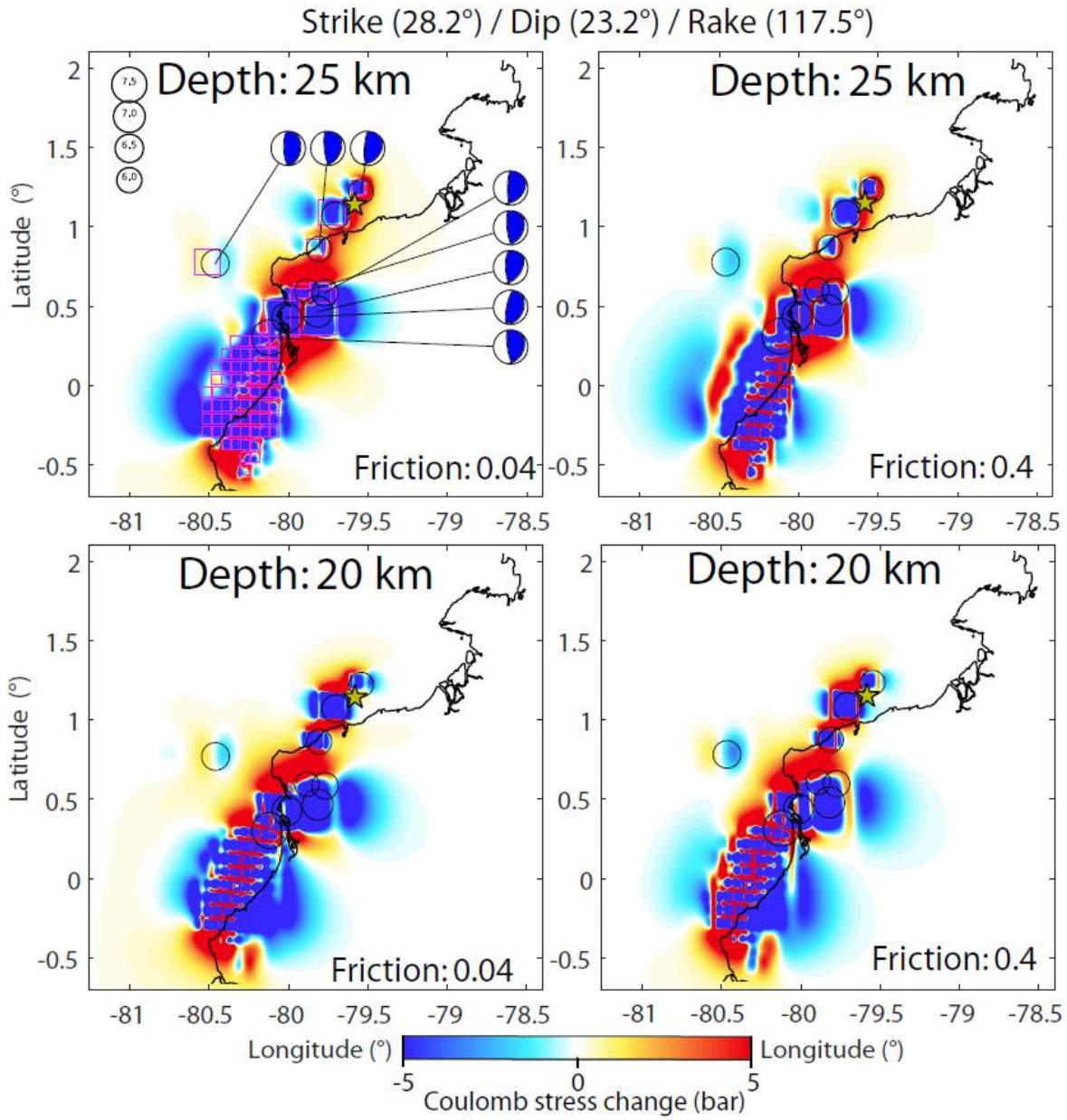

Figure S26: Coulomb stress change at two depths (20 and 25 km) and for two coefficients of friction (0.04 and 0.4). The receiver fault depicts the characteristics of the plate interface with average values resulting from focal mechanism in Figure S25. The yellow star represents the epicenter of the 1958 Mw7.7 earthquake (Swenson and Beck, 1996). We use as slip source all the megathrust Mw5.9+ earthquakes between 2015 and 2025 plotted on Figure S25. The coseismic slip of the 2016 Mw7.8 Pedernales earthquake is discretized (Nocquet *et al.*, 2017), while all the slip of all the other earthquake is considered as a single source point. The slip is estimated proportionally to the magnitude.

