



THE HISTORY OF SEISMIC AND ASEISMIC SLIP AT THE CENTRAL ECUADOR SUBDUCTION ZONE

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F. Rolandone (Sorbonne Université), M. Vallée (IPG Paris)

Students

J.-C. Villegas-Lanza, P. Jarrin, S. Vaca

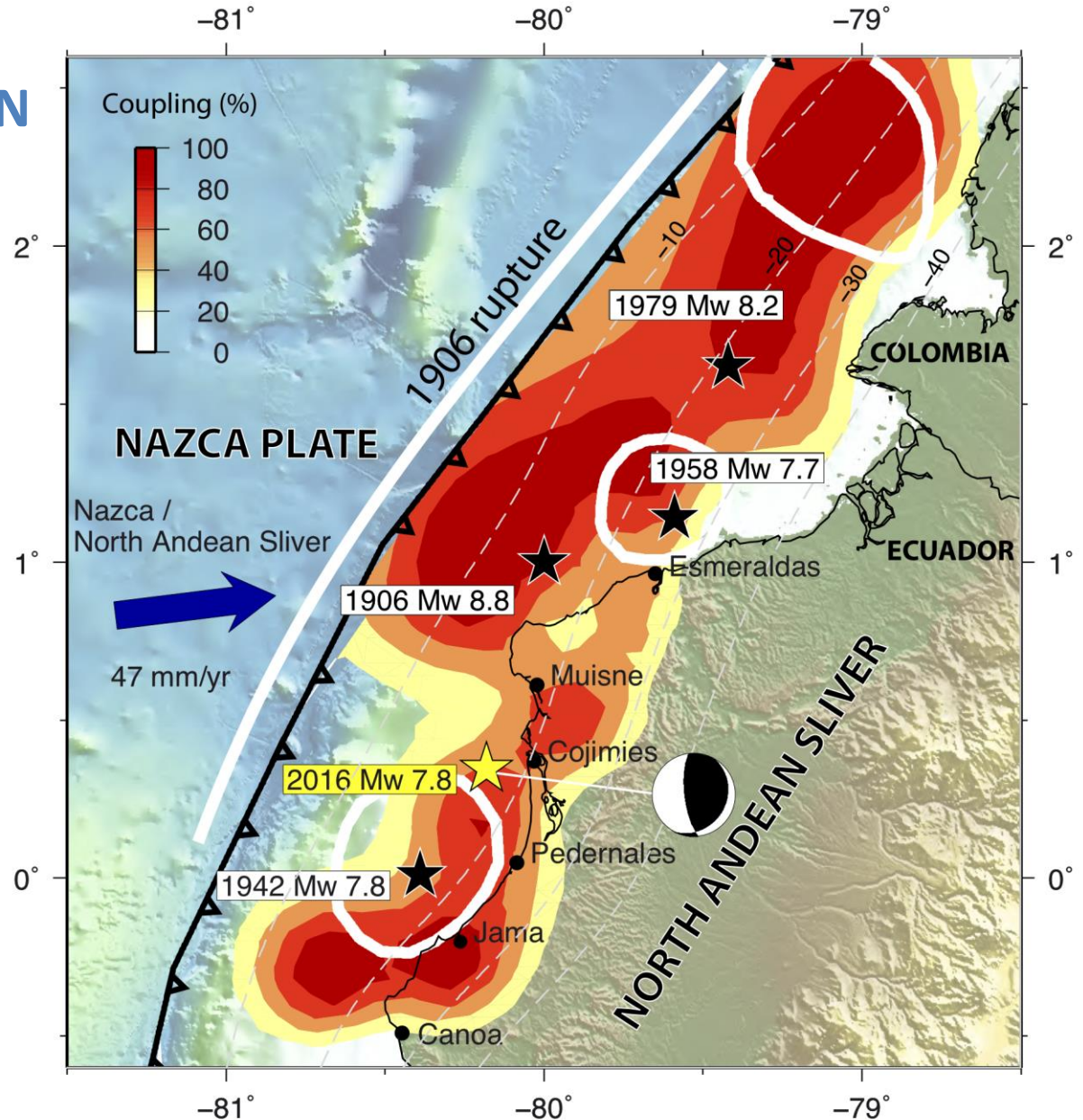
LMI SVAN

P. Mothes, A. Alvarado, L. Audin, J. Battaglia, J. Y. Collot, D. Cisneros, M. Chlieh, B. Delouis, Y. Font, R. Grandin, S. Hernandez, M. Plain, M. Régnier, M. Segovia, P. Charvis, H. Tavera, H. Yepes.

THE SEISMIC SEQUENCE AT THE ECUADOR-COLOMBIA SUBDUCTION ZONE SINCE 1906

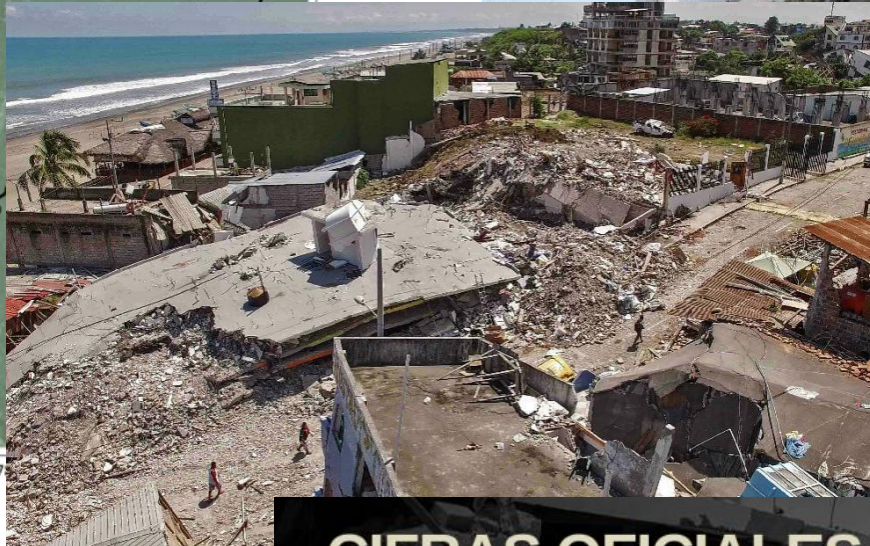
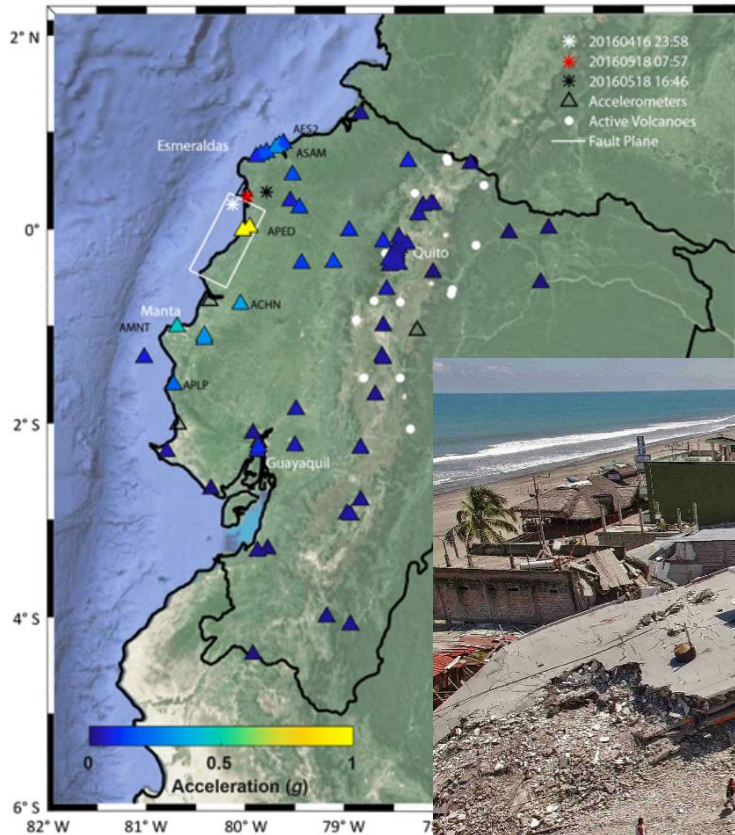
Kanamori & Mc Nally (1982),
Swenson & Beck (1995)

All large earthquakes of the
sequence have been recorded by
seismometers



Nocquet et al., (2017). See also Chlieh et al. (2014) and Gombert et al. (2018) for alternative interseismic coupling models

THE PEDERNALES APRIL 16 2016 ECUADOR EARTHQUAKE (Mw 7.8)



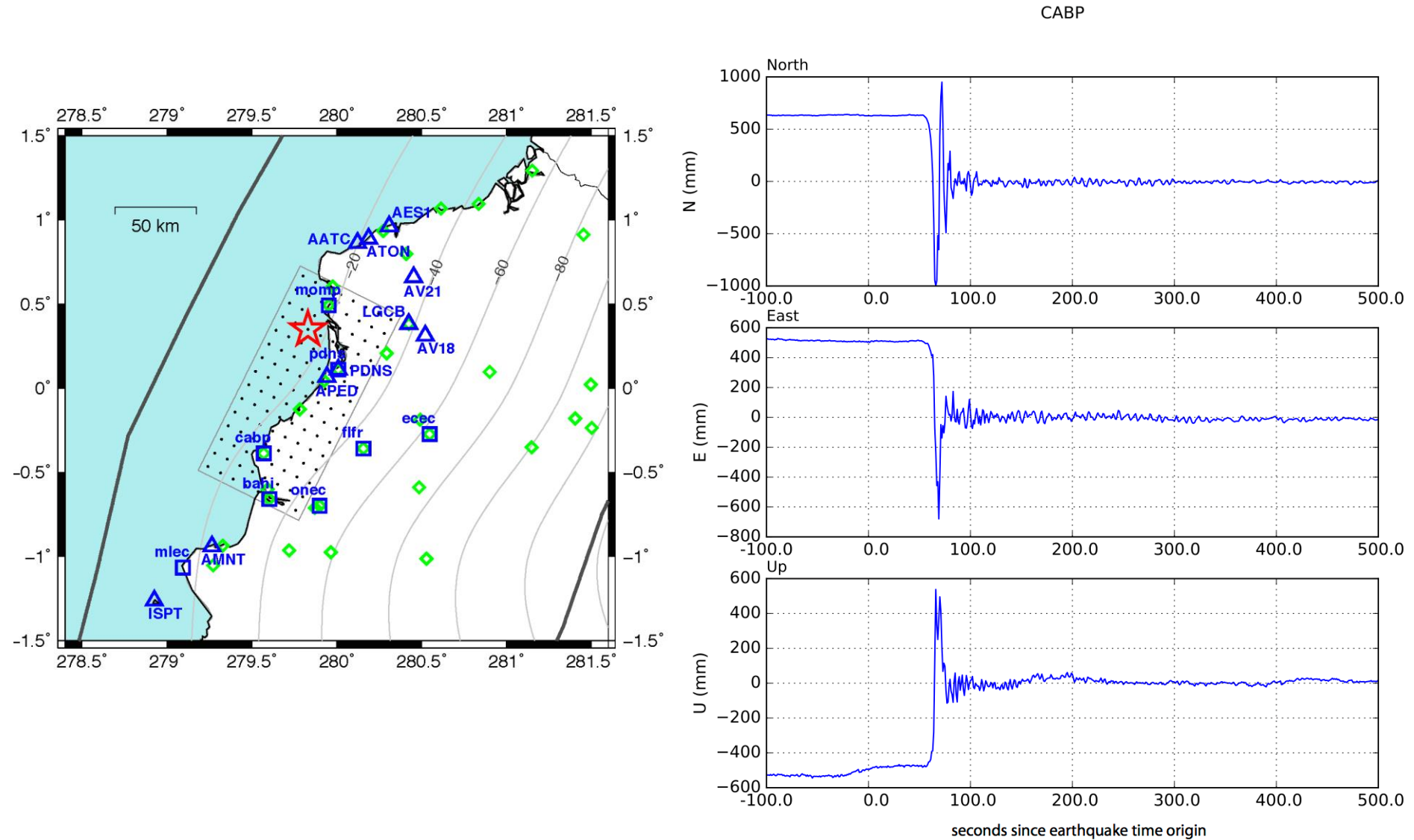
Beauval et al.,
BSSA, 2017

CIFRAS OFICIALES TRAS TERREMOTO EN ECUADOR

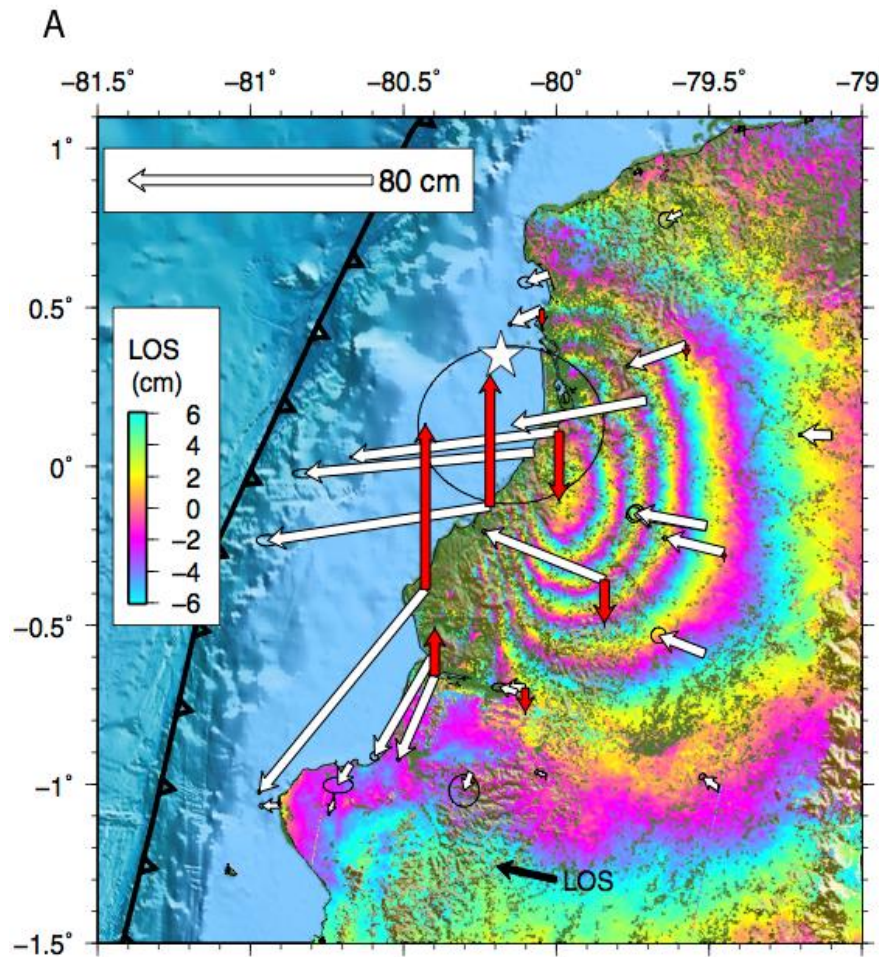
663	9	166	28775	113
PERSONAS FALLECIDAS(1)	PERSONAS DESAPARECIDAS (2)	ESCUELAS CON AFECTACION MEDIA Y GRAVE 560 AFECTADAS (6)	PERSONAS ALBERGADAS(4)	PERSONAS RESCATADAS CON VIDA (5)
737787	6998	2740	57481	6274
KITS DE ALIMENTOS ENTREGADOS (4)	EDIFICACIONES DESTRUIDAS (5)	EDIFICACIONES AFECTADAS (5)	VOLUNTARIOS REGISTRADOS(8)	PERSONAS HERIDAS Y OTRAS AFECTACIONES DIRECTAS(3)

Fuente: (1) DINASED/FGE, (2)DINASED (3) MTT2 (MSP, IESS, Instituto de Seguridad Social de la Policía Nacional, Instituto de Seguridad Social de las Fuerzas Armadas)(4) MTT4 CCFFAA (5) USAR SGR, (6) MTT (7) MTT 7.* Actualizado hasta 19/05/2016 (20:30)

