UAVSAR

UAVSAR (Uninhabited Aerial Vehicle Synthetic Aperture Radar), is an airborne, L-band, fully polarimetric radar, housed in a pod that is mounted to the belly of a piloted Gulfstream III aircraft. Interferometric radar images, or interferograms, are generated from repeat passes flown over a site of interest. Interferometric radar observations are made from the swaths received, which are approximately 22 km wide and typically between 100 and 300 km long (Donnellan et al., 2014).

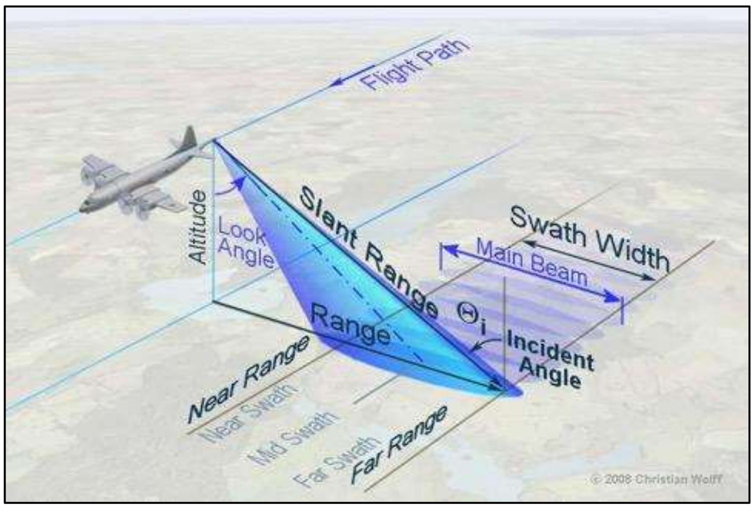


Figure 1: Demonstration of the uninhabited aerial vehicle flight path and how the swath path is determined. (Figure adapted from (Christian Wolff, 2008))

The wide swath of the UAVSAR instrument results in a large incidence angle variation across the swath. Near range incidence angles are approximately 25° whereas far range incidence angles are approximately 65° resulting in a 40° incidence angle variation across the swath.

Since repeat pass radar interferometric measurements only capture the component of surface motion along the line-of-sight vector, it is important to account for imaging geometry variations. Thus, a constant vertical displacement will exhibit a line-of-sight displacement that varies as the cosine of the look angle (angle between aircraft nadir vector and line of sight) and a constant cross-track displacement will exhibit a line-of-sight displacement that varies as the sine of the look angle.

Different fault geometries and types of slip produce different surface motions and project differently onto a line-of-sight change between points on the ground and instrument.

Interpreting line-of-sight changes for fault motions requires assumptions for the style of faulting. Slip of a certain orientation, corresponding to fault slip, can be projected onto line-of-sight between the ground and instrument using the following parameters (Donnellan et al., 2014).

