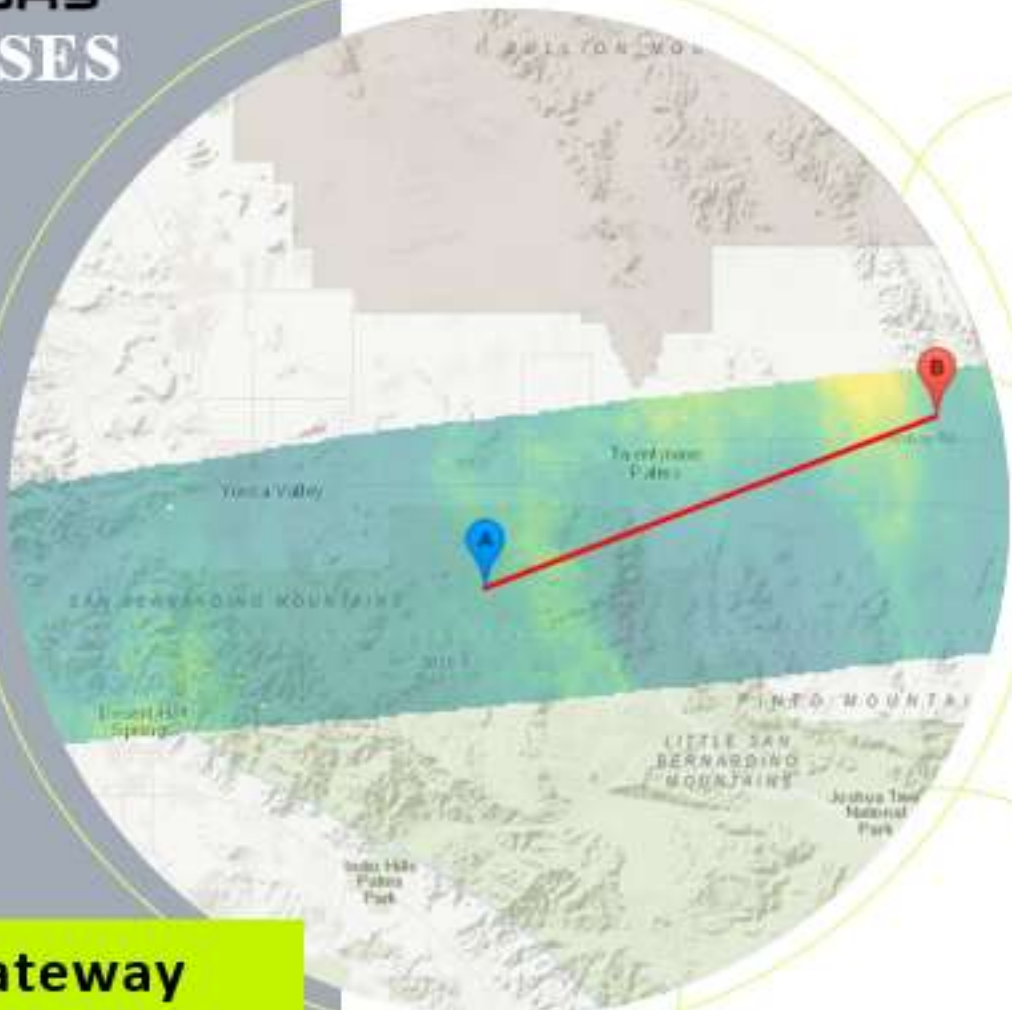
GeoGateway

EXERCISES



GeoGateway Exercises

UAVSAR

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Magnitude

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Exercise: Model and Analyze Interferograms

Step 1: Go to geo-gateway.org

Step 2: Click on the "**UAVSAR**" tab

There are two methods to search for a UAVSAR interferogram.

1. The "flight name/path" directly finds the flight name and path
2. The "latitude, longitude" option returns all flight paths crossing paths with the specified coordinates.

Step 3: In the case of this exercise, enter 26501 (flight name/path) in the search window and hit return. Select the second interferogram on the list (Name is SanAnd_26501_09083-010_10028-000_0174d_s01_L090HH_C2)

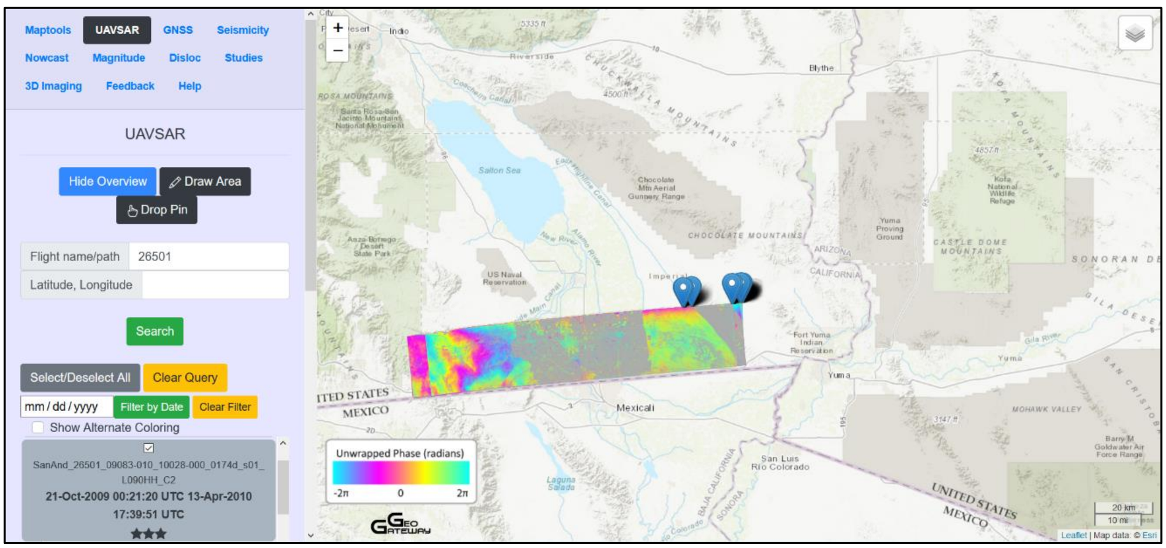


Figure 1: Interferograms displayed after searching 26501 flight name/path

Step 4: Check the box next to "Show Alternate Coloring" followed by re-selecting the interferogram

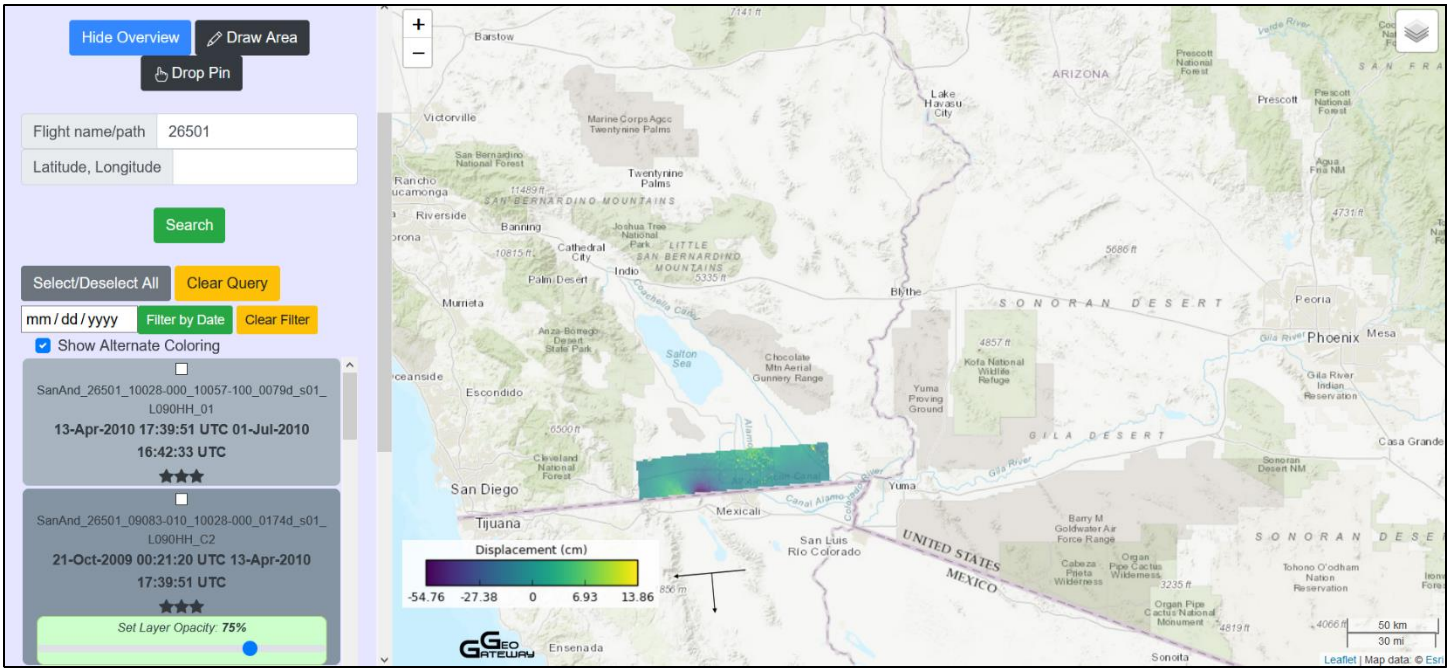


Figure 2: Interferogram displayed in units of displacement (cm)

Step 5: Zoom into the area of the two lobes that are green/yellow and purple.

