

The SLR monitoring crustal movement in South America



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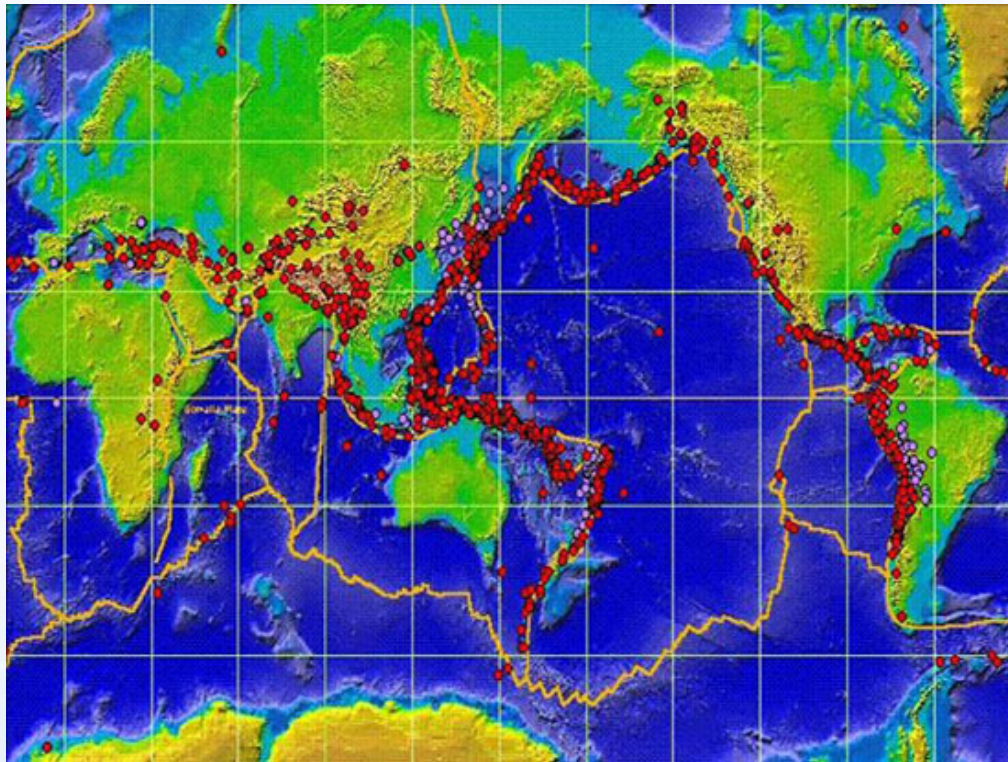
17th-SLR-May.16.2011

