

Some -very- incomplete bibliography about GPS and deformation

Workshop on megathrusts and tsunamis, ICTP, october 2014. marianne.metois@ingv.it

1 Deformation

- *Reid* (1910)
- Landers strike slip motion seen by GPS *Wald and Heaton* (1994)
- Dislocation formalism *Okada* (1985)
- Backslip hypothesis *Savage* (1983)
- Sagaing strike slip fault *Vigny et al.* (2003)
- Postseismic rebound *Trubienko et al.* (2014)
- Visco-elastic interseismic deformation *Trubienko et al.* (2013)
- Defnode/Tdefnode code *McCaffrey* (2002) and <http://web.pdx.edu/mccaf/www/defnode/>

2 GPS

- GPS details *Hofmann-Wellenhof et al.* (1993)
- PPP technique *Zumberge et al.* (1997)
- Ambiguity resolution methods *Bertiger et al.* (2010)
- orbits IGS *Beutler et al.* (1999)
- mathematical theory *King et al.* (1985)
- international terrestrial reference frame *Altamimi et al.* (2011)

2.1 Processing

- GAMIT software : *King and Bock* (1999), see also <http://www-gpsg.mit.edu/simon/gtgk/> - GLOBK software : *Herring et al.* (2008) - GIPSY-OASIS software : *Zumberge et al.* (1997), see also <https://gipsy-oasis.jpl.nasa.gov/> - BERNESE software : *Beutler et al.* (2001), see also <http://www.bernese.unibe.ch/>

2.2 Freely available time-series

- SOPAC <http://geodemo-c.ucsd.edu/gridsphere/gridsphere?cid=Time+Series+Plots>
- Nevada University <http://geodesy.unr.edu/billhammond/gpsnetmap/GPSNetMap.html>
- DT-INSU GPScope <https://gpscope.dt.insu.cnrs.fr/spip/spip.php?rubrique15>
- CATS plotting tools *Williams* (2008) <http://cyclesresearchinstitute.org/cats/index.shtml>

3 About GPS in Chile

- International Lab "Montessus de Ballore" <https://www.lia-mb.net/index.php/fr/Racine/About-Us/lia-montessus-de-ballore>
- <http://www.geologie.ens.fr/vigny/chili-f.html>
- Centro Sismologico Nacional <http://www.sismologia.cl/>
- Integrated Plate Boundary Observatory Chile <http://www.ipoc-network.org/>

3.1 Interseismic deformation

- South-Central Chile *Bevis et al.* (2001); *Klotz et al.* (2001); *Khazaradze* (2003); *Ruegg et al.* (2009); *Vigny et al.* (2009); *Métois et al.* (2012); *Métois et al.* (2014)
- North Chile *Kendrick et al.* (2001); *Chlieh et al.* (2004); *Béjar-Pizarro et al.* (2010); *Métois et al.* (2013)
- about sliver motion and paleomagnetic rotation *Brooks* (2003); *Brooks et al.* (2011); *Arriagada et al.* (2008)
- about mechanical interpretation of coupling *Kaneko et al.* (2010); *Hetland and Simons* (2010)

3.2 Megathrust earthquakes

- Darwin quake *Fitzroy et al.* (1966), *Darwin* (1851), *Campos et al.* (2002)
- the 1877 quake *Kausel* (1986); *Kausel and Campos* (1992)
- Arequipa 2001 quake *Ruegg and Olcay* (2001); *Perfettini* (2005)
- Tocopilla 2005 quake (see also lab session) *Béjar-Pizarro et al.* (2010); *Peyrat et al.* (2010) - Maule quake *Madariaga et al.* (2010); *Lorito et al.* (2011); *Moreno et al.* (2010); *Vigny et al.* (2011); *Ryder et al.* (2012); *Lin et al.* (2013b); *Yue et al.* (2014) ...
- Iquique quake *Ruiz et al.* (2014); *Bürgmann* (2014); *Schurr et al.* (2014); *Hayes et al.* (2014)

4 About GPS elsewhere

- Ocean Bottom Geodesy in Peru *Gagnon et al.* (2005), Japan *Sato et al.* (2011), Geomar array in Chile *Kopp et al.* (2014)
- Tohoku megathrust *Simons et al.* (2011), *Pollitz et al.* (2011), *Grapenthin and Freymueller* (2011), *Lin et al.* (2013a), *Kato et al.* (2012)
- Sumatra quake *Vigny et al.* (2005)
- Japanese coupling *Loveless and Meade* (2011); *Hashimoto et al.* (2009, 2012)
- New-Zealand coupling *Wallace et al.* (2004, 2014)
- SSE *Dragert et al.* (2004); *Vergnolle et al.* (2010); *Radiguet et al.* (2011); *Vallée et al.* (2013)

