

Exercise 2: Interferogram of Napa Earthquake

Sarproz processing tutorial series

By Yuxiao QIN

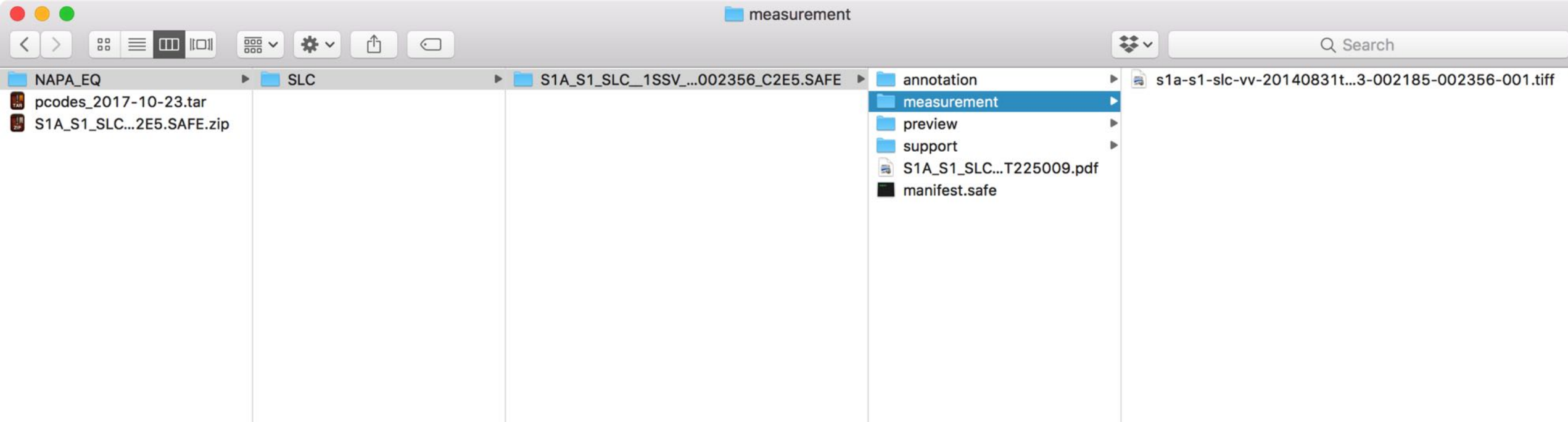
Downloading Sample Data

- Sample Data, Texas Houston, 2017 August Flood:
 - ~~ftp://johndoe:psinsar12138@128.46.174.159/data/TX_FLOOD/~~ SEE BELOW
 - To download, manually copy & paste this URL into Google Chrome's address bar.
 - In addition, you can use a ftp app, such as FileZilla. Manually enter the address, username and password.
 - Two data taken separately on 2017-Aug-05 and 2017-Aug-29 are included in the sample data.
 - Reference: https://www.wikiwand.com/en/Hurricane_Harvey
- Sample Data, Napa, California, 2014 August Earthquake:
 - ~~ftp://johndoe:psinsar12138@128.46.174.159/data/NAPA_EQ~~ SEE BELOW
 - Two data taken separately on 2014-Aug-07 and 2014-Aug-31 are included in the sample data.
 - Reference: http://www.wikiwand.com/en/2014_South_Napa_earthquake

!! the links above are no longer working
please find the data hereafter:

TEXAS FLOOD: <https://my.pcloud.com/publink/show?code=XZtlbE7ZvXKViLSdGrY6RIgY55UQ9uNXFRpk>

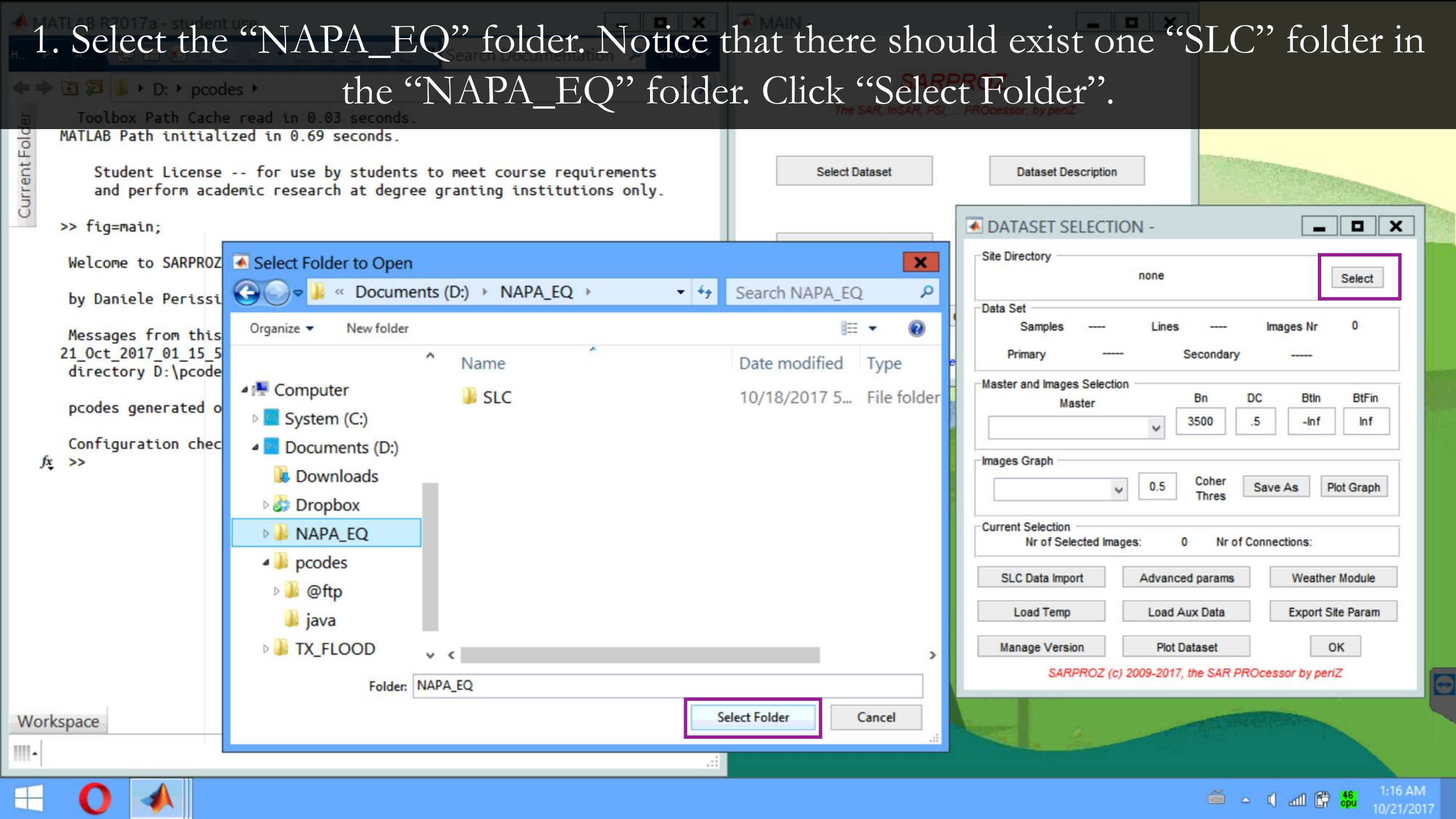
NAPA EARTHQUAKE: <https://my.pcloud.com/publink/show?code=XZ1DnU7ZtMAo6EHeMopShqpY5keOnS2z1lkk>

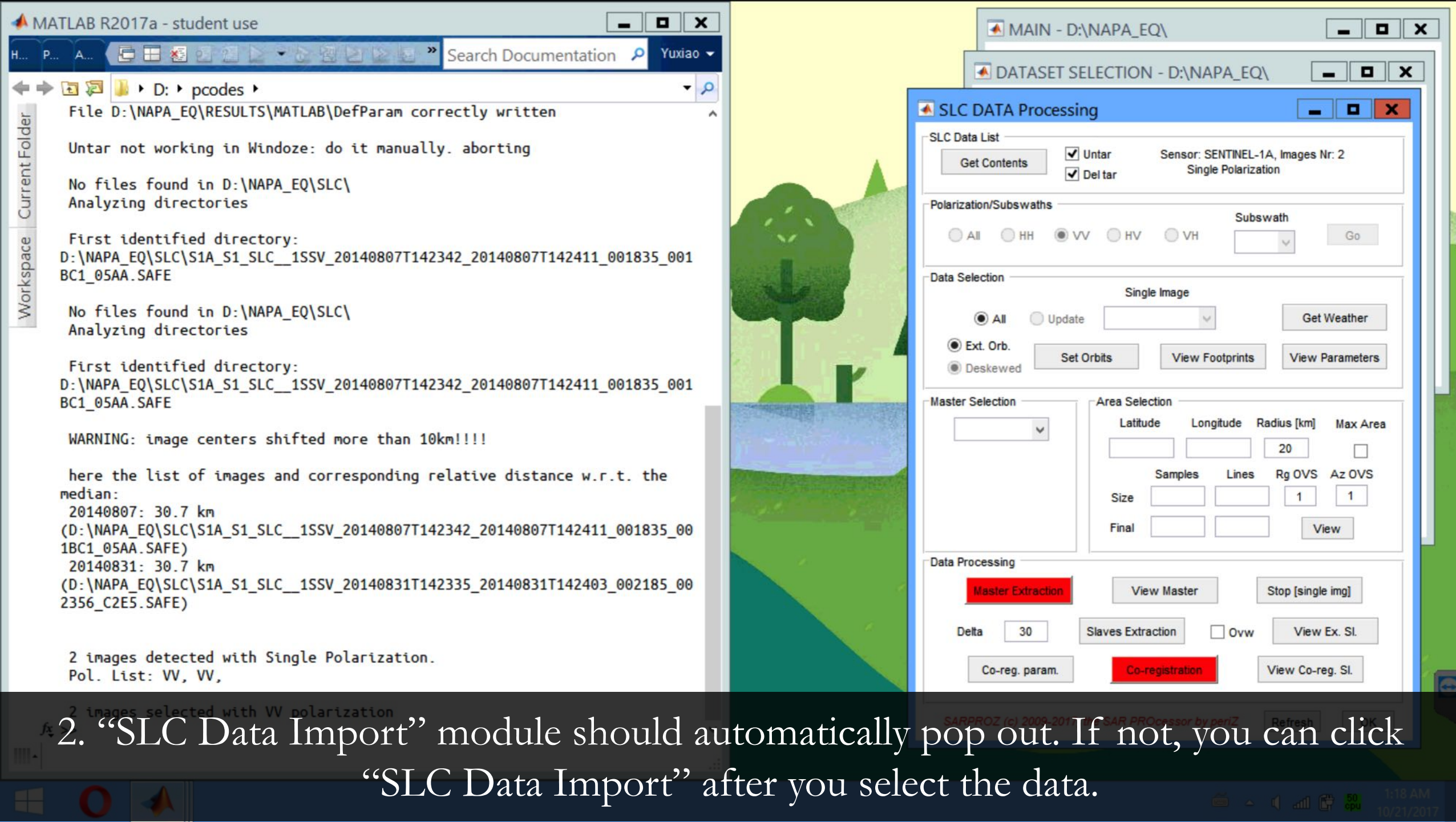


1. When you downloaded the sample data, you need to manually extract the compressed file. Please make sure after you extracted the compressed file, you have the EXTRACT folder structure AS SHOWN ON THIS PAGE. Delete the compressed file afterwards to save space.
2. PLEASE LEAVE AT LEAST 2.7GB AVAILABLE FOR THIS LAB. (Later you will be instructed to delete unnecessary files during the process, but at one point you must have 2.7GB on disk to process all data!)

Part 1: Import
Synthetic **A**perture **R**adar (SAR)
Single-**L**ook **C**omplex (SLC) data

1. Select the “NAPA_EQ” folder. Notice that there should exist one “SLC” folder in the “NAPA_EQ” folder. Click “Select Folder”.





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D:\pcodes

File D:\NAPA_EQ\RESULTS\MATLAB\DefParam correctly written

Untar not working in Windoze: do it manually. aborting

No files found in D:\NAPA_EQ\SLC\
Analyzing directories

First identified directory:
D:\NAPA_EQ\SLC\S1A_S1_SLC__1SSV_20140807T142342_20140807T142411_001835_001
BC1_05AA.SAFE

No files found in D:\NAPA_EQ\SLC\
Analyzing directories

First identified directory:
D:\NAPA_EQ\SLC\S1A_S1_SLC__1SSV_20140807T142342_20140807T142411_001835_001
BC1_05AA.SAFE

WARNING: image centers shifted more than 10km!!!!

here the list of images and corresponding relative distance w.r.t. the median:

20140807: 30.7 km
(D:\NAPA_EQ\SLC\S1A_S1_SLC__1SSV_20140807T142342_20140807T142411_001835_001
BC1_05AA.SAFE)
20140831: 30.7 km
(D:\NAPA_EQ\SLC\S1A_S1_SLC__1SSV_20140831T142335_20140831T142403_002185_00
2356_C2E5.SAFE)

2 images detected with Single Polarization.
Pol. List: VV, VV,

2 images selected with VV polarization

MAIN - D:\NAPA_EQ\

DATASET SELECTION - D:\NAPA_EQ\

SLC DATA Processing

SLC Data List

Get Contents ☒ Untar Sensor: SENTINEL-1A, Images Nr: 2
☒ Del tar Single Polarization

Polarization/Subswaths

All HH VV HV VH Subswath Go

Data Selection

Single Image

All Update Ext. Orb. Deskwewed Set Orbits View Footprints View Parameters Get Weather

Master Selection

Area Selection

Latitude Longitude Radius [km] Max Area

Size Samples Lines Rg OVS Az OVS

Final View

Data Processing

Master Extraction View Master Stop [single img]

Delta 30 Slaves Extraction Ovw View Ex. Sl.

Co-reg. param. Co-registration View Co-reg. Sl.

SARPROZ (c) 2009-2017, the SAR PROcessor by periz Refresh OK

3. Click "Get Contents" to read in data parameters.

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File D:\NAPA_EQ\RESULTS\MATLAB\DefParam correctly written

Untar not working in Windoze: do it manually. aborting

No files found in D:\NAPA_EQ\SLC\
Analyzing directories

First identified directory:
D:\NAPA_EQ\SLC\S1A_S1_SLC__1SSV_20140807T142342_20140807T142411_001835_001BC1_05AA.SAFE

No files found in D:\NAPA_EQ\SLC\
Analyzing directories

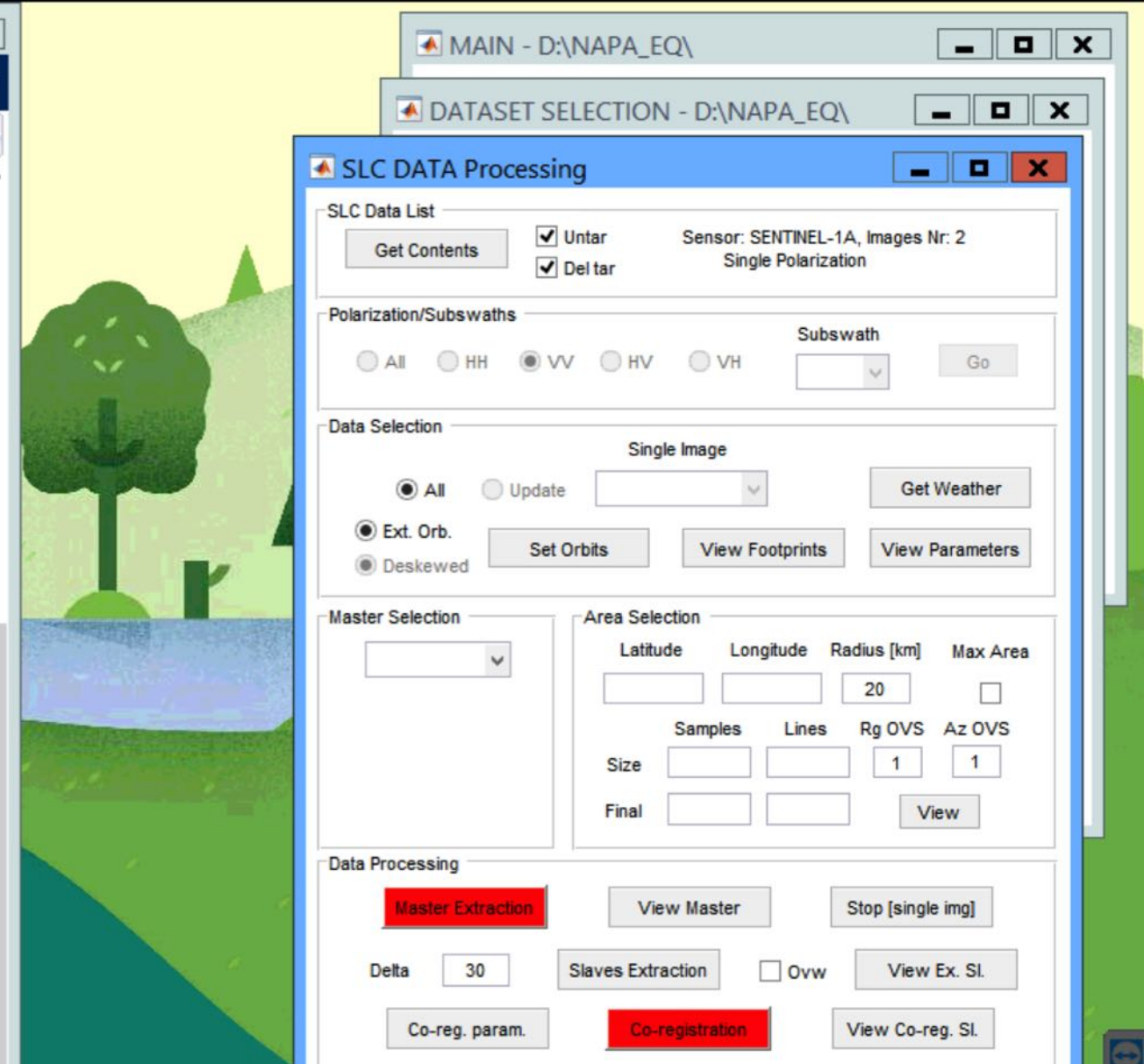
First identified directory:
D:\NAPA_EQ\SLC\S1A_S1_SLC__1SSV_20140807T142342_20140807T142411_001835_001BC1_05AA.SAFE