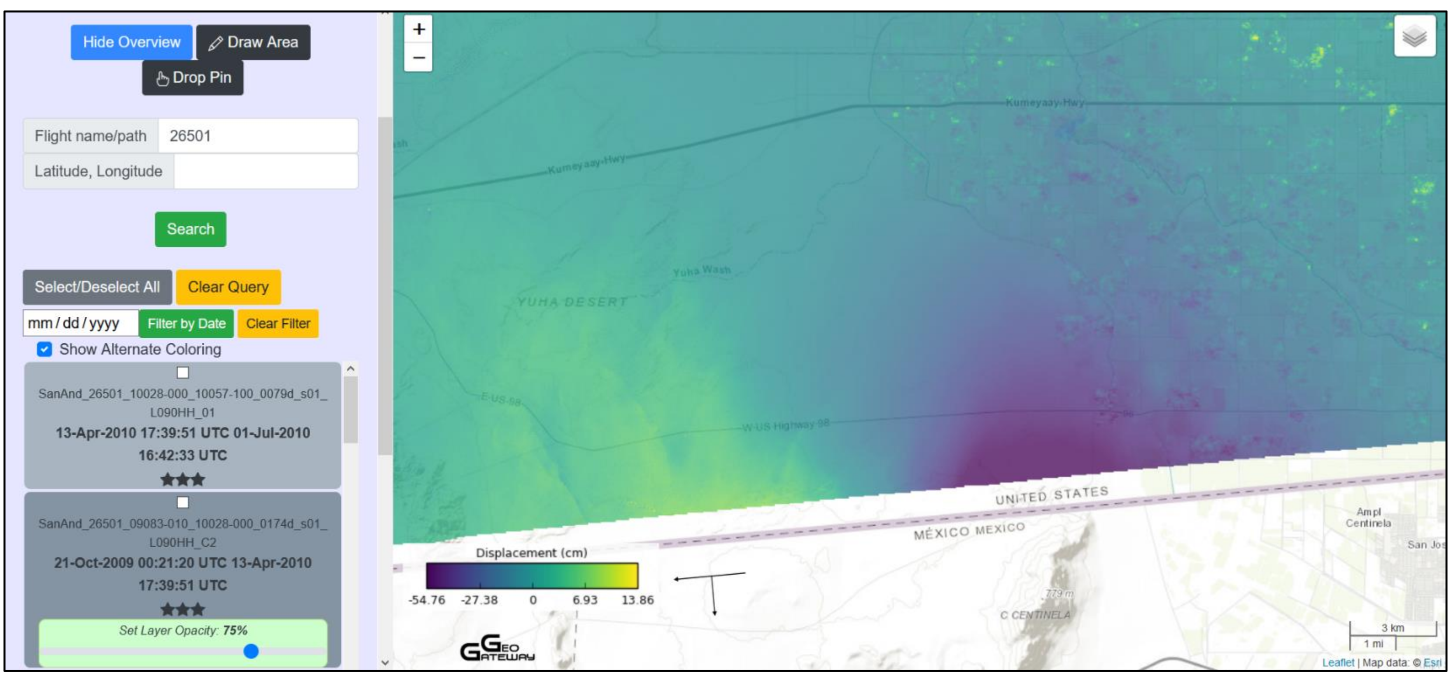


Figure 3: Interferogram shown zoomed into the two green/yellow and purple lobes. Yellow lobe shows more surface fracturing

Step 6: Click on the map.

a. Adjust the endpoints of the profile to be on the product but parallel to the south end of the product through the largest color difference.
b. Mouse over the plot and read the maximum and minimum ground range change from the upper right corner of the plot

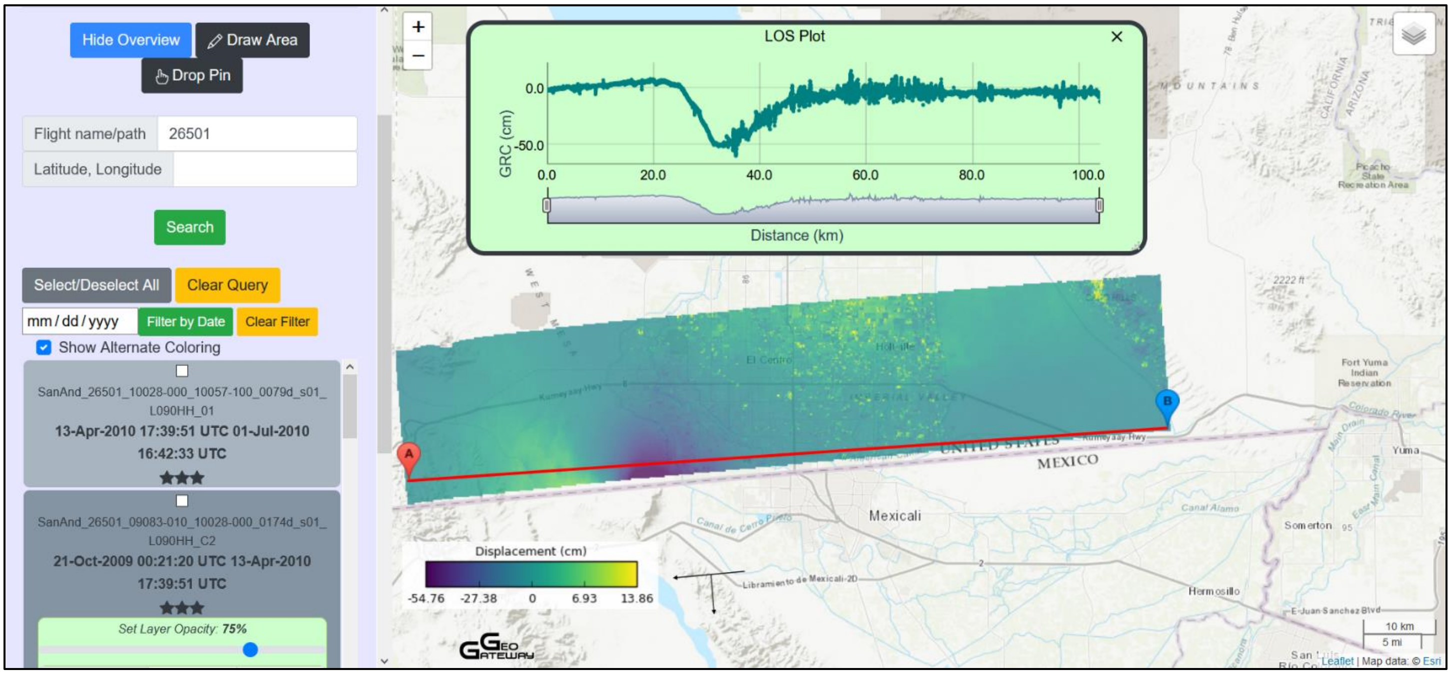


Figure 4: LOS Plot. Notice the ground range change that occurred across the two lobes.

The purple lobe moved away from the instrument on the aircraft. The negative (darker color) implies that the ground moved away from the instrument on the aircraft

Step 7: Visit the “Maptools” tab and select the “UCERF3 Faults.”