5 About Insar

- Principles by ESA *Ferretti et al.* (2007)
- Landers quake *Massonnet et al.* (1993)

References

- Altamimi, Z., X. Collilieux, and L. Métivier (2011), Itrf2008: an improved solution of the international terrestrial reference frame, *Journal of Geodesy*, 85(8), 457–473.
- Arriagada, C., P. Roperch, C. Mpodozis, P. Cobbold, et al. (2008), Paleogene building of the Bolivian Orocline: Tectonic restoration of the central Andes in 2-D map view, *Tectonics*, 27(6), TC6014, doi:10.1029/2008TC002269.
- Béjar-Pizarro, M., et al. (2010), Asperities and barriers on the seismogenic zone in North Chile: state-of-the-art after the 2007 Mw 7.7 Tocopilla earthquake inferred by GPS and InSAR data, *Geophysical Journal International*, 183(1), 390–406, doi:10.1111/j.1365-246X.2010.04748.x.
- Bertiger, W., S. D. Desai, B. Haines, N. Harvey, A. W. Moore, S. Owen, and J. P. Weiss (2010), Single receiver phase ambiguity resolution with gps data, *Journal of Geodesy*, 84(5), 327–337.
- Beutler, G., M. Rothacher, S. Schaer, T. Springer, J. Kouba, and R. Neilan (1999), The international gps service (igs): an interdisciplinary service in support of earth sciences, *Advances in Space Research*, 23(4), 631–653.
- Beutler, G., et al. (2001), Bernese gps software version 4.2, *Astronomical Institute, University of Berne*, 515.
- Bevis, M., E. Kendrick, R. Smalley Jr, B. Brooks, R. Allmendinger, and B. Isacks (2001), On the strength of interplate coupling and the rate of back arc convergence in the central Andes: An analysis of the interseismic velocity field, *Geochemistry Geophysics Geosystems*, 2(11), 1067, doi: 10.1029/2001GC000198.
- Brooks, B. a. (2003), Crustal motion in the Southern Andes (26°–36°S): Do the Andes behave like a microplate?, *Geochemistry Geophysics Geosystems*, 4(10), 1–14, doi:10.1029/2003GC000505.
- Brooks, B. a., et al. (2011), Orogenic-wedge deformation and potential for great earthquakes in the central Andean backarc, *Nature Geoscience*, 4(6), 380–383, doi:10.1038/ngeo1143.
- Bürgmann, R. (2014), Earth science: Warning signs of the iquique earthquake, *Nature*, 512(7514), 258–259.
- Campos, J., et al. (2002), A seismological study of the 1835 seismic gap in south-central Chile, *Physics of the Earth and Planetary Interiors*, 132(1-3), 177–195, doi:10.1016/S0031-9201(02)00051-1.
- Chlieh, M., J. B. de Chabalier, J. C. Ruegg, R. Armijo, R. Dmowska, J. Campos, and K. L. Feigl (2004), Crustal deformation and fault slip during the seismic cycle in the North Chile subduction zone, from GPS and InSAR observations, *Geophysical Journal International*, 158(2), 695–711, doi:10.1111/j.1365-246X.2004.02326.x.
- Darwin, C. (1851), *Geological observation on Coral Reefs, Volcanic Islands and on South America.*, 768 pp., Londres, Smith, Elder and Co.
- Dragert, H., K. Wang, and G. Rogers (2004), Geodetic and seismic signatures of episodic tremor and slip in the northern Cascadia subduction zone, *Earth, Planets, and Space*, 56(12), 1143–1150.