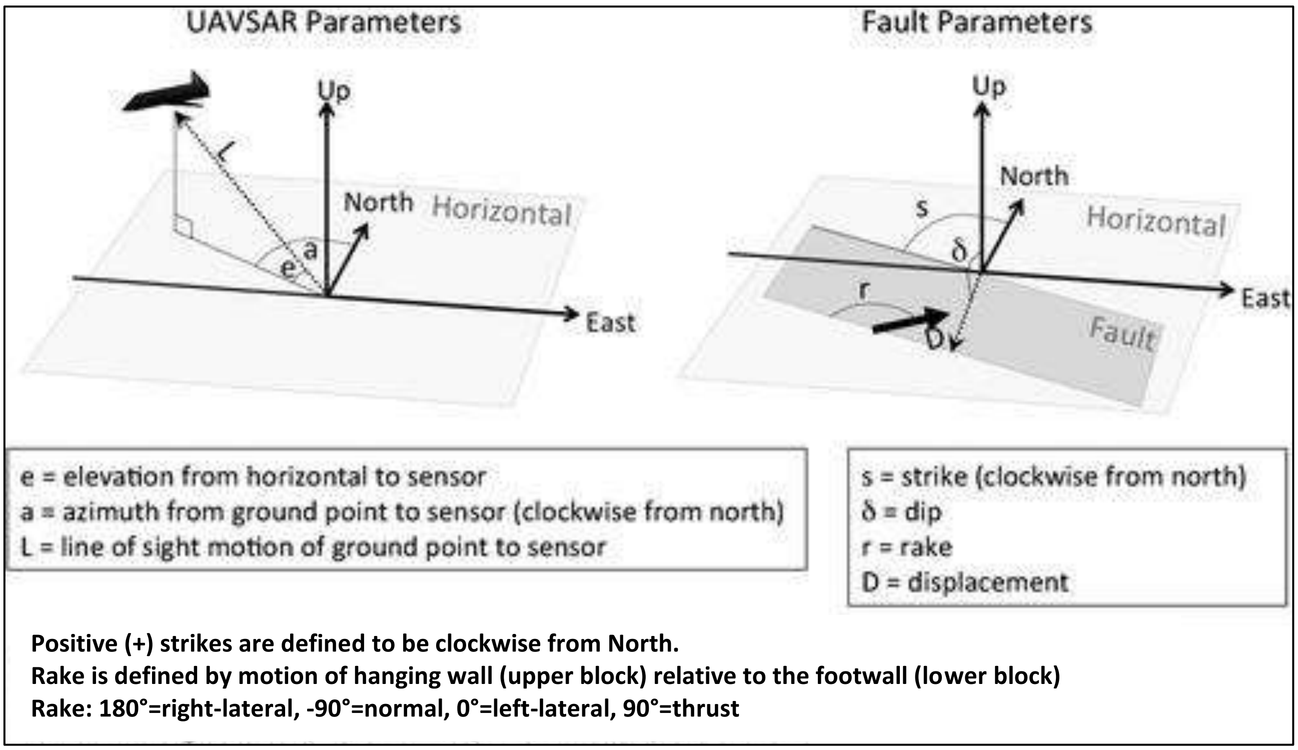


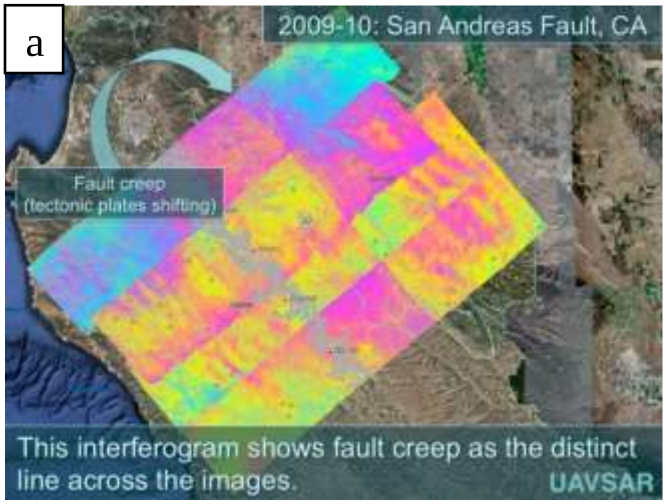
Figure 2: UAVSAR Parameters and Fault Parameters. (Figure adapted from (Donnellan et al., 2014))

To the right, we see two different radar images creating the interferogram (shows the change or difference from each radar image).

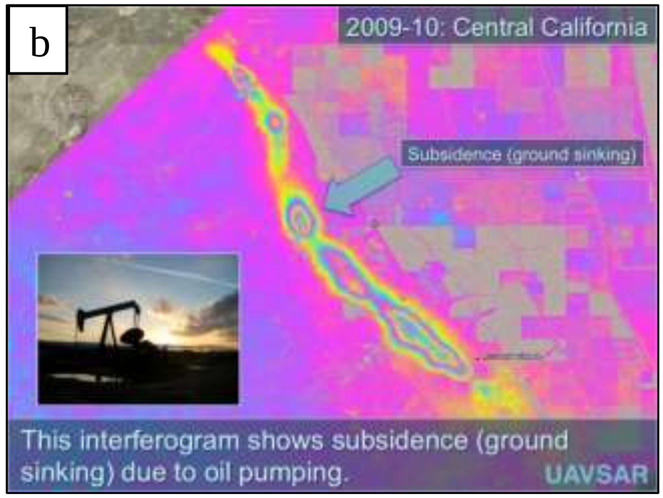
Figure 3: Demonstration the difference between two swaths in the same location on two different dates, which results in an interferogram. (Figure adapted from (Jet Propulsion Laboratory, 2014))