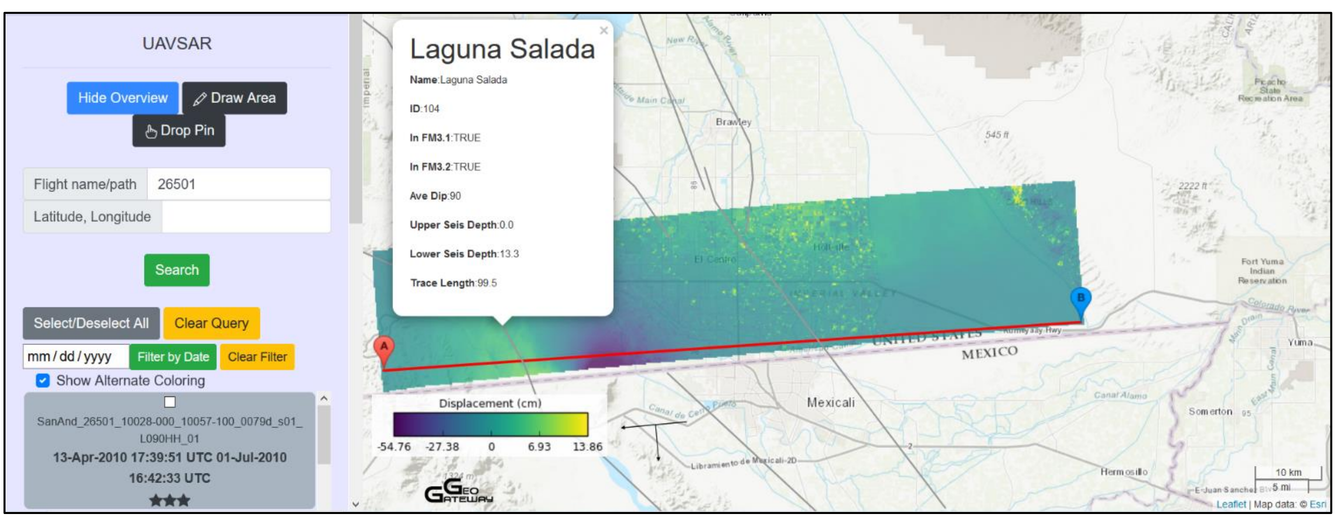


Figure 5: The mapped fault, Laguna Salada, ruptured when the earthquake took place.

Step 8: Scroll down and find line SanAnd_26501_10028-000_10057-100_0079d_s01_L090HH_02 with dates 13-Apr-2010 17:49:59 UTC 1-Jul-2010 16:49:41 UTC

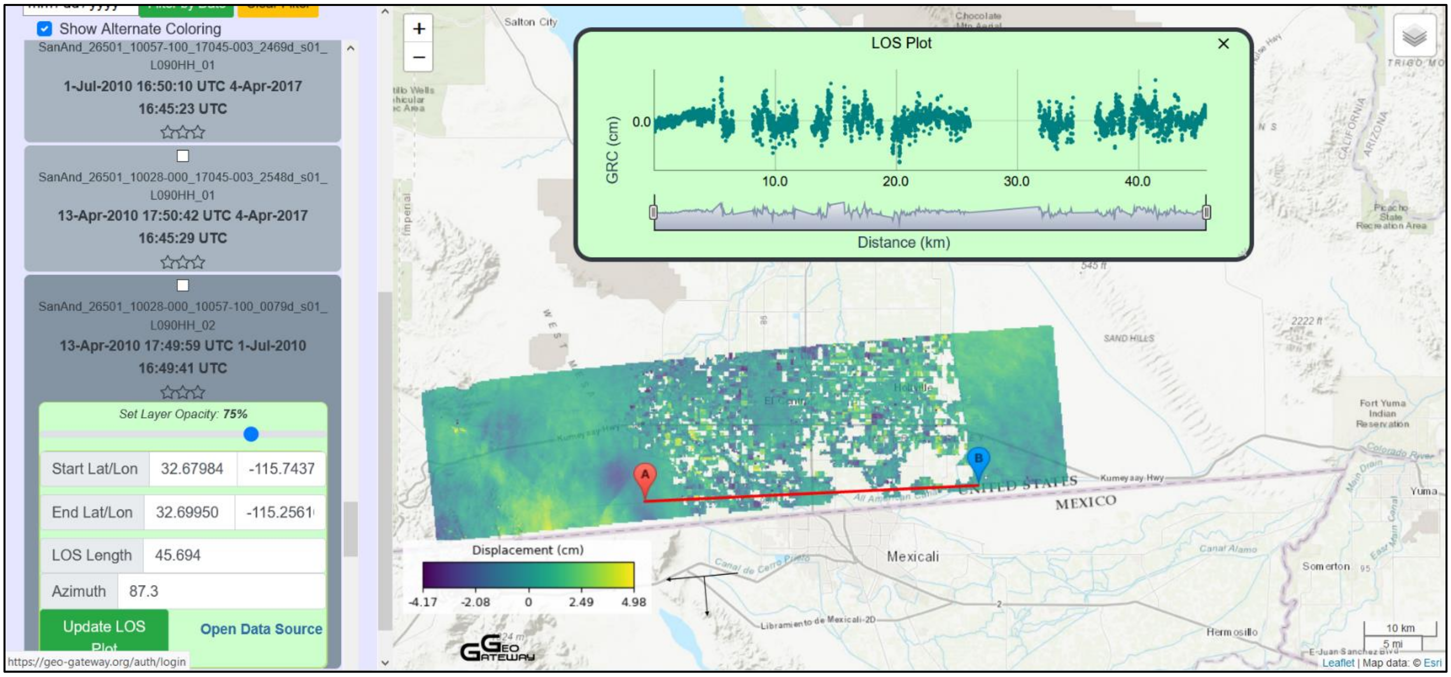


Figure 6: Notice the difference when selecting a different time frame, also some slips have error as shown from the absence in color.

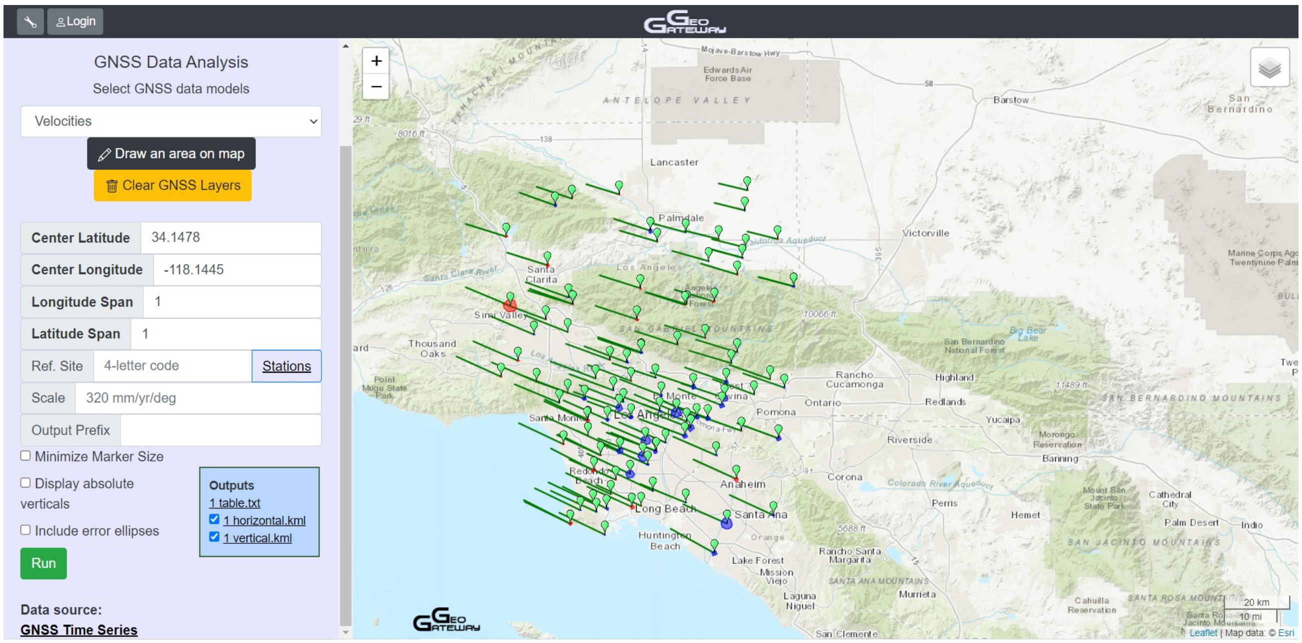
Exercise: Produce GNSS Velocities, Offsets, and Displacements