2010.2.27, M8.8 Chile



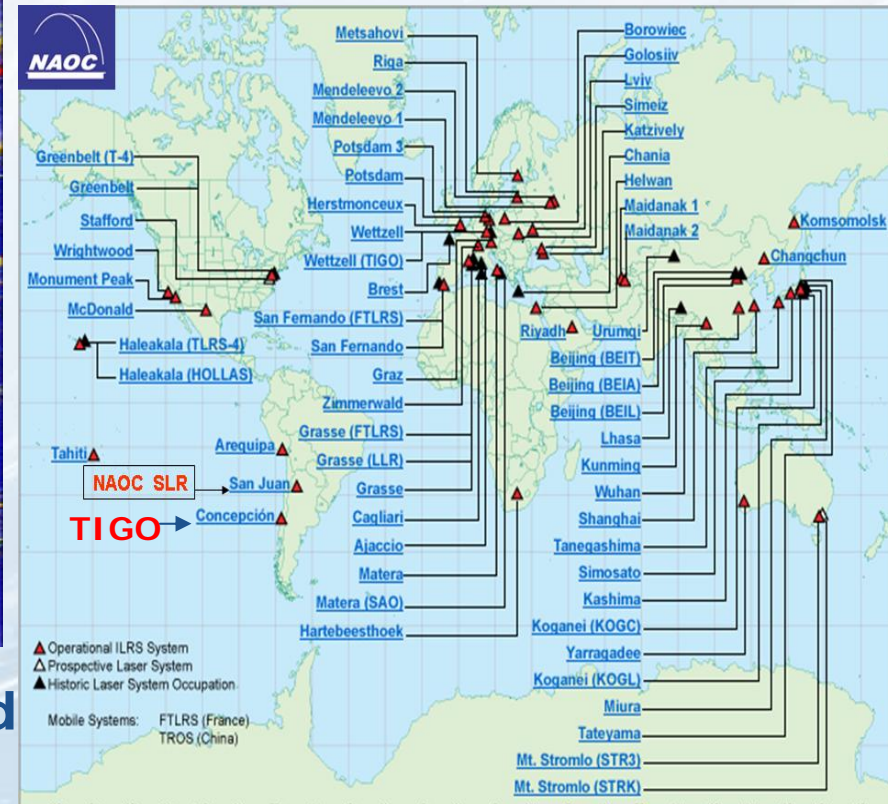
Fotomore.cn
8911-1111-8638

circum-Pacific seismic belt

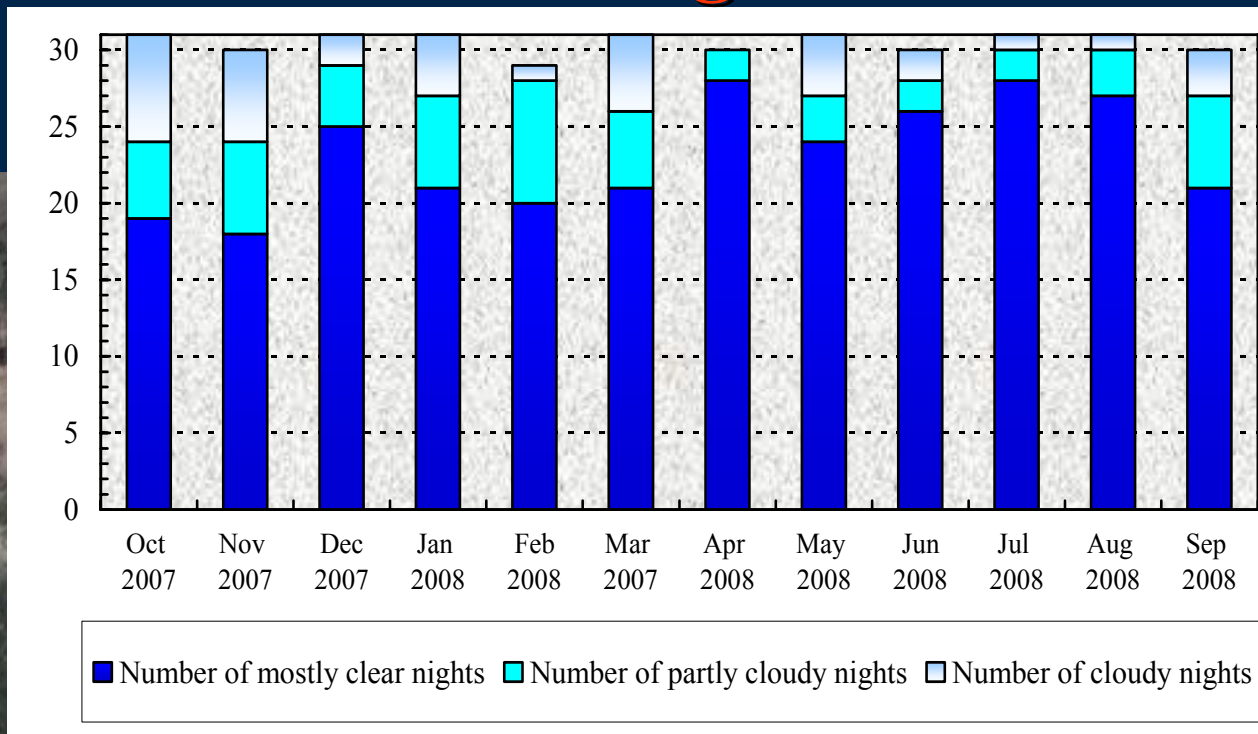


boundary between the Nazca and South American tectonic plates converge at a rate of 80 mm/ year. a thrust-faulting focal mechanism

SLR network



Observatorio Astronómico Felix Aguilar in San Juan of NUSJ



NUSJ, 68° .5W, 31° .5S, elevation: 727m

Fine weather: Dryness climate; High diaphaneity;

Many clear night ~300 nights/year

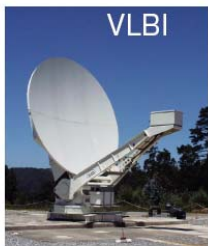
It is very excellent for astron. observations.

