

SARPROZ

The SAR, InSAR, PSInSAR, ... PROcessor by periz

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Dragon 3 Land Training course, SAR Practical, day 6

Part I

Tutorial on PSInSAR using SARPROZ

The image displays the SARPROZ software interface, which is used for processing Synthetic Aperture Radar (SAR) data to identify Persistent Scatterers (PS). The interface is divided into several main windows:

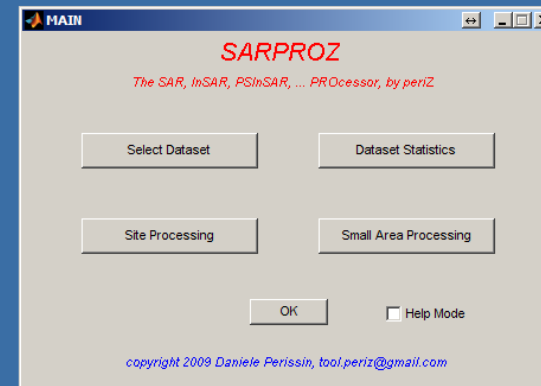
- MAIN - E:\TerraSAR_Harbour**: The main control window with buttons for "Select Dataset", "Dataset Statistics", "Site Processing", and "Small Area Processing".
- SITE PROCESSING - E:\TerraSAR_Harbour**: A central panel with multiple sections of processing options, each with a "Go" button:
 - Preliminary analysis**: Reflectivity map and amplitude stability index, Mask for sparse points selection.
 - InSAR processing**: Phase to height constants generation, Phase to flat constants generation, MST estimation, Residual fringes estimation and removal, Second order fringes removal, Interferograms processing, Coherence map generation, Synthetic coherence map generation.
 - Preliminary geocoding**: External DEM selection (default: SRTM), DEM visualization, Geocoding through external DEM, Geocoding through manual GCP selection, External DEM and synthetic amplitude in SAR coordinates.
 - Sparse points selection**: Load mask.
 - Amplitude processing**: Images equalization, Amplitude time series analysis, Sub-pixel positions analysis, Flat Cartesian coordinates estimation.
 - Post-analysis**: Geographic coordinates estimation, UTM coordinates estimation, DEM post-analysis, PS classification, Multi-sensor analysis, Tests.
 - Multi Image InSAR processing**: APS estimation.
 - Visualization tools**: Histograms.
- Figure 20 - GEOCODING - E:\TerraSAR_Harbour**: A 3D visualization of the data points in a coordinate system. The axes are labeled "North [m x 0.5]", "East [m x 0.5]", and "Height [m Geocoid (m x 1)]". A color scale at the bottom ranges from -20 to 60. A "Parameter" list on the right shows various parameters like Coherence, Height, Def. trend, etc.
- Figure 21 - GEOCODING - E:\TerraSAR_Harbour**: A 2D visualization of the data points overlaid on an aerial photograph (Ortofoto). The axes are "North [m x 0.5]" and "East [m x 0.5]". A color scale at the bottom ranges from 0.72 to 0.96. A "Parameter" list on the right shows various parameters like Coherence, Height, Def. trend, etc.
- Parameter Thresholding**: A sub-window with a dropdown menu for "Amp. Stab. Index" set to 8. It includes options for "Amplitude Extraction" (Local Maxima, Lobes suppression) and "Selected Points: 836".

http://ihome.cuhk.edu.hk/~b122066/index_files/download.htm

Synthetic Aperture Radar Interferometry, implemented by SARPROZ

Exercise 1, InSAR brief review,
ALOS data in Tibet

Run the tool by double-clicking on the executable file

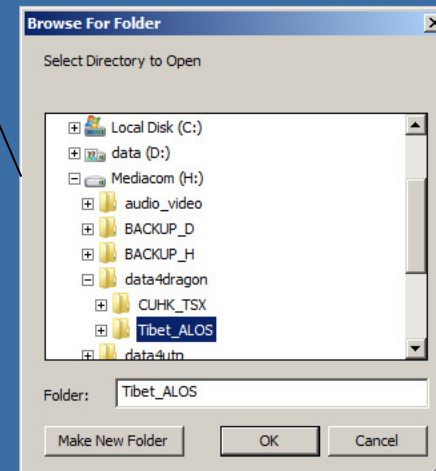
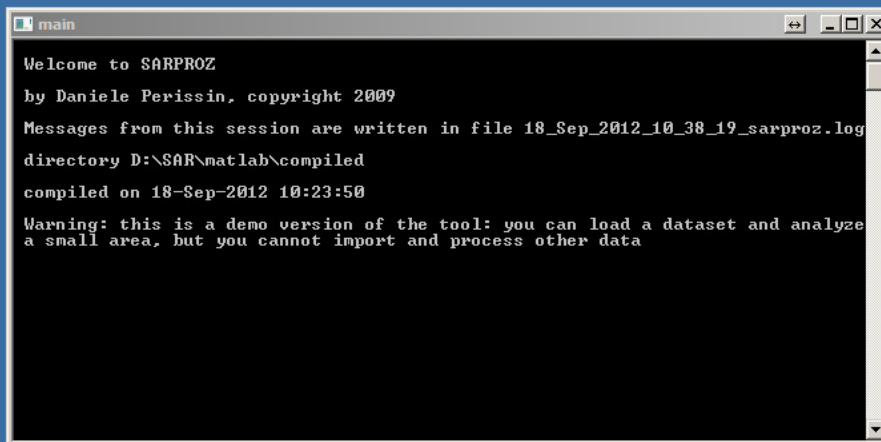
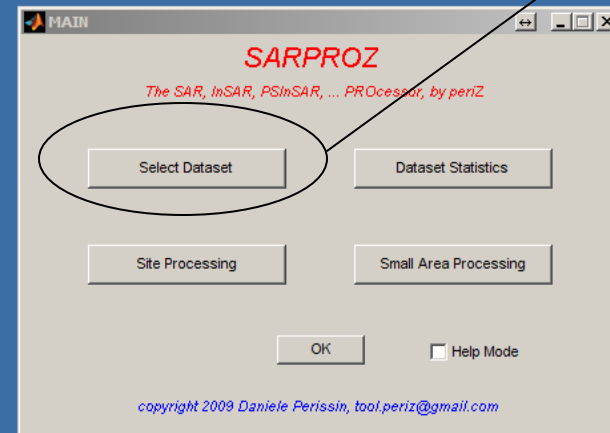
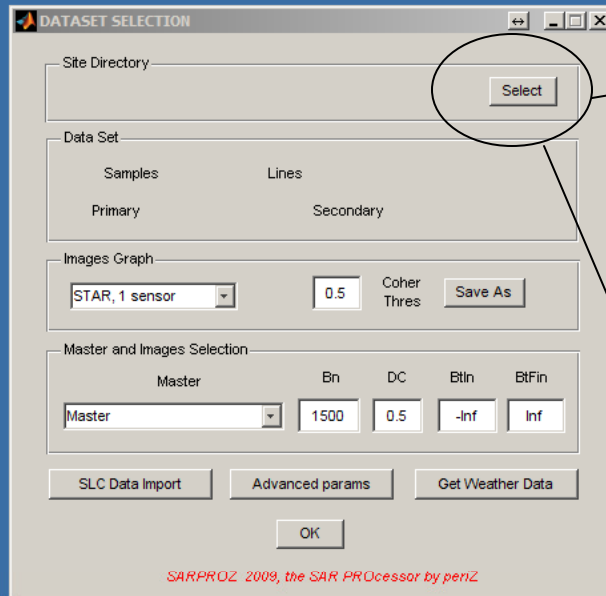


```
main
Welcome to SARPROZ
by Daniele Perissin, copyright 2009
Messages from this session are written in file 18_Sep_2012_10_38_19_sarproz.log
directory D:\SAR\matlab\compiled
compiled on 18-Sep-2012 10:23:50
Warning: this is a demo version of the tool: you can load a dataset and analyze
a small area, but you cannot import and process other data
```