WARNING: image centers shifted more than 10km!!!!

here the list of images and corresponding relative distance w.r.t. the median:

20140807: 30.7 km
(D:\NAPA_EQ\SLC\S1A_S1_SLC__1SSV_20140807T142342_20140807T142411_001835_001BC1_05AA.SAFE)
20140831: 30.7 km
(D:\NAPA_EQ\SLC\S1A_S1_SLC__1SSV_20140831T142335_20140831T142403_002185_002356_C2E5.SAFE)

2 images detected with Single Polarization.
Pol. List: VV, VV,



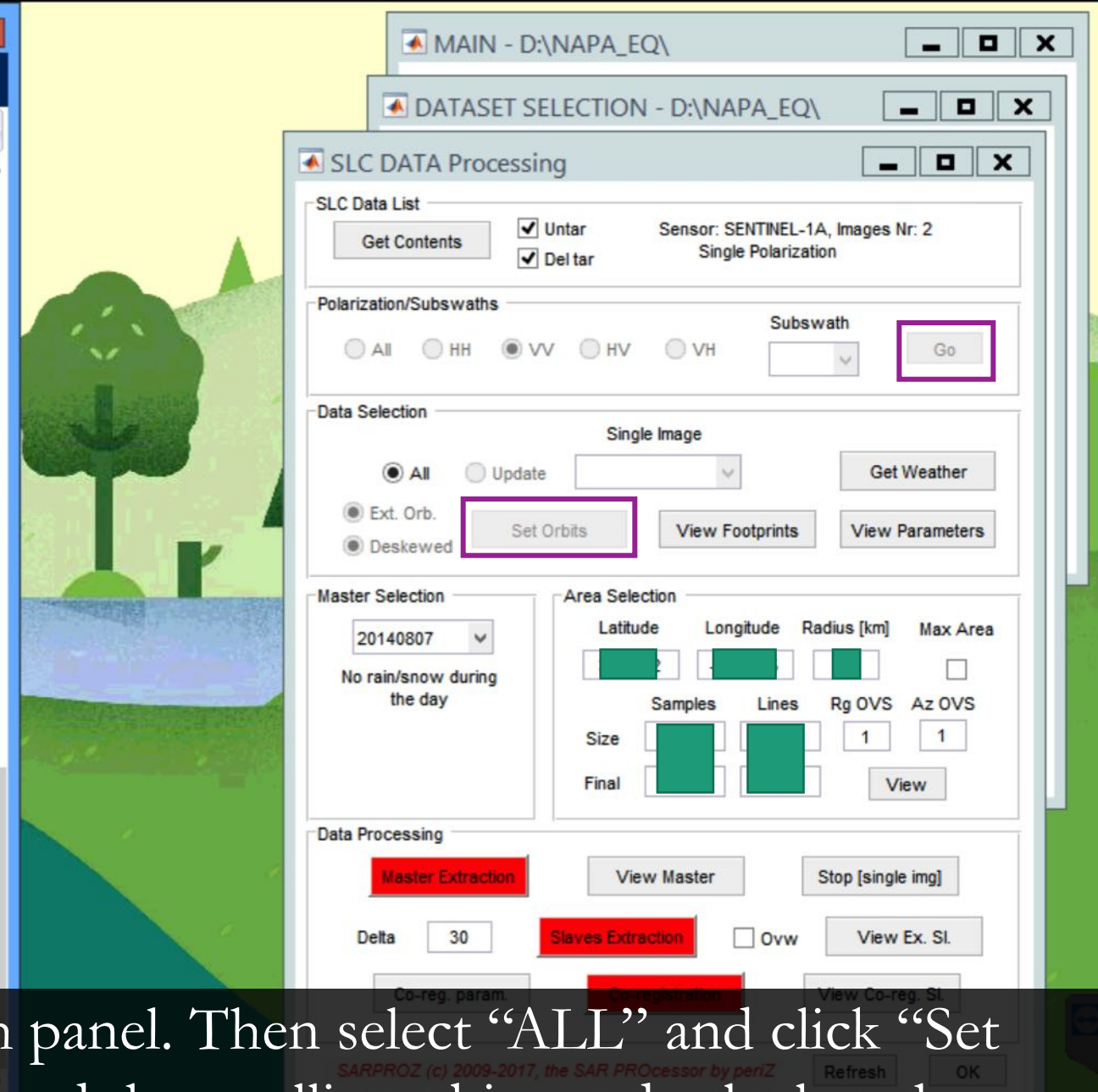
Again, remember to ALWAYS look at the log in the command window of Matlab. The log contains useful information and hints regarding the process.

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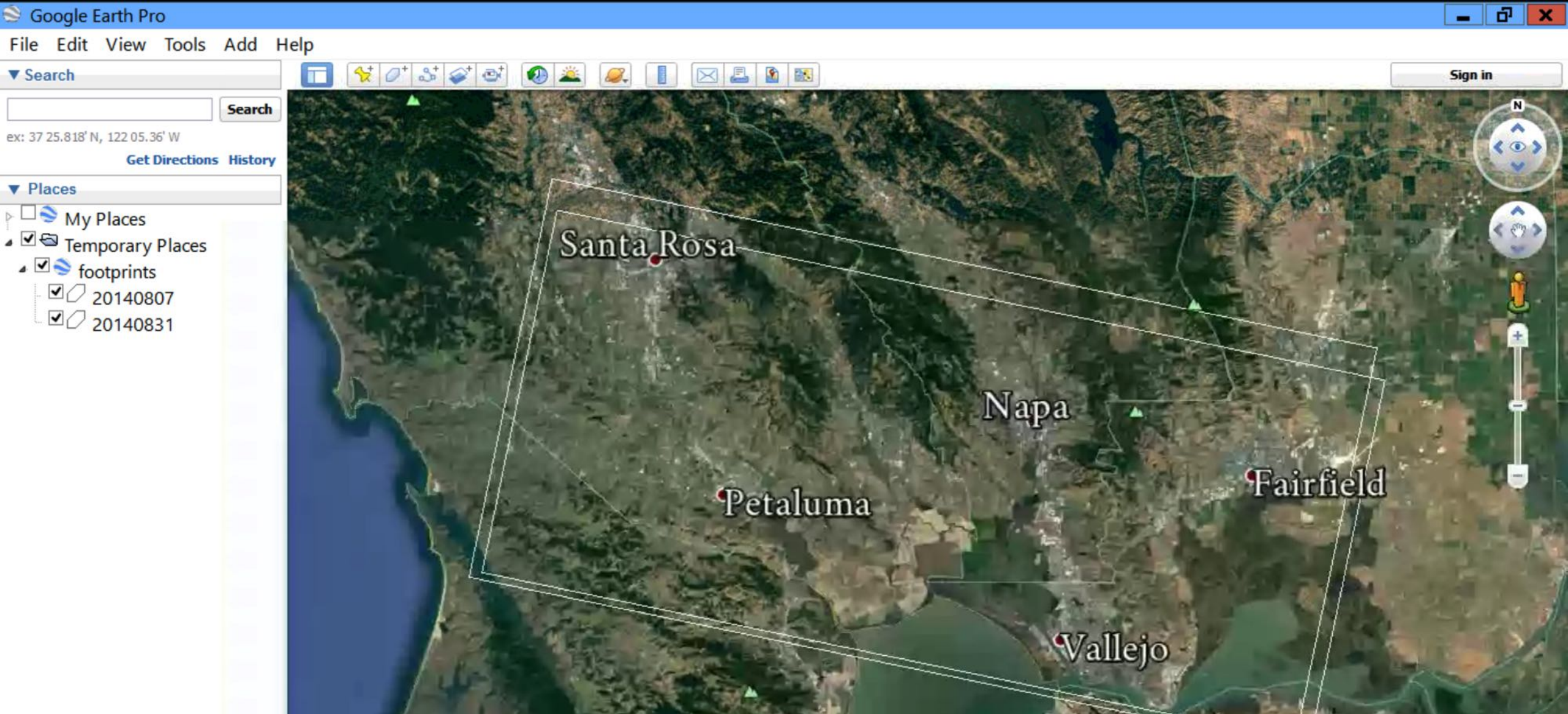
H... P... A... Search Documentation Yuxiao

D: \ pcodes \

```
writing the directory tree in D:\NAPA_EQ\  
  
Reading External Orbits  
  
Cannot Connect to FTP site for S1 External Orbits.  
Is your firewall blocking ftp protocol?  
  
Successully Downloaded S1A Orbit File for 2014/08/07  
  
Precise Orbit is used for S1A and 2014/08/07  
  
Cannot Connect to FTP site for S1 External Orbits.  
Is your firewall blocking ftp protocol?  
  
Successully Downloaded S1A Orbit File for 2014/08/31  
  
Precise Orbit is used for S1A and 2014/08/31  
  
Automatic Master: 20140807  
Polarization Mode: SINGLE, Channels: VV  
  
file D:\NAPA_EQ\...\SRTM\N37W123.hgt is missing. Trying to download it  
file D:\NAPA_EQ\...\SRTM\N37W123.hgt correctly downloaded  
file D:\NAPA_EQ\...\SRTM\N38W123.hgt is missing. Trying to download it  
file D:\NAPA_EQ\...\SRTM\N38W123.hgt correctly downloaded  
  
Chosen Master: 20140807  
Polarization: SINGLE, VV  
1 Slave images have not been extracted!!
```



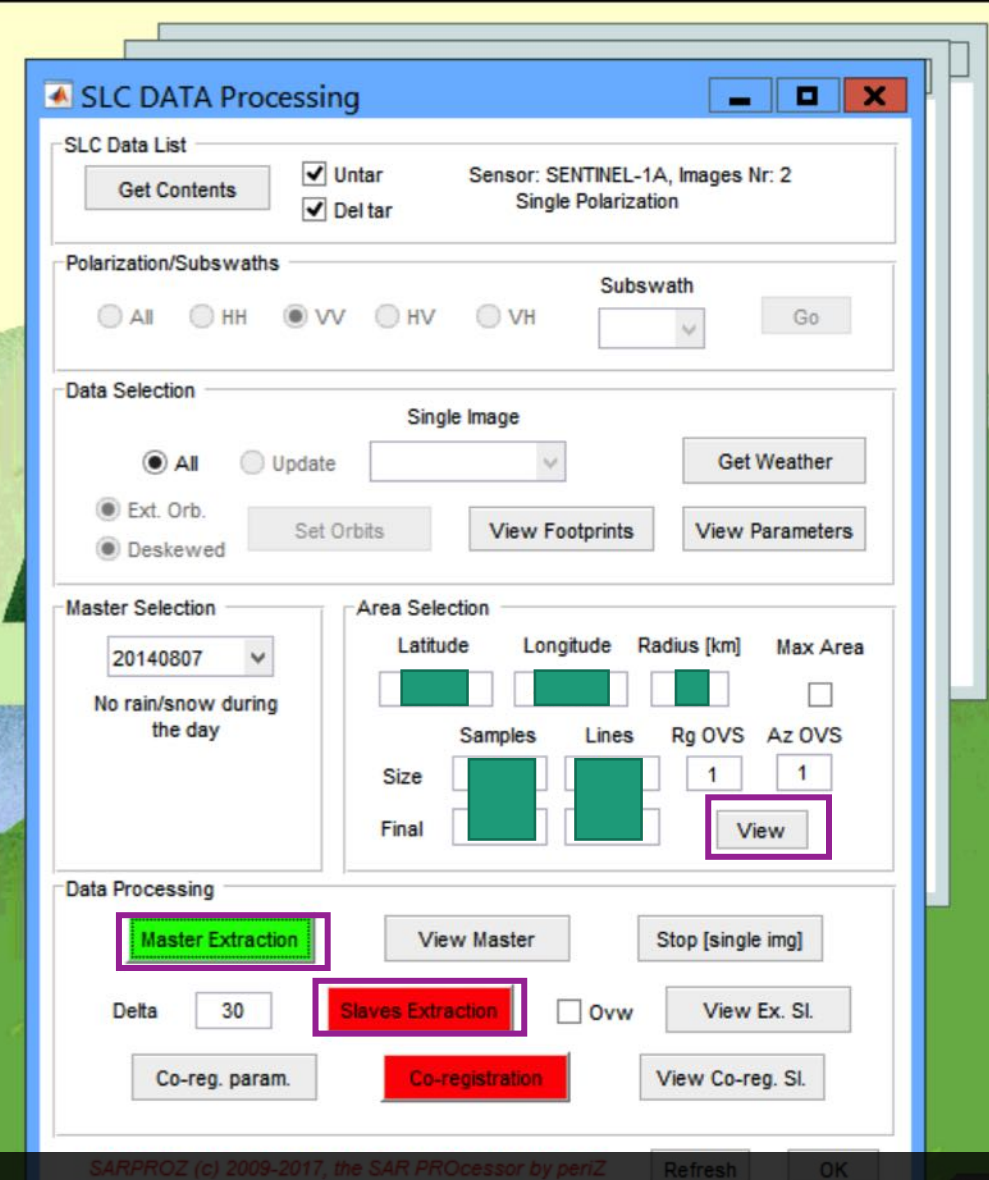
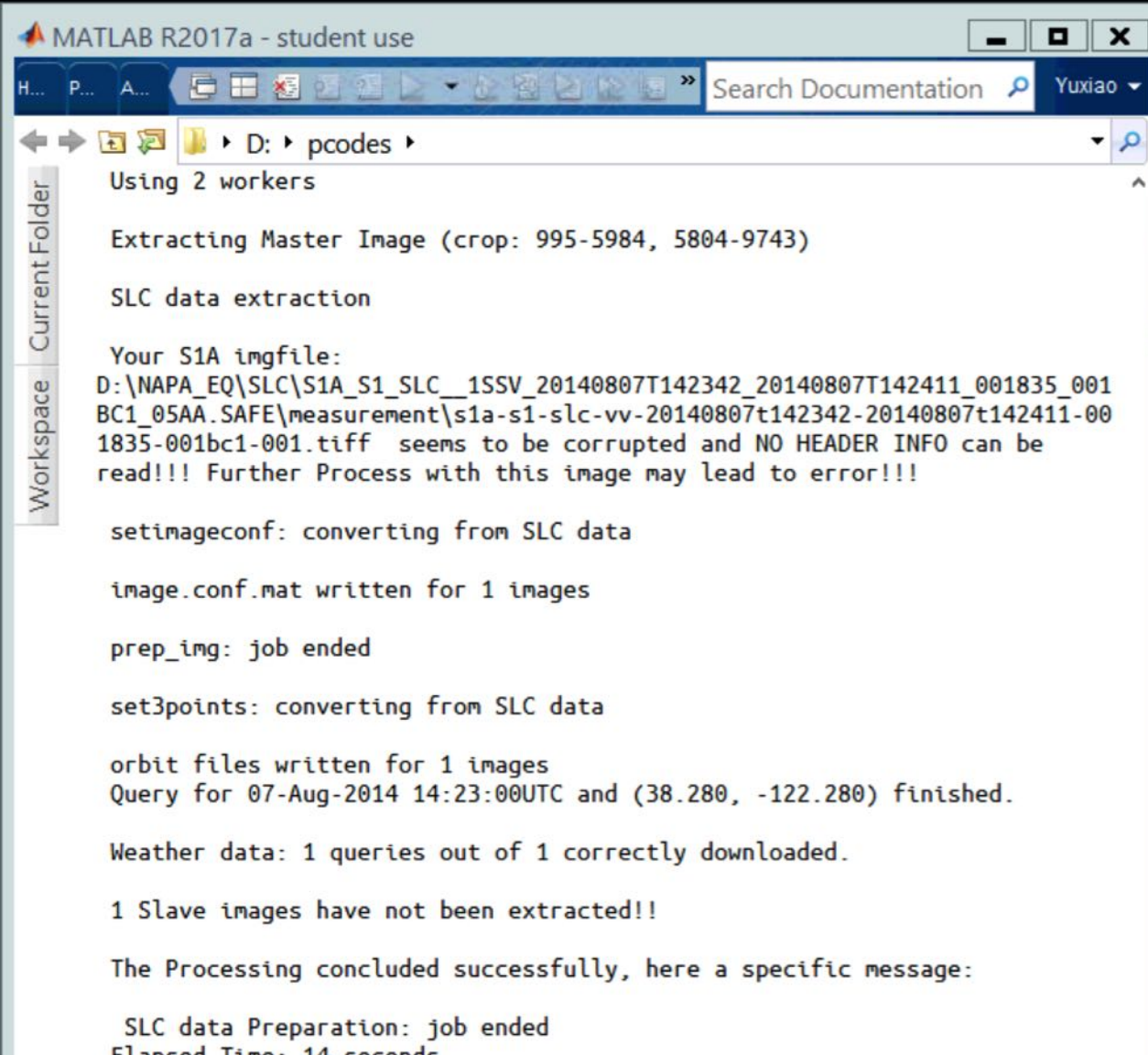
4. Click “Go” in Polarization/Subswath panel. Then select “ALL” and click “Set Orbits”. This will automatically download the satellite orbits, and calculate the footprint of SAR images.