SLR(7405) Germany & Chile

Observatorio Geodésico TIGO

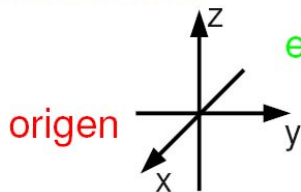


Espacio



Instrumentación de un punto de referencia fundamental

orientación



Tiempo



Campo de gravedad de la Tierra



gravímetro absoluto

gravímetro superconductor

Fotos muestran equipos de TIGO.

Erhard Sierk y Hajo Hase
Cartografía y Geodesia de Alemania (BKG)



❖ **2010.2.27 Chile EQ,**

Epicenter: $\phi = -36.122^\circ$, $\lambda = -72.898^\circ$

❖ **SLR-7405: $\phi = -36.843^\circ$, $\lambda = -73.025^\circ$**

distance between Epicenter and 7405 : ~80 km.

SLR-7405 also suffered some damage, the SLR is operational again after two months.

❖ **SLR-7406: $\phi = -31.509^\circ$, $\lambda = -68.623^\circ$**

distance between Epicenter and 7406: ~ 650 km.

distance between 7406 and 7405: ~716km.

Data processing methods (for Lageos)

- Reference Coordinate System

Inertial	J2000.0
Terrestrial	ITRF2000
Precession	IAU1976
Nutation	IAU1980

- Measurement model

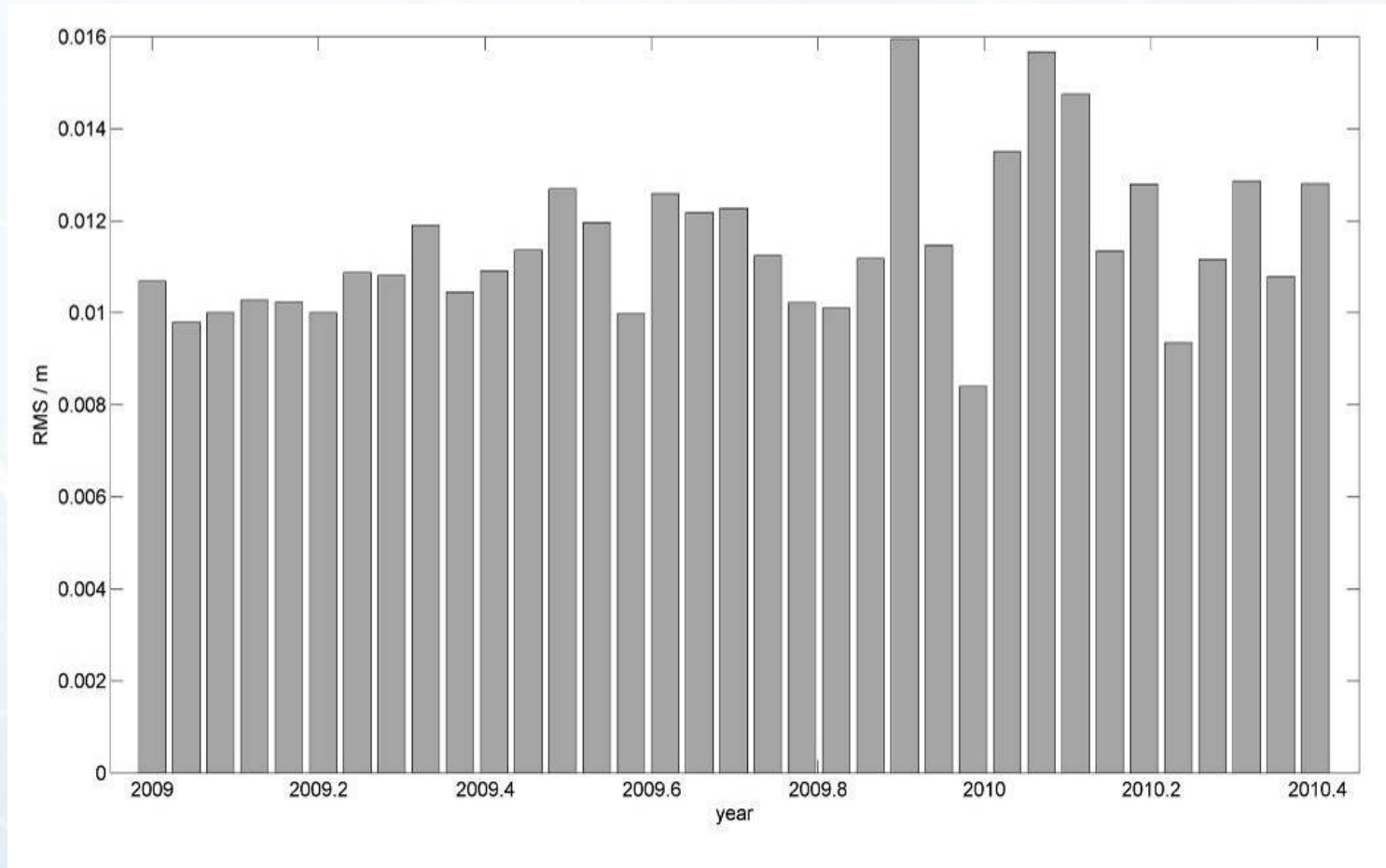
Plate tectonic motion	NNR-NUVEL1
earth solid tides	
rotational deformation	
ocean tide loading	CSR4.0
Tropospheric refraction	Marini/Murry model