Example UAVSAR uses:

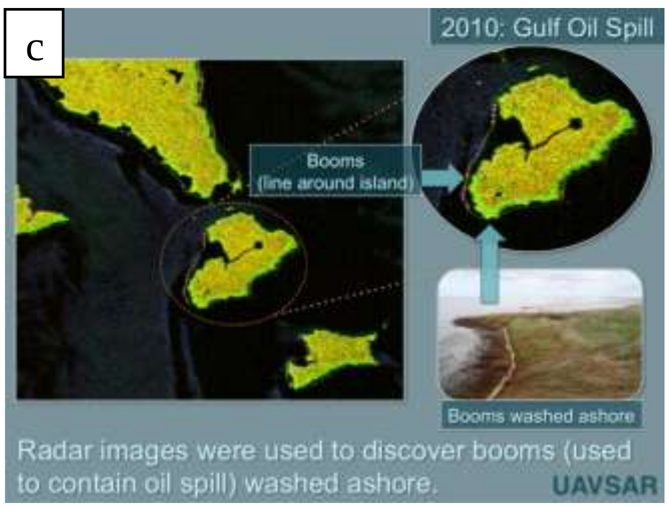
a



b



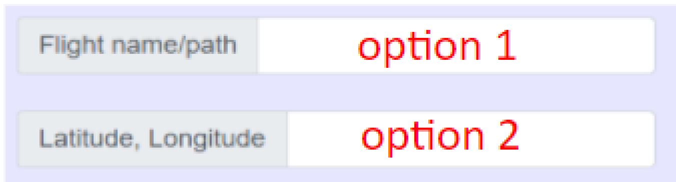
c



d

To upload UAVSAR interferograms, follow either method (1) or (2)

1. The “flight name/path” directly finds the flight name and path wanted
2. The “latitude, longitude” option returns all flight swaths crossing paths with those coordinates.



*Note options to draw an area or drop a pin can assist users to finding an interferogram