Step 1: Go to geo-gateway.org

Step 2: Click on the "**GNSS**" tab

Step 3: Construct a GNSS velocity map with no reference

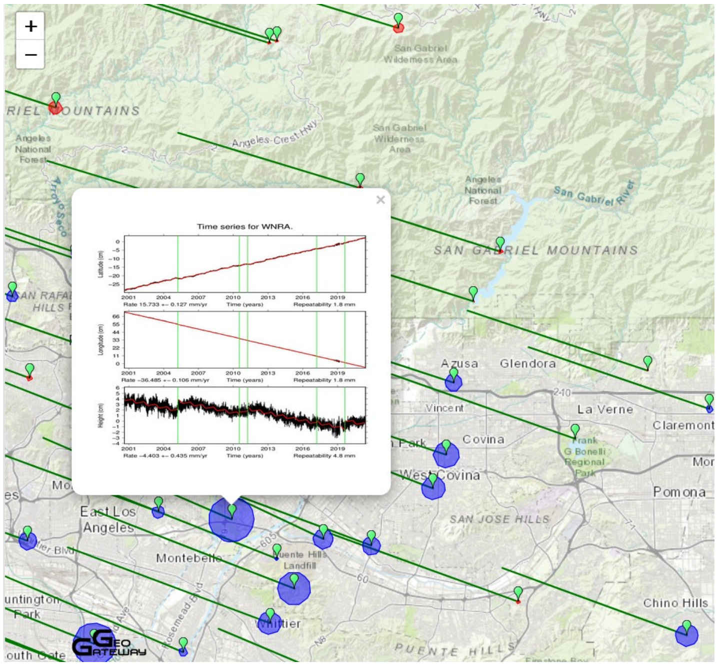
- **a.** Select center latitude and center longitude in decimal degrees
- **b.** Select longitude span and latitude span in degrees (try 1 degree)
- **c.** Leave reference site blank



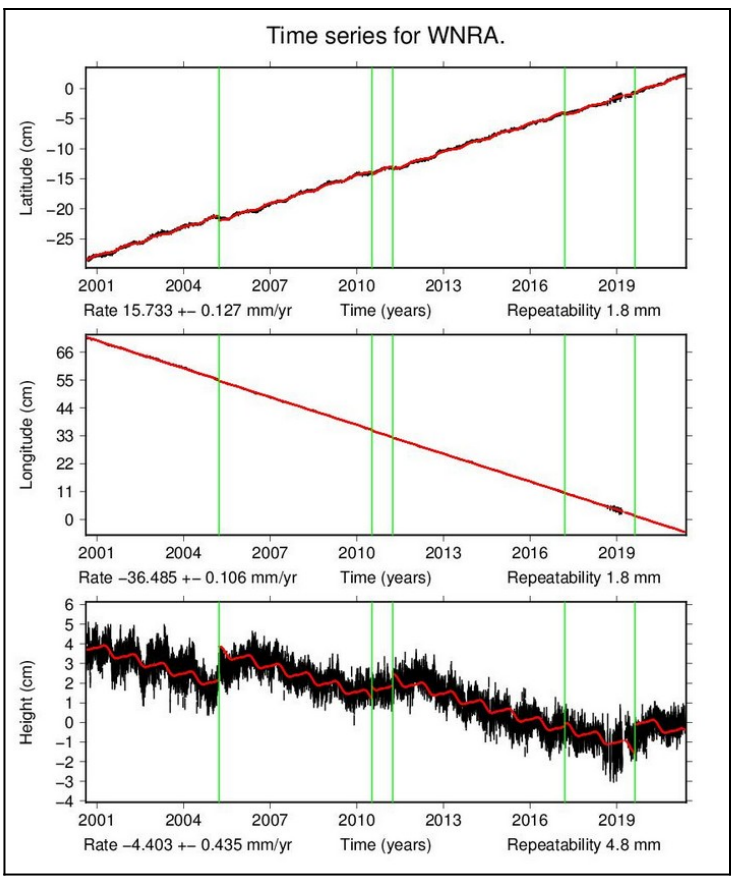
- **d.** Click on "Run"
- **e.** **Download the velocity table by clicking on "table.txt"**

Site	Lon	Lat	Delta E	Delta N	Delta V	Sigma E	Sigma N	Sigma V
AZU1	-117.896492	34.126020	-35.945000	11.890000	-1.635000	0.100000	0.110000	0.454000
BGIS	-118.159702	33.967120	-38.270000	15.292000	-4.142000	0.118000	0.136000	0.510000
BKMS	-118.094704	33.962260	-40.068000	17.099000	-0.828000	0.223000	0.264000	0.947000
BLSA	-118.028682	33.799545	-39.558000	16.391000	-0.786000	0.286000	0.333000	1.182000
BRAN	-118.277055	34.184896	-37.451000	13.931000	0.740000	0.099000	0.115000	0.483000
BTDM	-118.188231	34.292807	-35.552000	11.806000	1.226000	0.147000	0.153000	0.560000
CBHS	-118.629810	34.138563	-38.942000	17.629000	0.555000	0.051000	0.057000	0.218000
CCCO	-118.211202	33.876262	-37.277000	18.131000	-3.599000	0.203000	0.240000	0.859000
CCCS	-117.864947	33.862744	-36.802000	17.335000	1.927000	0.143000	0.170000	0.606000
CGDM	-117.964950	34.243994	-35.313000	10.754000	0.517000	0.050000	0.063000	0.221000
CHIL	-118.026004	34.333424	-34.415000	10.753000	0.259000	0.048000	0.056000	0.213000
CHMS	-117.827705	34.640463	-24.910000	5.466000	0.267000	0.094000	0.115000	0.391000
CIT1	-118.127290	34.136710	-36.874000	12.733000	-0.652000	0.105000	0.122000	0.429000
CJVG	-118.144233	34.530322	-30.862000	10.523000	-1.825000	0.205000	0.234000	0.825000
CLAR	-117.708814	34.109929	-35.101000	11.997000	-0.650000	0.097000	0.113000	0.403000
CMP9	-118.411429	34.353181	-36.487000	12.912000	-0.696000	0.099000	0.120000	0.412000
CRHS	-118.272771	33.823506	-39.009000	17.972000	0.312000	0.072000	0.084000	0.317000
CSDH	-118.256722	33.861479	-39.984000	17.710000	0.974000	0.059000	0.072000	0.245000
CSN1	-118.523817	34.253552	-37.876000	15.738000	-0.894000	0.092000	0.109000	0.382000
CTDM	-118.613215	34.516551	-35.061000	10.697000	0.916000	0.079000	0.095000	0.327000
CVHS	-117.901722	34.082013	-37.675000	12.633000	-2.493000	0.176000	0.208000	0.736000
DAM1	-118.397367	34.333997	-38.330000	11.540000	0.730000	0.366000	0.376000	1.601000
DAM2	-118.396869	34.334837	-36.844000	13.162000	0.735000	0.079000	0.081000	0.347000
DAM3	-118.397471	34.333992	-36.584000	12.826000	-0.056000	0.216000	0.210000	0.955000
DSHS	-118.348546	34.023934	-36.860000	17.245000	-0.390000	0.169000	0.196000	0.710000
DVPB	-117.860132	34.413414	-31.269000	9.248000	0.635000	0.045000	0.056000	0.194000