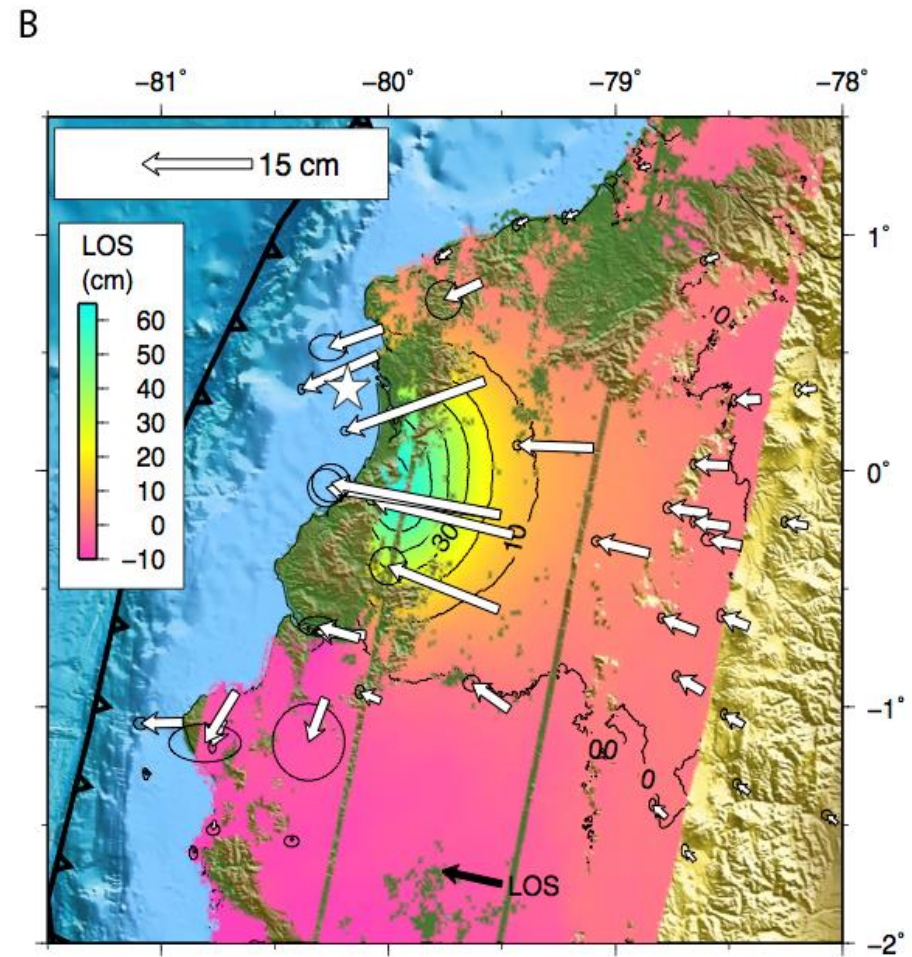
NEAR FIELD HIGH RATE GPS & ACCELEROGRAMS



COSEISMIC STATIC DISPLACEMENT FROM GPS & INSAR

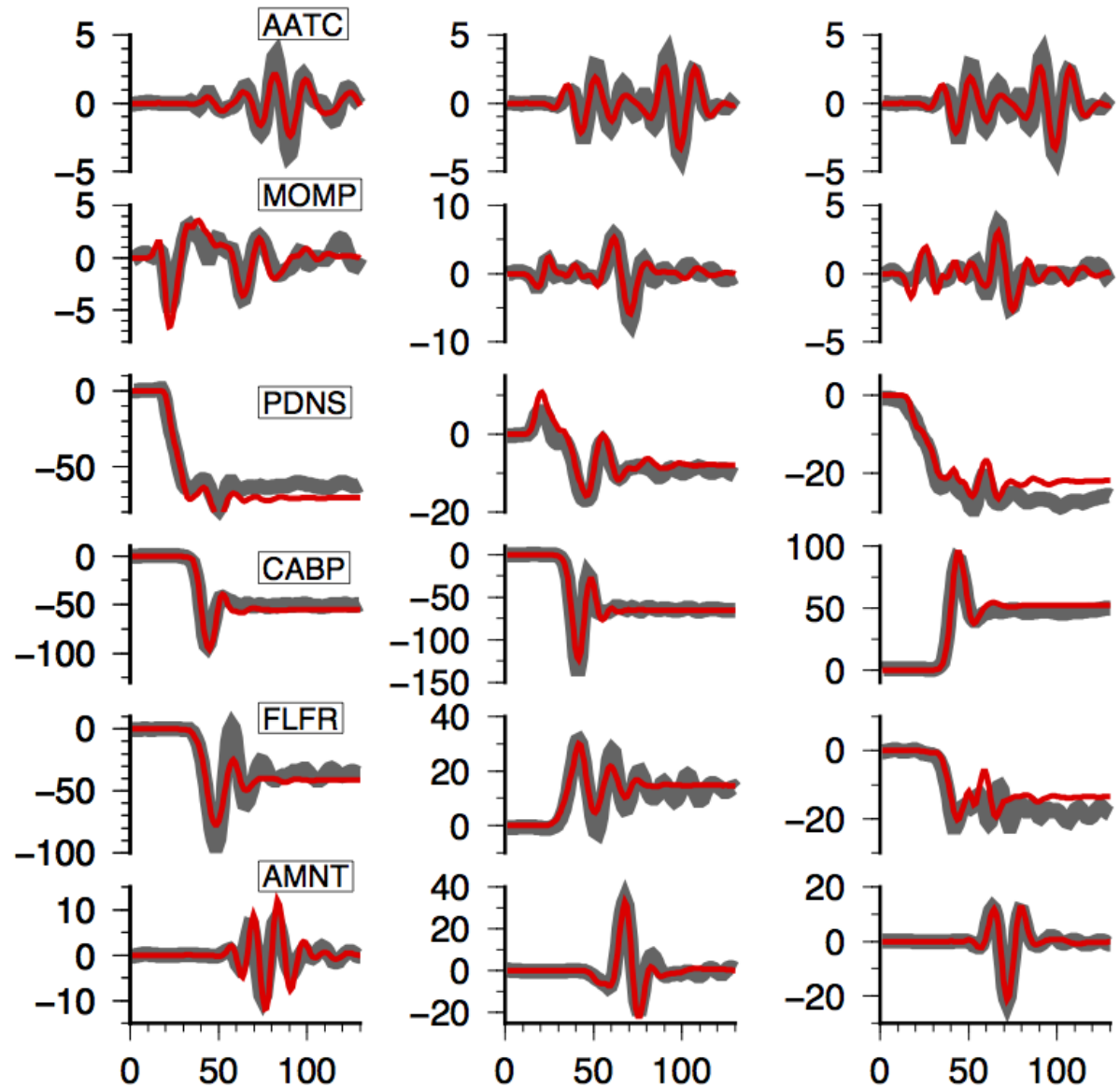
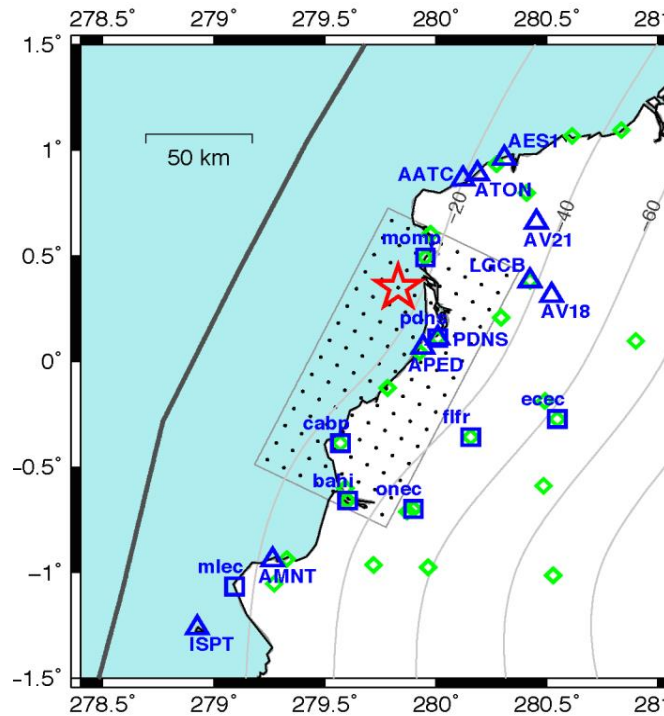


ALOS-2 descending (wrapped)
interferogram
L-band (24.55 cm)
2016/04/01-2016/04/29



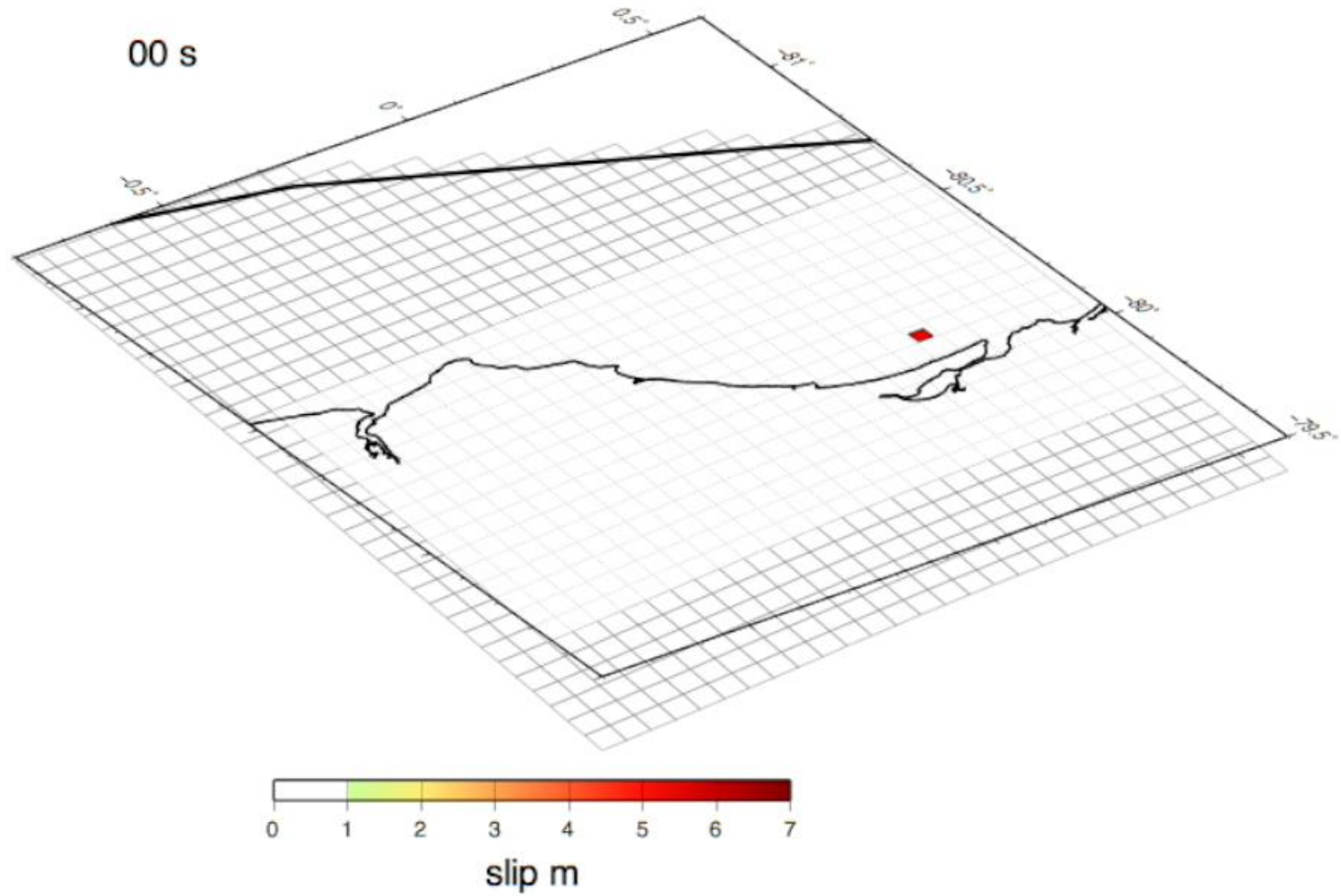
Sentinel-1 descending tracks
(unwrapped) interferogram
C-banded (5.55 cm) 2016/04/12-
2016/04/24

NEAR FIELD HIGH RATE GPS & ACCELEROGRAMS (FILTERED)