This is a Demo version!

Keep always the command prompt visible to read messages given by the tool

To start, press
"Select DataSet"
And then "Select"



Select the directory
"Tibet_ALOS"

The image shows the SARPROZ software interface. On the left is the 'DATASET SELECTION' dialog box, and on the right is the 'MAIN' window. A callout box points to the 'Bn' field in the 'Master and Images Selection' section of the dataset selection dialog.

DATASET SELECTION - H:\data4dragon\Tibet_ALOS

Site Directory: H:\data4dragon\Tibet_ALOS\ [Select]

Data Set:

Samples	1800	Lines	5700
Primary	ALOS-PaISAR	Secondary	

Images Graph:

[STAR, 1 sensor] [0.5] Coher Thres [Save As]

Master and Images Selection:

Master	Bn	DC	BtIn	BtFin
20070806 0 0 0 6 8	4500	0.5	-Inf	Inf

[SLC Data Import] [Advanced params] [Get Weather Data] [OK]

SARPROZ 2009, the SAR PROCessor by periz

MAIN - H:\data4dragon\Tibet_ALOS

SARPROZ
The SAR, InSAR, PSInSAR, ... PROCessor, by periz

[Select Dataset] [Dataset Statistics]

[Site Processing] [Small Area Processing]

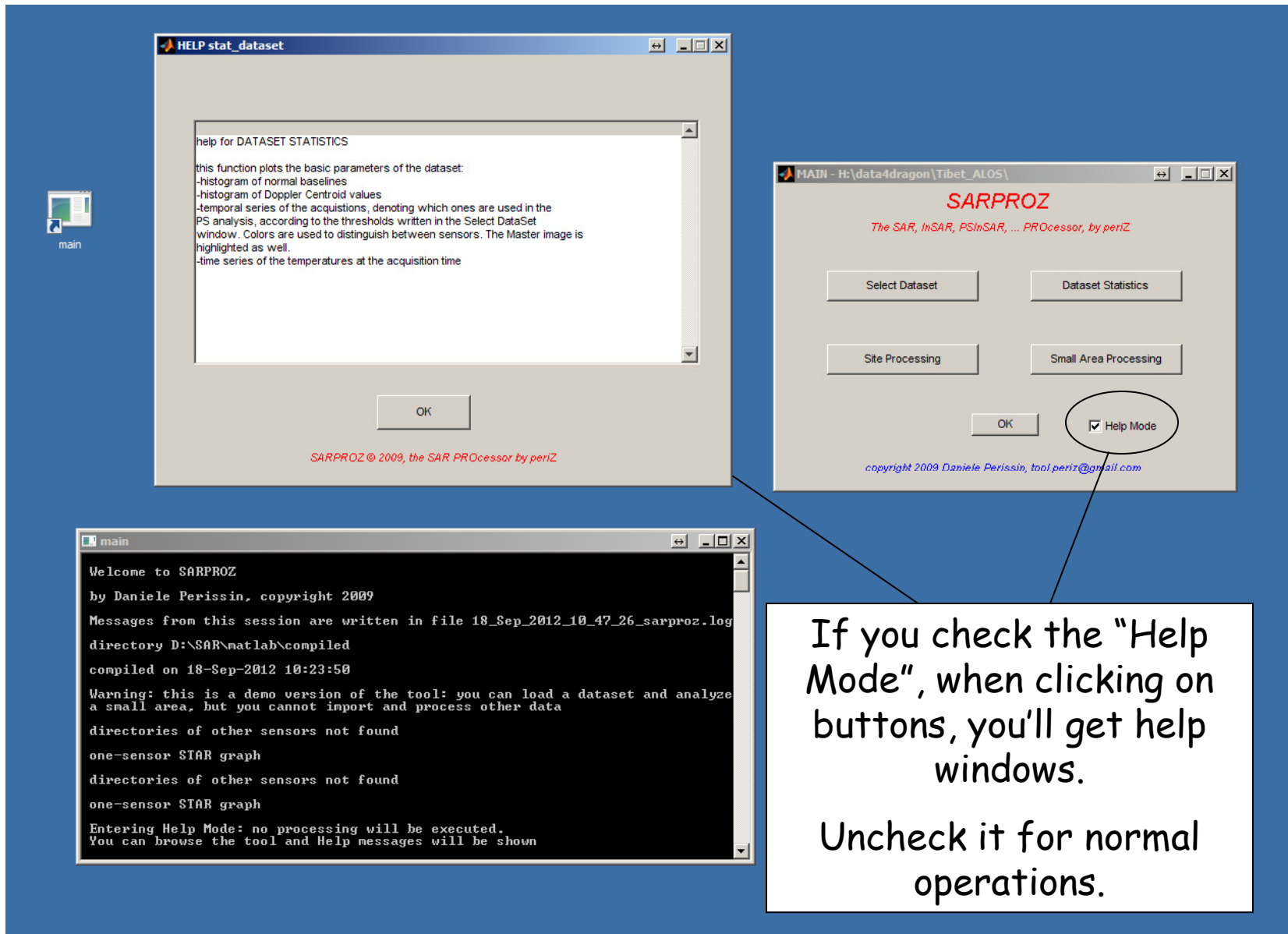
[OK] [Help Mode]