f. Click on a station to show the time series



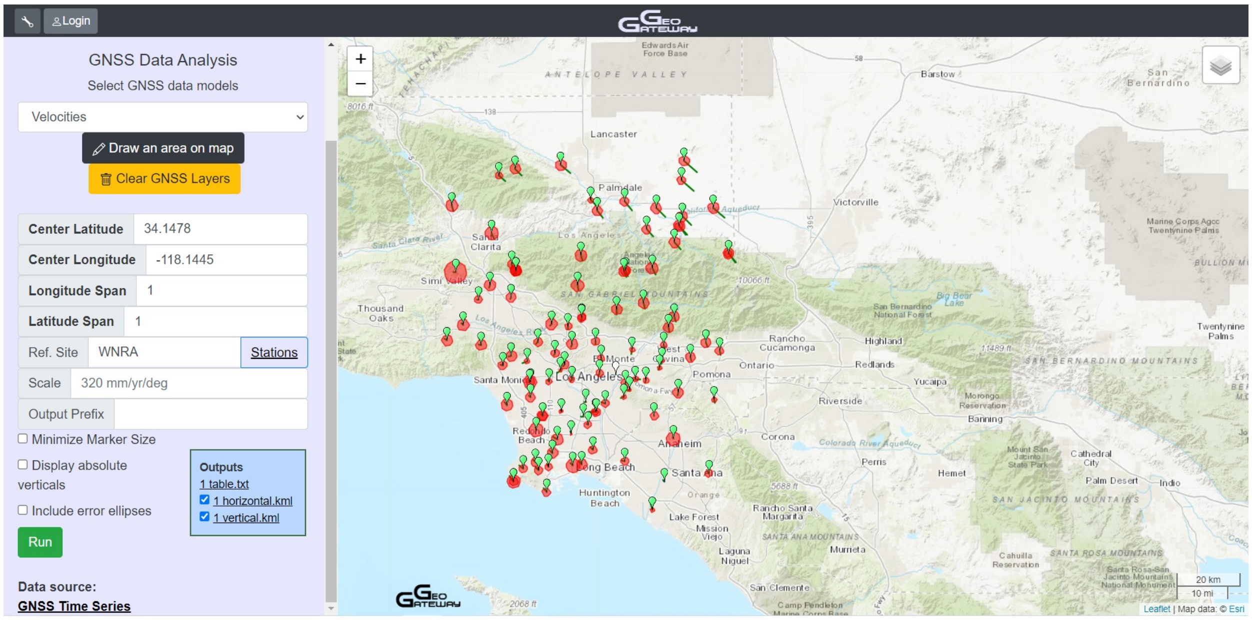
g. Click on the time series thumbnail to open the larger version of the graphs



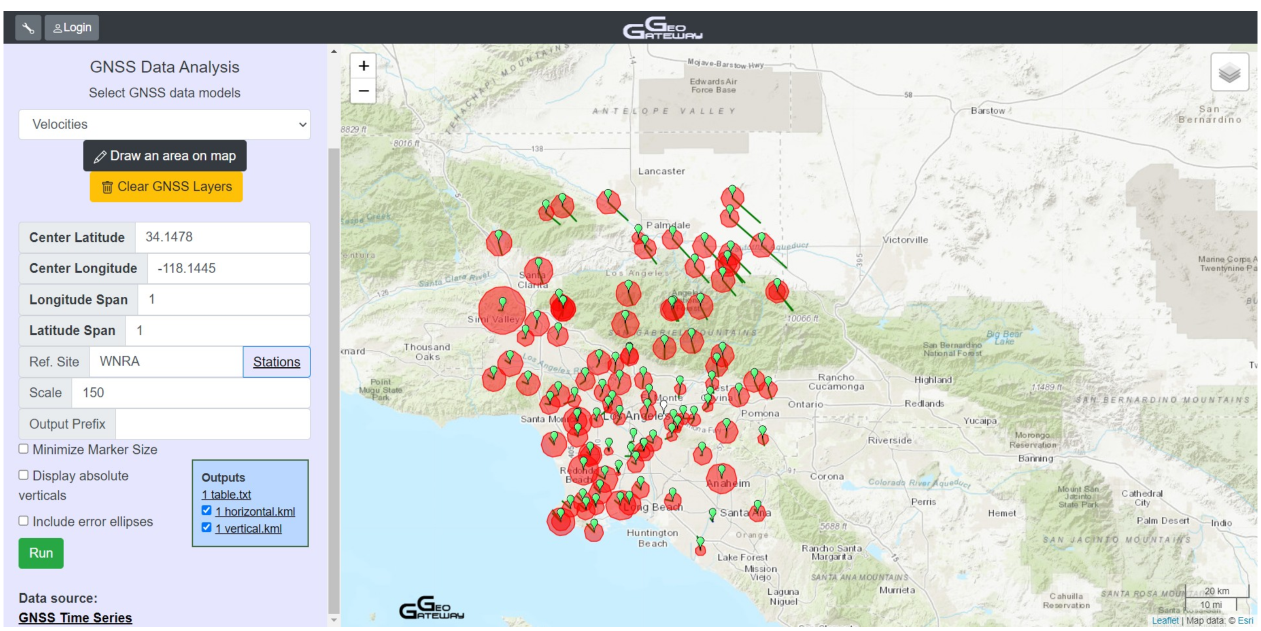
h. Download the KML file if you would like to save it. This can later be plotted using the "KML Uploader" on the Maptools tab

Step 4: Now construct a GNSS velocity map with a reference site

a. Select center latitude and center longitude
b. Select longitude span and latitude span in degrees (1 degree is often good)
c. Select a reference site from the previous plot
d. Click on "Run"

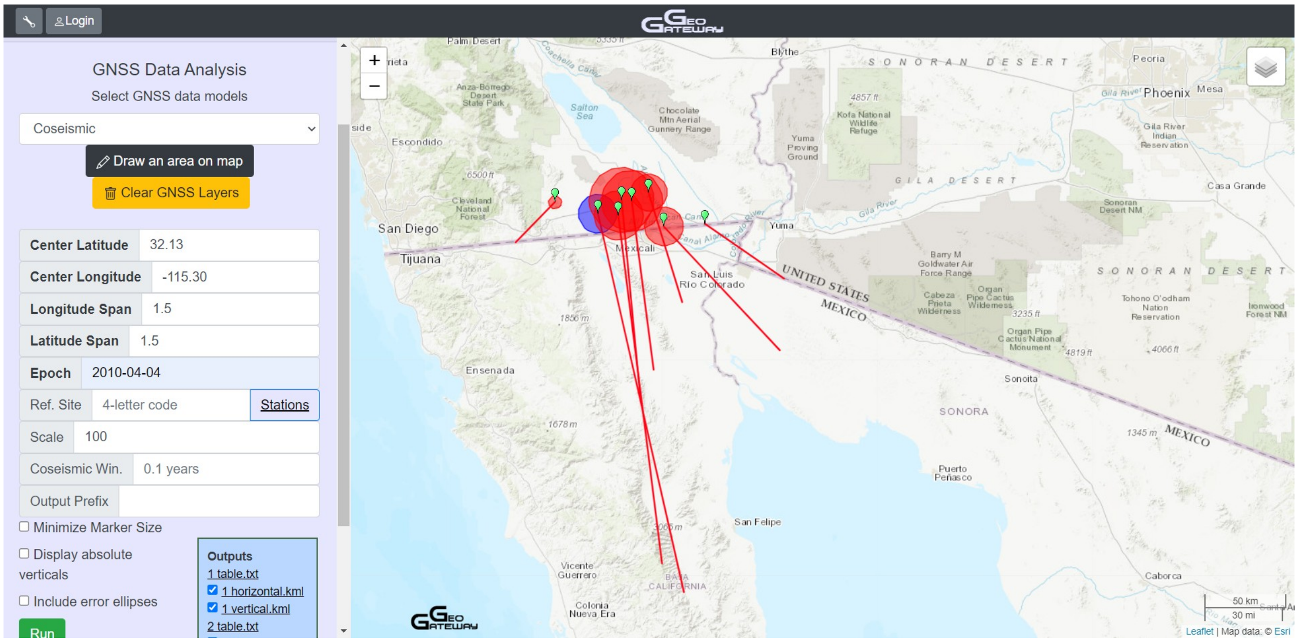


e. Vary the scale to see the result (hint – smaller number results in larger vectors).