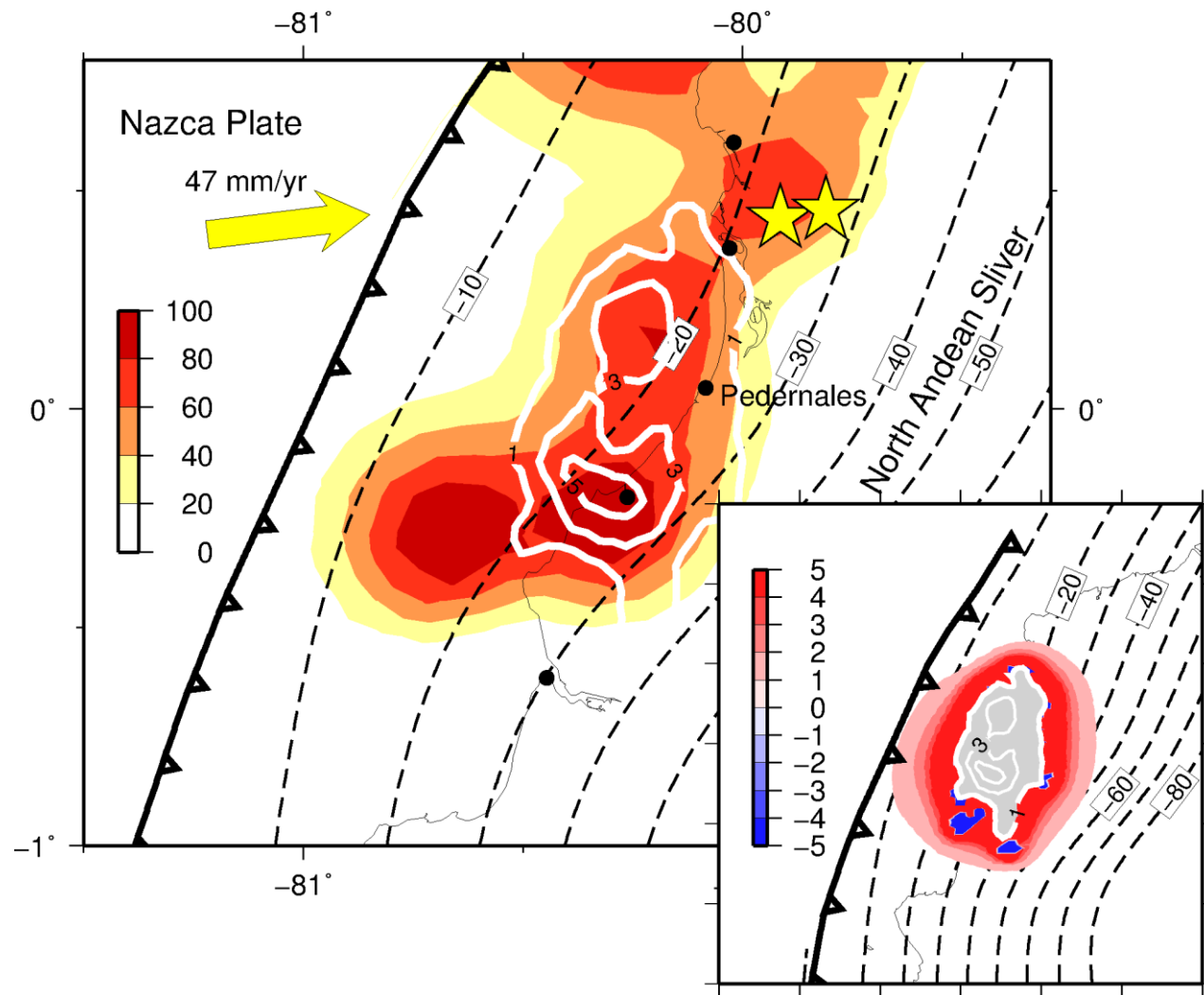


Pedernales 2016 April 16 Mw 7.8 earthquake

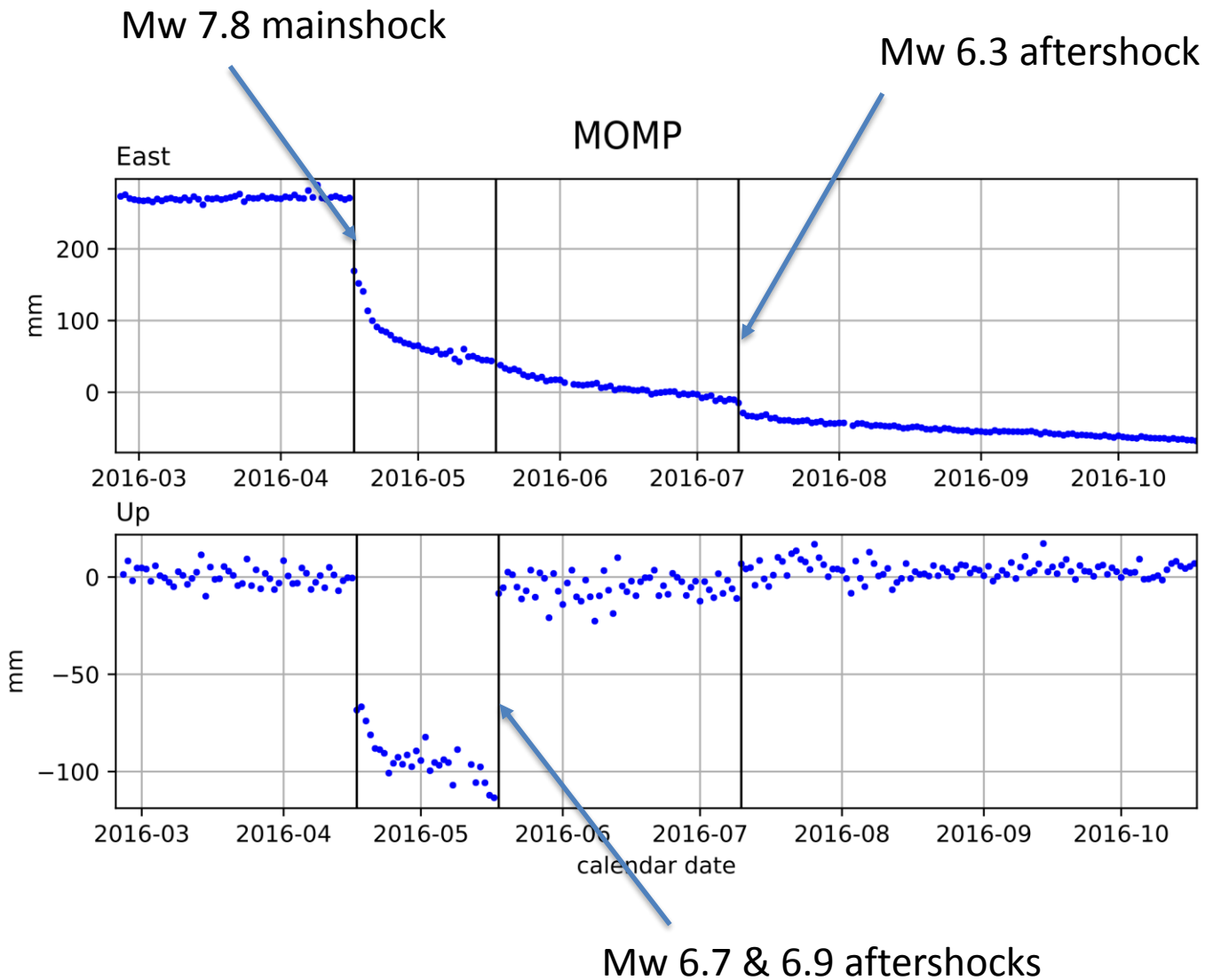
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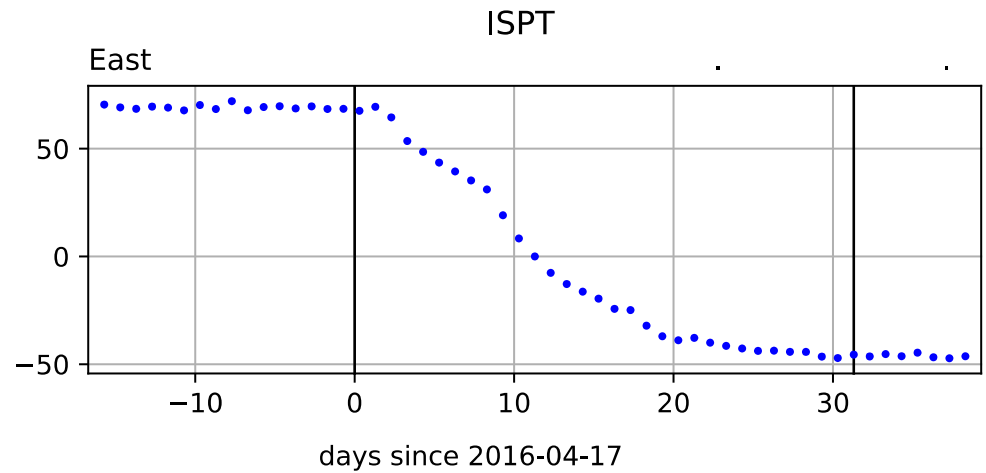
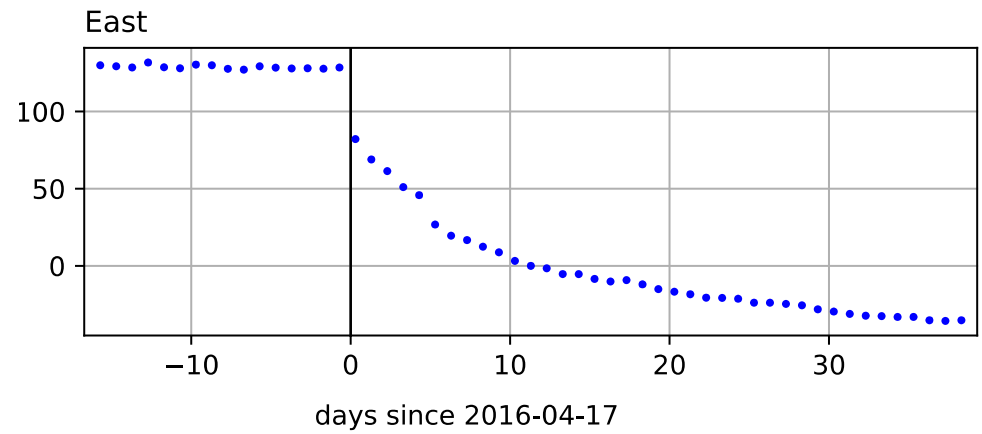
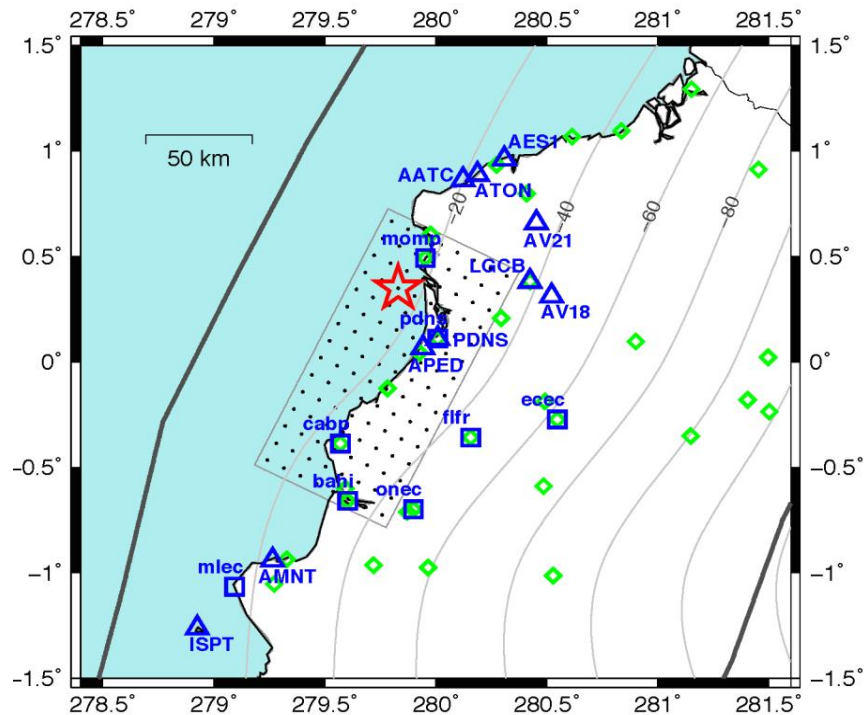
SLIP DISTRIBUTION & INTERSEISMIC COUPLING