copyright 2009 Daniele Perissin, tool.periz@gmail.com

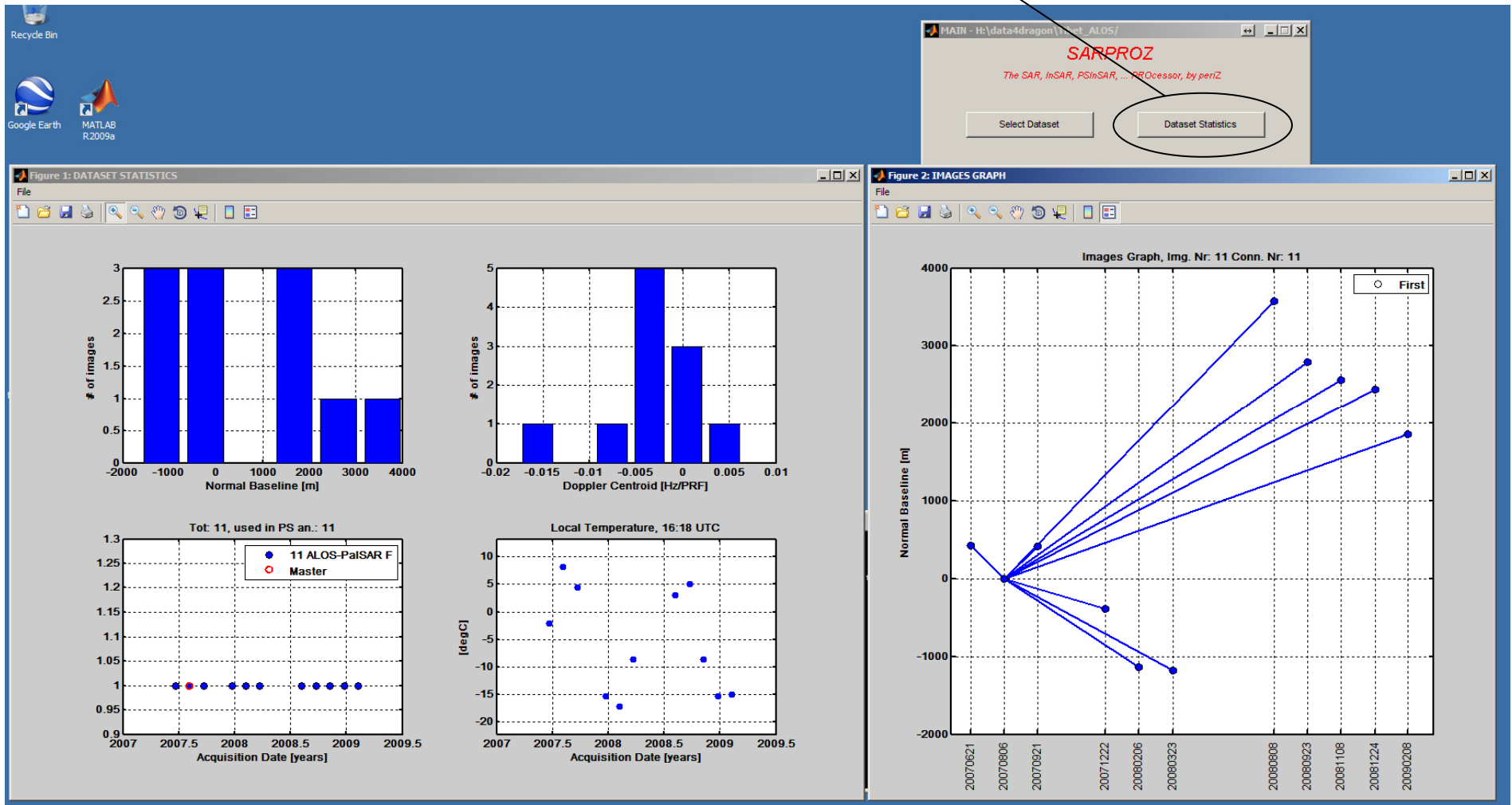
main

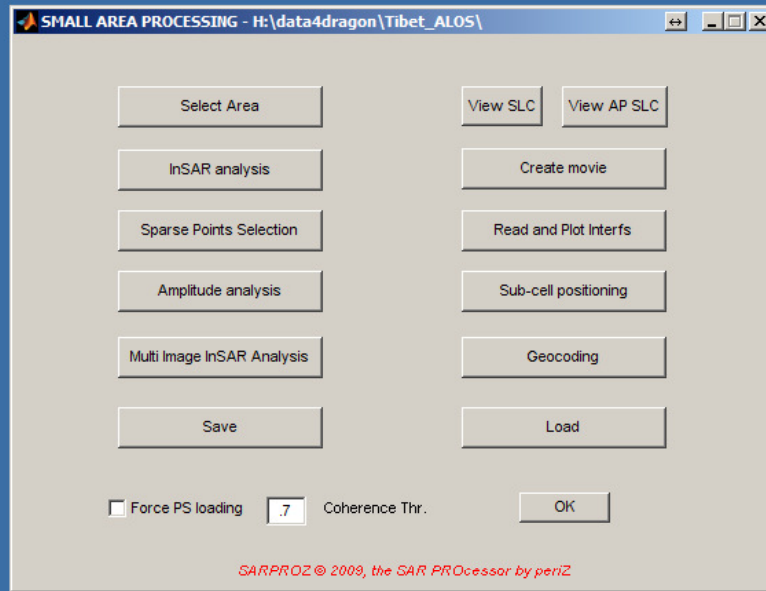
```
Welcome to SARPROZ
by Daniele Perissin, copyright 2009
Messages from this session are written in file 18_Sep_2012_10_38_19_sarproz.log
directory D:\SAR\matlab\compiled
compiled on 18-Sep-2012 10:23:50
Warning: this is a demo version of the tool: you can load a dataset and analyze
a small area, but you cannot import and process other data
directories of other sensors not found
one-sensor STAR graph
```