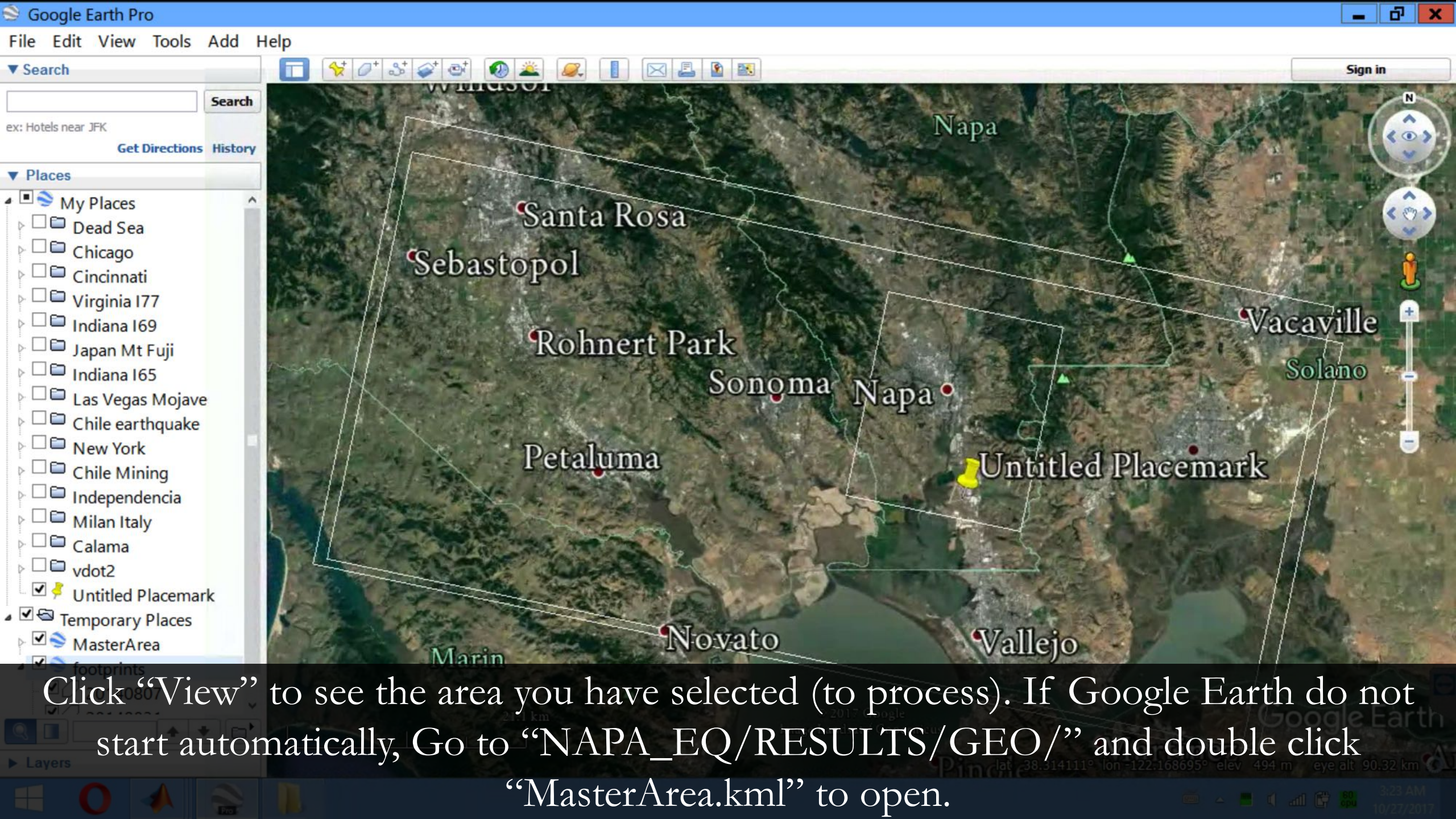
Click “View Footprints” to see the footprints of your image(s) on Google Earth. If Google Earth do not start automatically, Go to “NAPA_EQ/RESULTS/GEO/” and double click “footprints.kml” to open.

Select your own Area of Interest (AOI)

1. In this tutorial, you are asked to select your own AOI by putting down your own AOI center latitude, longitude and area radius.
2. You are asked to select an area close to the earthquake center, which is located at NAPA.
3. Select a center coordinates:
 - Limit your latitude between 38.2° and 38.3° ;
 - Limit your longitude between -122.4° and -122.2° ([a negative sign just means the west hemisphere](#));
 - Limit your range between 8km and 14km (a sufficient area is required to analysis the flood. On the other side, due to disk space restriction, you need to limit the size of extracted area).
 - Your AOI should centered around NAPA with the above restriction.



- In “Area Selection”, input your value for latitude, longitude and radius based on the info from previous page. You can click “View” to see your selected AOI.
The larger your processing area, the longer it takes to process.



Click “View” to see the area you have selected (to process). If Google Earth do not start automatically, Go to “NAPA_EQ/RESULTS/GEO/” and double click “MasterArea.kml” to open.

Figure 2

File Edit View Insert Tools Desktop Window Help

Image 20140831_VV

Sample [pix]

Line [pix]

Figure 1

File Edit View Insert Tools Desktop Window Help

Image 20140807

Sample [pix]

Line [pix]

Sensor: SENTINEL-1A, Images Nr: 2
Single Polarization

Subswath
HV VH

Single Image

Get Weather

View Footprints

View Parameters

Area Selection

Latitude Longitude Radius [km] Max Area

Samples Lines Rg OVS Az OVS

Size Final

View

View Master

Stop [single img]

Delta 30

Slaves Extraction

Co-reg. param.

Co-registration

View Ex. Sl.

View Co-reg. Sl.

Refresh

OK

SARPROZ (c) 2009-2017, the SAR PROcessor by periz

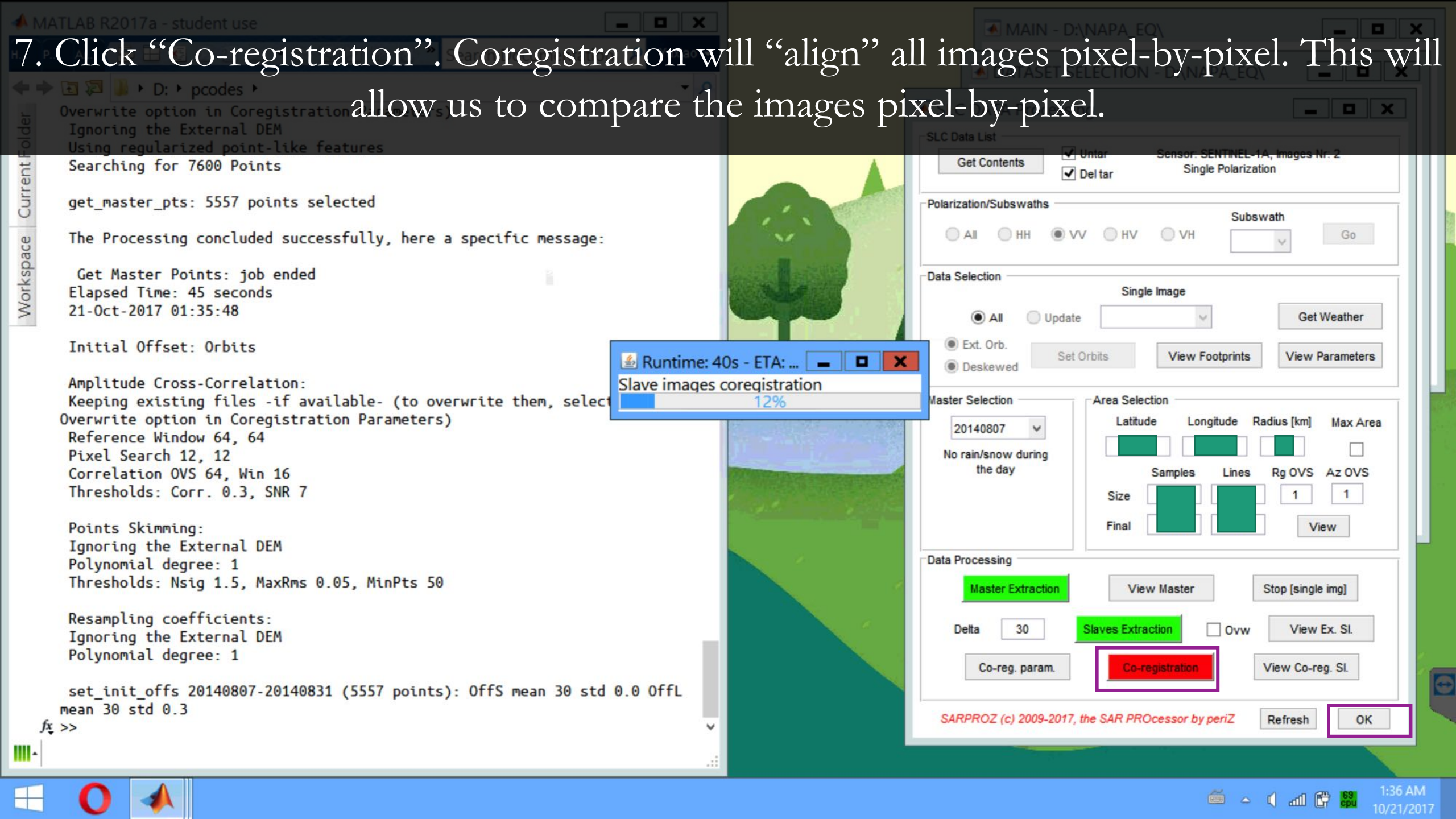
356_C2E5.SAFE\measurement\s1a-s1-slc-vv-20140831t142335-20140831t142403-002185-002356-001.tiff seems to be corrupted and NO HEADER INFO can be read!!! Further Process with this image may lead to error!!!

The Processing concluded successfully, here a specific message:

SIC data Preparation: job ended
27-Oct-2017 13:24:43

6. In sequence, click “Master Extraction” and “Slave Extraction”. You can also click “View Master/Slave” to view the SAR image. When the process is finished, the button will turn to green from red.

3:25 AM
10/27/2017



7. Click “Co-registration”. Coregistration will “align” all images pixel-by-pixel. This will allow us to compare the images pixel-by-pixel.

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D:\pcodes\

orbit files written for 1 images

To download Weather data, you need to fill in an API code in the Advanced Parameters.
Check the manual: http://sarproz.com/manual/adv_param.html

No Temperature data found: generating a synthetic sinusoid

synthetic temperatures written

get_timezone: negative result status!!

The coregistration was concluded succesfully

The Processing concluded successfully, here a specific message:

SLC data Preparation: job ended
Elapsed Time: 333 seconds
21-Oct-2017 01:40:36

File D:\NAPA_EQ\InputParFile.txt correctly updated

File D:\NAPA_EQ\RESULTS\MATLAB\DefParam correctly written

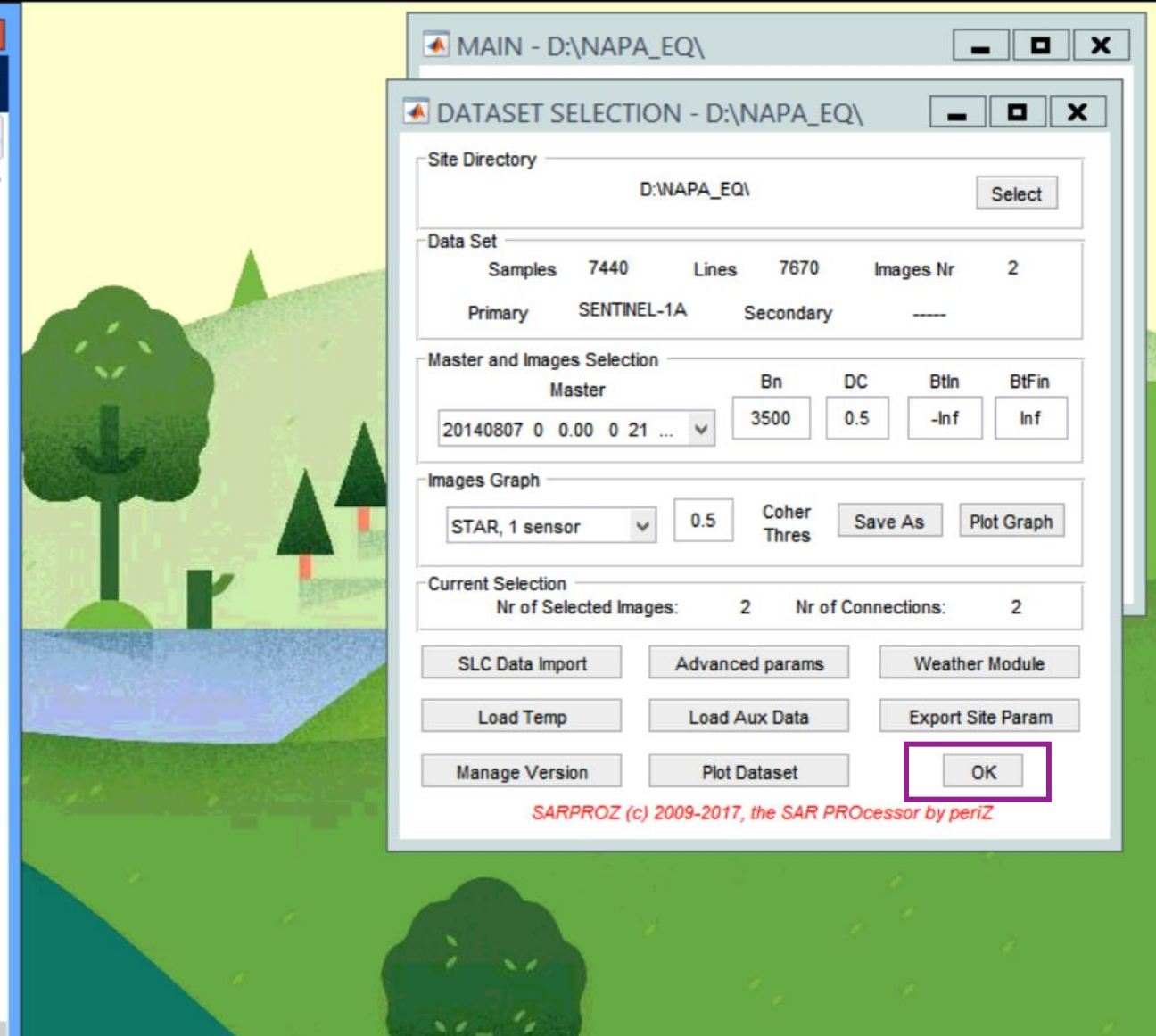
file D:\NAPA_EQ\RESULTS\MATLAB\MatrIncImgAll is missing. You can generate it via "Full Graph Coherence Estimation"