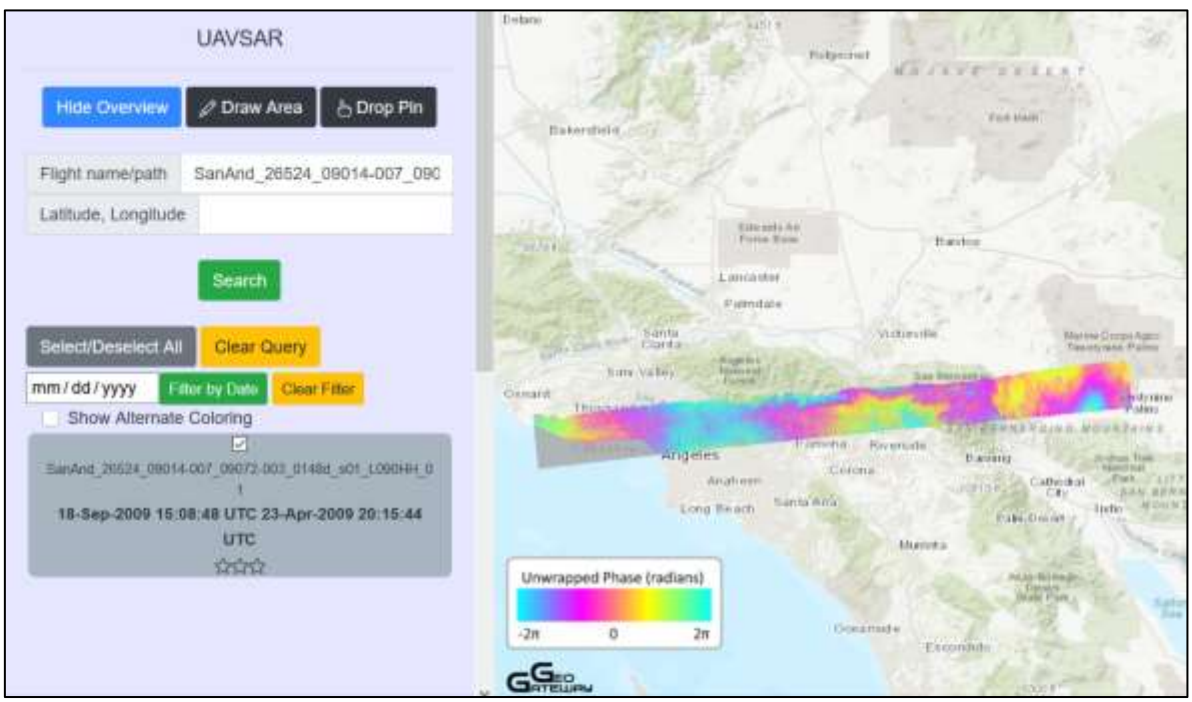


Figure 4: Demonstrates option 1 (inputting flight name/path)

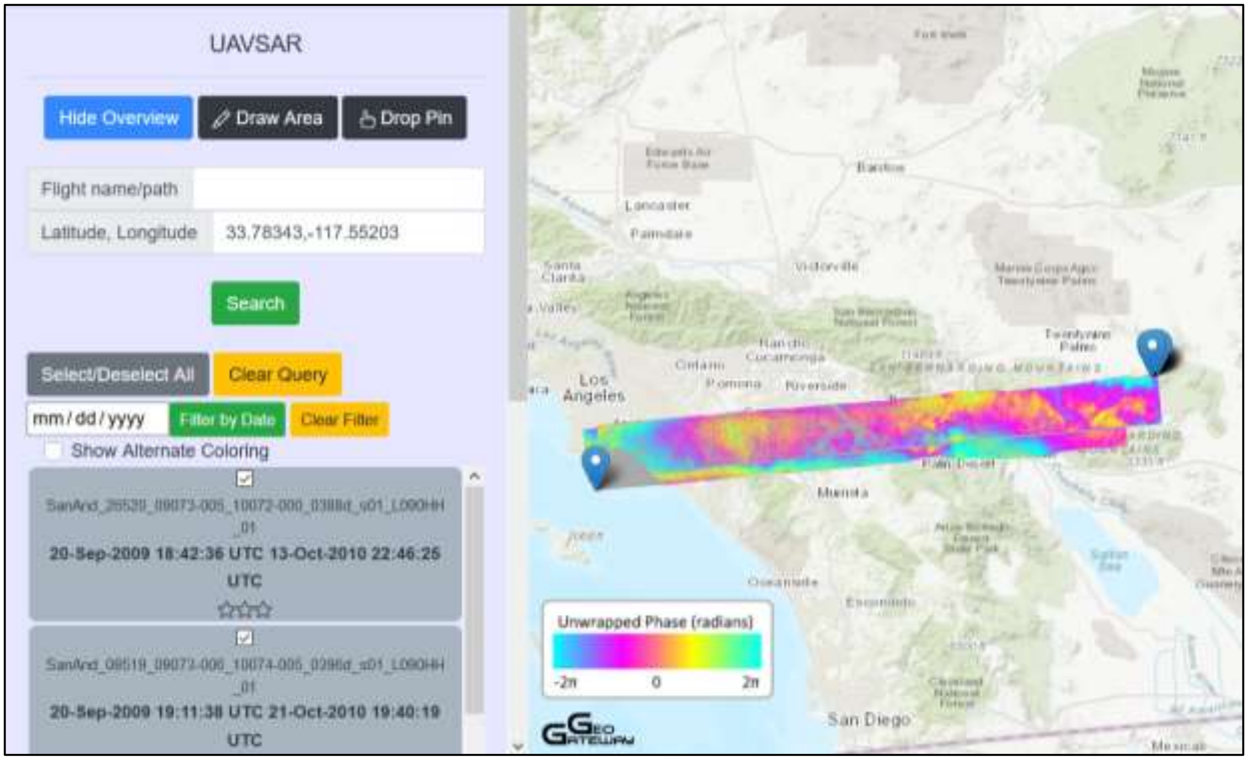


Figure 5: Demonstrates option 2 (inputting a latitude and longitude)

As shown in *figure 5* the option is given to filter by date by inputting (mm/dd/yyy), narrowing the selection.

To further look into the surface fracturing, click on "Show Alternate Coloring" below the "Filter by Date" option. Notice the units of displacement change to "cm."
*Note to set the swath opacity, move the blue dot to the left (less visibility) or right (more visibility).