Set the Maximum Bn to 4500m



Press "DataSet Statistics" to visualize the main parameters

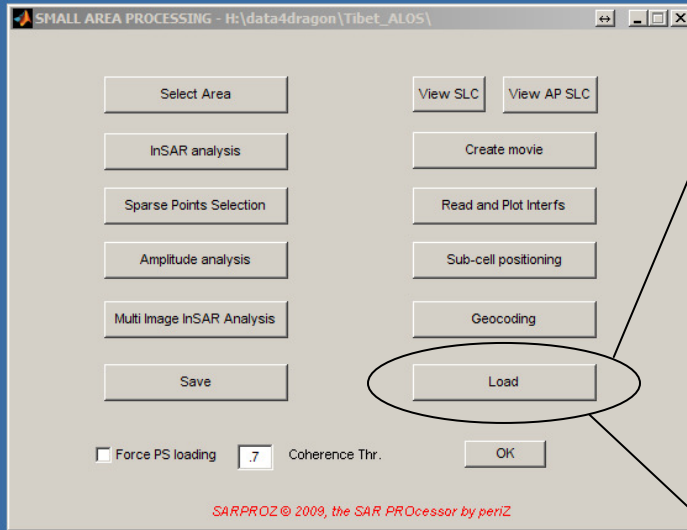




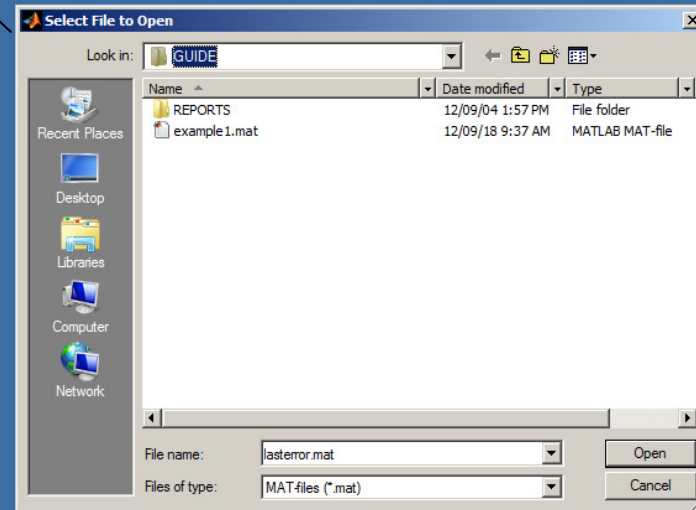
```
main
by Daniele Perissin, copyright 2009
Messages from this session are written in file 18_Sep_2012_10_47_26_sarproz.log
directory D:\SAR\matlab\compiled
compiled on 18-Sep-2012 10:23:50
Warning: this is a demo version of the tool: you can load a dataset and analyze
a small area, but you cannot import and process other data
directories of other sensors not found
one-sensor STAR graph
directories of other sensors not found
one-sensor STAR graph
Entering Help Mode: no processing will be executed.
You can browse the tool and Help messages will be shown
Exiting Help Mode
```

The Demo version works only on small areas. Press "Small Area Processing"

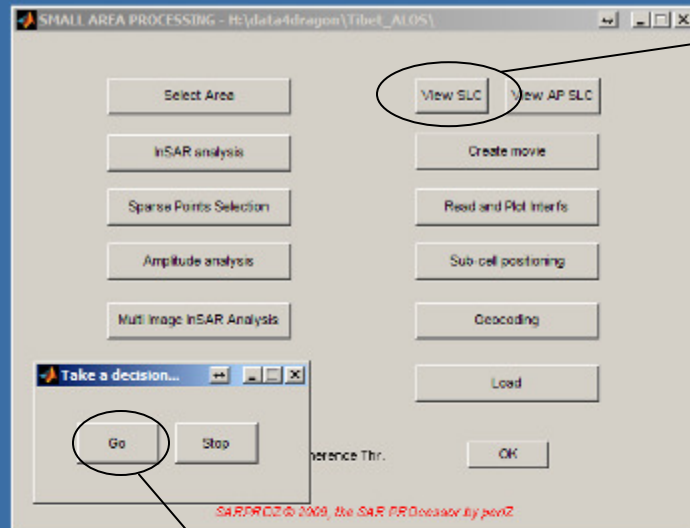
Examples have been pre-set.
Load "example1.mat"



```
main
Messages from this session are written in file 18_Sep_2012_10_47_26_sarproz.log
directory D:\SAR\matlab\compiled
compiled on 18-Sep-2012 10:23:50
Warning: this is a demo version of the tool: you can load a dataset and analyze
a small area, but you cannot import and process other data
directories of other sensors not found
one-sensor STAR graph
directories of other sensors not found
one-sensor STAR graph
Entering Help Mode: no processing will be executed.
You can browse the tool and Help messages will be shown
Exiting Help Mode
Select an area first!!
```

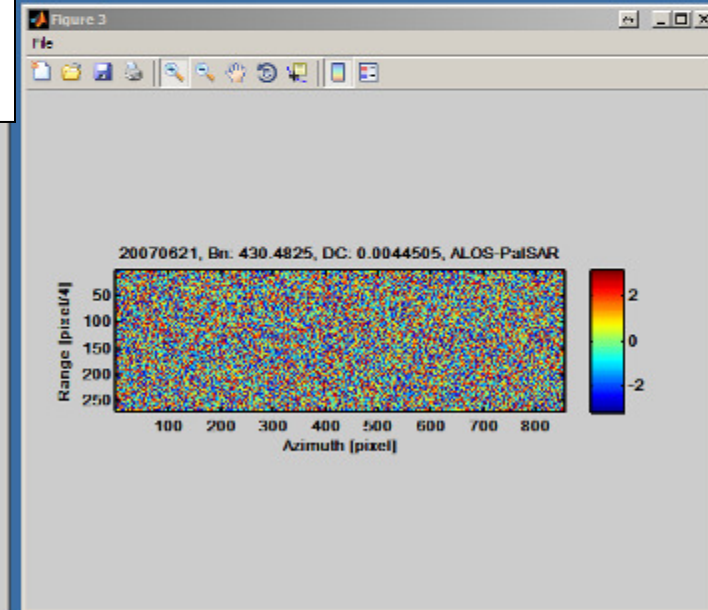


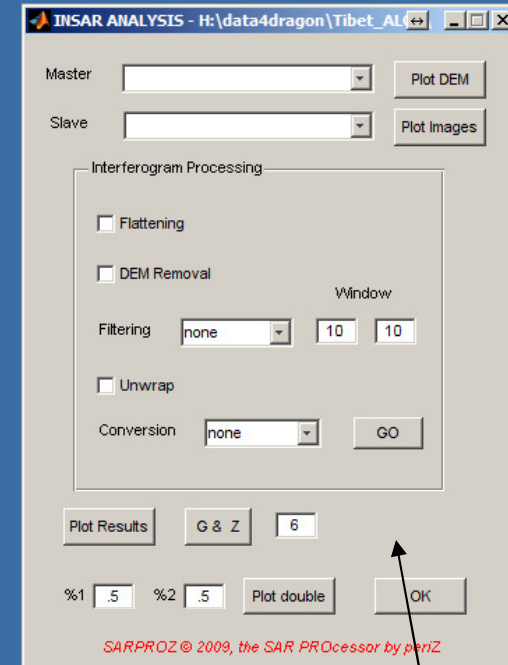
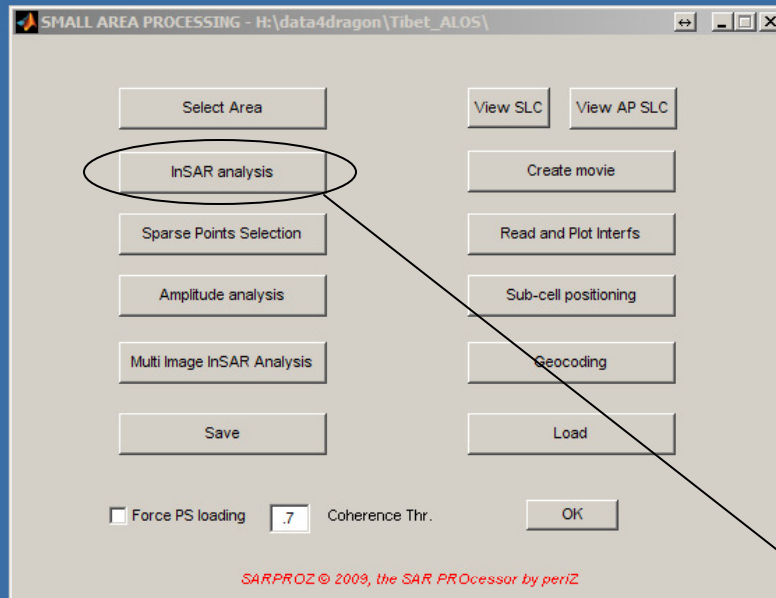
You can look at Amplitude and phase of all images through "view SLC"