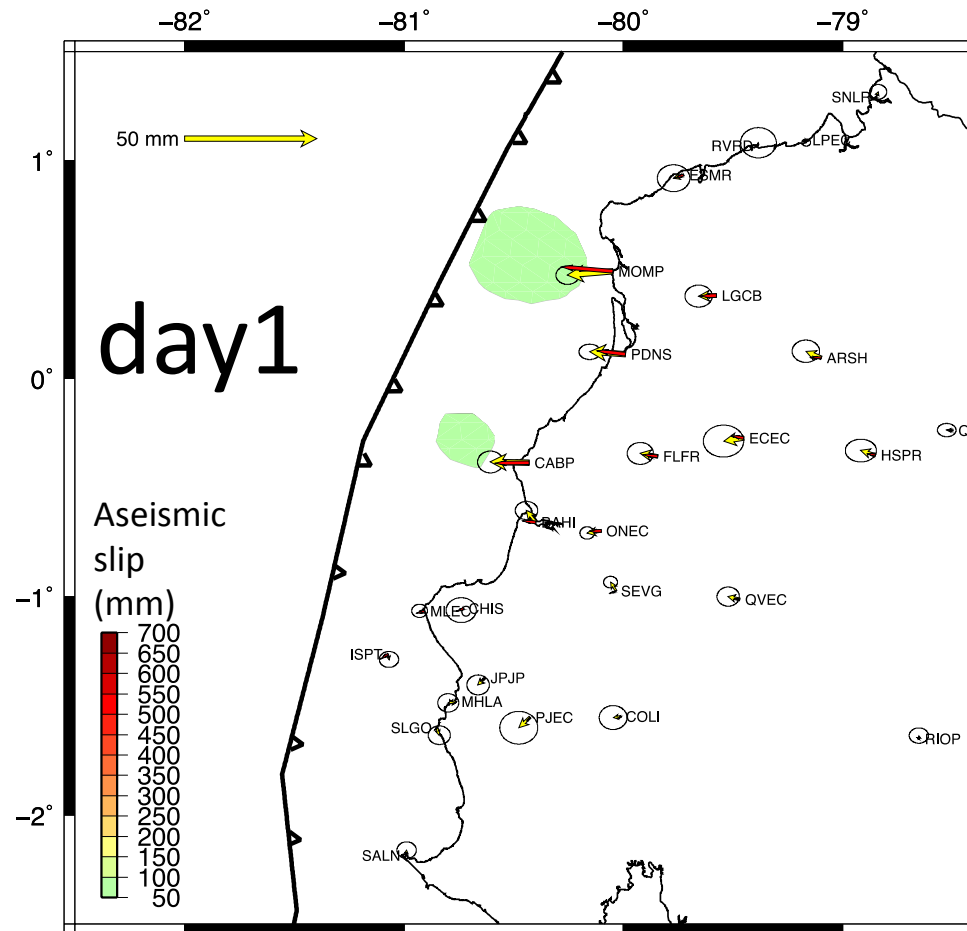
POST-EARTHQUAKE GPS TIME SERIES

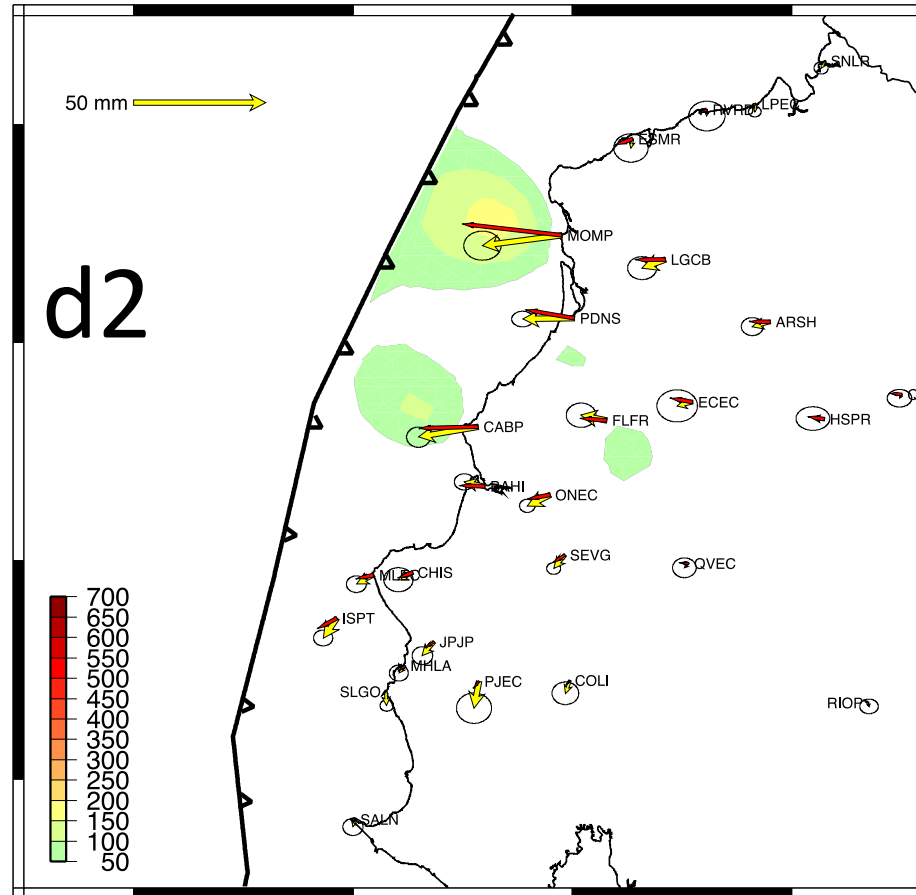


POST-EARTHQUAKE GPS TIME SERIES

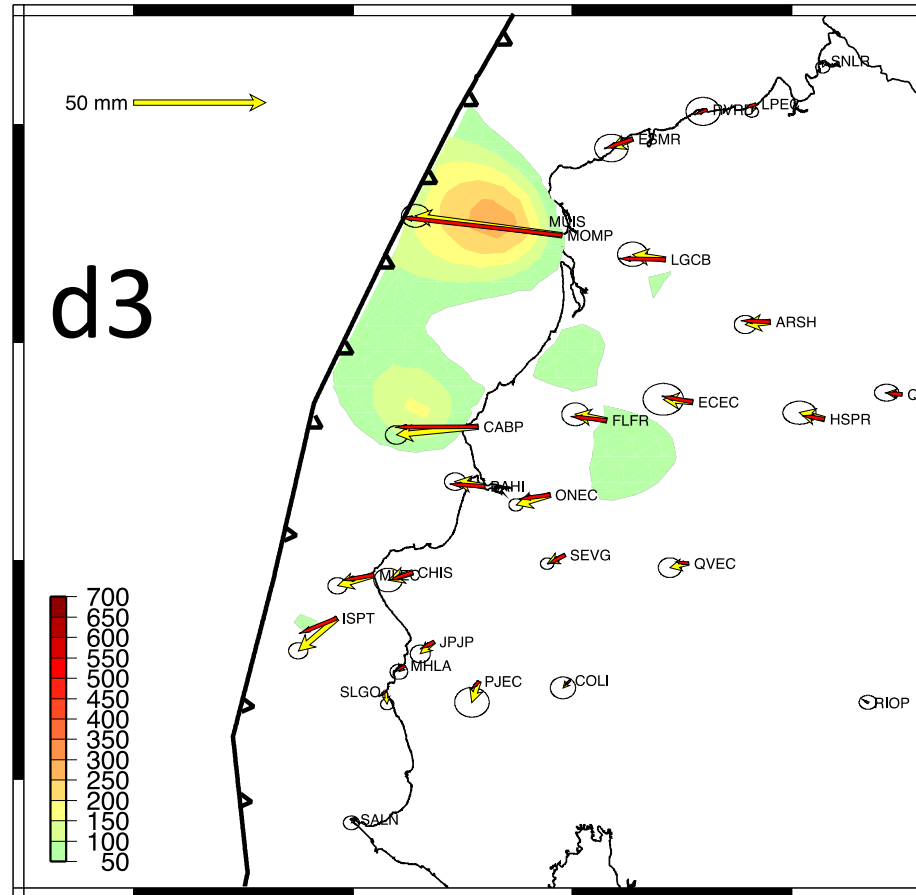


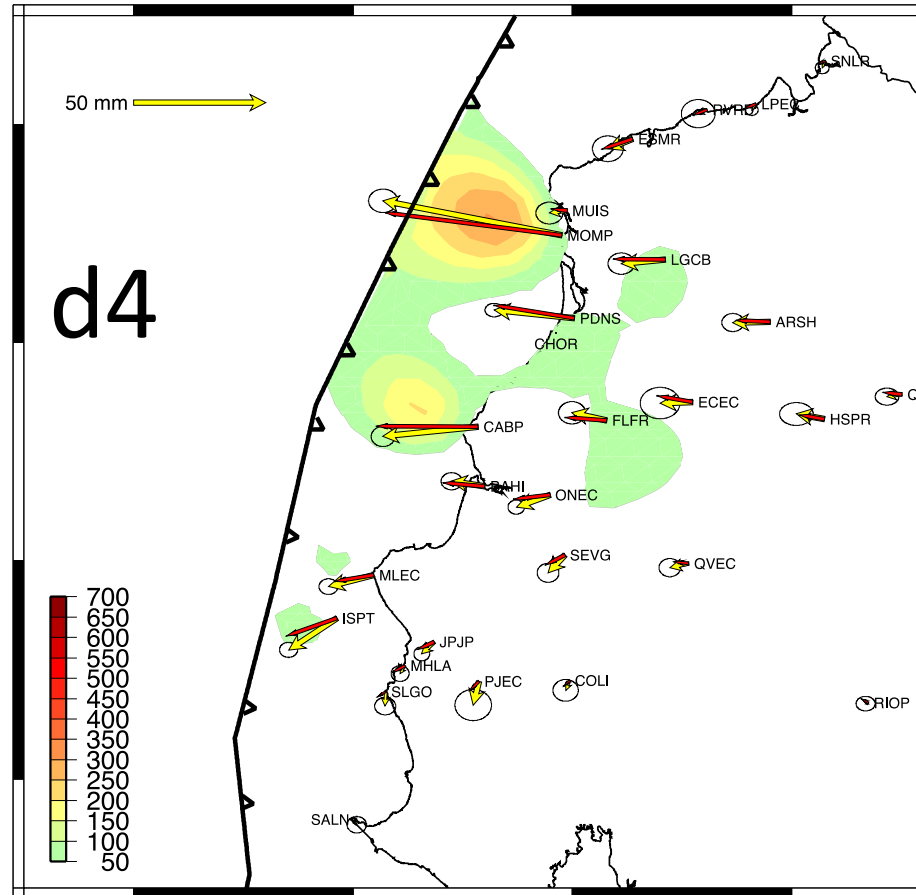
TIME DEPENDENT SLIP INVERSION OVER 30 DAYS

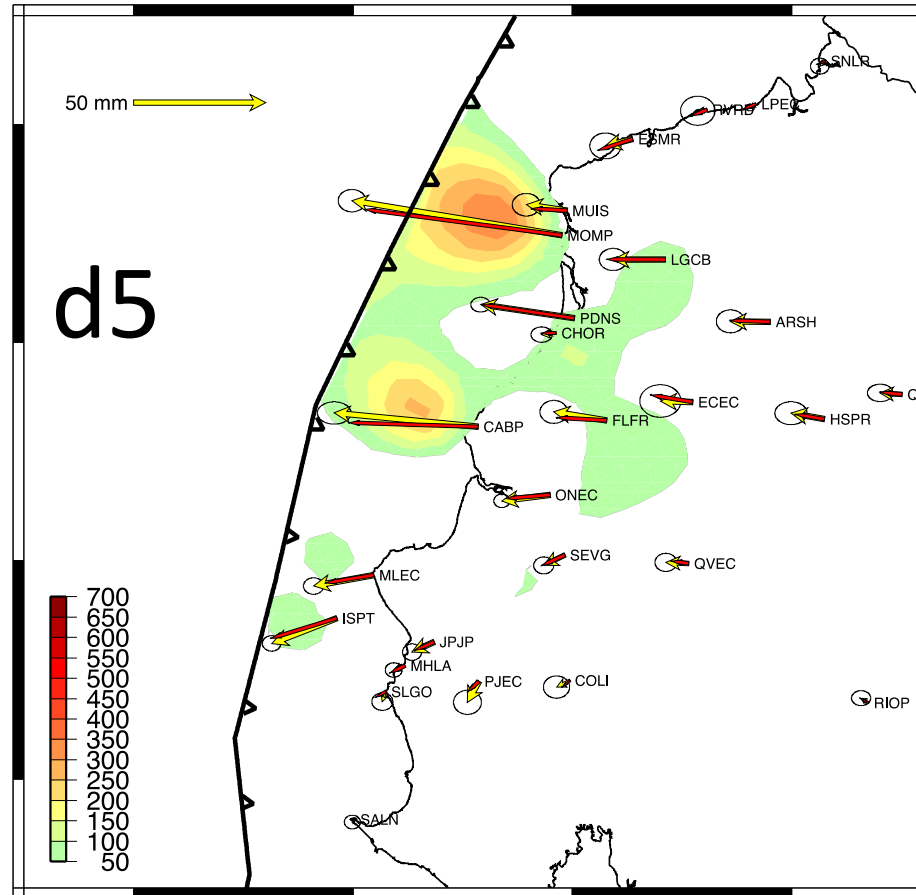


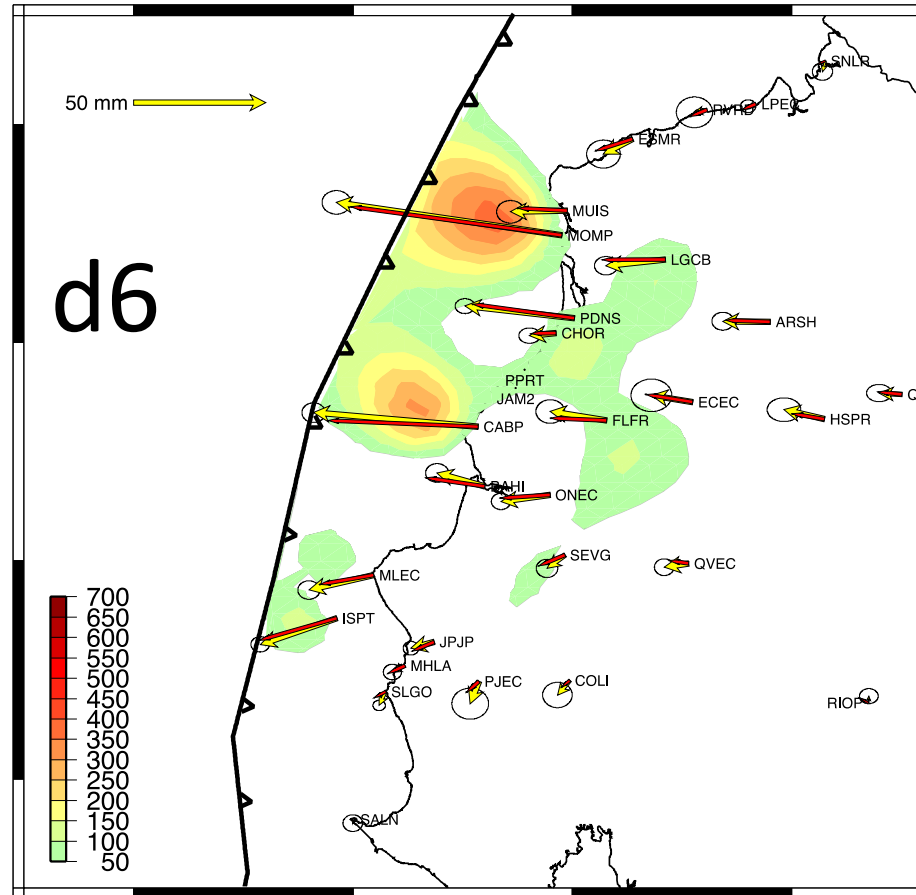


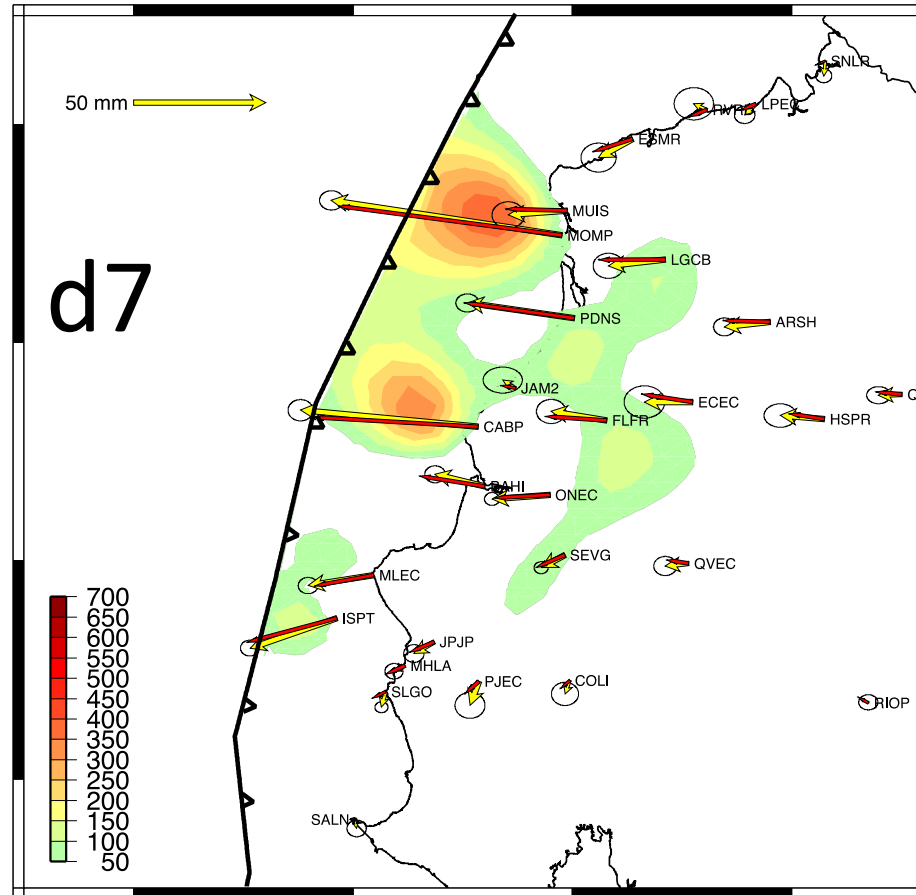
Onset of a Slow Slip Event