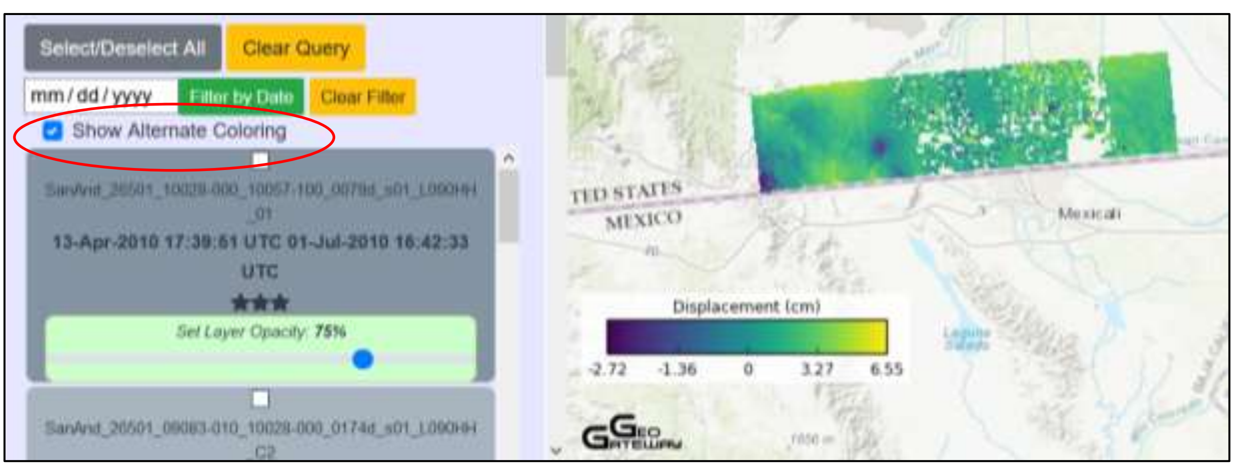


Figure 6: Demonstrates the change from the original unwrapped phase from figure 5, to displacement.

To look closer into the UAVSAR swaths,

1. Search for a flight path.
2. Select the flight path by clicking on it (flight path selection should be a darker color from the unselected paths).
3. Click on the UAVSAR flight path that is shown on the map, allowing the Line-of-Sight (LOS) tool to appear.