one-sensor STAR graph

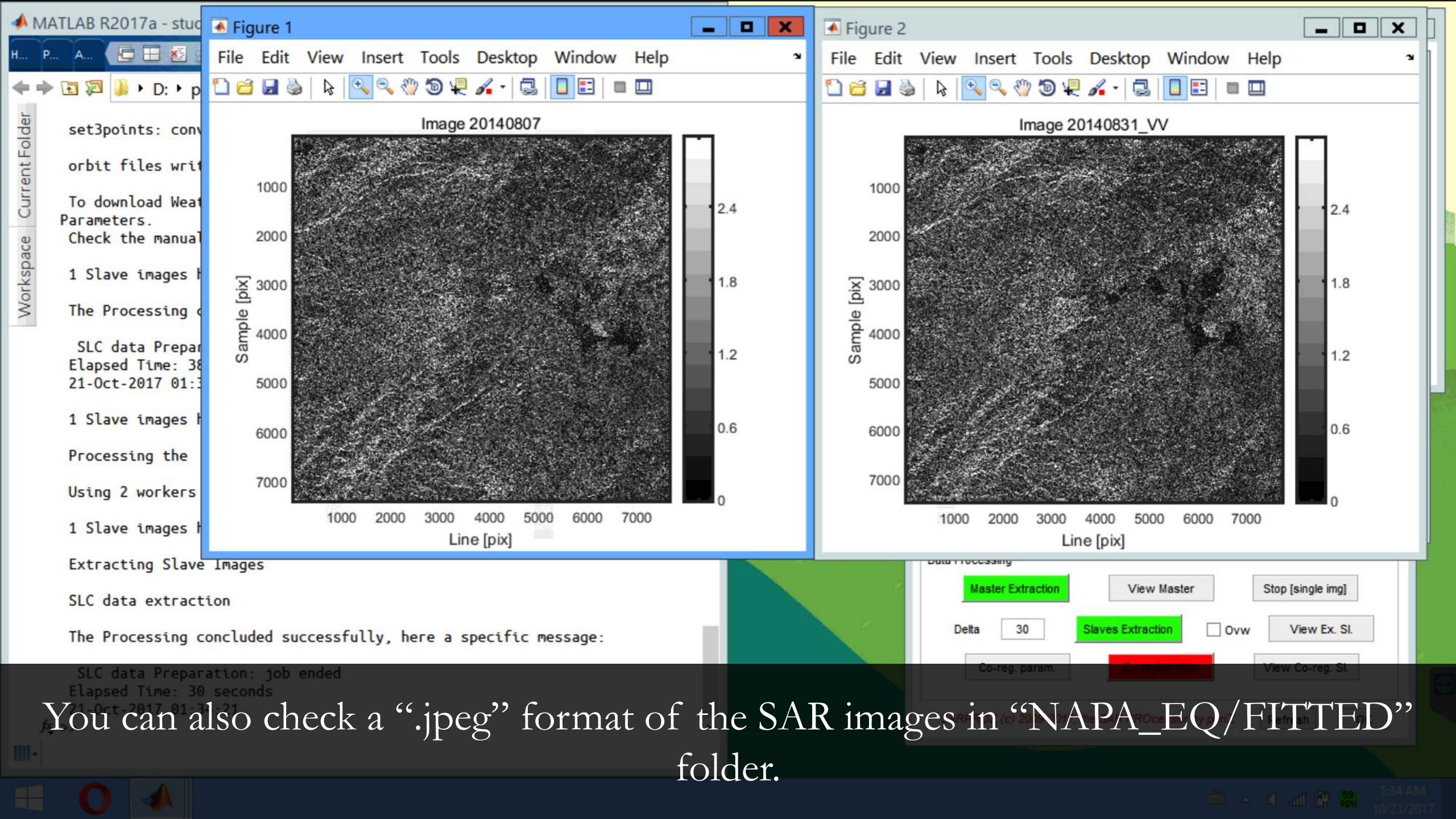
writing sparse file D:\NAPA_EQ\RESULTS\ModFit.mat

writing sparse file D:\NAPA_EQ\RESULTS\PSType.mat

writing sparse file D:\NAPA_EQ\RESULTS\EDen.mat



You will see the success message in command window when co-registration is completed. You can click "OK" to close "SLC Data Import" window. You can click "OK" to close "Dataset Selection" Window.



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D:\pcodes

```
Ignoring the External DEM
Polynomial degree: 1
Thresholds: Nsig 1.5, MaxRms 0.05, MinPts 50

Resampling coefficients:
Ignoring the External DEM
Polynomial degree: 1

set_init_offs 20140807-20140831 (2917 points): OffS mean 30 std 0.0 OffL
mean 30 std 0.0

amp_corr2: 20140807-20140831, 2771 input points, 2762 outputed, 1918 over
thresholds

cull_points 20140807-20140831: 1918 input, 1856 output

setimageconf: converting from SLC data

image.conf.mat written for 1 images

set3points: converting from SLC data

orbit files written for 1 images
Query for 31-Aug-2014 14:23:00UTC and (38.280, -122.280) finished.

Weather data: 1 queries out of 1 correctly downloaded.

The coregistration was concluded succesfully |

The Processing concluded successfully, here a specific message:
```

SLC DATA Processing

SLC Data List

Get Contents ☒ Untar Sensor: SENTINEL-1A, Images Nr: 2
☒ Del tar Single Polarization

Polarization/Subswaths

☐ All ☐ HH ☒ VV ☐ HV ☐ VH Subswath Go

Data Selection

Single Image

☒ All ☐ Update Get Weather

☐ Ext. Orb. Set Orbits View Footprints View Parameters

☐ Deskewed

Master Selection

20140807

No rain/snow during the day

Area Selection

| Latitude | Longitude | Radius [km] | Max Area |
|----------------------|----------------------|----------------------|----------------------|
| <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

| Samples | Lines | Rg OVS | Az OVS |
|----------------------|----------------------|----------------------|----------------------|
| <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

Size Final View

Data Processing

Master Extraction View Master Stop [single img]

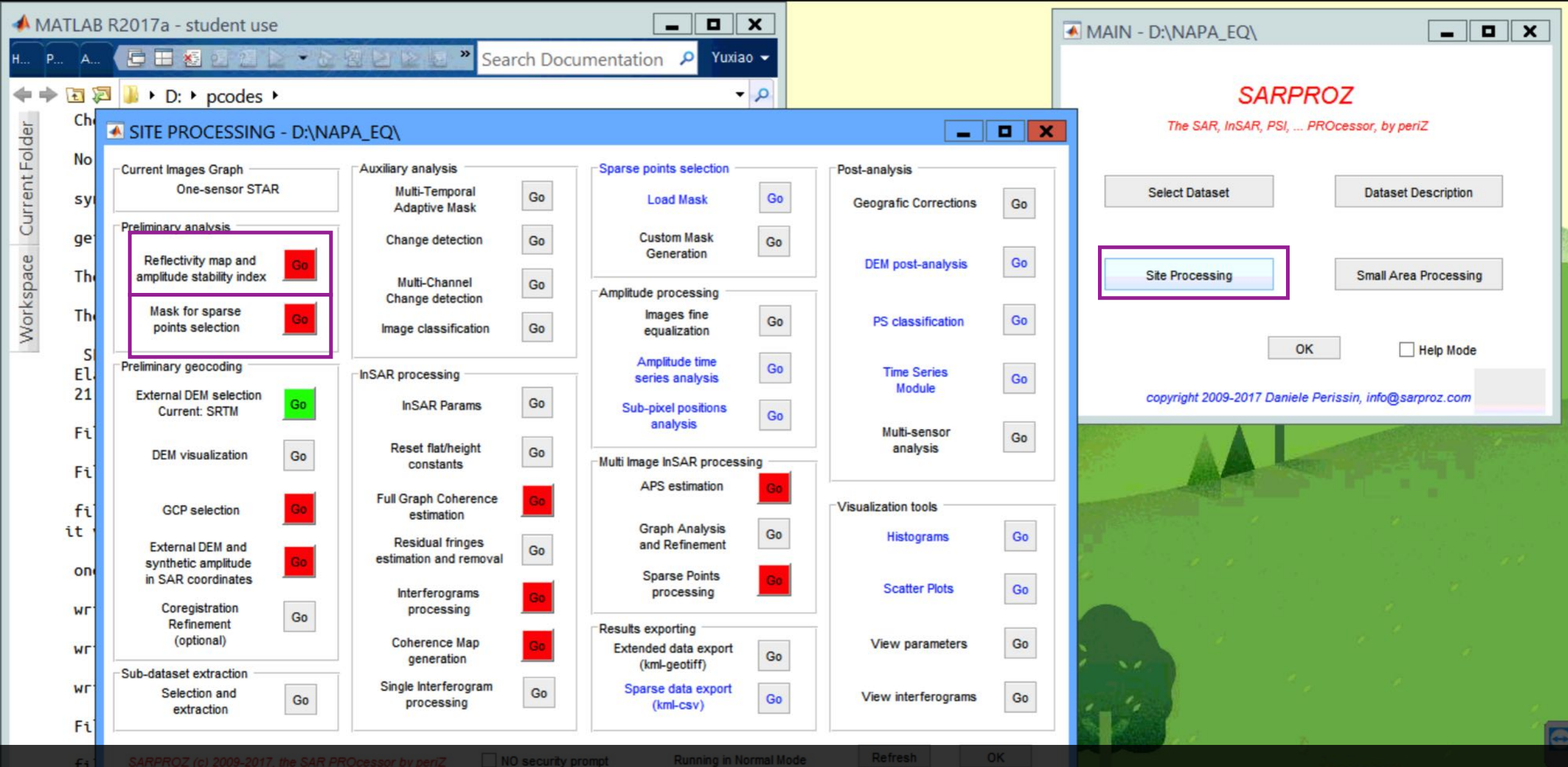
Delta 30 Slaves Extraction ☐ Ovw View Ex. Sl.

Co-reg. param. Co-registration View Co-reg. Sl.

Refresh OK

At this point, to save space, you can delete (or move to an external disk of yours) the whole “SLC” folder. This will save you ~1.7GB space. If later you need to reprocess everything, you can download the data from ftp again.

Part 2: Pre-process for generating interferogram



1. Click “Site Processing” in the main window. In the new site processing window, click “Reflectivity map and amplitude stability Index” to generate reflectivity map.

MATLAB R2017a - student use

Workspace Current Folder

D:\pcodes\

one-sensor STAR graph

writing sparse file D:\NAPA_EQ\RESULTS\ModFit.mat

writing sparse file D:\NAPA_EQ\RESULTS\PSType.mat

writing sparse file D:\NAPA_EQ\RESULTS\EDem.mat

File D:\NAPA_EQ\InputParFile.txt correctly updated

file D:\NAPA_EQ\RESULTS\MATLAB\InSarParam written!

the tool is going to process Reflectivity Map Calculation proceed (no is default) ?

Processing the Reflectivity Map Calculation

Using 2 workers

preparation of files for quick view: job ended

File D:\NAPA_EQ\InputParFile.txt correctly updated

The Processing concluded successfully, here a specific

Reflectivity Map Calculation: job ended

Elapsed Time: 61 seconds

21-Oct-2017 01:42:31

Processing the Sparse Mask Generation

Using 2 workers

crea masch: selecting local maxima

SET MASK

Mask Options

- ☐ All Points (no mask)
- ☒ Local Maxima
- ☐ Loc Max, no range lobes
- ☐ Loc Max, no range/azimuth lobes
- ☐ Regular Grid Rq 10 Az 10

Go OK

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Analysis

- Temporal Mask Go
- Detection Go
- Channel detection Go
- Classification Go
- Processing Go
- AR Params Go

DEM visualization Go

Reset flat/height Go

GCP selection

External DEM and synthetic amplitude in SAR coordinates Go

Coregistration Refinement (optional) Go

Sub-dataset extraction Selection and extraction Go

Regular range estimation and removal Go

Interferograms processing Go

Coherence Map generation Go

Single Interferogram processing Go

Sparse points selection

- Load Mask Go
- Custom Mask Generation Go

Amplitude processing

- Images fine equalization Go
- Amplitude time series analysis Go
- Sub-pixel positions analysis Go

Multi Image InSAR processing

- APS estimation Go
- Graph Analysis and Refinement Go
- Sparse Points processing Go

Results exporting

- Extended data export (kml-geotiff) Go
- Sparse data export (kml-csv) Go

Post-analysis

- Geographic Corrections Go
- DEM post-analysis Go
- PS classification Go
- Time Series Module Go
- Multi-sensor analysis Go

Visualization tools

- Histograms Go
- Scatter Plots Go
- View parameters Go
- View interferograms Go

Runtime: 1s - ETA: u... Mask creation 0%

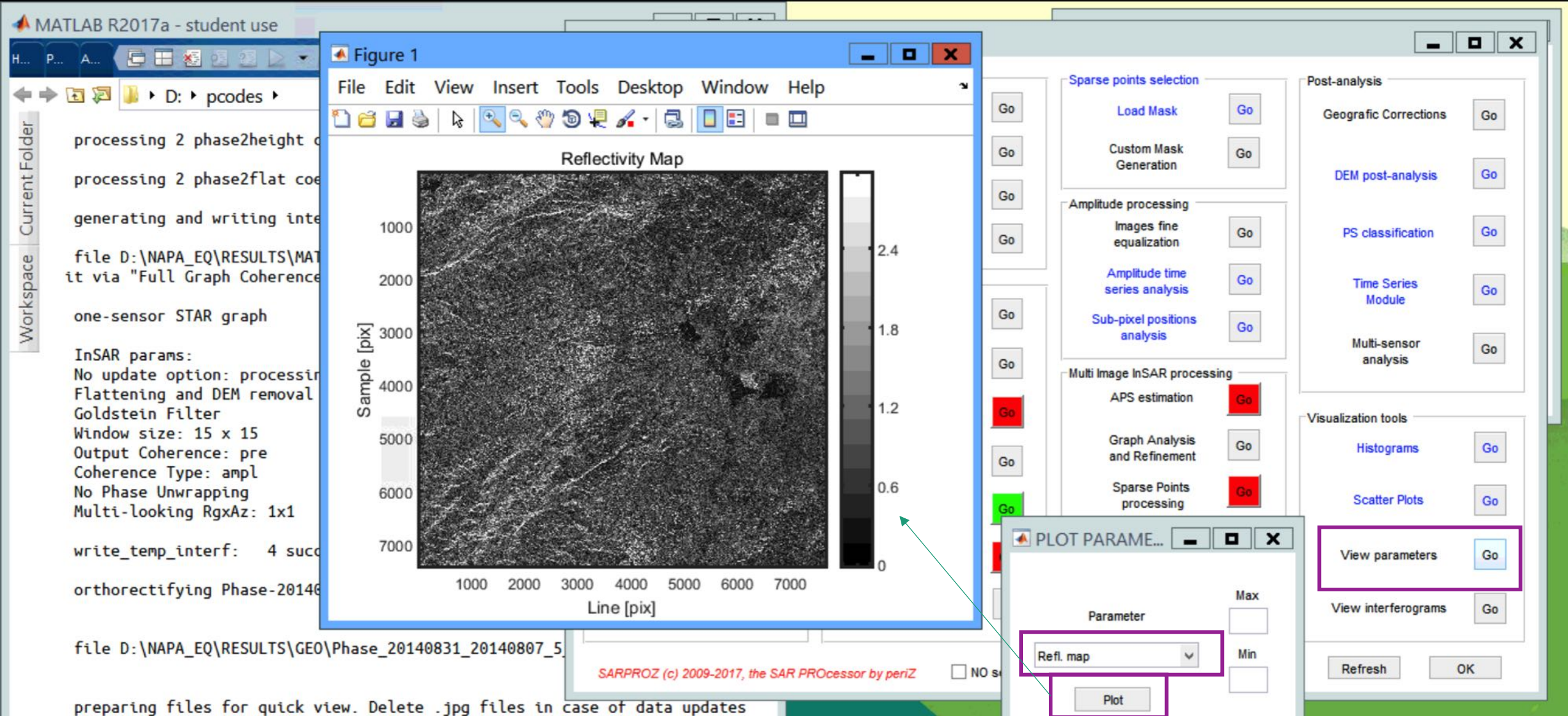
SARPROZ (c) 2009-2017, the SAR PROcessor by periz

NO security prompt

Running in Normal Mode

Refresh OK

2. Click “Mask for sparse points selection” and Click “Go” in the new popped up window. Click “OK” to close the window when it is finished.