- Ferretti, A., A. Monti-Guarnieri, C. Prati, F. Rocca, and D. Massonet (2007), *InSAR Principles-Guidelines for SAR Interferometry Processing and Interpretation*, vol. 19.
- Fitzroy, R., P. P. King, and C. Darwin (1966), *Narrative of the surveying voyages of His Majesty, s ships Adventure and Beagle, between the years 1826 and 1836, describing their examination of the southern shores of South America, and the Beagle's circumnavigation of the globe*, vol. 3, H. Colburn.
- Gagnon, K., C. D. Chadwell, and E. Norabuena (2005), Measuring the onset of locking in the Peru-Chile trench with GPS and acoustic measurements., *Nature*, 434(7030), 205–8, doi: 10.1038/nature03412.
- Grapenthin, R., and J. T. Freymueller (2011), The dynamics of a seismic wave field: Animation and analysis of kinematic gps data recorded during the 2011 tohoku-oki earthquake, japan, *Geophysical Research Letters*, 38(18).
- Hashimoto, C., A. Noda, T. Sagiya, and M. Matsuúra (2009), Interplate seismogenic zones along the Kuril–Japan trench inferred from GPS data inversion, *Nature Geoscience*, 2(2), 141–144, doi: 10.1038/ngeo421.
- Hashimoto, C., A. Noda, and M. Matsuúra (2012), The Mw 9.0 northeast Japan earthquake: total rupture of a basement asperity, *Geophysical Journal International*, doi:10.1111/j.1365-246X.2011.05368.x.
- Hayes, G. P., et al. (2014), Continuing megathrust earthquake potential in chile after the 2014 iquique earthquake, *Nature*, 512(7514), 295–298.
- Herring, T., R. King, and S. McClusky (2008), Introduction to gamit/globk, *Mass. Inst. of Technol., Cambridge, MA, Tech. Rep.*
- Hetland, E., and M. Simons (2010), Post-seismic and interseismic fault creep II: transient creep and interseismic stress shadows on megathrusts, *Geophysical Journal International*, 181(1), 99–112, doi:10.1111/j.1365-246X.2009.04482.x.
- Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins (1993), Global positioning system. theory and practice., *Global Positioning System. Theory and practice.*, by Hofmann-Wellenhof, B.; Lichtenegger, H.; Collins, J.. Springer, Wien (Austria), 1993, 347 p., ISBN 3-211-82477-4, Price DM 79.00. ISBN 0-387-82477-4 (USA)., 1.
- Kaneko, Y., J. Avouac, and N. Lapusta (2010), Towards inferring earthquake patterns from geodetic observations of interseismic coupling, *Nature Geoscience*, 3(5), 363–369, doi:10.1038/ngeo843.
- Kato, A., K. Obara, T. Igarashi, H. Tsuruoka, S. Nakagawa, and N. Hirata (2012), Propagation of slow slip leading up to the 2011 mw 9.0 tohoku-oki earthquake, *Science*, 335(6069), 705–708.
- Kausel, E. (1986), Los terremotos de agosto de 1868 y mayo de 1877 que afectaron el sur del Perú y norte de Chile, *Boletín de la Academia Chilena de Ciencias*, 3, 8–14.
- Kausel, E., and J. Campos (1992), The Ms = 8 tensional earthquake of 9 December 1950 of northern Chile and its relation to the seismic potential of the region, *Physics of the Earth and Planetary Interiors*, 72(3-4), 220–235, doi:10.1016/0031-9201(92)90203-8.

- Kendrick, E., M. Bevis, R. Smalley Jr., and B. Brooks (2001), An integrated crustal velocity field for the central Andes, *Geochemistry Geophysics Geosystems*, 2(11), doi:10.1029/2001GC000191.
- Khazaradze, G. (2003), Short- and long-term effects of GPS measured crustal deformation rates along the south central Andes, *Journal of Geophysical Research*, 108(B6), 1–13, doi: 10.1029/2002JB001879.
- King, R., and Y. Bock (1999), Documentation for the gamit gps analysis software, *Mass. Inst. of Technol., Cambridge Mass.*
- King, R. W., E. Masters, C. Rizos, A. Stolz, and J. Collins (1985), *Surveying with GPS*, School of Surveying, the University of New South Wales.
- Klotz, J., G. Khazaradze, and D. Angermann (2001), Earthquake cycle dominates contemporary crustal deformation in Central and Southern Andes, *Earth and Planetary Science Letters*, 193, doi:10.1016/S0012-821X(01)00532-5.
- Kopp, H., D. Lange, E. Contreras-Reyes, J. H. Behrmann, J. J. McGuire, and E. R. Flueh (2014), Seafloor geodetic monitoring of the central andean subduction zone: The geosea array.
- Lin, W., et al. (2013a), Stress state in the largest displacement area of the 2011 tohoku-oki earthquake, *Science*, 339(6120), 687–690.
- Lin, Y.-n. N., et al. (2013b), Coseismic and postseismic slip associated with the 2010 maule earthquake, chile: Characterizing the araucos peninsula barrier effect, *Journal of Geophysical Research: Solid Earth*, 118(6), 3142–3159.
- Lorito, S., F. Romano, S. Atzori, X. Tong, A. Avallone, J. McCloskey, M. Cocco, E. Boschi, and A. Piatanesi (2011), Limited overlap between the seismic gap and coseismic slip of the great 2010 Chile earthquake, *Nature Geoscience*, 4(3), 173–177, doi:10.1038/ngeo1073.
- Loveless, J., and B. Meade (2011), Spatial correlation of interseismic coupling and coseismic rupture extent of the 2011 MW= 9.0 Tohoku-oki earthquake, *Geophys. Res. Lett.*, 38, L17,306, doi: 10.1029/2011GL048561.
- Madariaga, R., M. Métois, C. Vigny, and J. Campos (2010), Central chile finally breaks, *Science*, 328(5975), 181–182.
- Massonnet, D., M. Rossi, C. Carmona, F. Adragna, G. Peltzer, K. Feigl, and T. Rabaute (1993), The displacement field of the landers earthquake mapped by radar interferometry, *Nature*, 364(6433), 138–142.
- McCaffrey, R. (2002), Crustal block rotations and plate coupling, *Plate Boundary Zones, Geodyn. Ser.*, doi:10.1029/GD030p0101.
- Métois, M., A. Socquet, and C. Vigny (2012), Interseismic coupling, segmentation and mechanical behavior of the central Chile subduction zone, *J. geophys. Res.*, 117(B03406), doi: 10.1029/2011JB008736.
- Métois, M., A. Socquet, C. Vigny, D. Carrizo, S. Peyrat, A. Delorme, E. Maureira, M.-C. Valderas-Bermejo, and I. Ortega (2013), Revisiting the north chile seismic gap segmentation using gps-derived interseismic coupling, *Geophysical Journal International*, 194(3), 1283–1294.