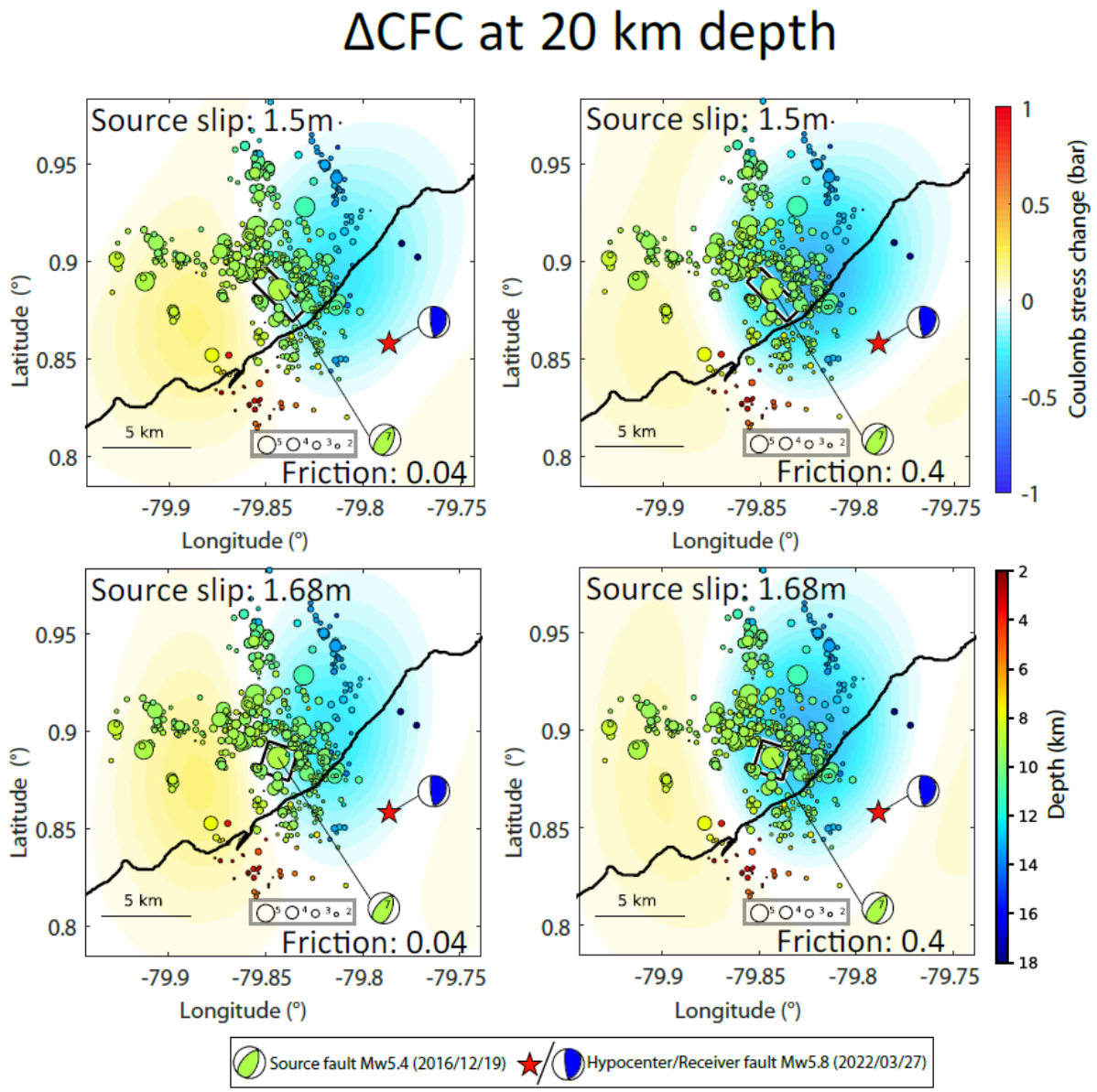

Figure S27: Coulomb stress change caused by the slip of the Mw5.4 event, computed at 20 km depth. Coefficient of friction varies between 0.04 and 0.4, and source slip values between 0.5 and 5m. The same rupture of the source slip is marked by a black rectangle. Green focal mechanism with id number (7): Mw5.4 (2016) earthquake source slip. Red star and blue focal mechanism: Hypocenter and receiver fault for the Mw5.8 event of 2022 (Chalumeau *et al.*, 2024).

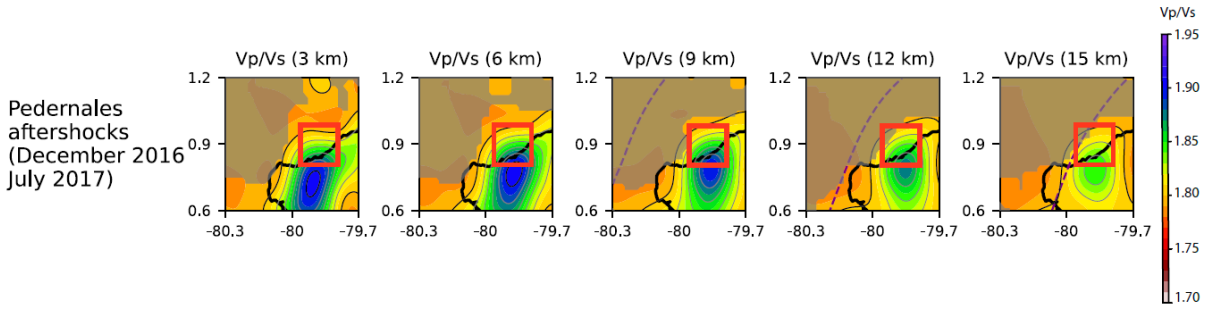

Figure S28: Map view of Vp/Vs depth sections in the Atacames area (Wickham-Piotrowski *et al.*, 2026). The Vp/Vs is computed for a time interval ranging from December 3rd, 2016 to July 11th, 2017. The values in the region of the location of the seismic swarm are constantly above 1.85, which is higher than the background value of 1.79. Purple dashed line: Plate interface model after Font *et al.* (2013). Red box: 2016 Atacames swarm.