You can click “View Parameters” in visualization tools panel. Then select “Refl. Map” in parameter and click “plot” to plot it. You can also go to “NAPA_EQ/RESULT” and open “MeanFirst.jpg” to check the jpeg format of reflectivity map.

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Current Folder

Workspace

Using 2 workers

preparation of files for quick view: job ended

File D:\NAPA_EQ\InputParFile.txt correctly updated

The Processing concluded successfully, here a specific

Reflectivity Map Calculation: job ended
Elapsed Time: 61 seconds
21-Oct-2017 01:42:31

Processing the Sparse Mask Generation

Using 2 workers

crea_masch: selecting local maxima

writing sparse file D:\NAPA_EQ\RESULTS\Maschera.mat

File D:\NAPA_EQ\InputParFile.txt correctly updated

The Processing concluded successfully, here a specific

Sparse Mask Generation: job ended
Elapsed Time: 14 seconds
21-Oct-2017 01:54:45

sel_par: neither file D:\NAPA_EQ\RESULTS\DemSynt nor
D:\NAPA_EQ\RESULTS\DemSynt.mat found

files D:\NAPA_EQ\RESULTS\DemSynt and D:\NAPA_EQ\RESULTS\DemSynt.mat not
found

SITE PROCESSING - D:\NAPA_EQ

Current Images Graph
One-sensor STAR

Preliminary analysis

Reflectivity map and
amplitude stability index

Mask for sparse
points selection

Preliminary geocoding

External DEM selection
Current: SRTM

DEM visualization

GCP selection

External DEM and
synthetic amplitude
in SAR coordinates

Coregistration
Refinement
(optional)

Sub-dataset extraction
Selection and
extraction

Figure 1

File Edit View Insert Tools Desktop Window Help

600 700 800 900 1000 1100

100 200 300 400 500 600

1400 1200 1000 800 600 400 200 0

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3. Click “DEM Visualization” to visualize the DEM inside your area of interest (AOI).
The four black cross indicates the four corner of AOI.

GCP - D:\NAPA_EQ\

GCP Coordinates

North [m] / Lat [°]

East [m] / Lon [°]

Ext. DEM Height

Sample Zone

Line Hemi.

Coord

☒ Geo

☐ UTM

☐ Local

Pixel Selection

☒ Adjust to Radar Target ☐ Force my pixel

Reset GCP & Orbits Write

Auto GCP

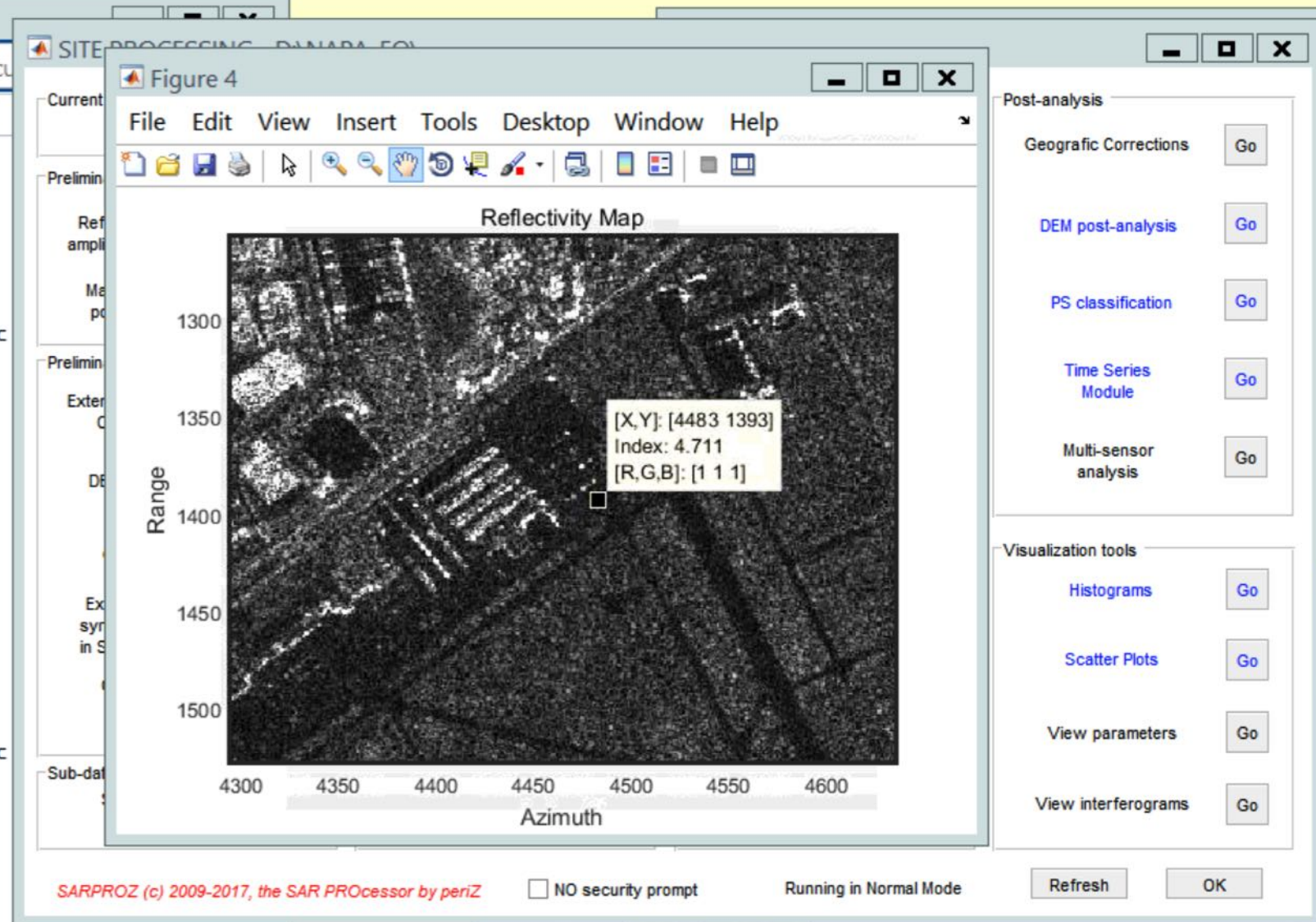
Through Ext. DEM

GCP Plot

☒ OVR

Ok

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4. Click “GCP Selection”. In “Auto GCP” Panel, click “Keep Current Orbits”. When the process is finished, click “OK” to close the window.

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Workspace Current Folder

D:\pcodes

Using 2 workers

```
loading GCP:
north coordinate (UTM): 4229612.0
East coordinate (UTM): 563767.0
UTM Zone: 10
Hemisphere: North
ellipsoidal height (WGS84): 11
sample: 2542
line: 5476

checking for SRTM files

missing SRTM files will be automatically downloaded, s
found

Reading SRTM data

WARNING WARNING WARNING!!!!!! 57 VOID DEM VALUES!!!!!!

DEM processing started

Using a grid of 3.81 m in ground range and 3.64 m in g

loading GCP:
north coordinate (UTM): 4229612.0
East coordinate (UTM): 563767.0
UTM Zone: 10
Hemisphere: North
ellipsoidal height (WGS84): 11
sample: 2542
line: 5476
```

SITE PROCESSING - D:\NAPA_EQ\

Current Images Graph
One-sensor STAR

Preliminary analysis

- Reflectivity map and amplitude stability index
- Mask for sparse points selection

Preliminary geocoding

- External DEM selection
Current: SRTM
- DEM visualization

Auxiliary analysis

- Multi-Temporal Adaptive Mask
- Change detection
- Multi-Channel Change detection
- Image classification

InSAR processing

- InSAR Params
- Reset flat/height

Sparse points selection

- Load Mask
- Custom Mask Generation

Amplitude processing

- Images fine equalization
- Amplitude time series analysis
- Sub-pixel positions analysis

Multi Image InSAR processing

- APS estimation
- Graph Analysis and Refinement
- Sparse Points processing

Results exporting

- Extended data export (kml-geotiff)
- Sparse data export (kml-csv)

Post-analysis

- Geographic Corrections
- DEM post-analysis
- PS classification
- Time Series Module
- Multi-sensor analysis

Visualization tools

- Histograms
- Scatter Plots
- View parameters
- View interferograms

DEM processing

Runtime: 26s - ETA: ...

10%

External DEM and synthetic amplitude in SAR coordinates

Coregistration Refinement (optional)

Sub-dataset extraction
Selection and extraction

Interferograms processing

Coherence Map generation

Single Interferogram processing

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5. Click “External DEM and synthetic amplitude in SAR coordinates”.

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Workspace: Current Folder

D:\pcodes\

missing SRTM files will be automatically downloaded, s found

Reading SRTM data

WARNING WARNING WARNING!!!!!! 57 VOID DEM VALUES!!!!!!

DEM processing started

Using a grid of 3.81 m in ground range and 3.64 m in g

loading GCP:
north coordinate (UTM): 4229612.0
East coordinate (UTM): 563767.0
UTM Zone: 10
Hemisphere: North
ellipsoidal height (WGS84): 11
sample: 2542
line: 5476

preparation of files for quick view: job ended

The Processing concluded successfully, here a specific

DEM resampling: job ended
Elapsed Time: 187 seconds
21-Oct-2017 02:10:47

The Processing concluded successfully, here a specific

DEM in SAR Coordinates : job ended
Elapsed Time: 187 seconds
21-Oct-2017 02:10:47

EXTENDED DATA EXPORT - D:\NAPA_EQ

2 **Data to export**

☒ Parameter Refl. map ☐ Phase

☐ All Current Interferograms ☐ Coher. Thres.

☐ Single Interferogram

Ref ☐ SAR ☒ Geo S/Lat L/Lon

3 **Options**

Mode **Orthorectify**

File Type Kml

Downsampling Rg 5 Az 5

Saturation Min Max

4 **Go**

Results exporting

1 **Extended data export (kml-geotiff)**

Post-analysis

Geographic Corrections Go

DEM post-analysis Go

PS classification Go

Time Series Module Go

Multi-sensor analysis Go

Visualization tools

Histograms Go

Scatter Plots Go

View parameters Go

View interferograms Go

SARPROZ (c) 2009-2017, the SAR PROcessor by periz

NO security prompt

Running in Normal Mode

Refresh OK

10. CHECK THE CORRECTNESS of your GCP: Geocode your reflectivity map to Google Earth. Click “Extended data export” in “Results exporting” panel.

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Search Doc

Workspace Current Folder

D: \ pcodes \

missing SRTM files will be automatically downloaded, s
found

Reading SRTM data

WARNING WARNING WARNING!!!!!! 57 VOID DEM VALUES!!!!!!

DEM processing started

Using a grid of 3.81 m in ground range and 3.64 m in g

loading GCP:
north coordinate (UTM): 4229612.0
East coordinate (UTM): 563767.0
UTM Zone: 10
Hemisphere: North
ellipsoidal height (WGS84): 11
sample: 2542
line: 5476

preparation of files for quick view: job ended

The Processing concluded successfully, here a specific

DEM resampling: job ended
Elapsed Time: 187 seconds
21-Oct-2017 02:10:47

The Processing concluded successfully, here a specific

EXTENDED DATA EXPORT - D:\NAPA_EQ\

Data to export

☒ Parameter Refl. map ☐ Phase

☐ All Current Interferograms ☐ Coher. Thres.

☐ Single Interferogram

Ref

☐ SAR ☒ Geo S/Lat L/Lon

Options

Mode Orthorectify

File Type Kml

Downsampling

Rg 5 Az 5

Saturation

Min Max

Go OK

SARPROZ (c) 2009-2017, the SAR PROcessor by periz

GCP selection Go

External DEM and synthetic amplitude in SAR coordinates Go

Coregistration Refinement (optional) Go

Sub-dataset extraction Selection and extraction Go

Full Graph Coherence estimation Go

Residual fringes estimation and removal Go

Interferograms processing Go

Coherence Map generation Go

Single Interferogram processing Go

APS estimation Go

Graph Analysis and Refinement Go

Sparse Points processing Go

Results exporting

Extended data export (kml-geotiff) Go

Sparse data export (kml-csv) Go

Post-analysis

Geographic Corrections Go

DEM post-analysis Go

PS classification Go

Time Series Module Go

Multi-sensor analysis Go

Visualization tools

Histograms Go

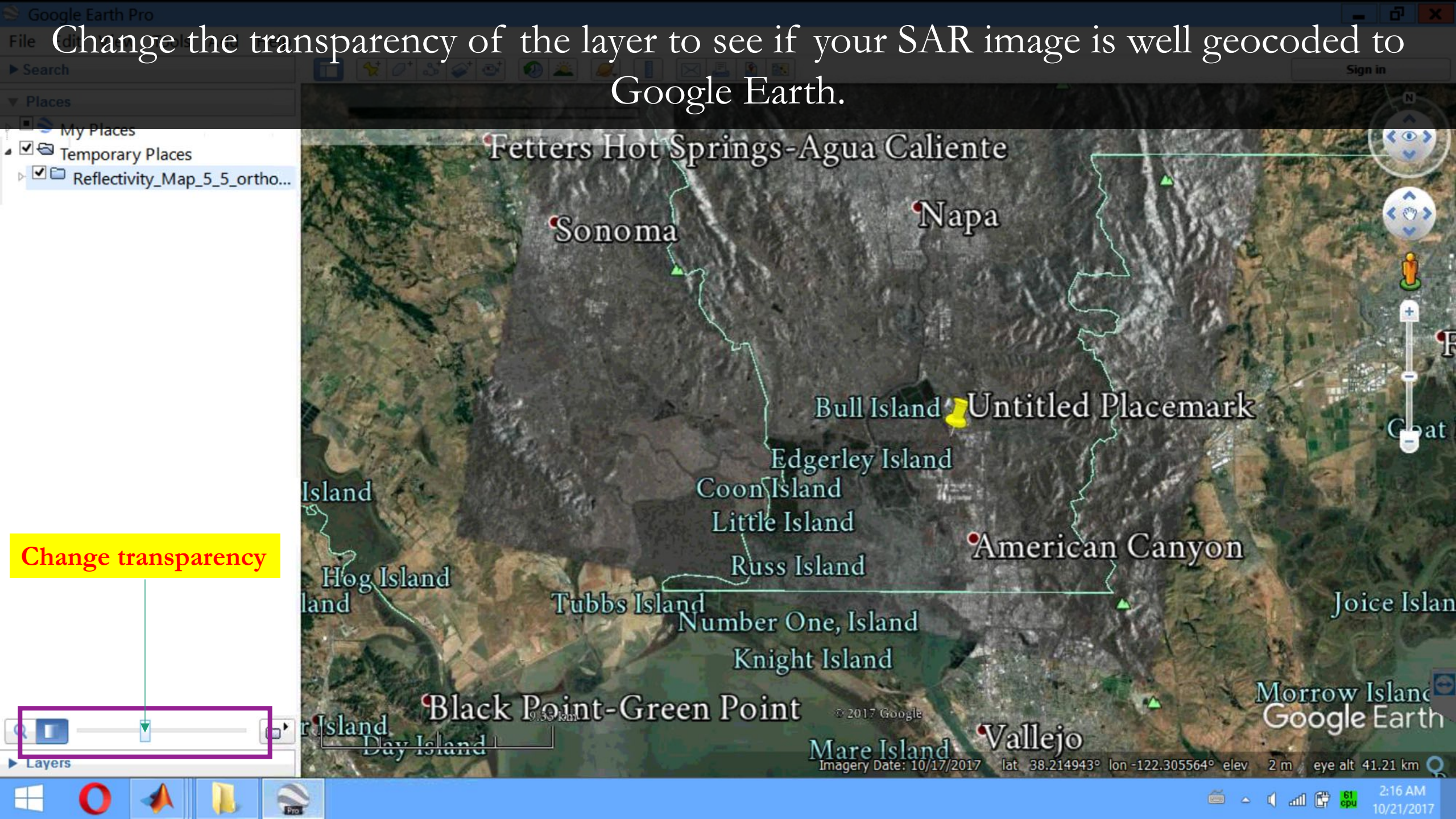
Scatter Plots Go

View parameters Go

View interferograms Go

SARPROZ (c) 2009-2017, the SAR PROcessor by periz ☐ NO security prompt Running in Normal Mode Refresh OK

Choose “Refl. Map” in Parameter; Choose “Orthorectify” in Mode, Press “Go”. If your Google Earth does not start automatically, go to “NAPA_EQ/RESULTS/GEO/” and open “Reflectivity_Map_5_5_ortho.kmz”.