Data processing methods (for Lageos)

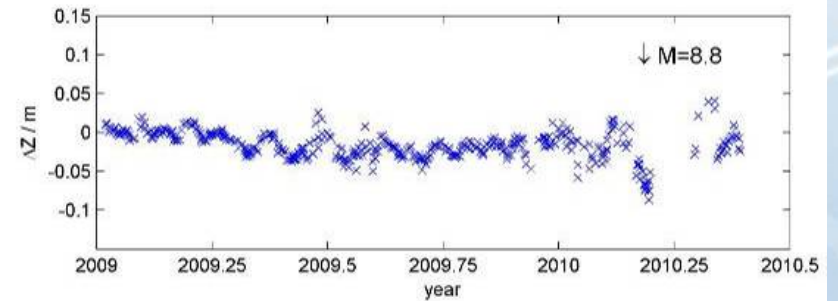
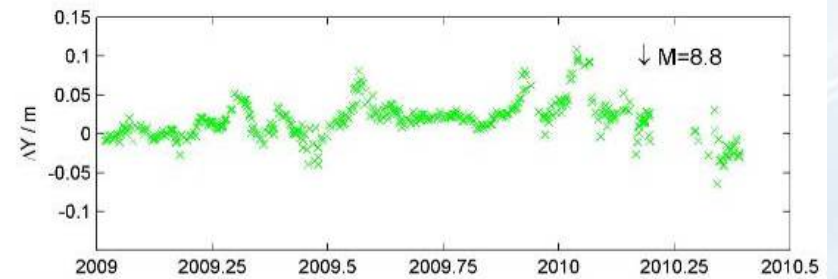
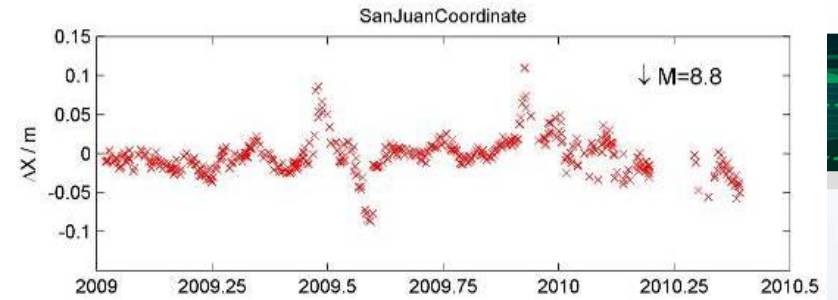
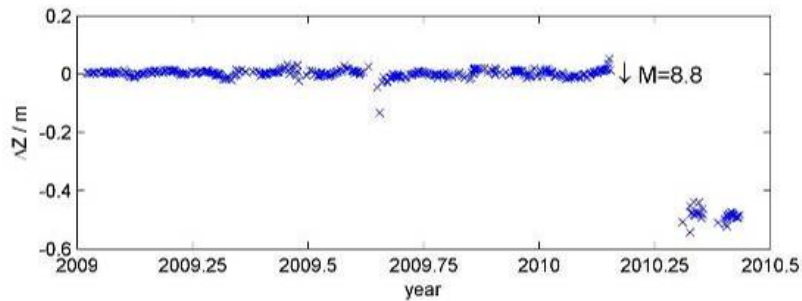
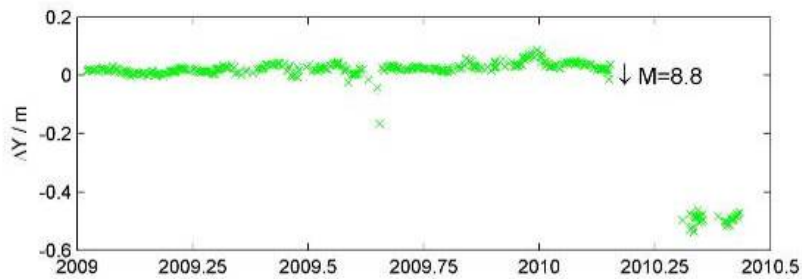
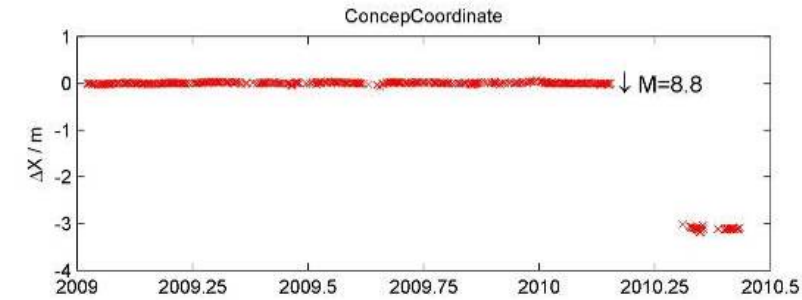
- Dynamical Model