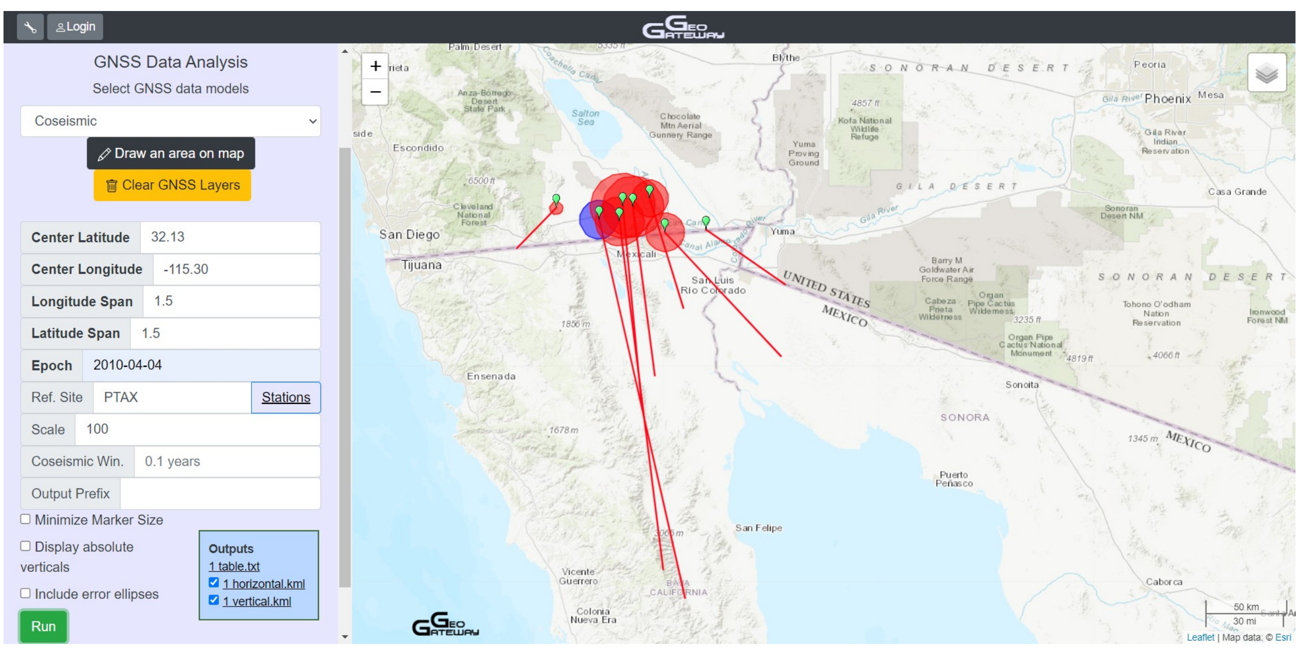


Step 5: Repeat for coseismic displacements

a. Select center latitude and center longitude near a large event (e.g. El Mayor – Cucapah earthquake).
b. Enter time of earthquake
c. **Print plot with no reference**



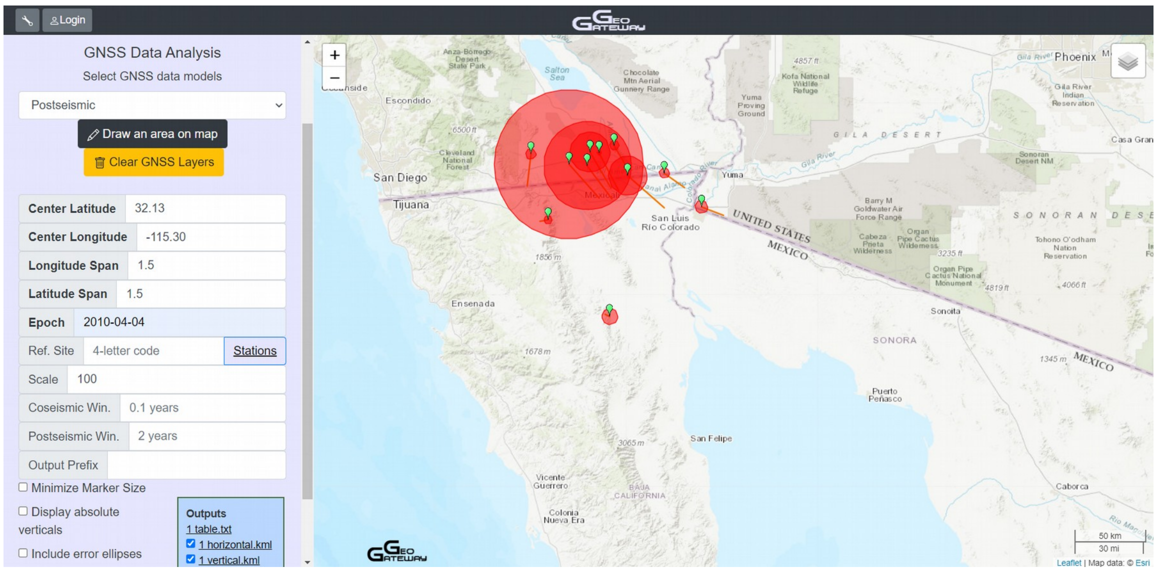
d. **Print new plot with a reference station**



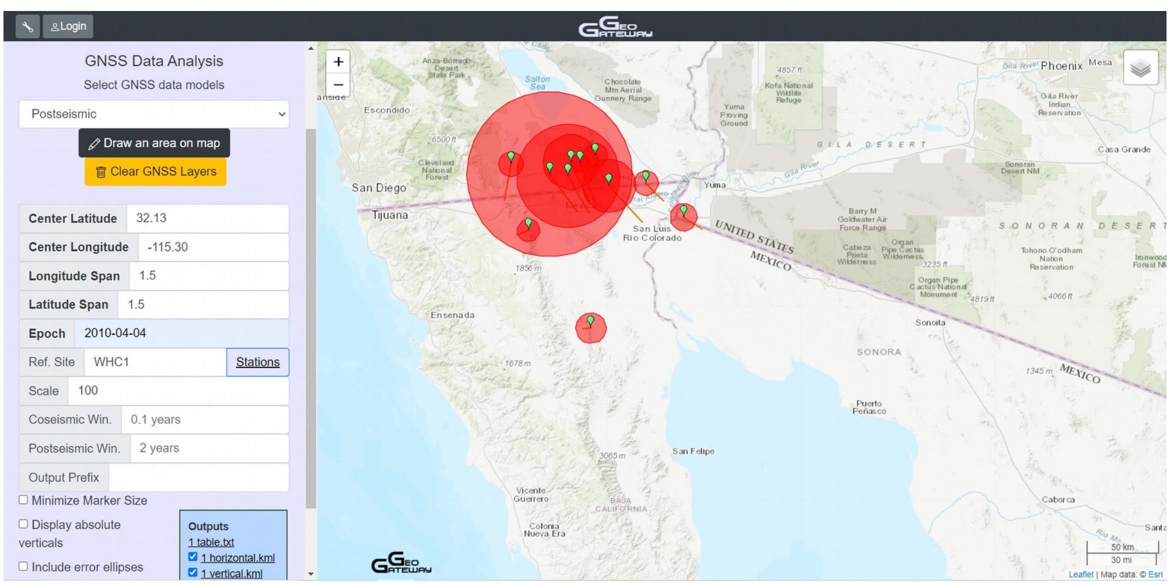
Step 6: Repeat for postseismic displacements

- **a.** Select center latitude and center longitude of a large event (e.g. El Mayor – Cucapah earthquake)
- **b.** Enter time of earthquake
- **c.** Experiment with different postseismic windows