Change the transparency of the layer to see if your SAR image is well geocoded to Google Earth.

Change transparency

Part 3: Generate Interferogram

The screenshot displays the SARPROZ software interface, specifically the 'Single Interferogram Processing' dialog box. The interface is divided into several sections, with key steps highlighted by numbered yellow callouts:

- 1:** Points to the 'Single Interferogram processing' button at the bottom of the main window.
- 2:** Points to the 'Pair Selection' section, showing 'Master' and 'Slave' image dates and coordinates.
- 3:** Points to the 'Preset and Coherence Options' section, where 'Goldstein' is selected for 'Presets' and '15' is entered for 'Fix Window Size'.
- 4:** Points to the 'Interferogram Processing & Writing' section, where 'Flattening' and 'DEM Removal' are checked.
- 5:** Points to the 'GO' button in the 'Interferogram Processing & Writing' section.
- 6:** Points to the 'Write' button in the 'Interferogram Processing & Writing' section.
- 7:** Points to the 'Read & Plot' button in the 'Results Visualization & Export' section.

The background shows a MATLAB R2017a window with a command window displaying the progress of the processing, including 'Elapsed Time: 187 seconds' and 'Processing 2 phase 2h...'. The taskbar at the bottom shows the system time as 2:17 AM on 10/21/2017.

The screenshot displays the SARPROZ software interface, specifically the 'Single Interferogram Processing' dialog box. The interface is divided into several sections, with key steps highlighted by numbered yellow callouts:

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- 4:** Points to the 'Interferogram Processing & Writing' section, where 'Flattening' and 'DEM Removal' are checked.
- 5:** Points to the 'GO' button in the 'Interferogram Processing & Writing' section.
- 6:** Points to the 'Write' button in the 'Interferogram Processing & Writing' section.
- 7:** Points to the 'Read & Plot' button in the 'Results Visualization & Export' section.

The background shows a MATLAB R2017a window with a command window displaying the following text:

```

The Processing concluded successfully, here a specific
Elapsed Time: 187 seconds
No Reference
orthorectifying Reflectivity Map
File D:\NAPA_EQ\RESULTS\GEO\Reflectivity_Map_5_5_ortho
Processing 2 phase2helix
Runtime: 5s - ETA: u...
Interferograms processing
0%
Generating and writing interferograms
file D:\NAPA_EQ\RESULTS\GEO\Matrix\IncInGail is missing
it via "Full Graph Coherence Estimation"
one-sensor Star graph
Processing:
No update option: processing all data
Flattening and DEM removal
Window size: 15 x 15
Output Coherence: pre-filtering
Coherence Type: ampl.-weighted
No Phase Unwrapping
Multi-looking RgxAz: 1x1
fx >>
  
```

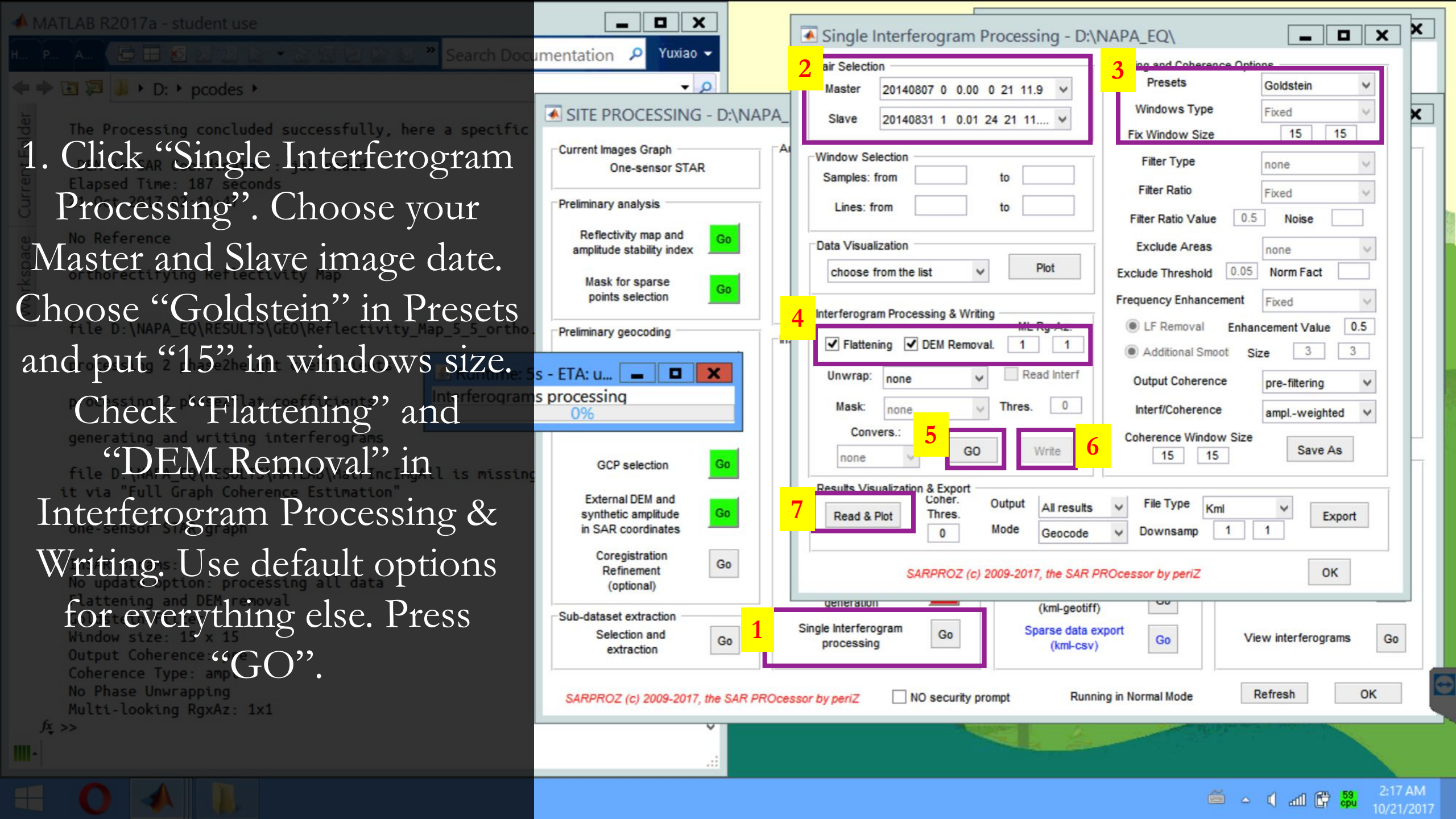
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The background shows a MATLAB R2017a window with a command window displaying the following text:

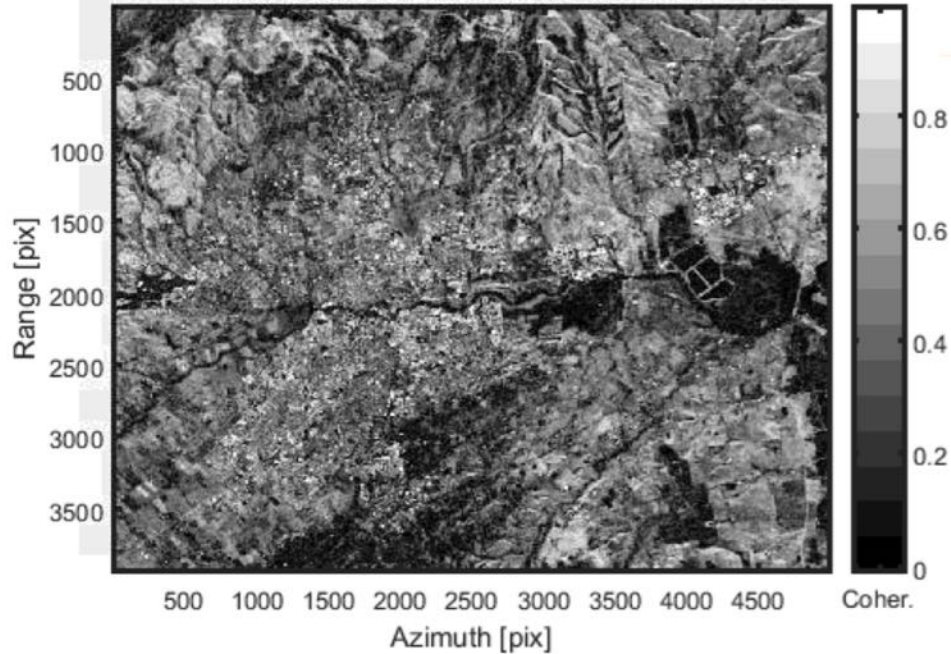
```

The Processing concluded successfully, here a specific
Elapsed Time: 187 seconds
No Reference
orthorectifying Reflectivity Map
File D:\NAPA_EQ\RESULTS\GEO\Reflectivity_Map_5_5_ortho
Processing 2 phase2helix
Runtime: 5s - ETA: u...
Interferograms processing
0%
Generating and writing interferograms
file D:\NAPA_EQ\RESULTS\GEO\Matrix\IncInGail is missing
it via "Full Graph Coherence Estimation"
one-sensor Star graph
Processing:
No update option: processing all data
Flattening and DEM removal
Window size: 15 x 15
Output Coherence: pre-filtering
Coherence Type: ampl.-weighted
No Phase Unwrapping
Multi-looking RgxAz: 1x1
fx >>
  
```

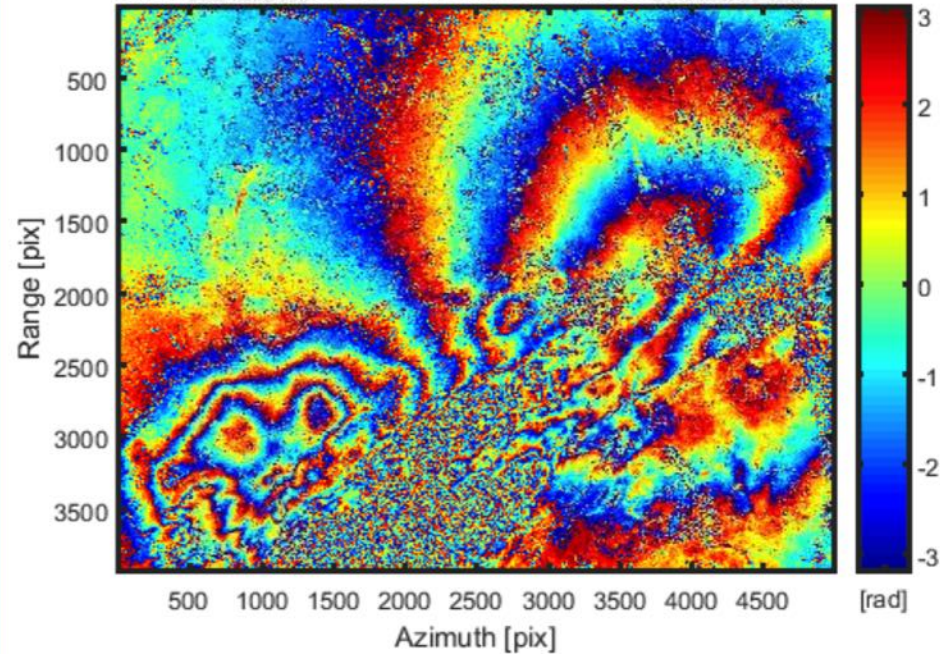


2. Click “Write” after process complete. Click “Read & Plot” to plot the interferogram and the corresponding coherence map.

Coherence Interf: 20140831-20140807



Phase Interf: 20140831-20140807, Bn: 2, Hamb: 32118.3



Flattening and Denoising
Goldstein Filter
Window size: 15 x 15
Output Coherence: pre
Coherence Type: ampl
No Phase Unwrapping
Multi-looking RgxAz: 1x1

write_temp_interf: 4 successfully moved file(s)

fx >>

extraction

Go

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OK

SARPROZ (c) 2009-2017, the SAR PROcessor by periz

☐ NO security prompt

Running in Normal Mode

Refresh

OK

MATLAB R2017a - student use

Search Docu

Workspace Current Folder

D:\pcodes\

InSAR params:
No update option: processing all data
Flattening and DEM removal
Goldstein Filter
Window size: 15 x 15
Output Coherence: pre
Coherence Type: ampl
No Phase Unwrapping
Multi-looking RgxAz: 1x1

write_temp_interf: 4 successfully moved file(s)

This algorithm implements a sparse Least Square unwrap and dirty solution (not accurate) to be used with care.

generating and writing interferograms

file D:\NAPA_EQ\RESULTS\MATLAB\MatrIncImgAll is missing it via "Full Graph Coherence Estimation"

one-sensor STAR graph

InSAR params:
No update option: processing all data
Flattening and DEM removal
Goldstein Filter
Window size: 15 x 15
Output Coherence: pre
Coherence Type: ampl
Phase Unwrapping
Multi-looking RgxAz: 1x1
Coherence Type: ampl
Using Mask file: coher

Current Images Graph
One-sensor STAR

Preliminary analysis
Reflectivity map and amplitude stability index **Go**
Mask for sparse points selection **Go**

Preliminary geocoding
External DEM selection Current: SRTM **Go**
DEM visualization **Go**
GCP selection **Go**
External DEM and synthetic amplitude in SAR coordinates **Go**
Coregistration Refinement (optional) **Go**
Sub-dataset extraction Selection and extraction **Go**

Auxiliary
Ch
A
Ch
Ch
Ima

InSAR
R
Full
F
est

Single Interferogram Processing - D:\NAPA_EQ\

Pair Selection
Master 20140807 0 0.00 0 21 15.3
Slave 20140831 2 0.01 24 21 13....

Window Selection
Samples: from to
Lines: from to

Data Visualization
choose from the list Plot

Interferogram Processing & Writing
☒ Flattening ☒ DEM Removal ML Rg-Az: 1 1
☒ Unwrap: Sparse LS ☐ Read Interf
Mask: Coherence Thres. 0.3
Convers.: Displ [mm] **GO** Write
Results Visualization & Export
Read & Plot Coher. Thres. 0 Output All results File Type Kml
Mode Geocode Downsamp 1 1 **Export**