earth gravity field	JGM-3 30*30
n-body perturbation	JPL ephemerides DE403 (sun/moon)
ocean tide model	CSR4.0+TEG4
relativistic correction	1-body
solar radiation pressure	conical
earth radiation and albedo	
thermal radiator (y-bias)	
empirical drag	
empirical RTN acceleration	

POD of Lageos & Assessment of station coordinates



RMS of Lageos POD residual
Time span: 2009.01.01-2010.06.22
Mean RMS: 0.012m



Coordinate changes of Concepción(7405) and San Juan (7406) After M8.8 Chile earthquake

Yin Z Q, Han Y B, Podestá R, Liu W D, et al. *Chinese Sci Bull*, 2011, 56: 738–742, doi: 10.1007/s11434-010-4324-8

SLR-7405 and SLR-7406 coordinate based on ITRF2000

	X / m	Y / m	Z / m	STD/ Δ X / m	STD/ Δ Y / m	STD/ Δ Z / m
7405 bef. EQ	1492032.7583	-4887946.0478	-3803566.0389	0.014	0.018	0.012
7405 aft. EQ	1492029.6433	-4887946.5663	-3803566.5262	0.031	0.017	0.020
7405 aft.—bef.	-3.114	-0.5185	-0.4873	×	×	×
ITRF08 to 2k (7405)	1492032.7512	-4887946.0714	-3803566.0414	×	×	×
7405 bef. EQ—ITRF	0.0071	0.0236	0.0025	×	×	×
7406 bef. EQ	1984104.2205	-5068867.1380	-3314482.6836	0.022	0.022	0.015
7406 aft. EQ	1984104.1988	-5068867.1653	-3314482.6986	0.014	0.023	0.031
7406 aft.—bef.	-0.0217	-0.0273	-0.015	×	×	×
ITRF08 to 2k (7406)	1984104.2214	-5068867.1582	-3314482.6687	×	×	×
7406 bef. EQ—ITRF	-0.0009	0.0202	-0.0149	×	×	×