- **d. Print plot with no reference**

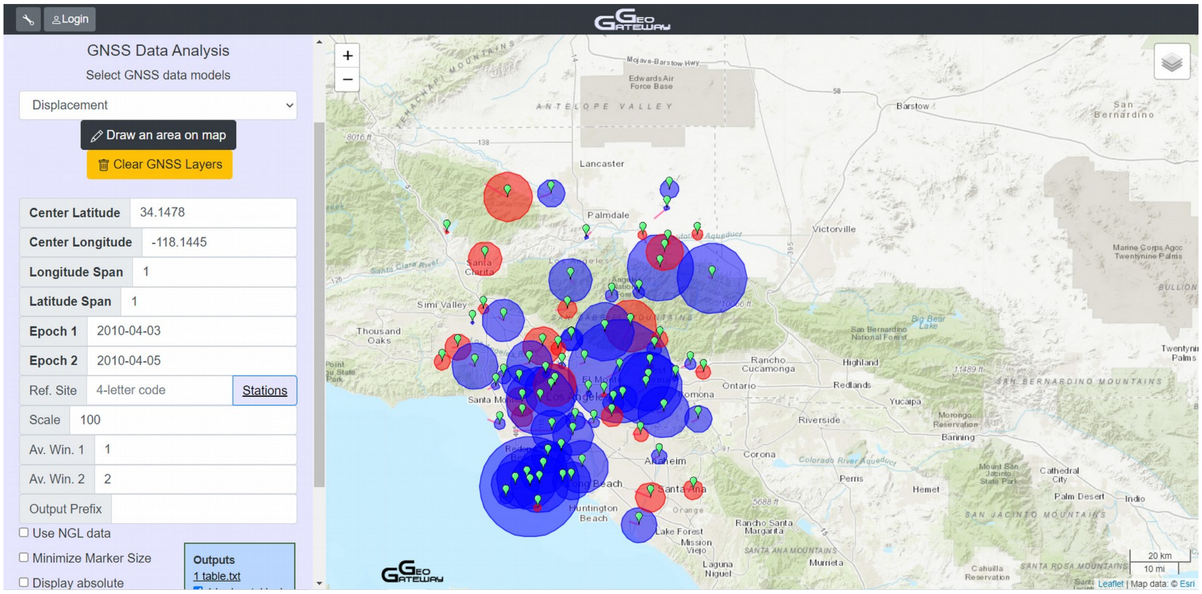


- **e. Print new plot with a reference station**

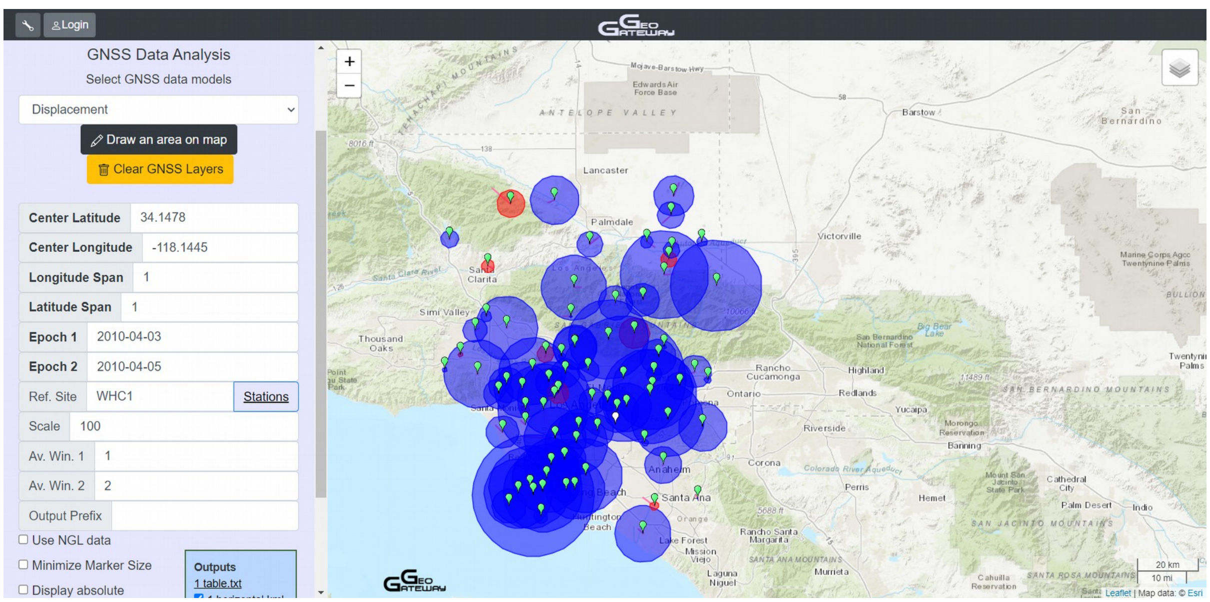


Step 7: Repeat for displacements

- **a.** Select center latitude and center longitude
- **b.** Enter two times to calculate displacements between time 1 and time 2
- **c.** **Print plot with no reference**



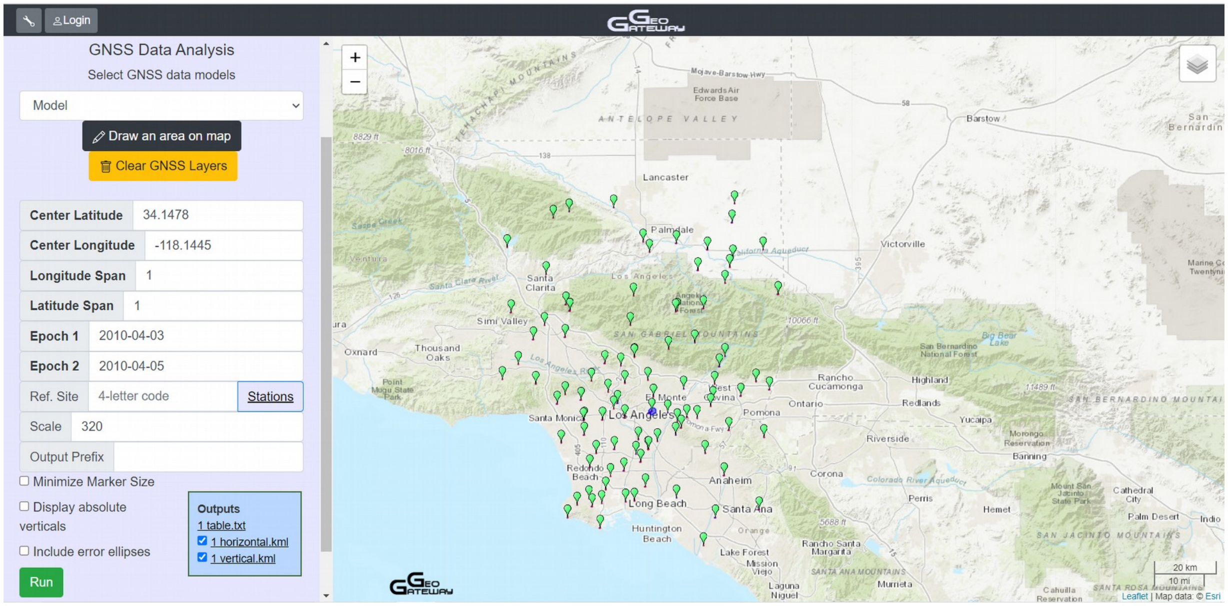
d.



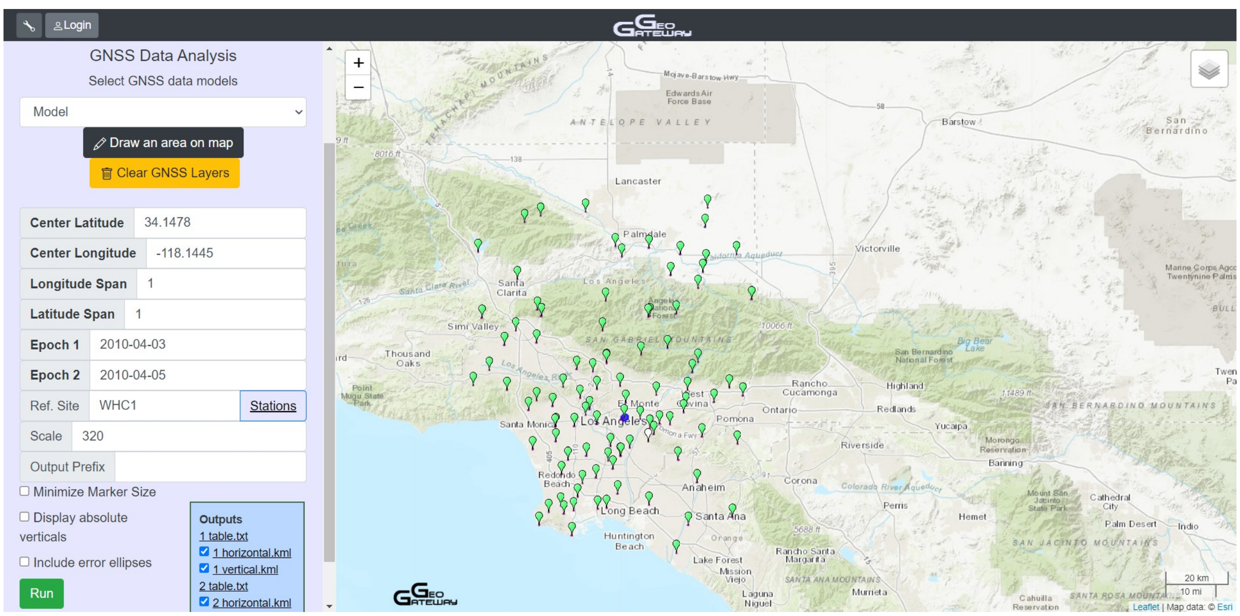
Step 8: Repeat for model

- **a.** Select center latitude and center longitude
- **b.** Enter two times to calculate displacements between time 1 and time 2