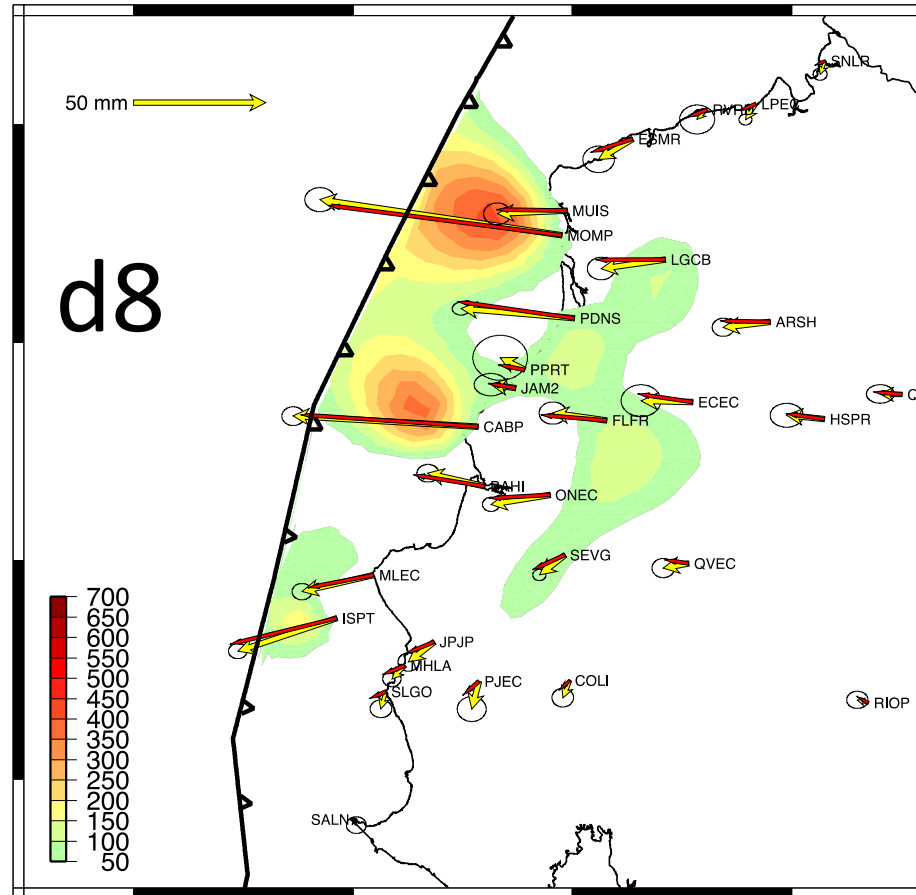


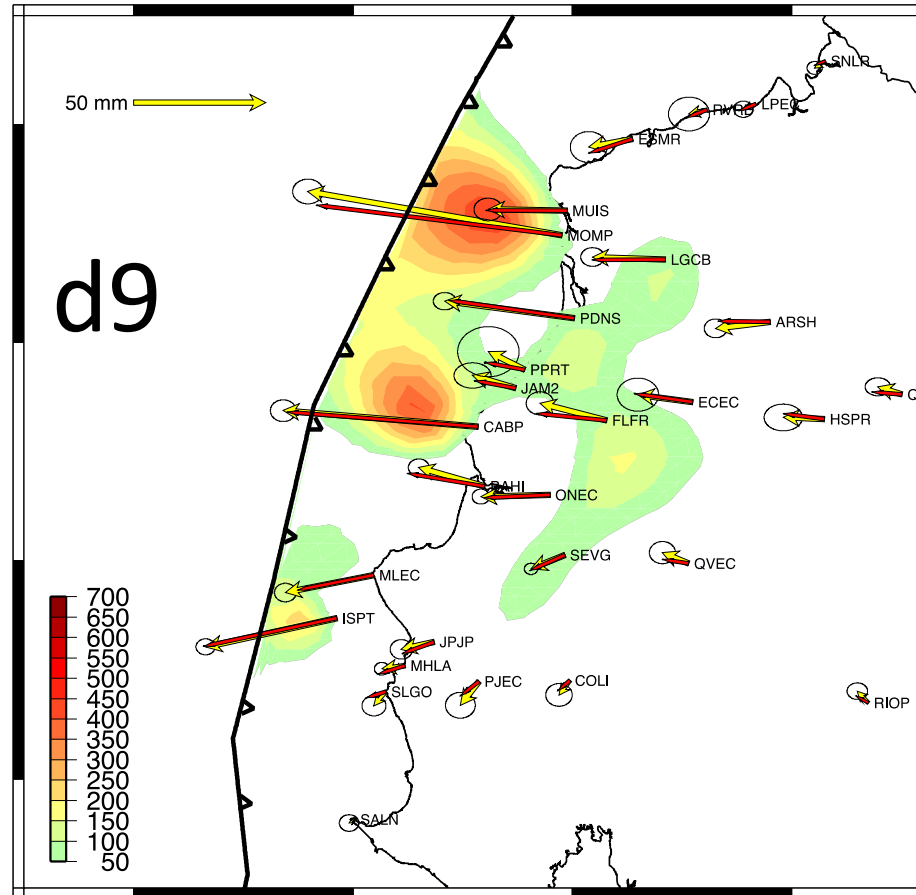


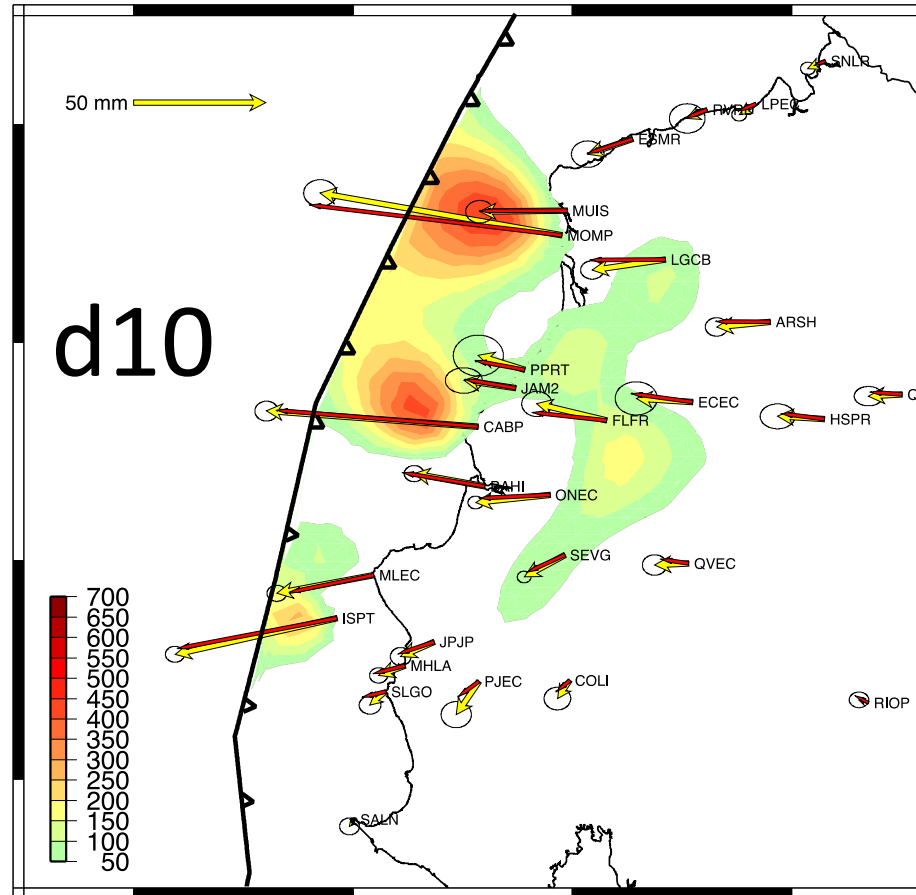


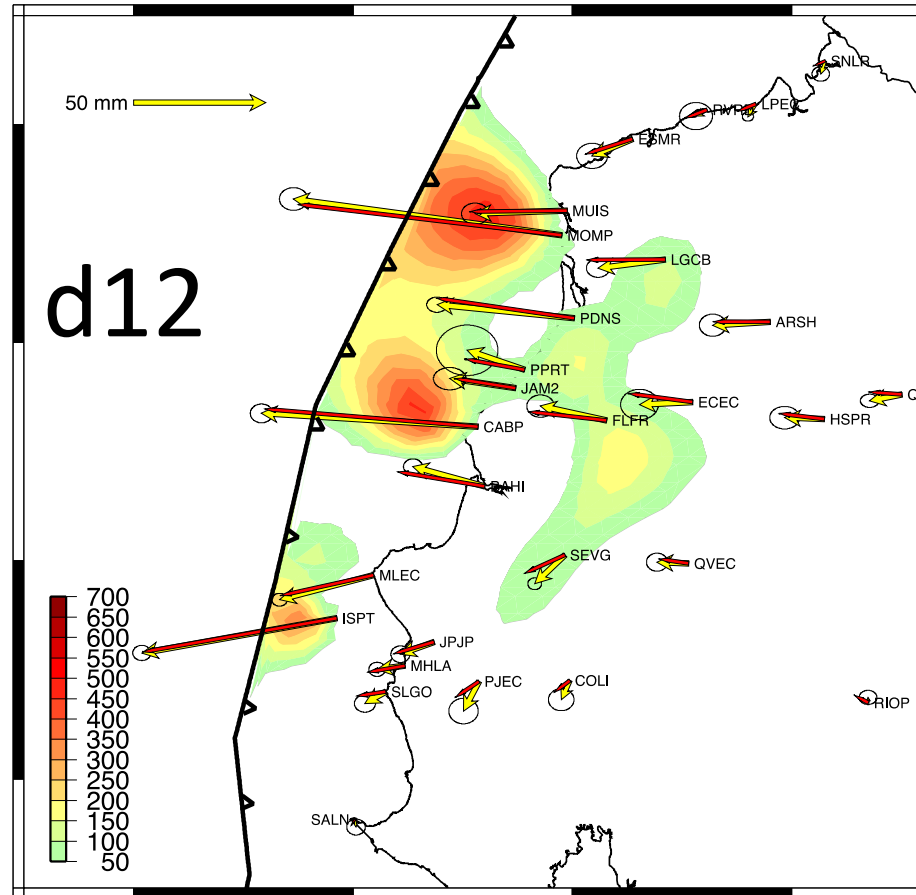


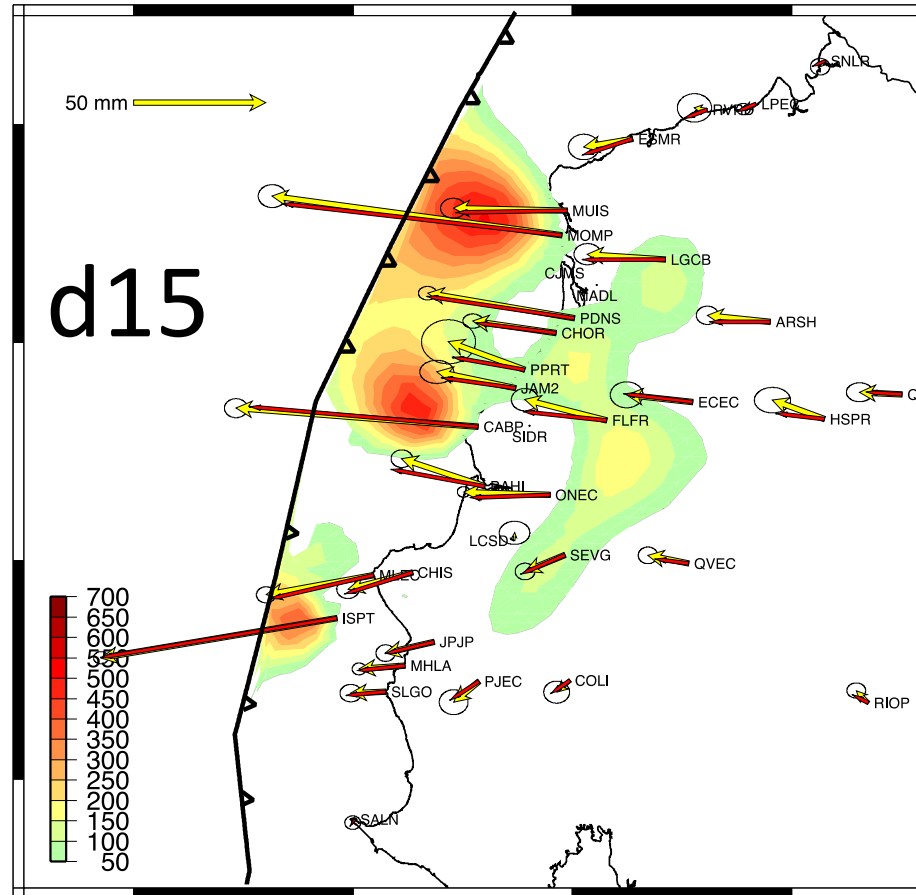


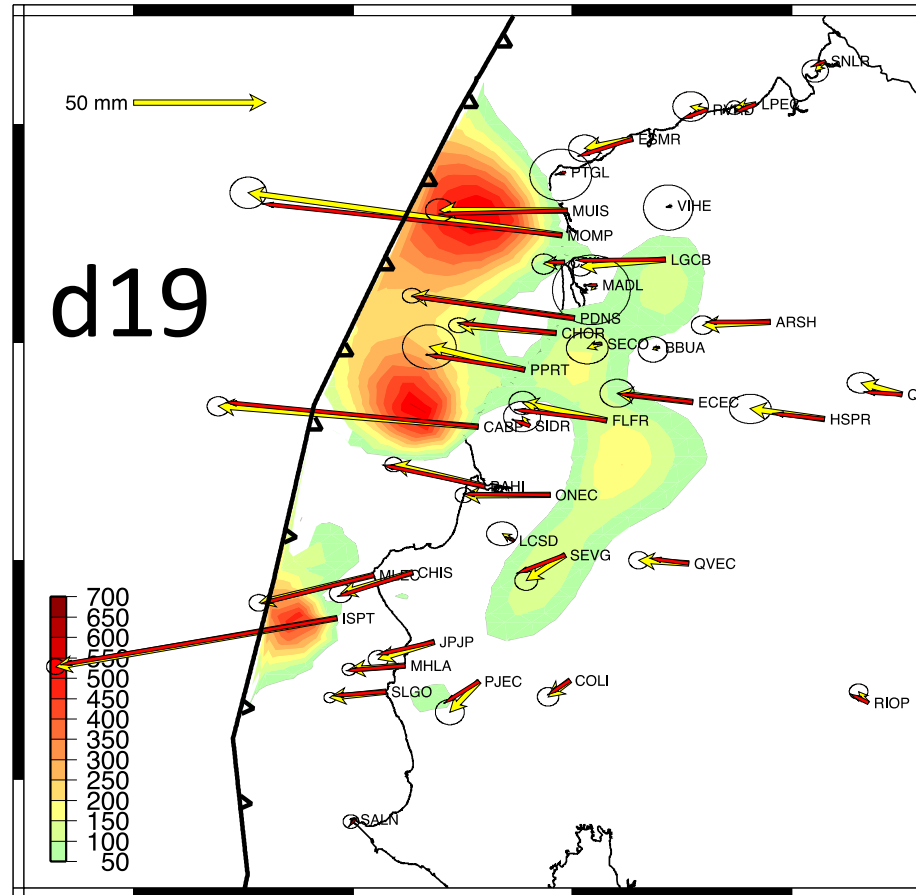


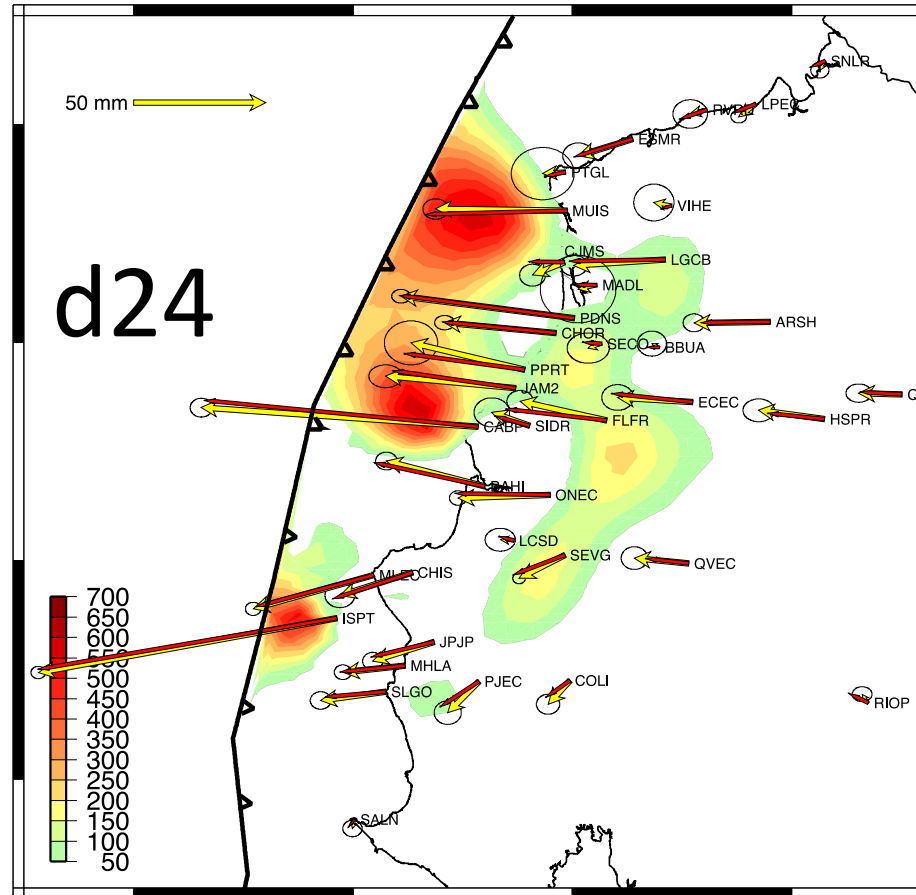


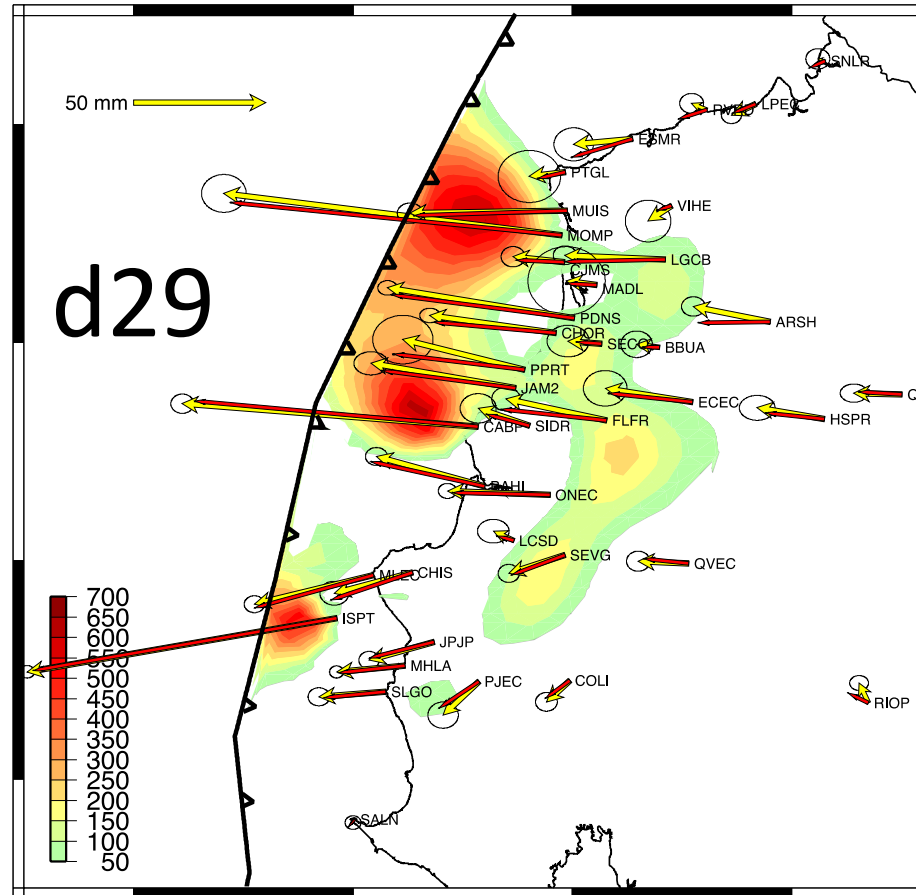




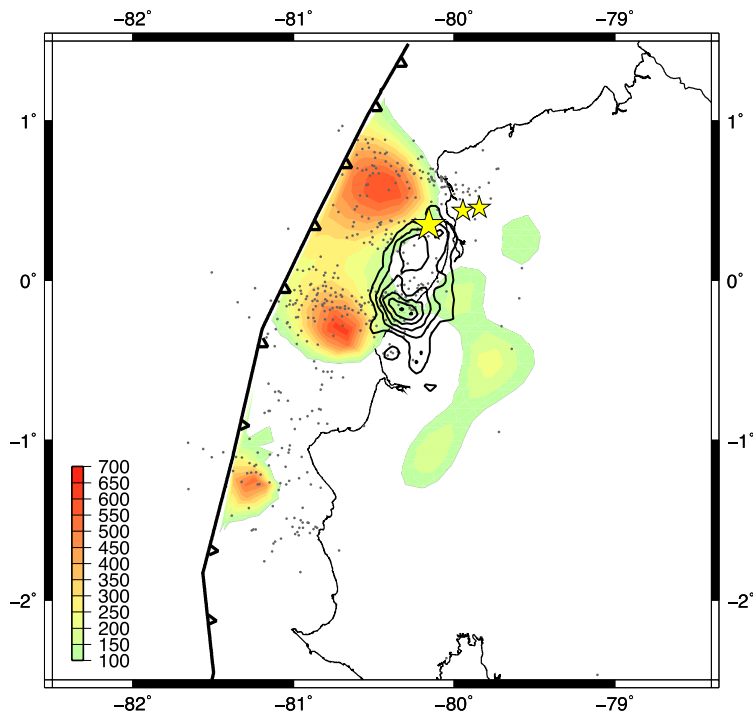
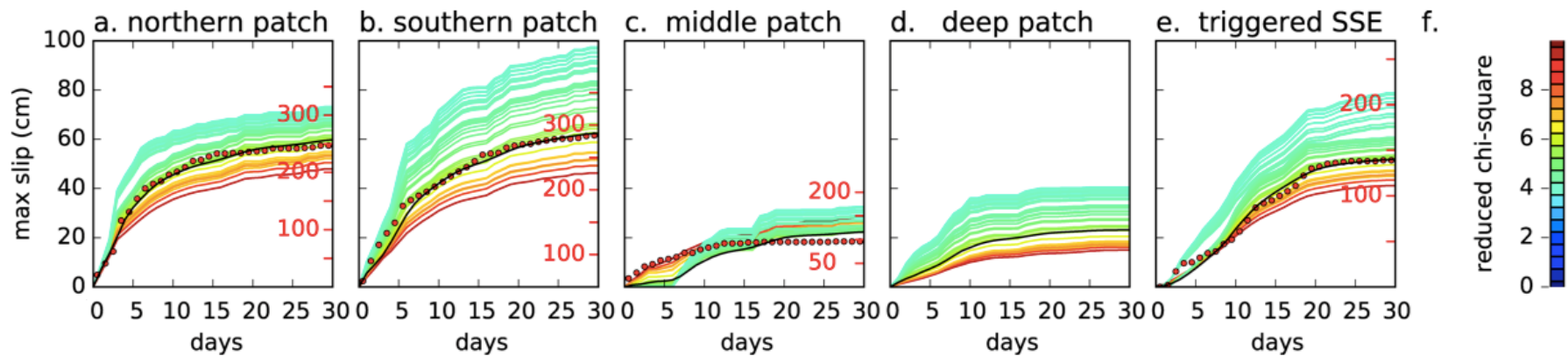