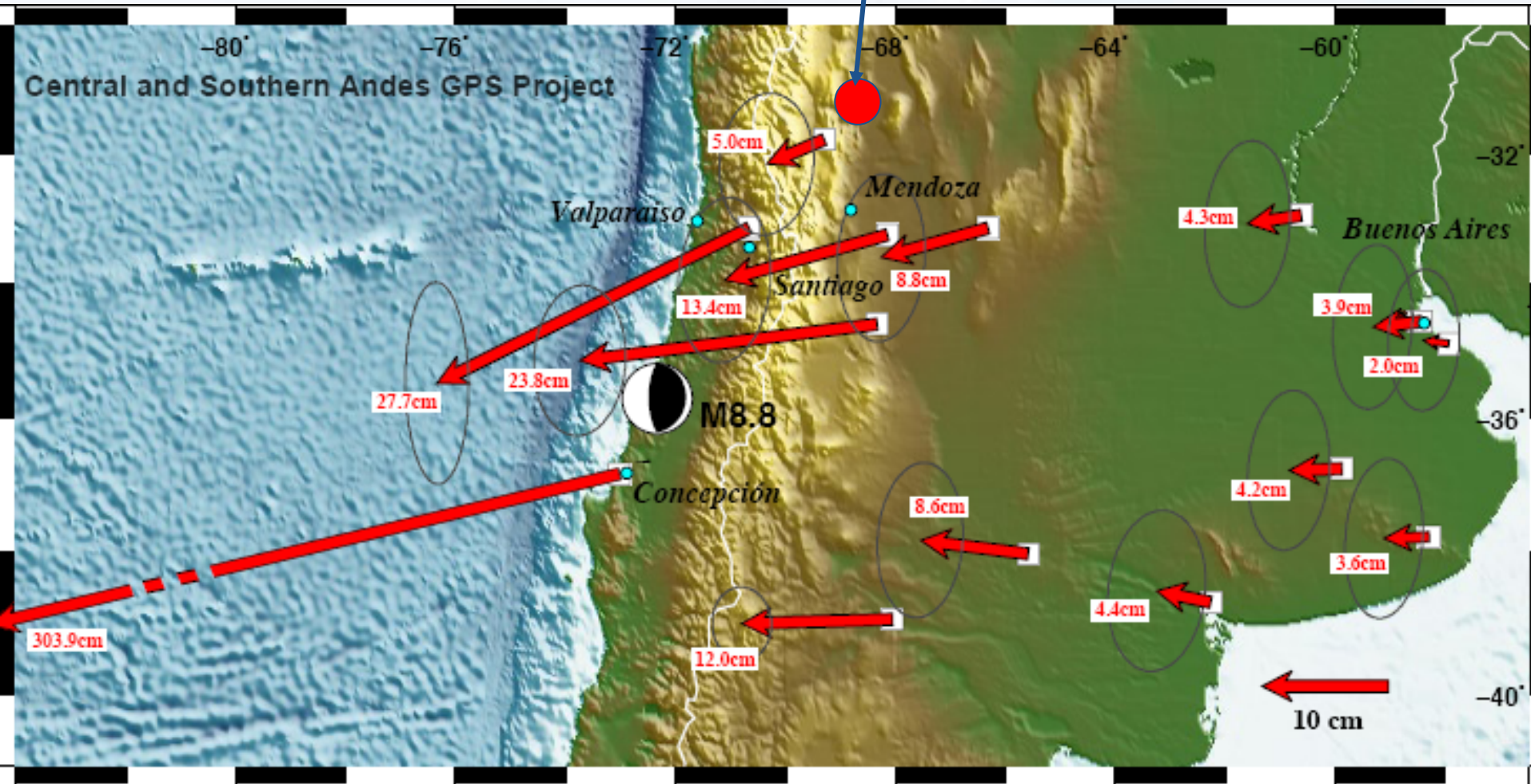
bef. EQ means before 2010.2.27; aft. EQ: after earthquake