Press "Go" to visualize the next image

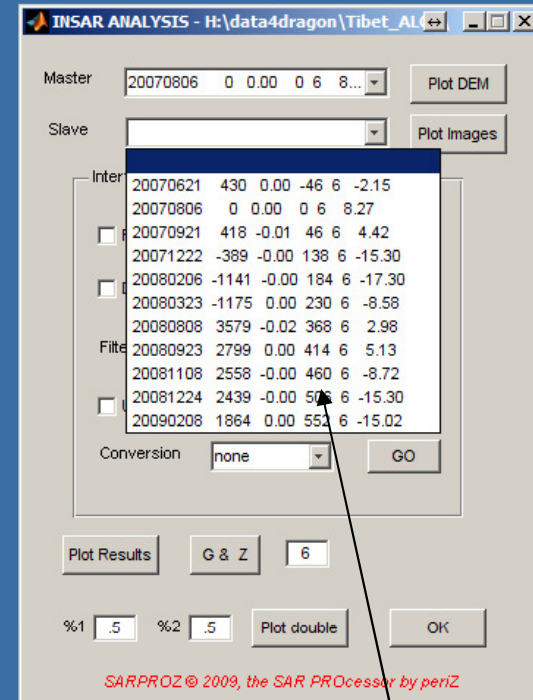
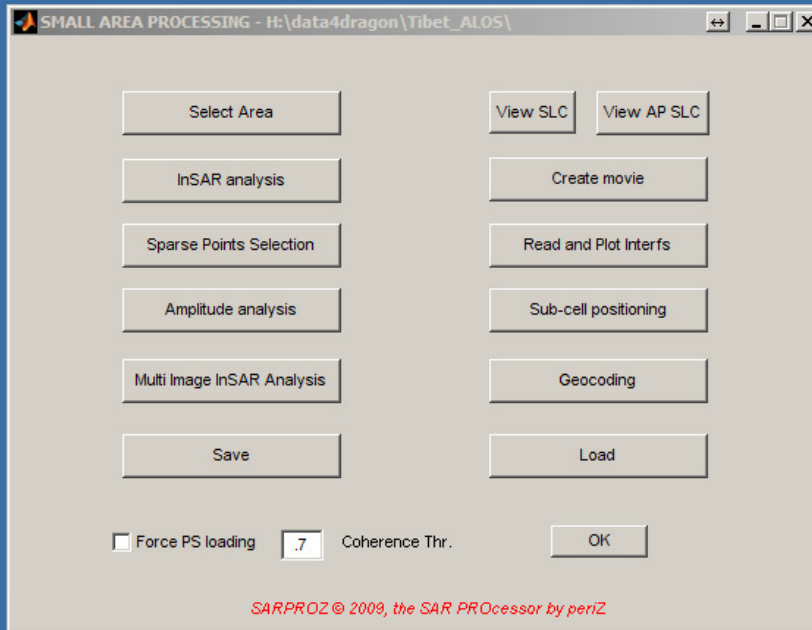
```
main
Messages from this session
directory D:\SAR\matlab\
compiled on 18-Sep-2012
Warning: this is a demo
a small area, but you ca
directories of other sen
one-sensor STAR graph
directories of other sen
one-sensor STAR graph
Entering Help Mode: no
You can browse the tool
Exiting Help Mode
Select an area first??
```