EARLY AFTERSLIP & AFTERSHOCKS



Seismic/aseismic budget for 1 month:

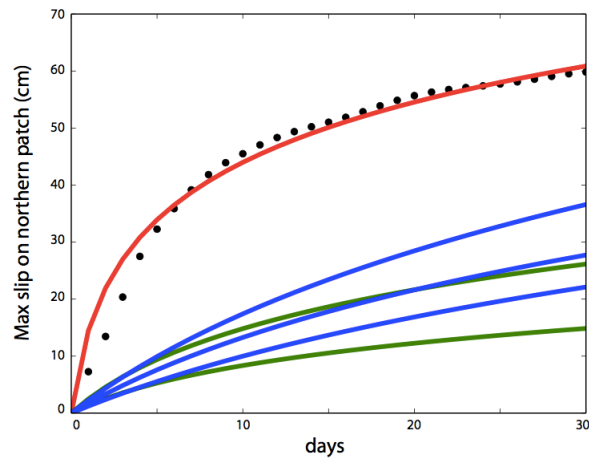
Total postseismic moment Mw 7.4
30% of the co-seismic moment released

Seismicity accounts for ~10 % of the postseismic deformation

Spatial and temporal correlation aftershocks/aseismic slip

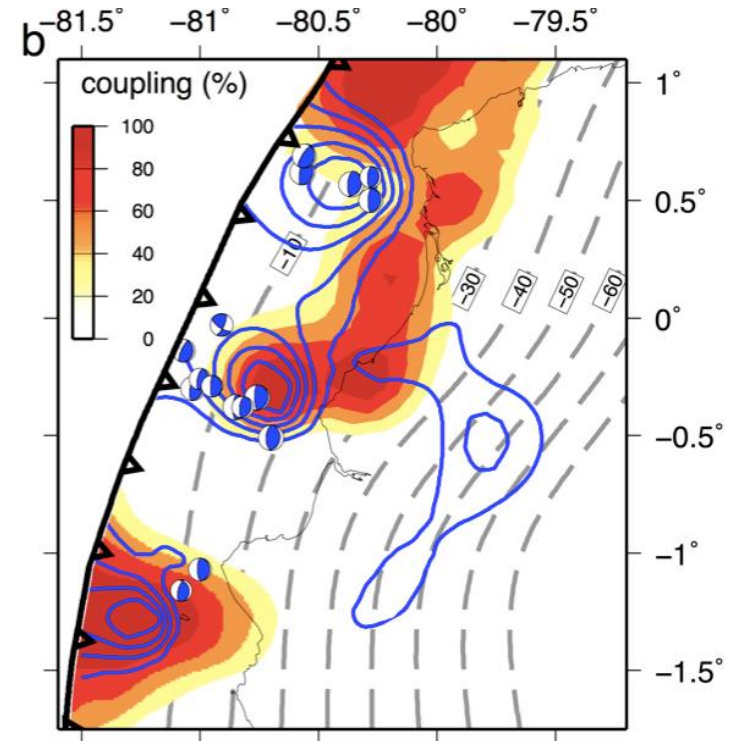
Aftershocks primarily driven by afterslip

TWO UNUSUAL CHARACTERISTICS OF AFTERSLIP AFTER THE PEDERNALES EARTHQUAKE



Pisco Mw 8.0 EQ (Perfettini et al. 2010)

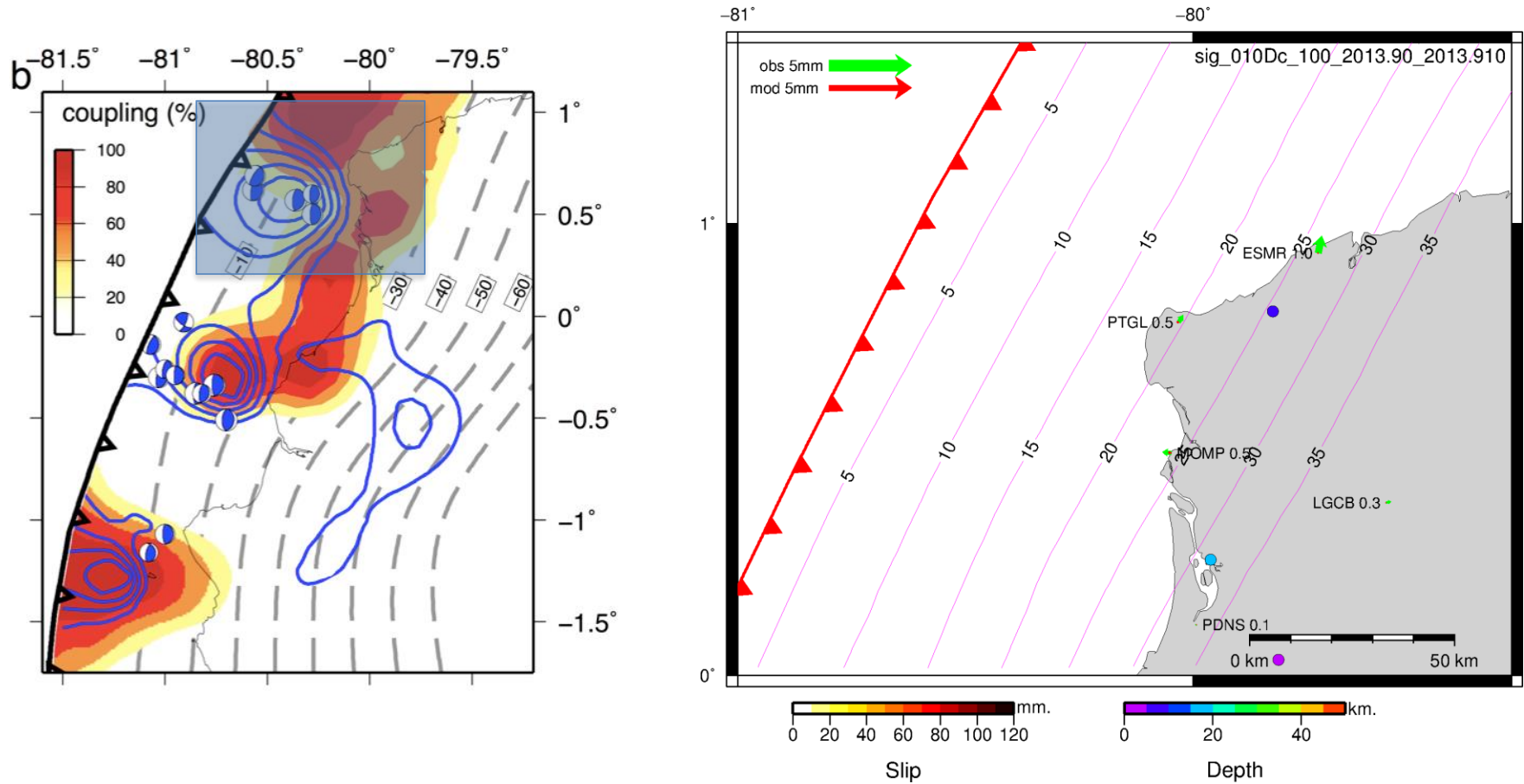
Maule Mw 8.8 EQ (Lin et al., 2013)



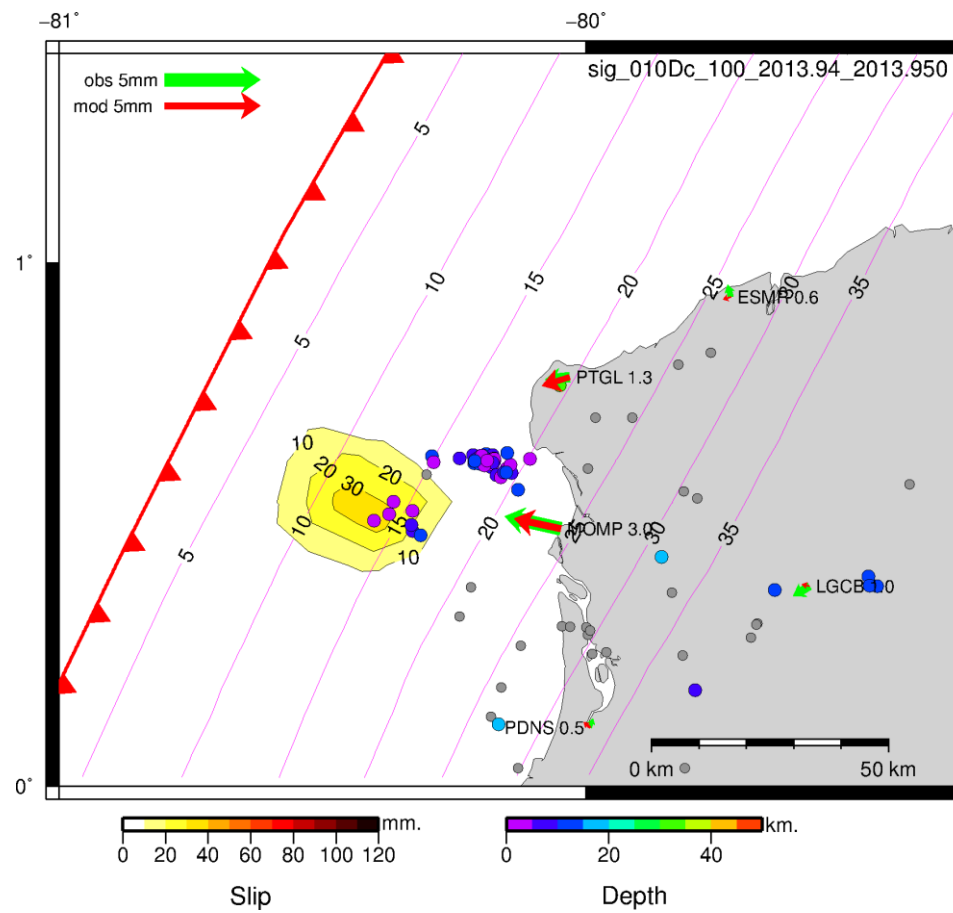
SSE north of the Pedernales rupture

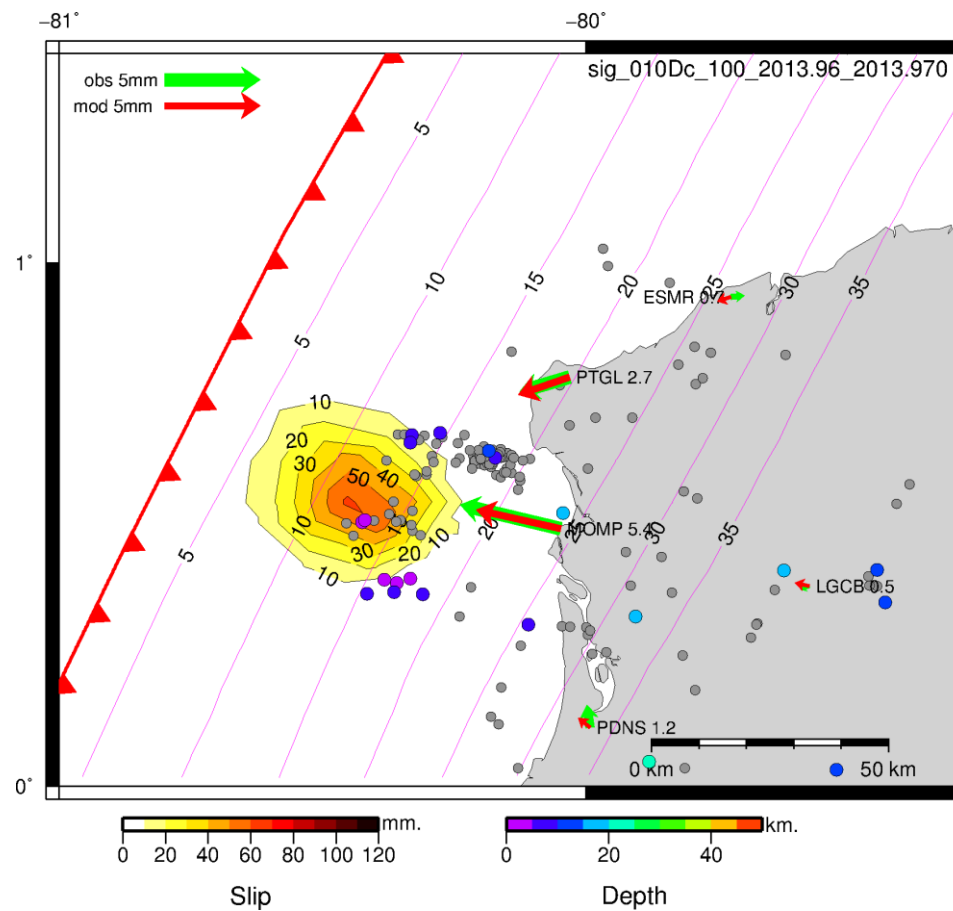
Slip kinematic inversion every 3 days and micro-seismicity