c. Print plot with no reference

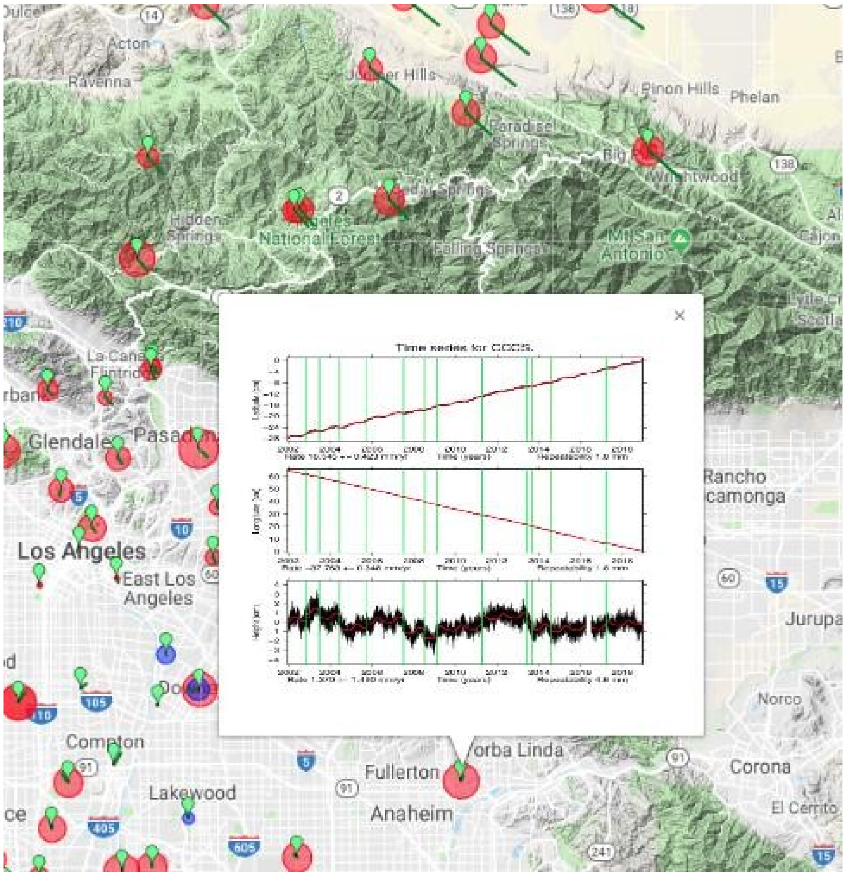


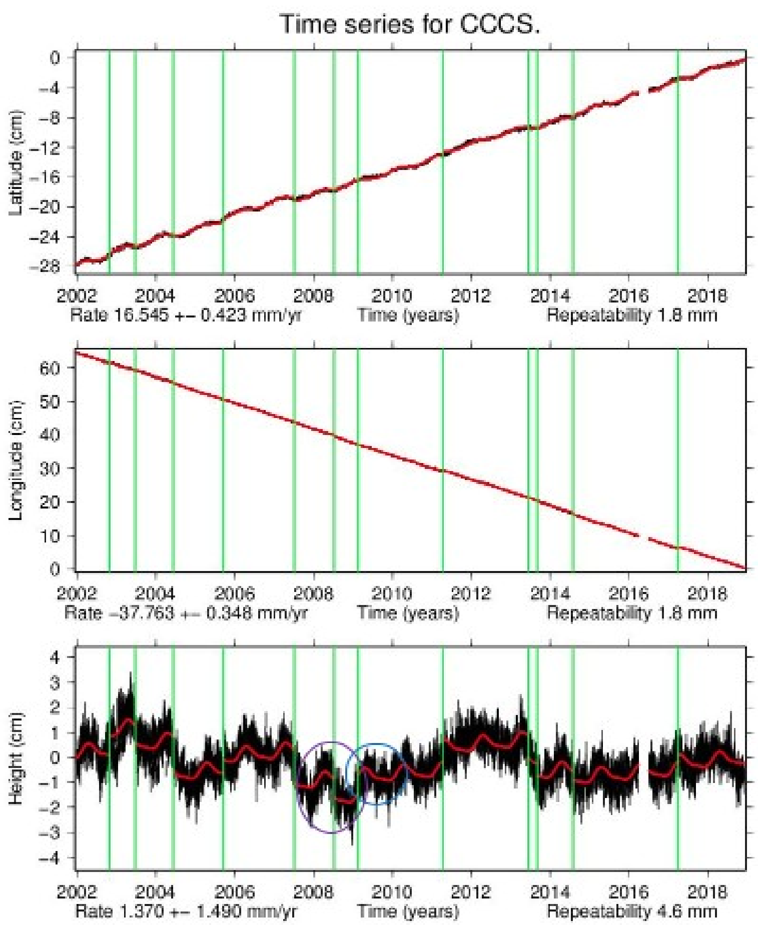
d. Print new plot with a reference station



Step 9: Find and print a time series that shows an offset and postseismic motion

a. Label offset
b. Label postseismic motion
c. Point to time series


Acton
Ravenna
Pinon Hills
Phelan
Wrightwood
National Forest
Mt San Antonio
Glendale
Los Angeles
East Los Angeles
Rancho Cucamonga
Jurupa
Norco
Compton
Lakewood
Fullerton
Anaheim
Corona
El Cerrito
Time series for CCCS.


Time series for CCCS.
Latitude (cm)
Rate 16.545 +- 0.423 mm/yr
Time (years)
Repeatability 1.8 mm
Longitude (cm)
Rate -37.763 +- 0.348 mm/yr
Time (years)
Repeatability 1.8 mm
Height (cm)
Rate 1.370 +- 1.490 mm/yr
Time (years)
Repeatability 4.6 mm

Exercise: Calculating Moment Magnitude

GeoGateway allows users to determine the magnitude of an earthquake. In this exercise, users will generate a moment magnitude 6.0 earthquake.

Step 1: Go to geo-gateway.org

Step 2: Click on the "**Magnitude**" tab

Step 3: Enter parameters to create a moment magnitude 6.0 earthquake (hint: length and width should be equal)

- **a.** Length (km): 4
- **b.** Width (km): 4
- **c.** Slip (m): 2
- **d.** Shear Modulus (10^{11} dyne/cm^2): 4

Results: As shown in *figure 1*, the seismic moment equates to 1.3 x 10^{25} and the moment magnitude equates to 6.0.

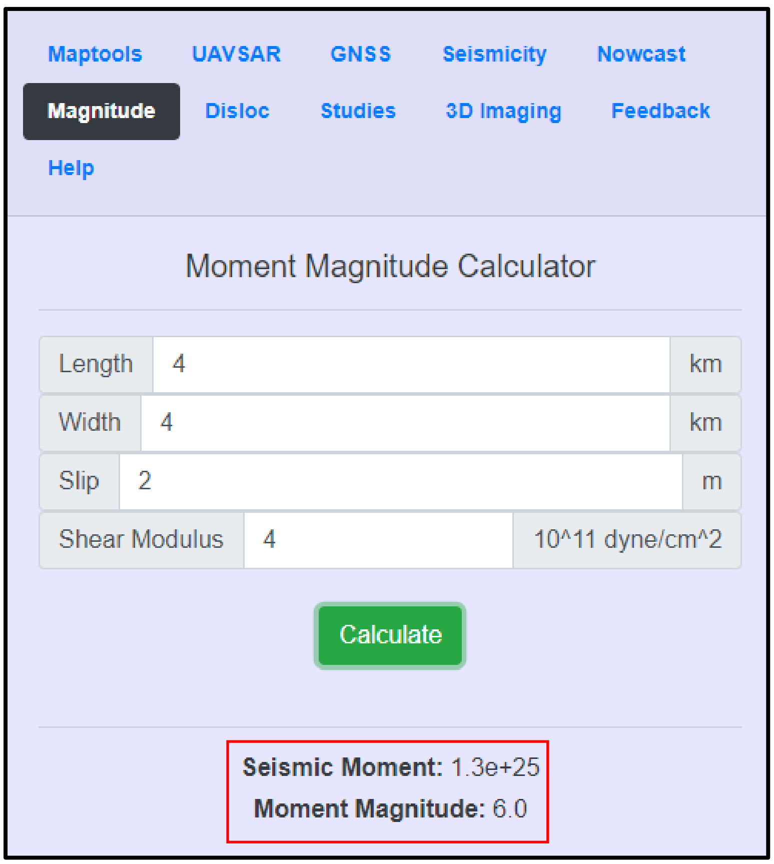


Figure 1: Results of seismic moment and moment magnitude generated by GeoGateway's Moment Magnitude Calculator

Extra: Use GeoGateway's Moment Magnitude Calculator to estimate the number of earthquakes.

Assume a San Andreas fault slip rate of 35 mm/yr. Use the above slip to estimate the number of M6 earthquakes that should occur over 100 years at that slip rate

Answer

35 mm/yr x 100 years = 3,500 mm
3,500 mm to m = 3.5 m
Slip is 2 m
2 m / 3. m = **0.57 earthquake(s)**