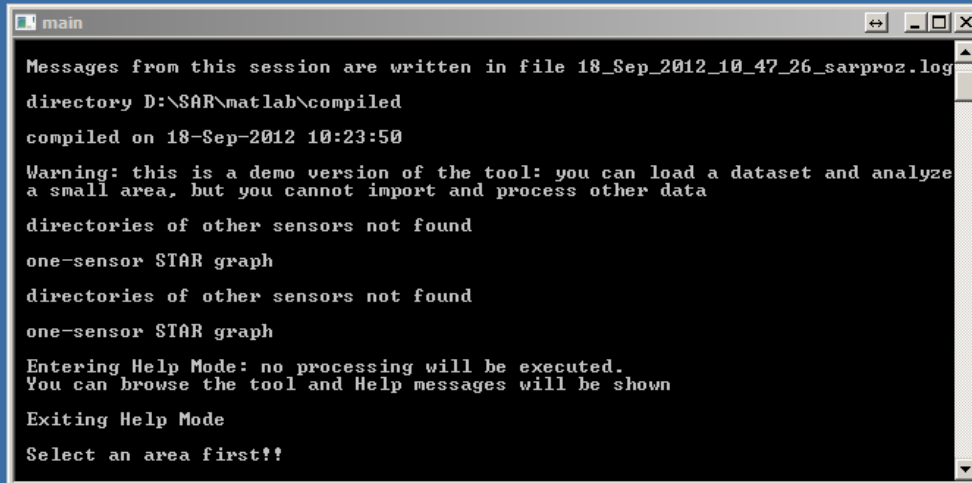


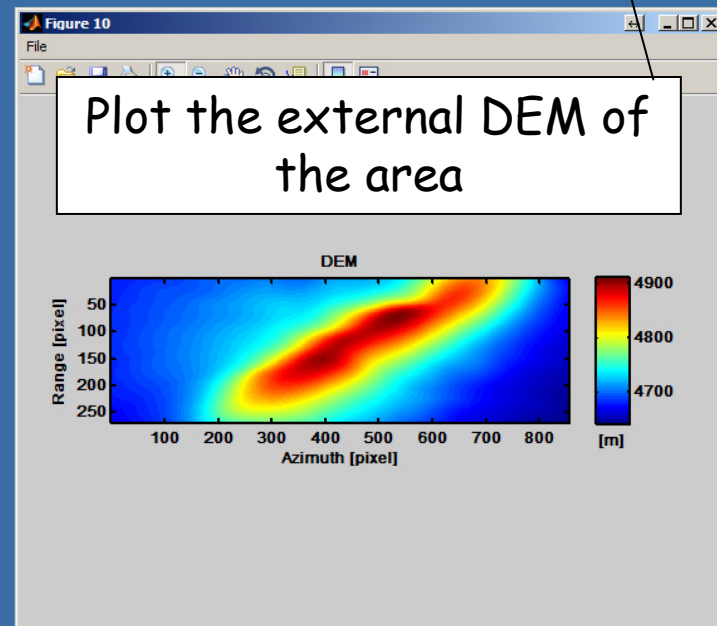
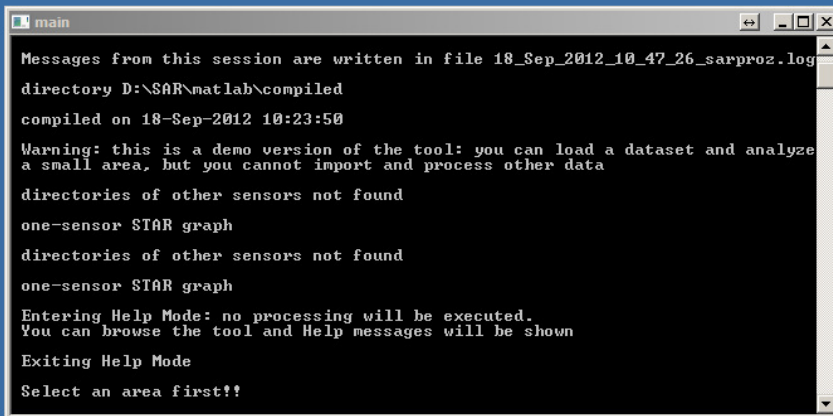
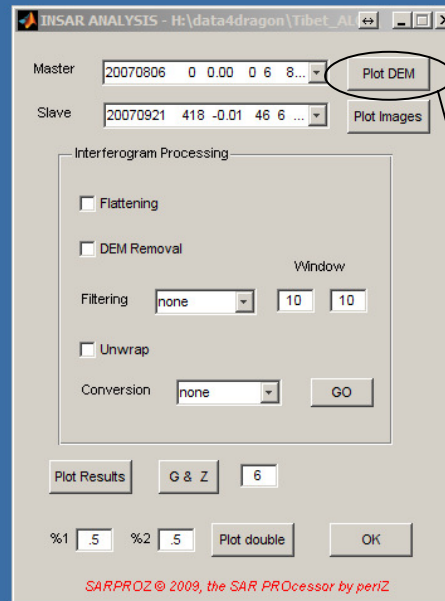
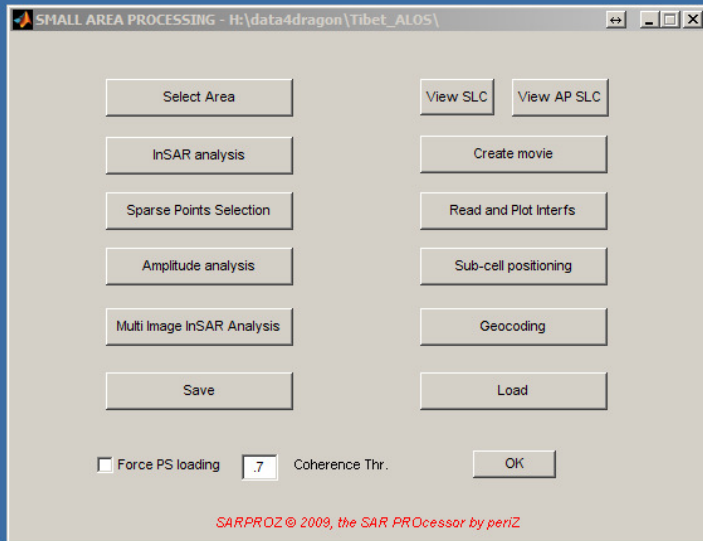
```
main
Messages from this session are written in file 18_Sep_2012_10_47_26_sarproz.log
directory D:\SAR\matlab\compiled
compiled on 18-Sep-2012 10:23:50
Warning: this is a demo version of the tool: you can load a dataset and analyze
a small area, but you cannot import and process other data
directories of other sensors not found
one-sensor STAR graph
directories of other sensors not found
one-sensor STAR graph
Entering Help Mode: no processing will be executed.
You can browse the tool and Help messages will be shown
Exiting Help Mode
Select an area first!!
```

Interferograms can be generated through the module "InSAR analysis"



Choose Master and Slave images from the list





SMALL AREA PROCESSING - It:\data\dragon\tibet_ALOS\

Plot intensity and phase of the images

INSAR ANALYSIS - It:\data\dragon\tibet_ALOS\

Master: 20070806 0 0.00 0 8 8... Plot DEM
Slave: 20070921 418 -0.01 46 6 ... Plot Images

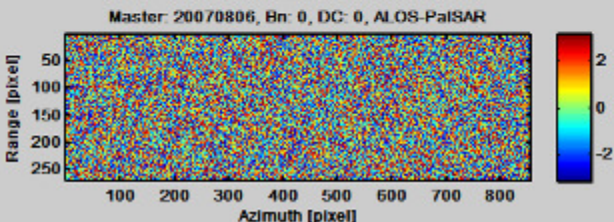
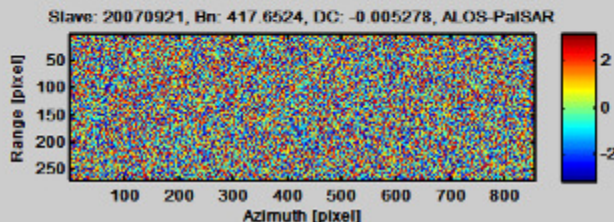


Figure 5



```
main
Messages from t
directory D:\SA
compiled on 18-
Warning: this i
a small area, b
directories of
one-sensor STAR
directories of
one-sensor STAR
Entering Help M
You can browse
Exiting Help Mo
Select an area
```

Figure 2

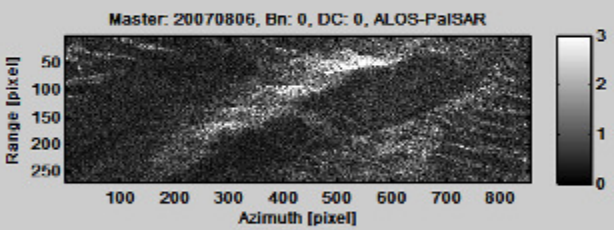
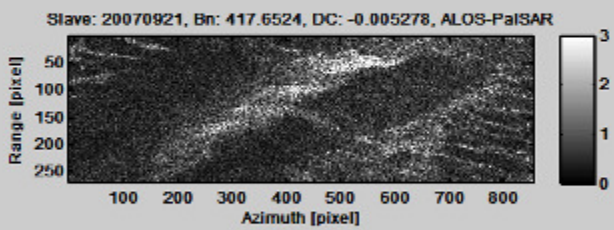