STD of Δ X/ Δ Y/ Δ Z: ~2cm

ITRF08to2k: ~2cm

Result from GPS

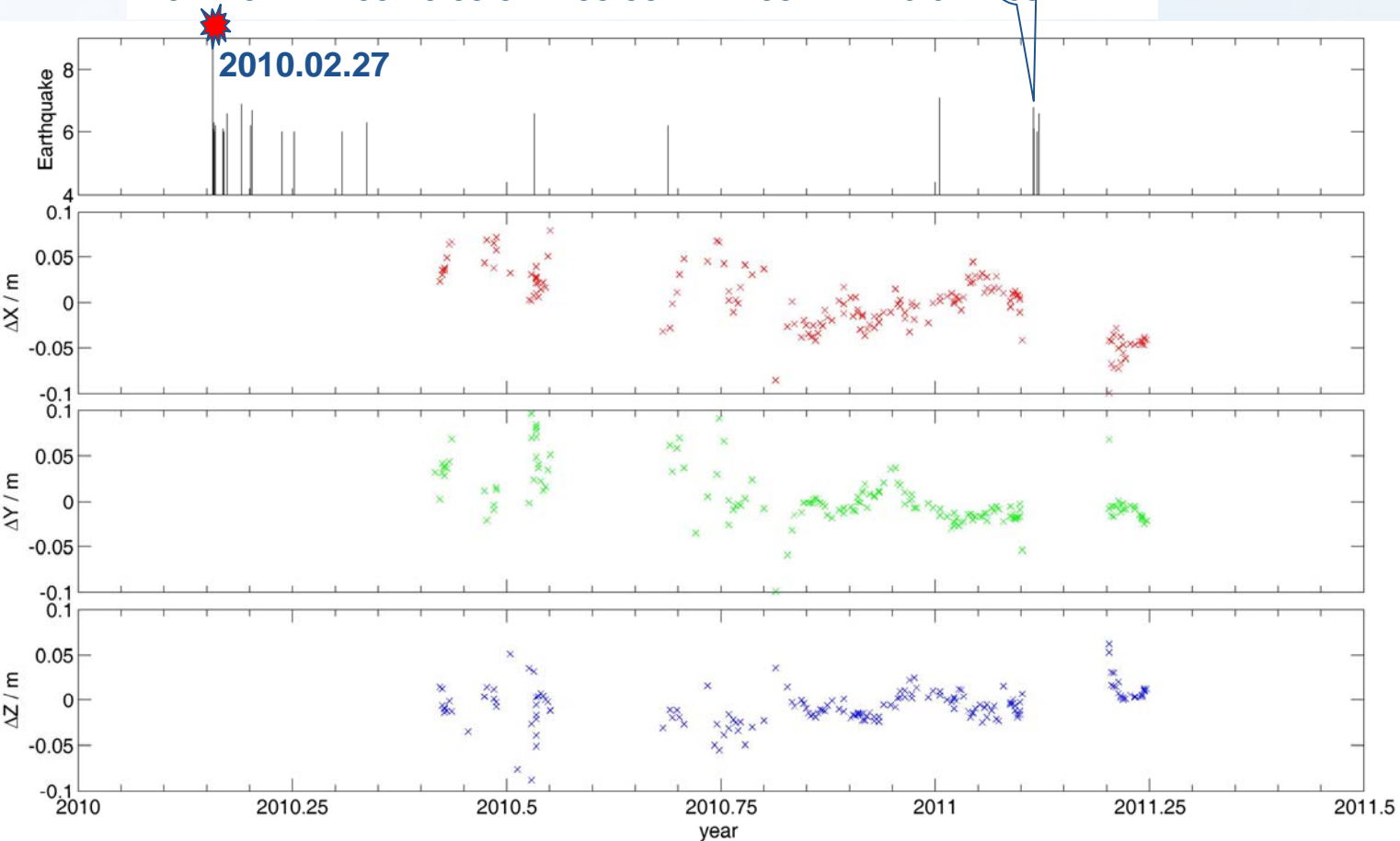
San Juan



YR	MO	DA	TIME	LAT	LONG	DEP	MAG	DIST	
2010	07	14	08 32	21.49	-38.07	-73.31	22	6.6	138
2010	09	09	07 28	01.72	-37.03	-73.41	16	6.2	40
2011	01	02	20 20	17.69	-38.37	-73.35	24	7.1	171
2011	02	11	20 05	30.79	-36.47	-73.12	27	6.8	41
2011	02	11	23 39	21.31	-37.20	-73.20	15	6.0	42
2011	02	12	01 17	01.41	-37.02	-72.95	16	6.1	21
2011	02	13	10 35	06.74	-36.65	-73.18	17	6.0	25
2011	02	14	03 40	09.92	-35.38	-72.83	21	6.6	163