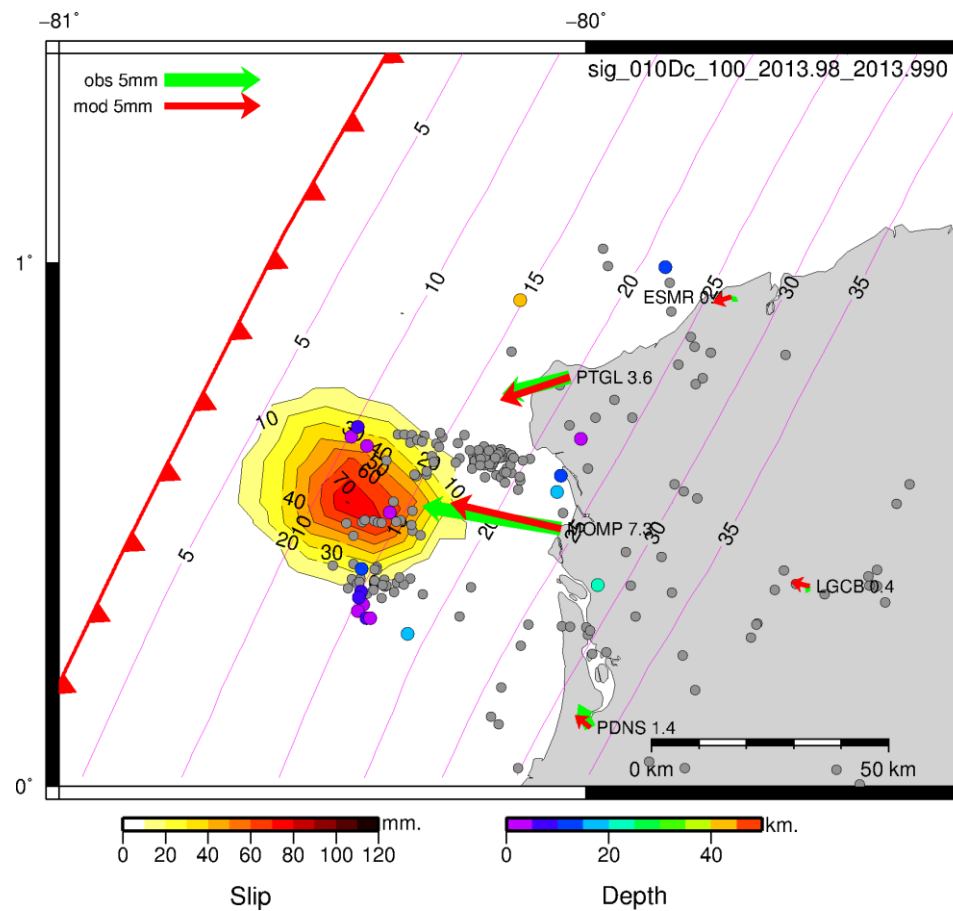
November 2013 – January 2014

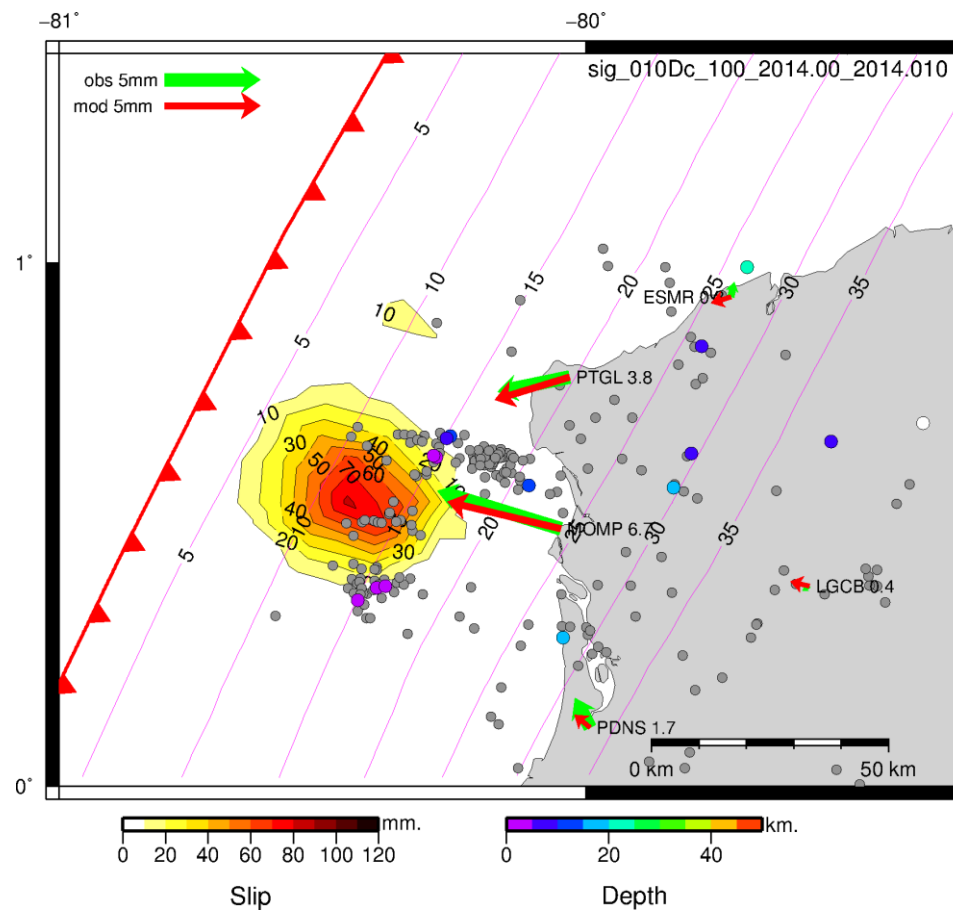


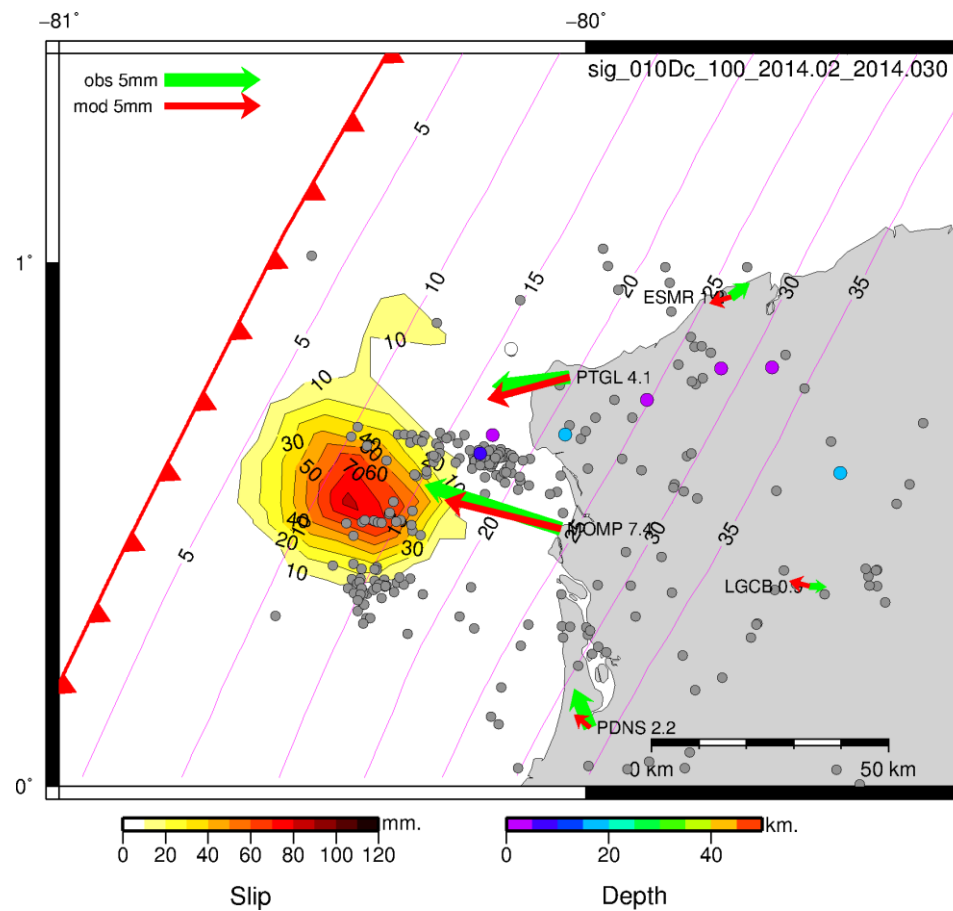
Vaca et al., Tectonophysics, 2018

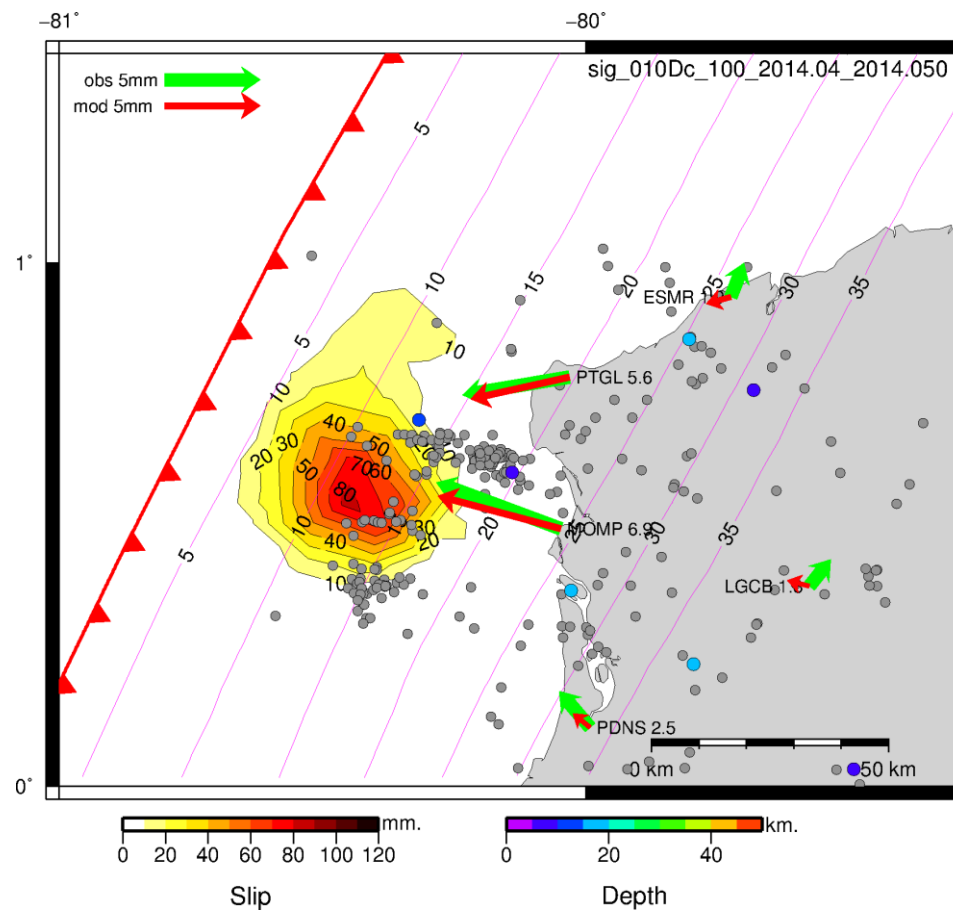


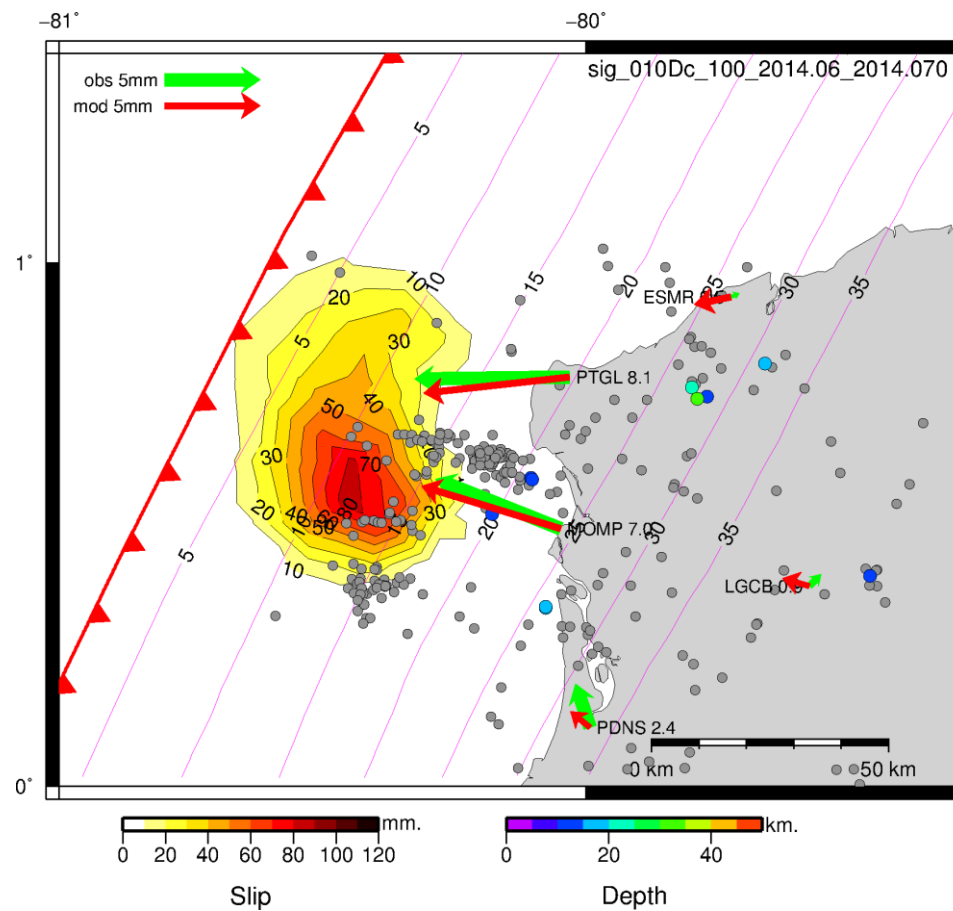


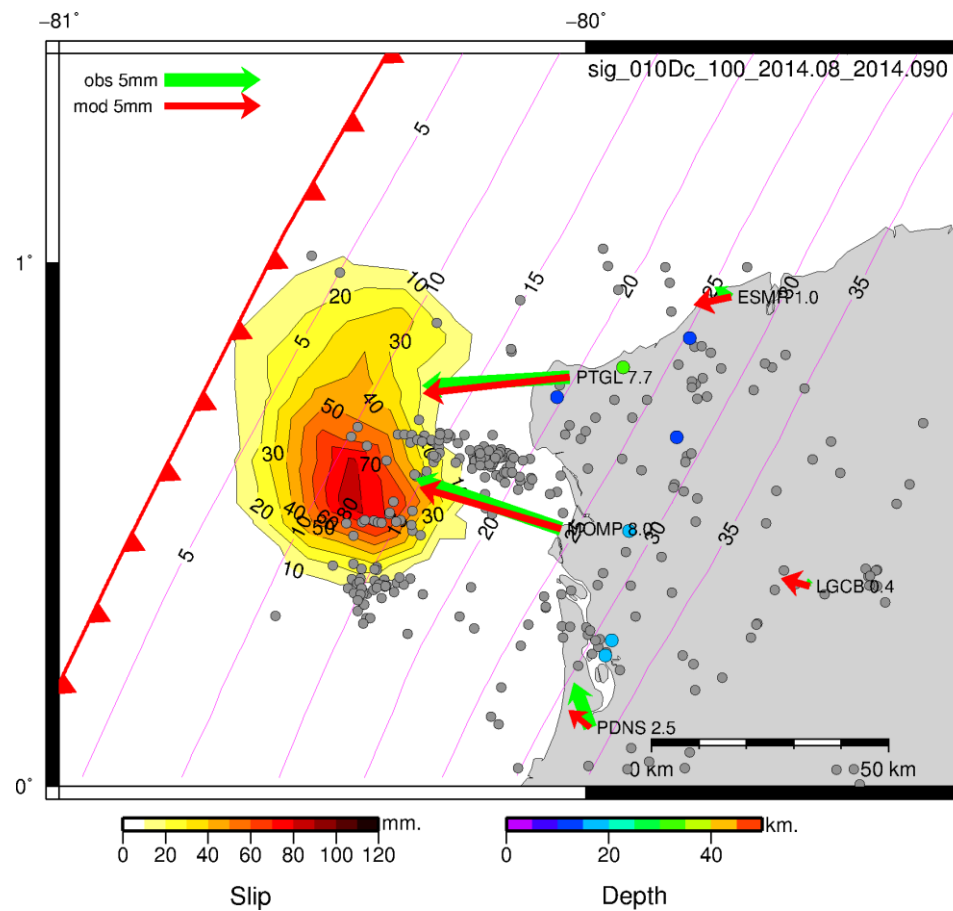




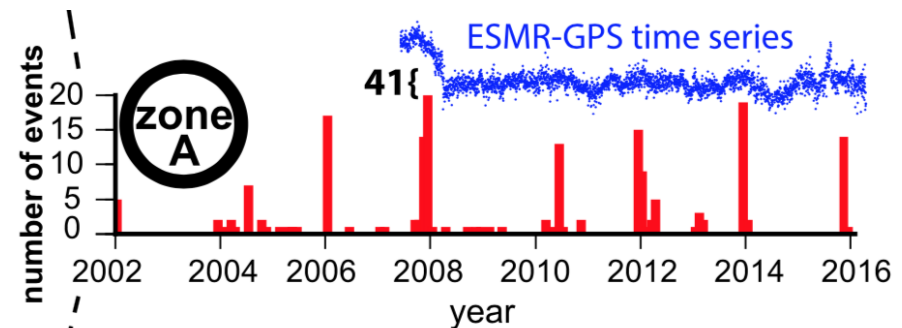
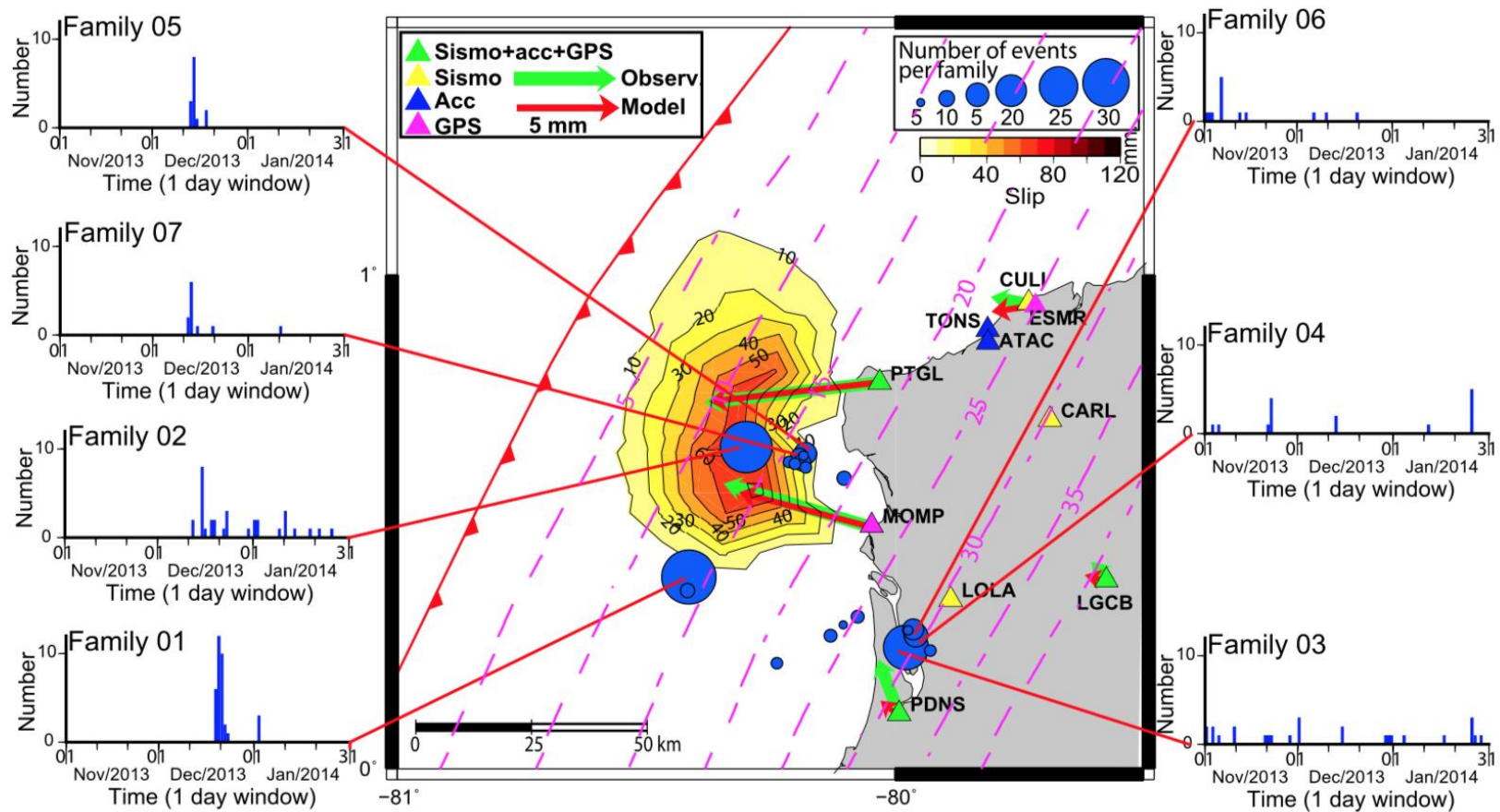




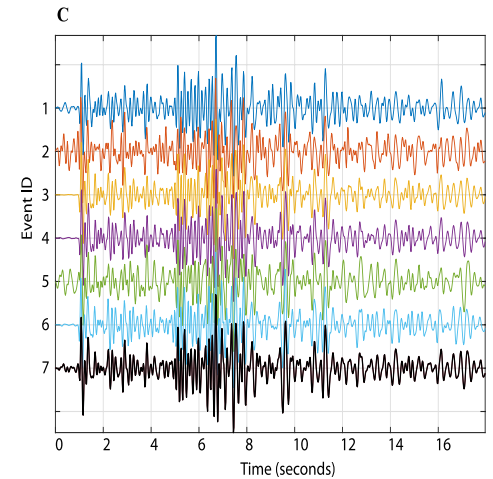
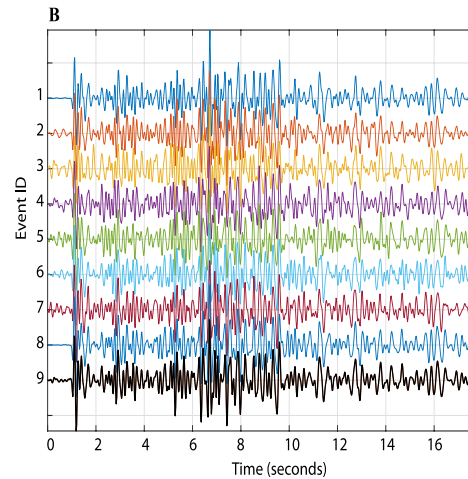
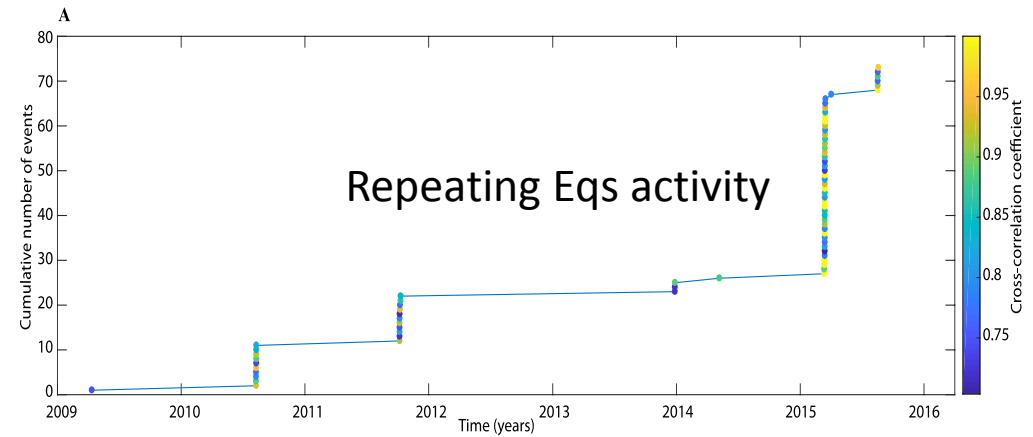
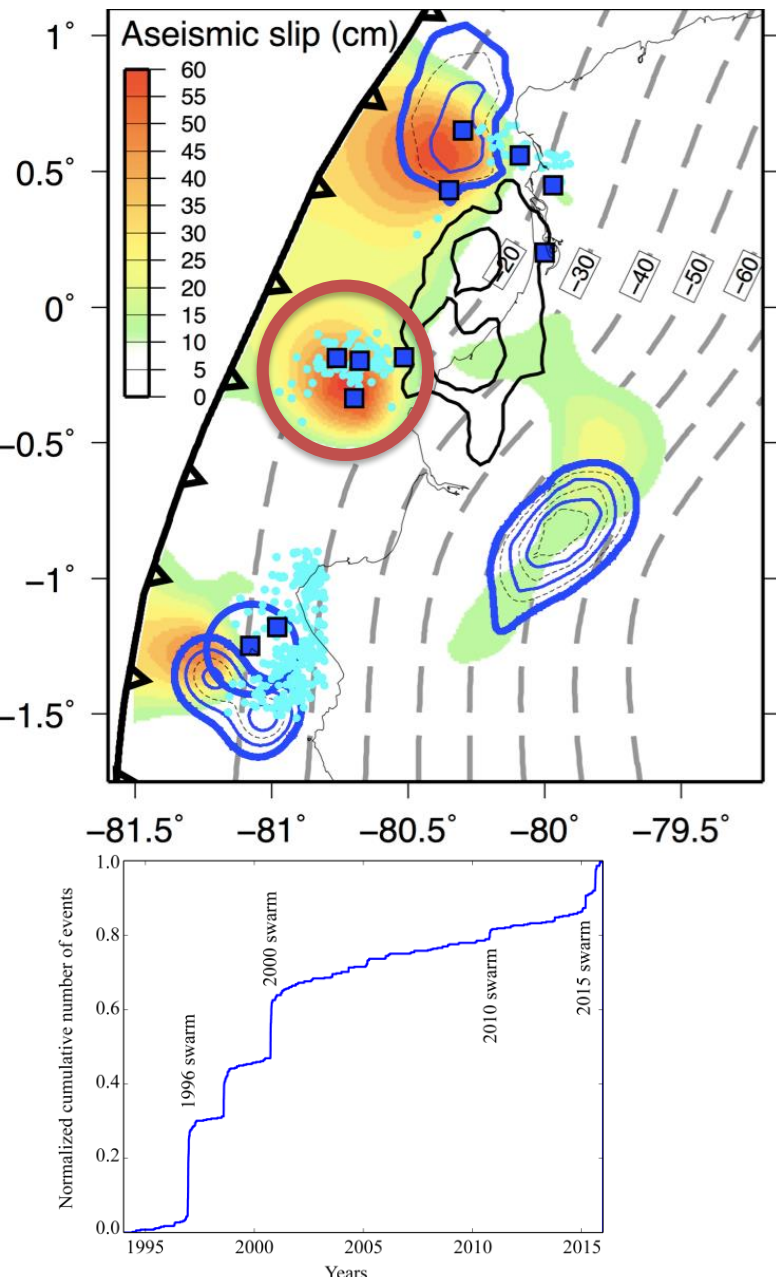




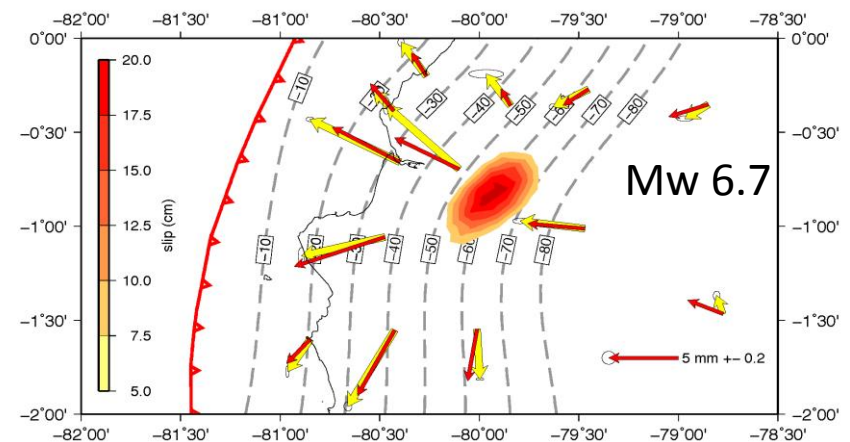
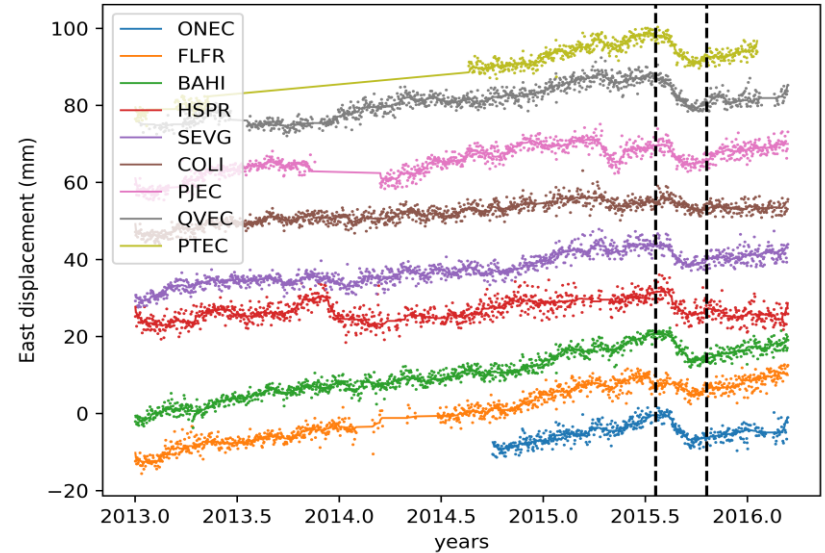