Figure 4

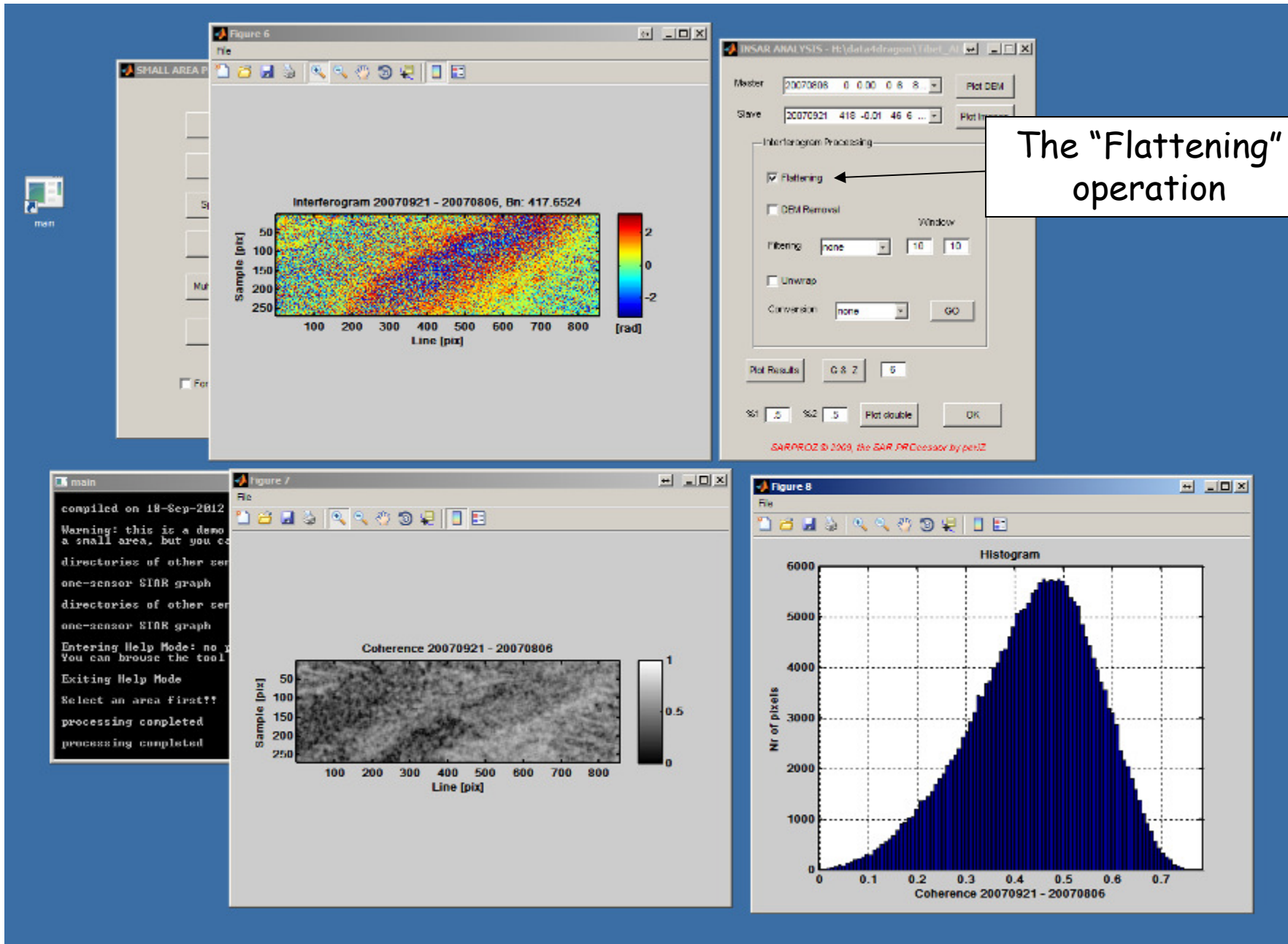


The image displays the SARPROZ software interface for SAR interferometry processing. It consists of several windows:

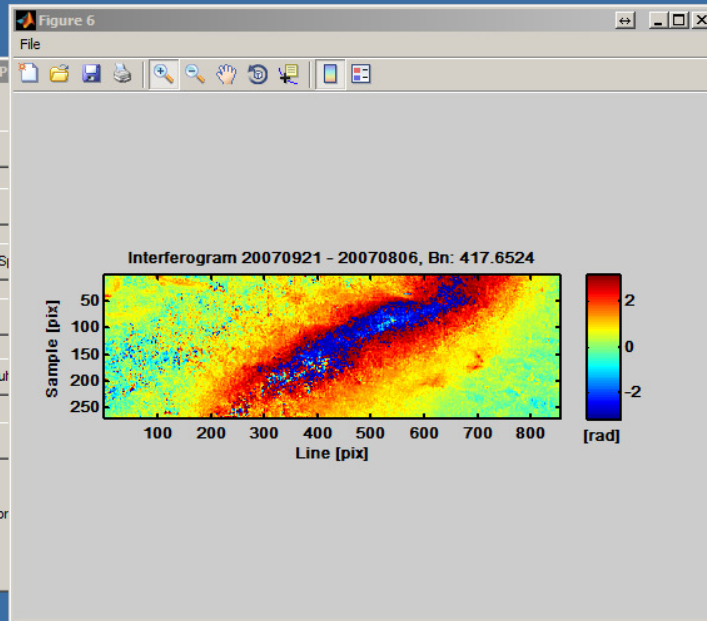
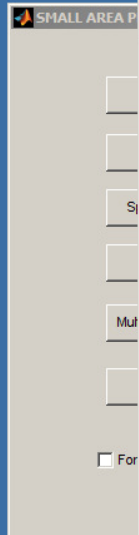
- Figure 6:** Shows an interferogram plot titled "Interferogram 20070921 - 20070806, Bn: 417.6524". The plot has axes for "Sample [pix]" (0 to 250) and "Line [pix]" (0 to 800). A color scale on the right ranges from -2 to 2 [rad].
- INSAR ANALYSIS Panel:** Contains input fields for "Master" (20070806) and "Slave" (20070921). Under "Interferogram Processing", there are checkboxes for "Flattening", "DBM Removal", and "Unwrap", and dropdown menus for "Filtering" (none) and "Conversion" (none). A "GO" button is circled in red. Below are "Plot Results", "G.S.Z", and "Plot double" buttons.
- Figure 8:** Shows a histogram titled "Histogram" of coherence. The x-axis is "Coherence 20070921 - 20070806" (0 to 0.7) and the y-axis is "Nr of pixels" (0 to 6000). The histogram shows a bell-shaped distribution centered around 0.5.
- Terminal Window:** Shows command-line output including "Warning: this is a demo a small area, but you can use the same directories of other one-sensor STAR graph" and "processing completed".

Two callout boxes provide instructions:

- 1) Choose the processing options and press "Go"** (pointing to the GO button).
- 2) Press "Plot Results" to check the output** (pointing to the Plot Results button).