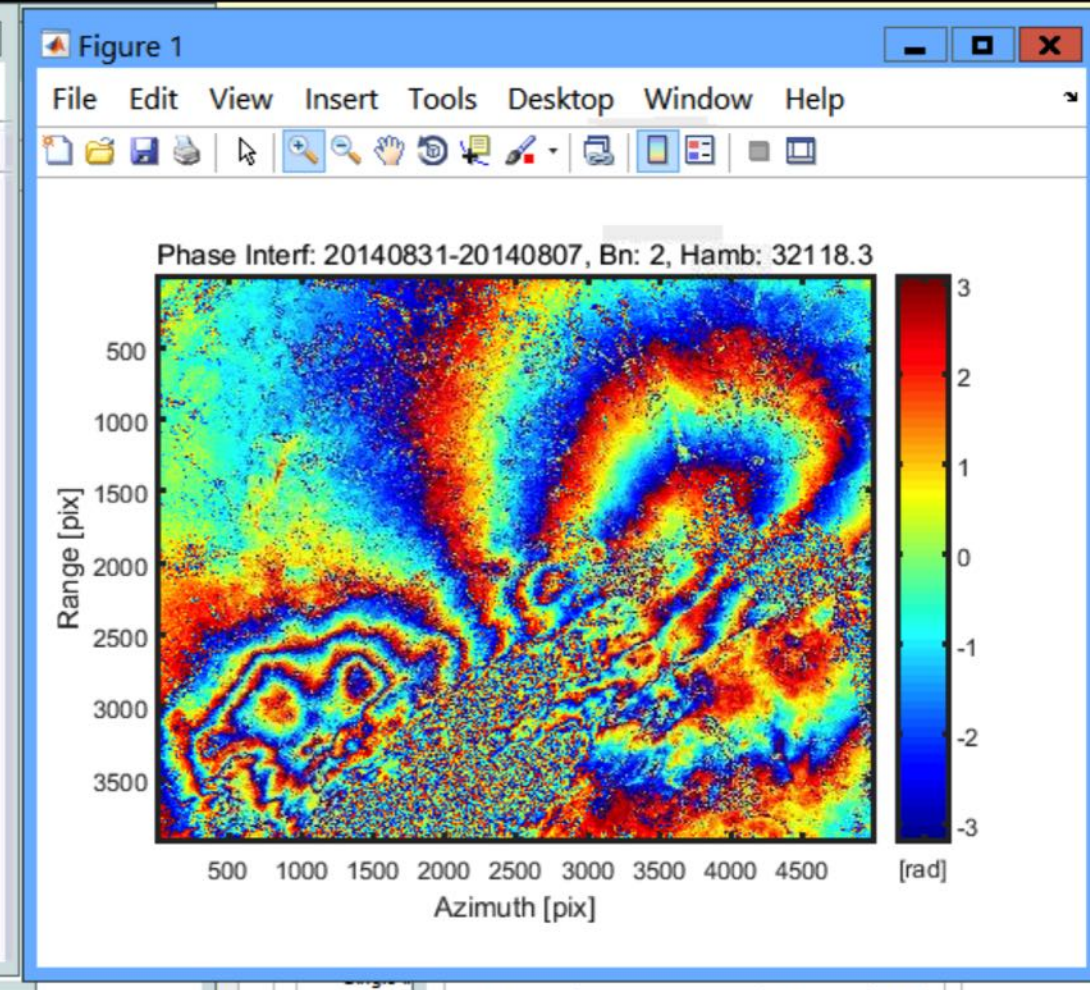
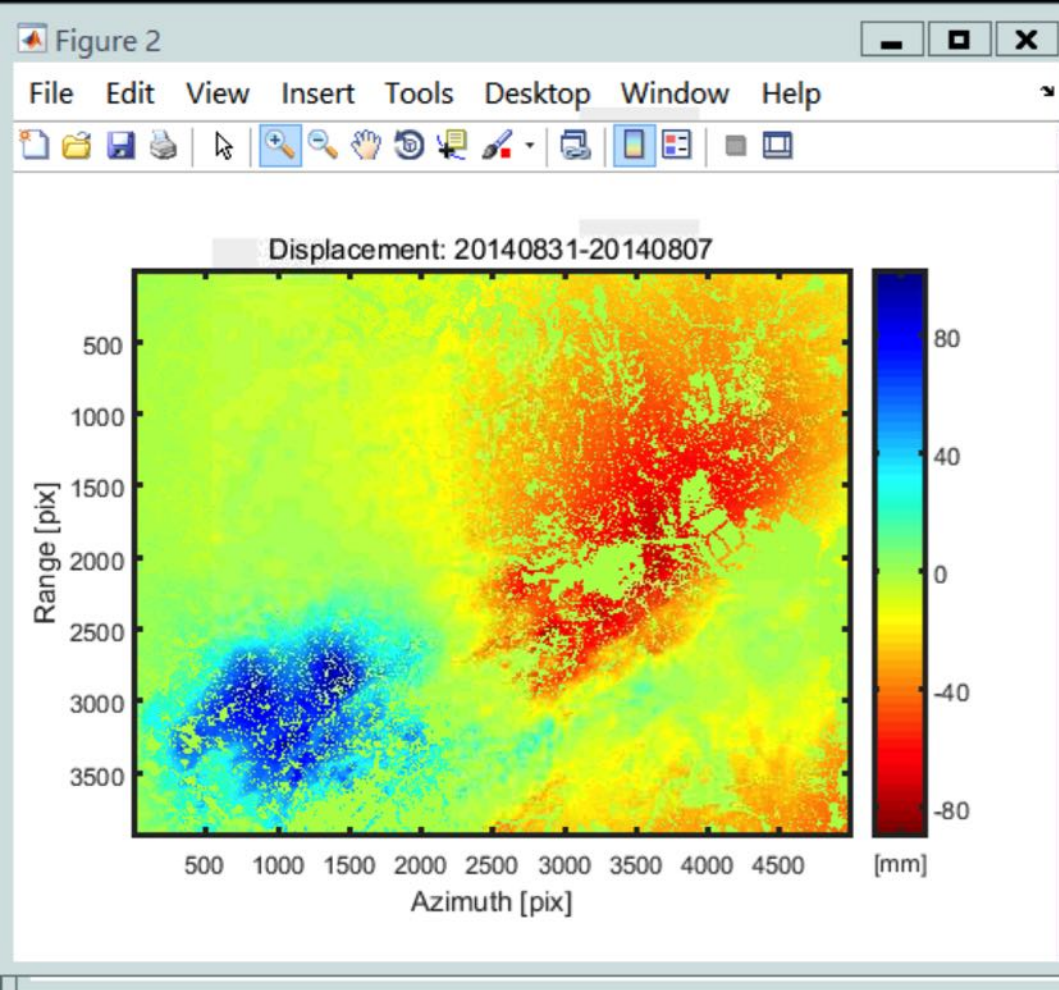
Filtering and Coherence Options
Presets Goldstein
Windows Type Fixed
Fix Window Size 15 15
Filter Type none
Filter Ratio Fixed
Filter Ratio Value 0.5 Noise
Exclude Areas none
Exclude Threshold 0.05 Norm Fact
Frequency Enhancement Fixed
☒ LF Removal Enhancement Value 0.5
☒ Additional Smoot Size 3 3
Output Coherence pre-filtering
Interf/Coherence ampl.-weighted
Coherence Window Size 15 15 Save As

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NO security prompt Running in Normal Mode Refresh OK

8
9
10
11
12
13

3. At last, we want to unwrap the interferogram. Select “Sparse L(east) S(quare)” for Unwrap. Select “Coherence” for Mask and input “0.3” as threshold. Select “Displacement [mm]” for Conversion. Click “GO” again to run interferogram unwrap.



post-analysis

Geographic Corrections

DEM post-analysis

Coherence Options

Coherence Type

Coherence Type

Coherence Size

Coherence Type

Coherence Type

Coherence Value Noise

Coherence Areas

Coherence Threshold Norm Fact

Coherence Enhancement

Coherence Enhancement Value

Coherence Smoothing Size

Coherence

Interf/Coherence

Coherence Window Size

Results Visualization & Export

Read & Plot

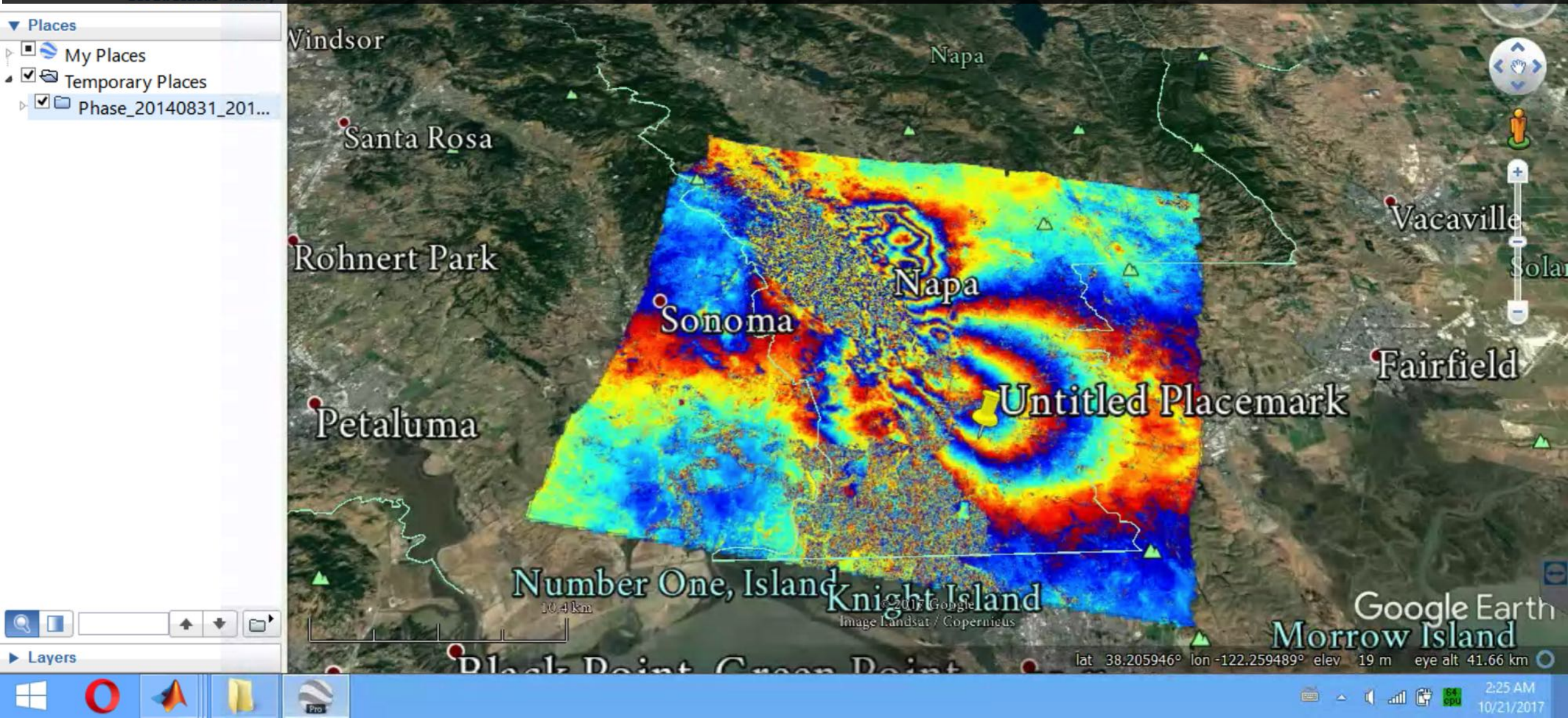
Coherence Thres.

Output All results

Mode Geocode

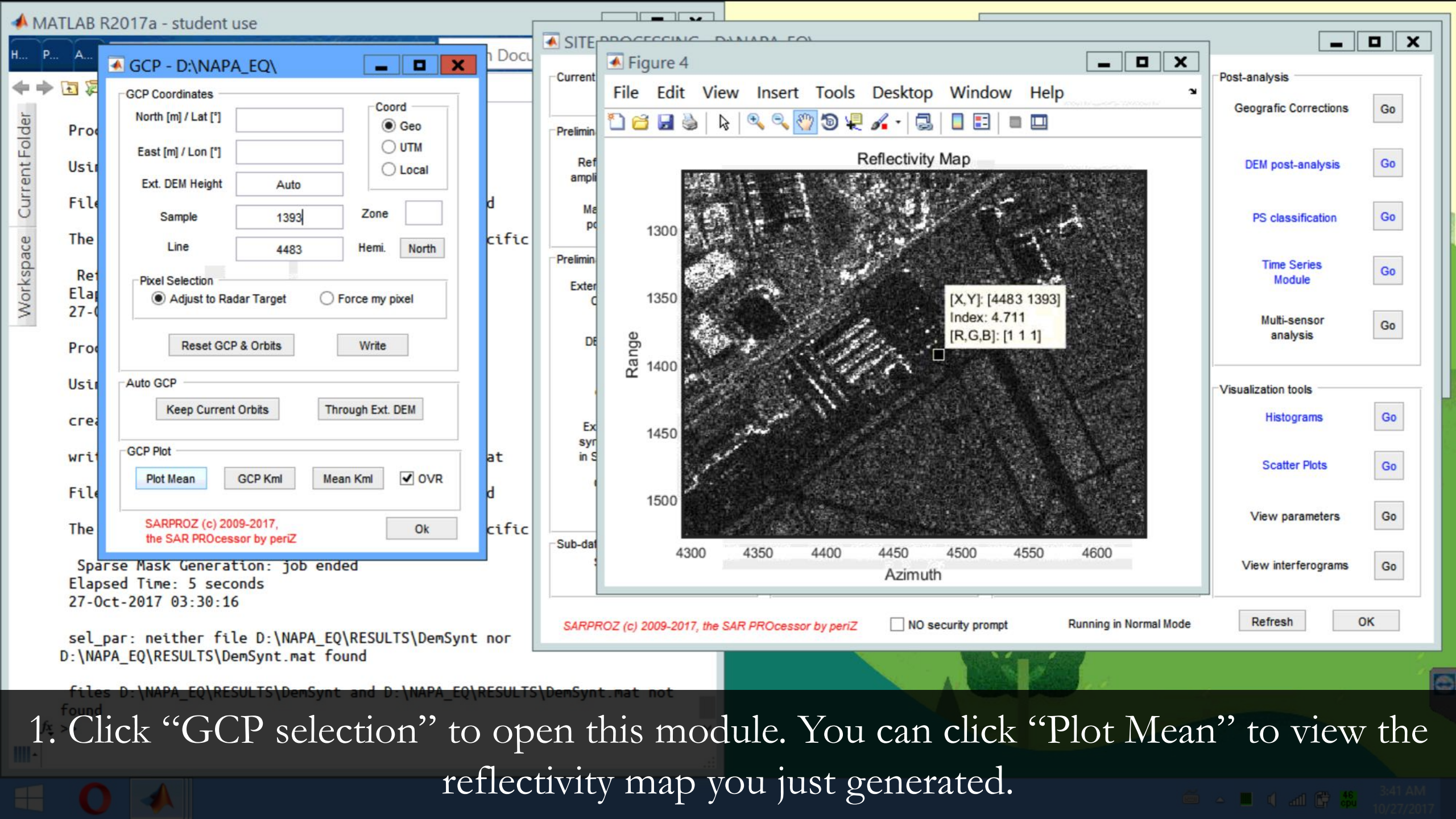
Click on “Read & Plot” again to plot the unwrapped interferogram. Compare it with the wrapped one. Please pay special attention to the colorbar scale.

At last, you should also geocode the final product to Google Earth. Select “Orthorectify” in Mode, keep default downsample as 5*5. Click “Export”. The KMZ file could also be found in “NAPA_EQ/RESULTS/GEO/” folder.