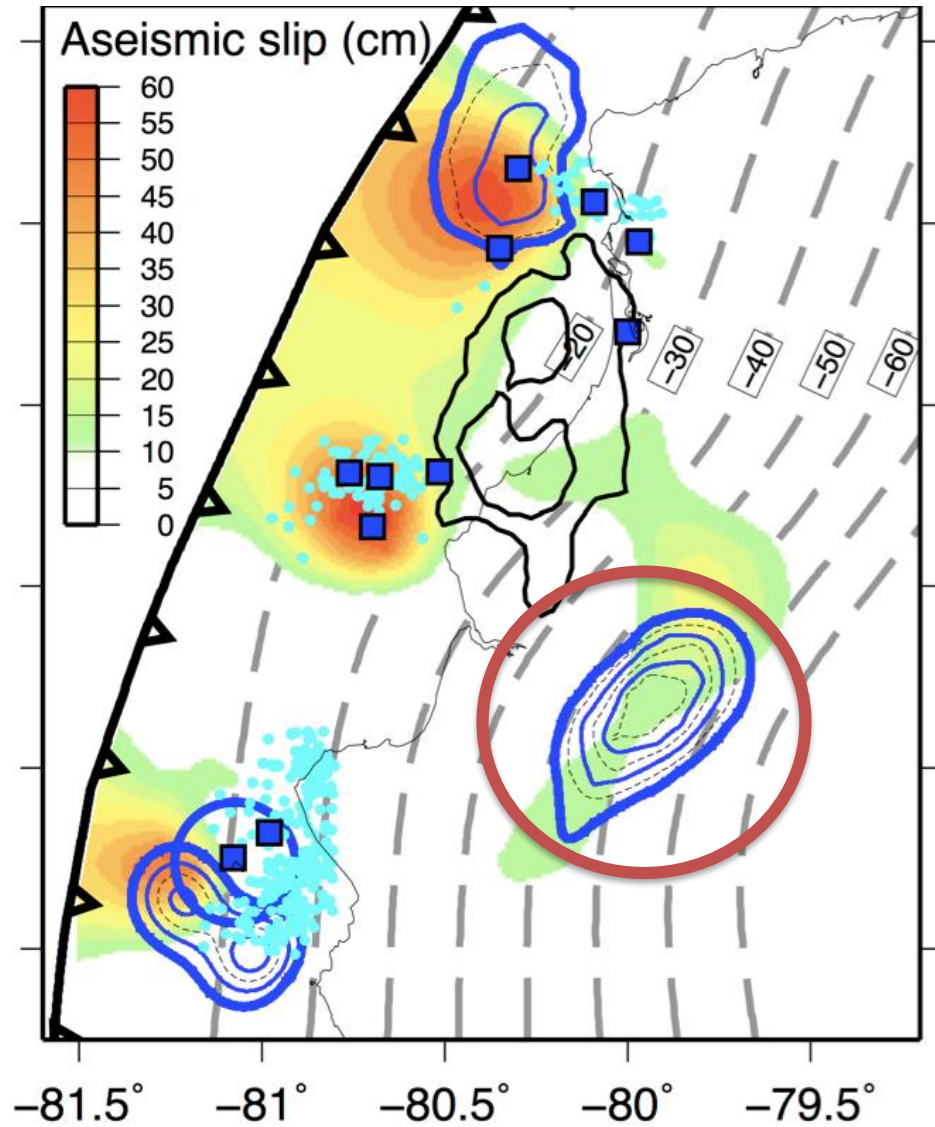
Global geodetic moment: $M_w \sim 6.3$



SEISMIC SWARMS AND REPEATING EARTHQUAKES AT THE SOUTHERN SHALLOW PATCH



A DEEP SSE



SSEs, seismic swarms & repeating earthquakes

CONCLUSIONS

SSE & (early) afterslip likely obey the same friction law

Spatial & temporal organization of slip modes

Although some of patches appear to be locked during a few years, some of them release stress aseismically while others are seismic

The Ecuador case suggests:

A better anticipation for the location of future large ruptures can be gained by documenting precisely and jointly Interseismic locking and episodic transient slips