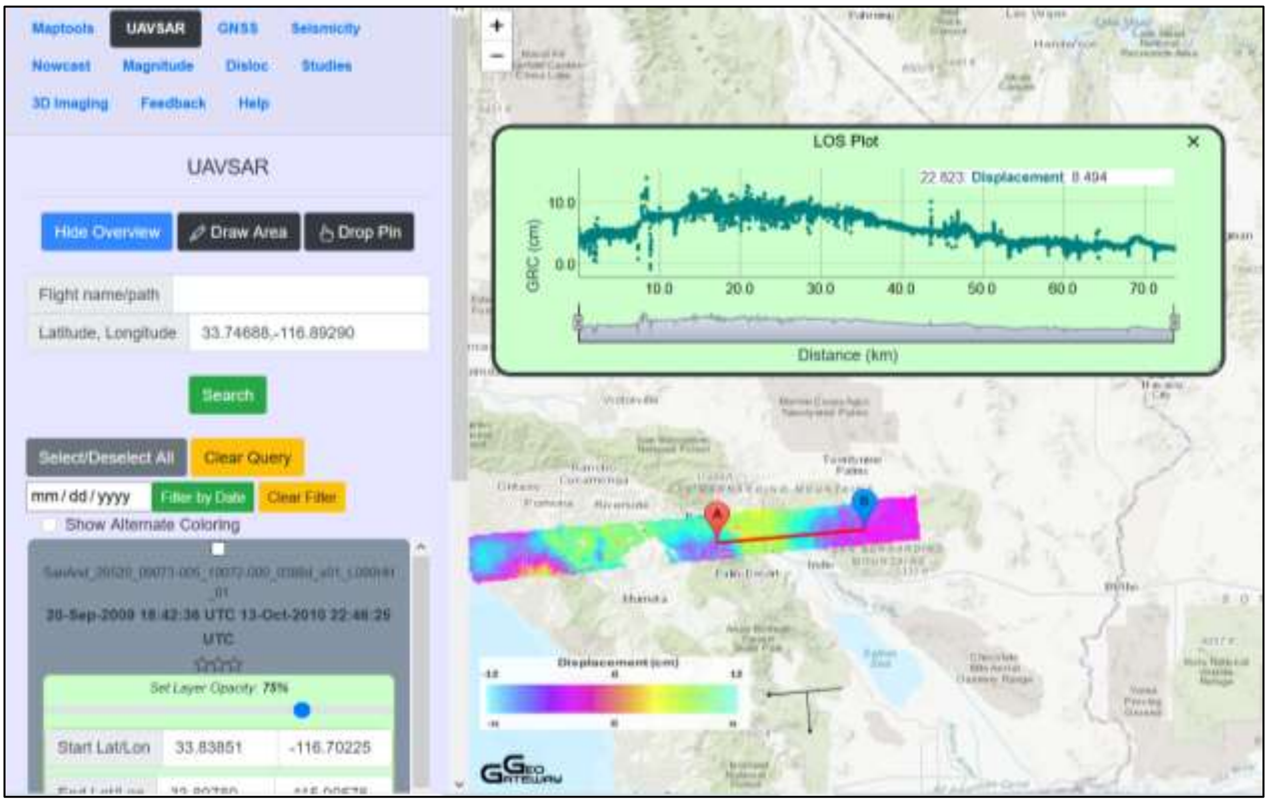


Figure 7: Line-of-Sight tool

Place the two markers on any location along the UAVSAR swath, to look at different ground range change.

The LOS tool allows users to study ground range change (cm), along a distance (km).

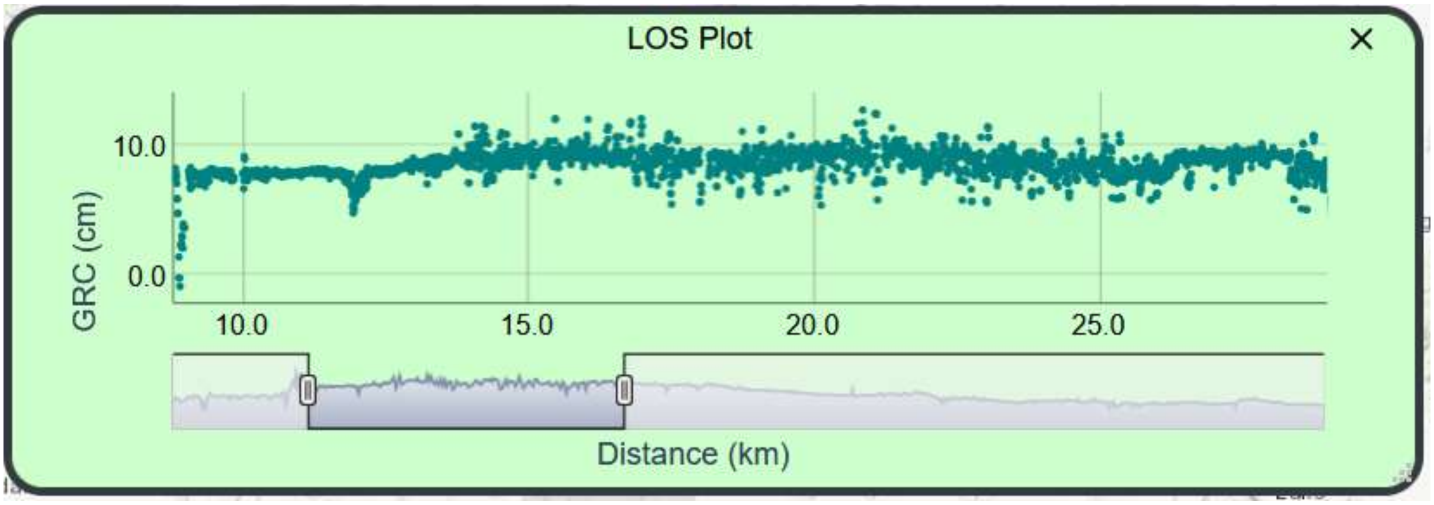


Figure 8: Line-of-Sight tool set to specific distance

Users are able to choose a distance of focus by moving  as shown in *figure 8*.