- Métois, M., C. Vigny, A. Socquet, A. Delorme, S. Morvan, I. Ortega, and C.-M. Valderas-Bermejo (2014), Gps-derived interseismic coupling on the subduction and seismic hazards in the atacama region, chile, *Geophysical Journal International*, 196(2), 644–655.
- Moreno, M., M. Rosenau, and O. Oncken (2010), 2010 Maule earthquake slip correlates with pre-seismic locking of Andean subduction zone., *Nature*, 467(7312), 198–202, doi: 10.1038/nature09349.
- Okada, Y. (1985), Surface deformation due to shear and tensile faults in a half-space, *Bulletin of the Seismological Society of America*.
- Perfettini, H. (2005), Geodetic displacements and aftershocks following the 2001 M_w = 8.4 Peru earthquake: Implications for the mechanics of the earthquake cycle along subduction zones, *Journal of Geophysical Research*, 110(B9), 1–19, doi:10.1029/2004JB003522.
- Peyrat, S., R. Madariaga, E. Buforn, J. Campos, G. Asch, and J. P. Vilotte (2010), Kinematic rupture process of the 2007 Tocopilla earthquake and its main aftershocks from teleseismic and strong-motion data, *Geophysical Journal International*, 182(3), 1411–1430, doi:10.1111/j.1365-246X.2010.04685.x.
- Pollitz, F. F., R. Bürgmann, and P. Banerjee (2011), Geodetic slip model of the 2011 m9. 0 tohoku earthquake, *Geophysical Research Letters*, 38(7).
- Radiguet, M., F. Cotton, M. Vergnolle, M. Campillo, B. Valette, V. Kostoglodov, and N. Cotte (2011), Spatial and temporal evolution of a long term slow slip event: the 2006 Guerrero Slow Slip Event, *Geophysical Journal International*, 184(2), 816–828.
- Reid, H. (1910), *The California Earthquake of April 18, 1906: The Mechanics of the Earthquake/By Harry Fielding Reid*, Carnegie Inst.
- Ruegg, J., and M. Olcay (2001), Co-, post-and pre (?) seismic displacements associated with the Mw 8.4 Southern Peru earthquake of 23 June 2001 from continuous GPS measurements, *Seismological Research Letters*, 72(6), 673–678.
- Ruegg, J., a. Rudloff, C. Vigny, R. Madariaga, J. de Chabalier, J. Campos, E. Kausel, S. Barrientos, and D. Dimitrov (2009), Interseismic strain accumulation measured by GPS in the seismic gap between Constitución and Concepción in Chile, *Physics of the Earth and Planetary Interiors*, 175(1-2), 78–85, doi:10.1016/j.pepi.2008.02.015.
- Ruiz, S., M. Métois, A. Fuenzalida, J. Ruiz, F. Leyton, R. Grandin, C. Vigny, R. Madariaga, and J. Campos (2014), Intense foreshocks and a slow slip event preceded the 2014 iquique mw 8.1 earthquake, *Science*, 345(6201), 1165–1169.
- Ryder, I., A. Rietbrock, K. Kelson, R. Bürgmann, M. Floyd, A. Socquet, C. Vigny, and D. Carrizo (2012), Large extensional aftershocks in the continental forearc triggered by the 2010 maule earthquake, chile, *Geophysical Journal International*, 188(3), 879–890.
- Sato, M., T. Ishikawa, N. Ujihara, S. Yoshida, M. Fujita, M. Mochizuki, and A. Asada (2011), Displacement above the hypocenter of the 2011 Tohoku-Oki earthquake, *Science*, 332(6036), 1395.
- Savage, J. (1983), A dislocation model of strain accumulation and release at a subduction zone, *Journal of Geophysical Research*, 88(3), 4984–4996.