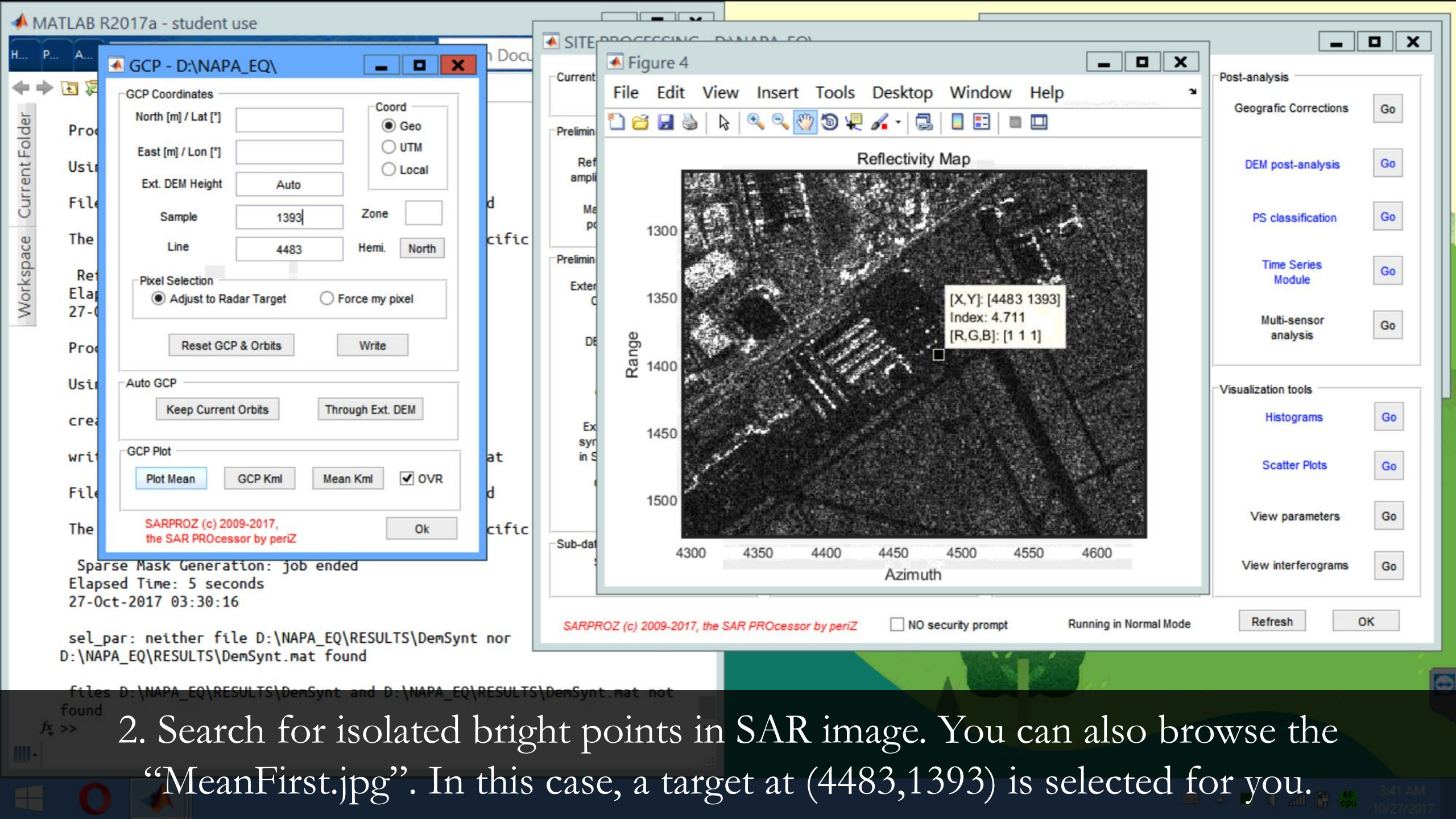


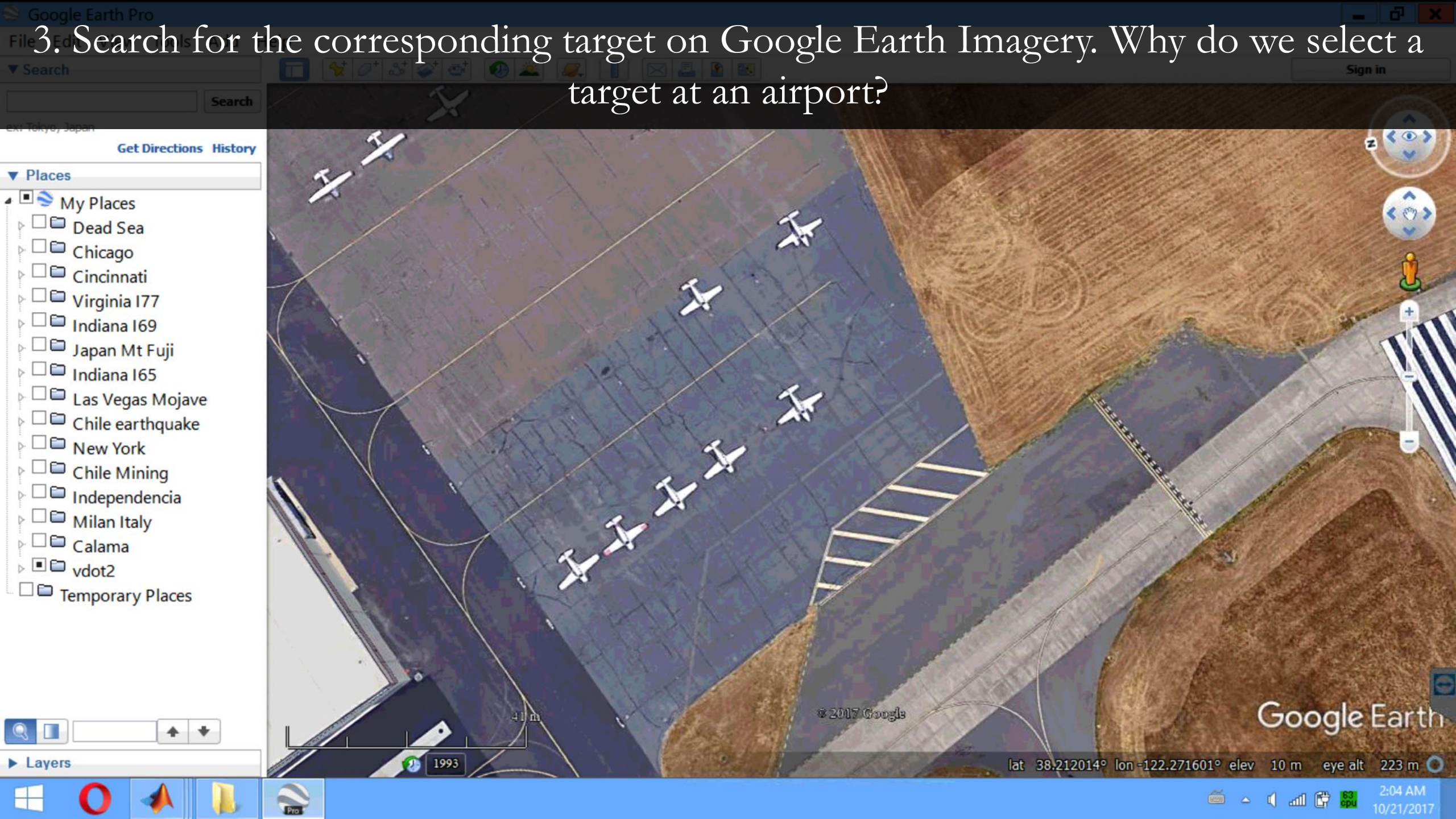
(Optional)
Manually Geocode your SAR Image

- You need to geocode our SAR image to latitude/longitude coordinates, and show it on Google Earth.
- One ground control point (GCP) is required.
 - You need to search carefully for one target that appears both on SAR image and Google Earth (Optical Imagery).
 - You need to find the corresponding SAR coordinates AND lat/lon coordinates.
 - You need to input the two coordinates system for your GCP.
- A guide will be provided for this one.



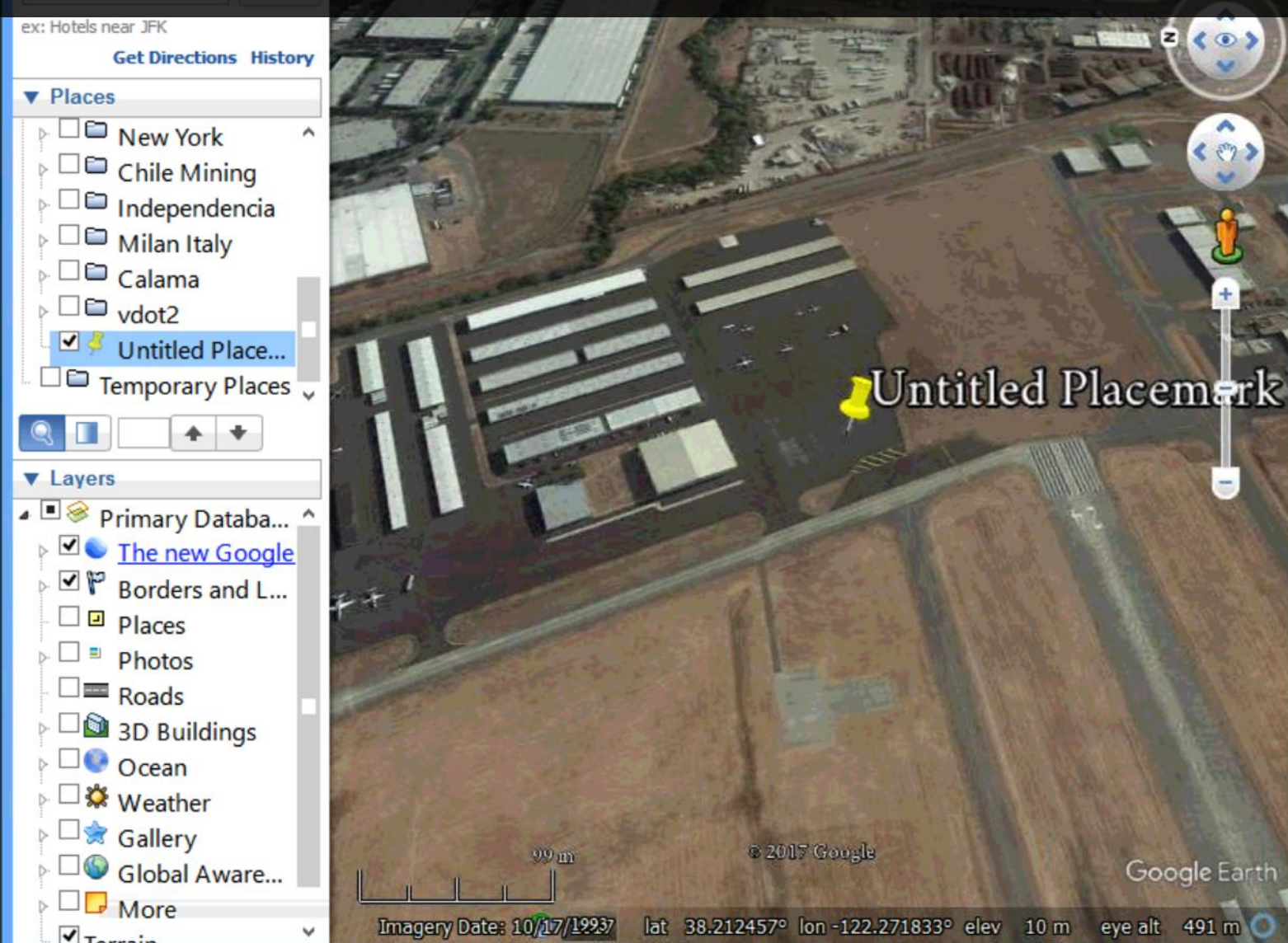
1. Click “GCP selection” to open this module. You can click “Plot Mean” to view the reflectivity map you just generated.



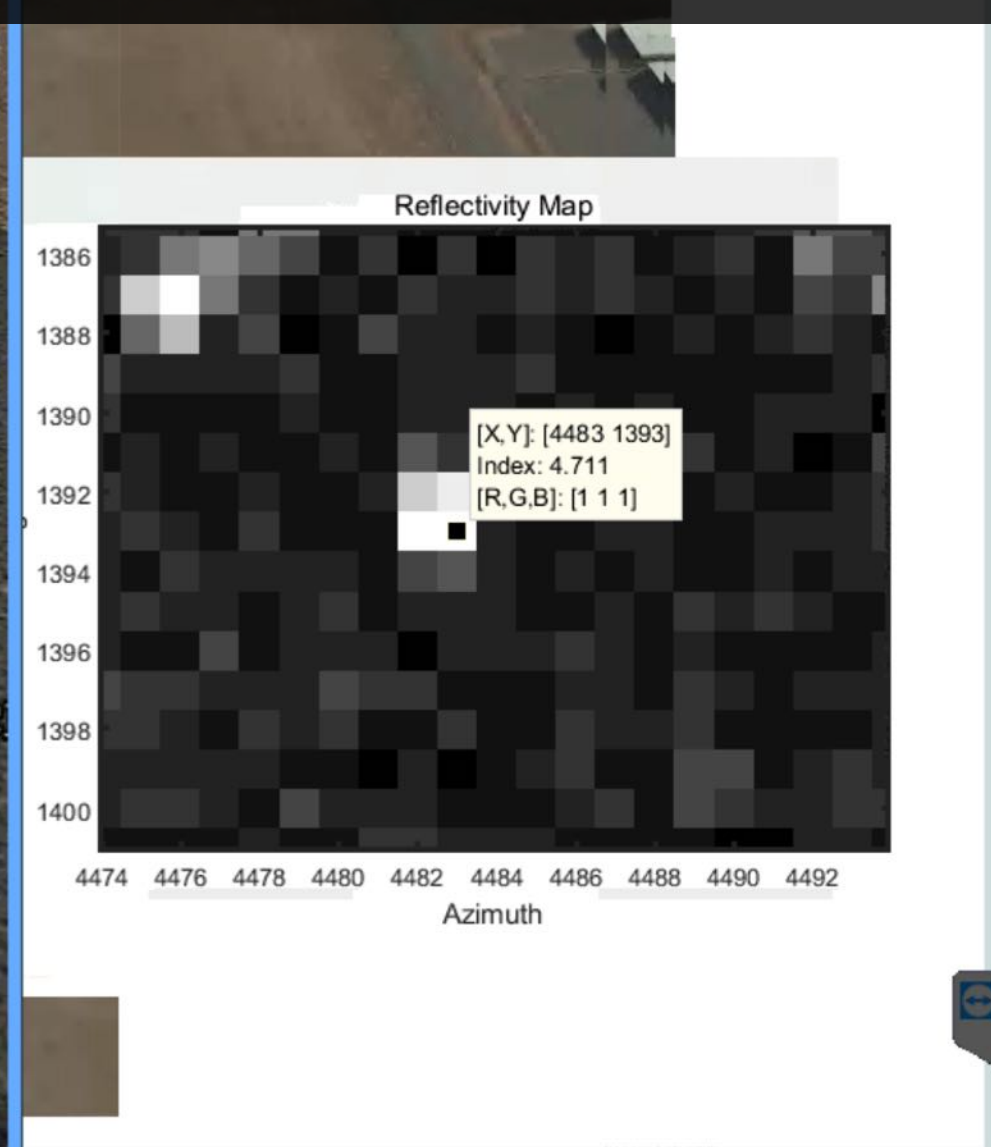


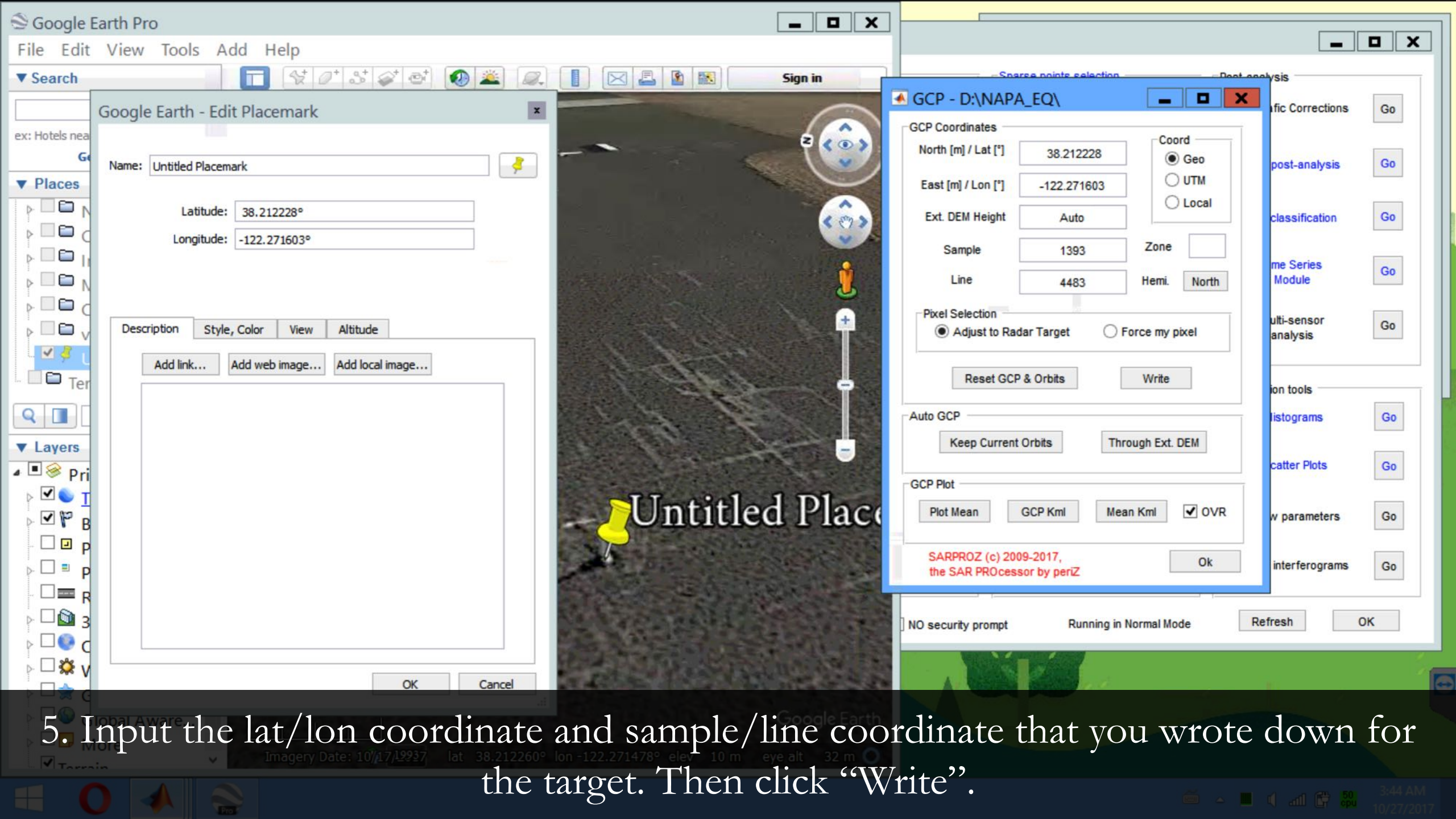
3. Search for the corresponding target on Google Earth Imagery. Why do we select a target at an airport?

4. Compare the GCP that shows on a SAR imagery and an optical imagery. Remember to uncheck “3D Buildings” in “Layers” in side panel of Google Earth.



Zoom in the two targets and write down their coordinates. In the case of SAR imagery, choose the pixel in the middle with the highest intensity.





5. Input the lat/lon coordinate and sample/line coordinate that you wrote down for the target. Then click “Write”.

Bye