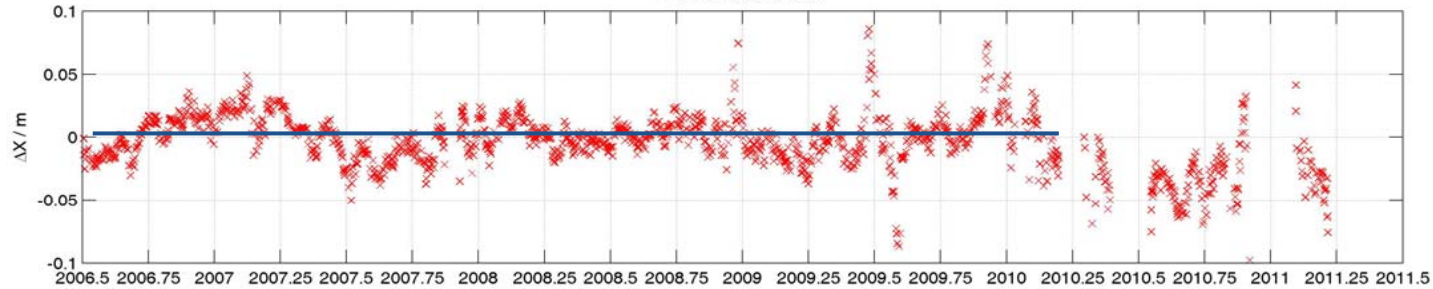
Earth quake > M6
center: SLR-7405
Radius: 1000 km



Coordinate of Concepción(7405)

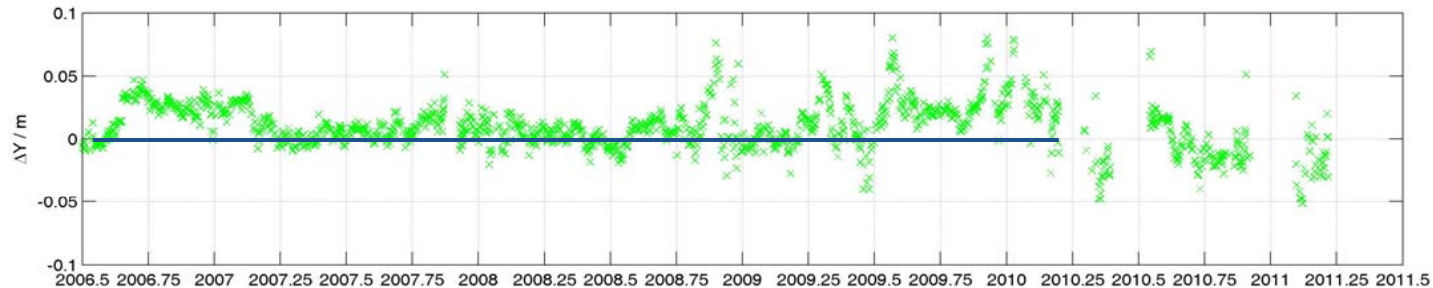
SLR-7406 coordinate from 2006 -> now

SanJuanCoordinate

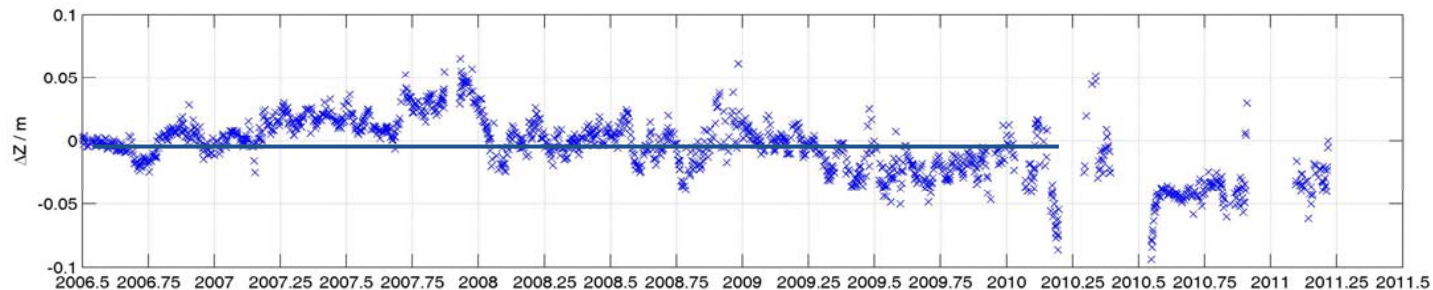


Average before
And after EQ

1984104.222m
1984104.189m
 $\Delta = 0.033\text{m}$



-5068867.145m
-5068867.165m
 $\Delta = 0.019\text{m}$



-3314482.669m
-3314482.708m
 $\Delta = 0.039\text{m}$

Future plan of San Juan SLR-7406

- ❖ change the laser system to a semiconductor pumped laser (KHz) and thus bring the system to high repetition rate and daylight ranging capabilities.
- ❖ install a GPS receiver collocated with the SLR system.
- ❖ VLBI (in several years)



Thank You !