- Schurr, B., et al. (2014), Gradual unlocking of plate boundary controlled initiation of the 2014 iquique earthquake, *Nature*.
- Simons, M., et al. (2011), The 2011 magnitude 9.0 Tohoku-Oki earthquake: Mosaicking the megathrust from seconds to centuries, *Science*, 332(6036), 1421, doi:10.1126/science.1206731.
- Trubienko, O., L. Fleitout, J.-D. Garaud, and C. Vigny (2013), Interpretation of interseismic deformations and the seismic cycle associated with large subduction earthquakes, *Tectonophysics*, 589, 126–141.
- Trubienko, O., J.-D. Garaud, and L. Fleitout (2014), Models of postseismic deformation after megathrust earthquakes: the role of various rheological and geometrical parameters of the subduction zone, *Solid Earth Discussions*, 6(1), 427–466.
- Vallée, M., et al. (2013), Intense interface seismicity triggered by a shallow slow slip event in the central Ecuador subduction zone, *Journal of Geophysical Research: Solid Earth*, 118(6), 2965–2981.
- Vergnolle, M., A. Walpersdorf, V. Kostoglodov, P. Tregoning, J. Santiago, N. Cotte, S. Franco, et al. (2010), Slow slip events in Mexico revised from the processing of 11 year GPS observations, *J. geophys. Res.*, 115, B08,403, doi:10.1029/2009JB006852.
- Vigny, C., A. Socquet, C. Rangin, N. Chamot-Rooke, M. Pubellier, M.-N. Bouin, G. Bertrand, and M. Becker (2003), Present-day crustal deformation around Sagaing fault, Myanmar, *Journal of Geophysical Research: Solid Earth (1978–2012)*, 108(B11).
- Vigny, C., et al. (2005), Insight into the 2004 Sumatra–Andaman earthquake from GPS measurements in Southeast Asia, *Nature*, 436(7048), 201–206.
- Vigny, C., A. Rudloff, J.-C. Ruegg, R. Madariaga, J. Campos, and M. Alvarez (2009), Upper plate deformation measured by GPS in the Coquimbo Gap, Chile, *Physics of the Earth and Planetary Interiors*, 175(1–2), 86–95, doi:10.1016/j.pepi.2008.02.013.
- Vigny, C., et al. (2011), The 2010 Mw 8.8 Maule megathrust earthquake of Central Chile, monitored by GPS., *Science*, 332(6036), 1417–21, doi:10.1126/science.1204132.
- Wald, D. J., and T. H. Heaton (1994), Spatial and temporal distribution of slip for the 1992 Landers, California, earthquake, *Bulletin of the Seismological Society of America*, 84(3), 668–691.
- Wallace, L., J. Beavan, R. McCaffrey, and D. Darby (2004), Subduction zone coupling and tectonic block rotations in the North Island, New Zealand, *Journal of Geophysical Research*, 109(B12), B12,406, doi:10.1029/2004JB003241.
- Wallace, L. M., U. A. Cochran, W. L. Power, and K. J. Clark (2014), Earthquake and tsunami potential of the Hikurangi subduction thrust, New Zealand: Insights from paleoseismology, GPS, and tsunami modeling, *Oceanography*, 27(2), 104–117.
- Williams, S. D. (2008), CATS: GPS coordinate time series analysis software, *GPS solutions*, 12(2), 147–153.

Yue, H., T. Lay, L. Rivera, C. An, C. Vigny, X. Tong, and J. C. Báez Soto (2014), Localized fault slip to the trench in the 2010 maule, chile mw= 8.8 earthquake from joint inversion of high-rate gps, teleseismic body waves, insar, campaign gps, and tsunami observations, *Journal of Geophysical Research: Solid Earth*.

Zumberge, J., M. Heflin, D. Jefferson, M. Watkins, and F. Webb (1997), Precise point positioning for the efficient and robust analysis of gps data from large networks, *Journal of Geophysical Research: Solid Earth (1978–2012)*, *102*(B3), 5005–5017.