The "Flattening" operation



INSAR ANALYSIS - H:\data4dragon\Tibet_AU

Master: 20070806 0 0.00 0 6 8... Plot DEM

Slave: 20070921 418 -0.01 46 6 ... Plot Images

Interferogram Processing

Flattening

DEM Removal

Filtering: GoldStein Window: 10 10

Unwrap

Conversion: none GO

Plot Results G & Z 6

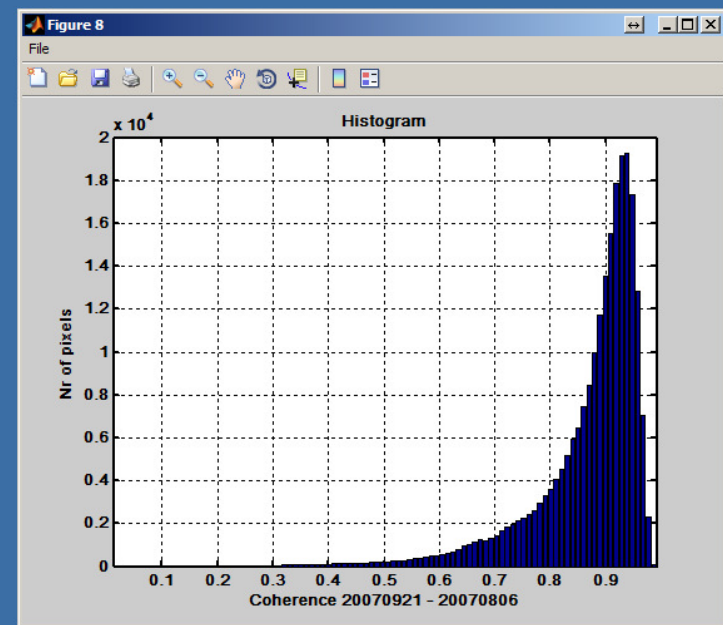
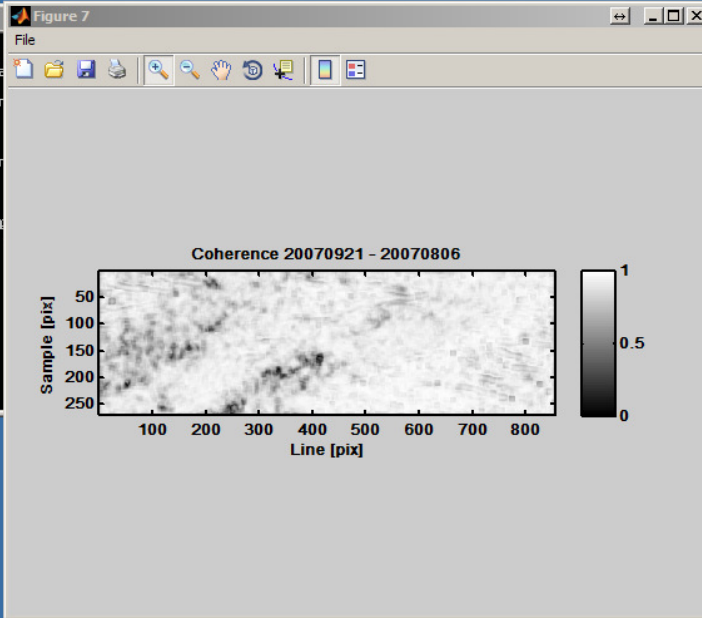
%1 .5 %2 .5 Plot double OK

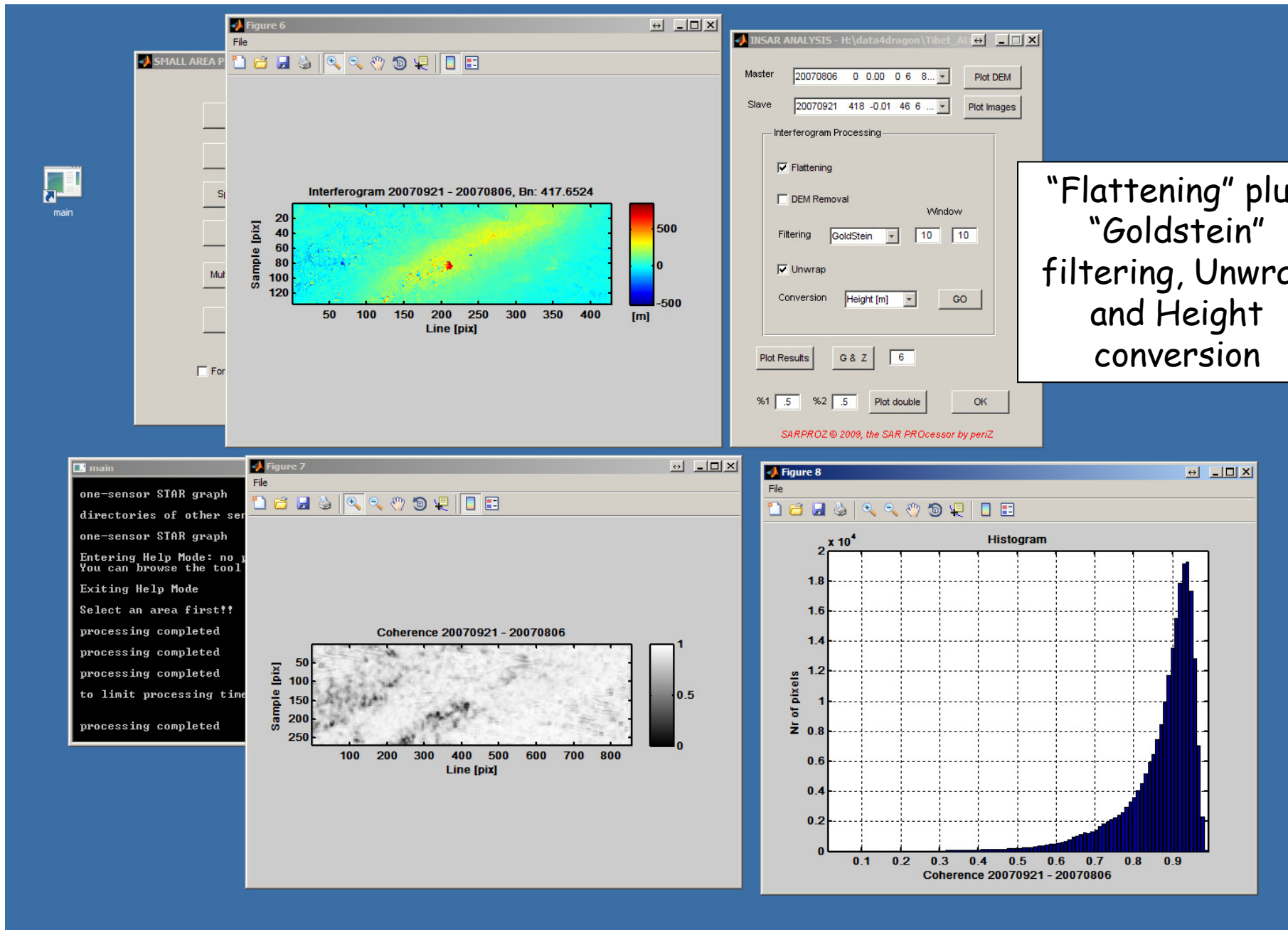
SARPROZ © 2009, the SAR PROCessor by penZ

"Flattening" plus "Goldstein" filtering

```

main
Warning: this is a demo
a small area, but you ca
directories of other ser
one-sensor STAR graph
directories of other ser
one-sensor STAR graph
Entering Help Mode: no p
You can browse the tool
Exiting Help Mode
Select an area first!!
processing completed
processing completed
processing completed
  
```

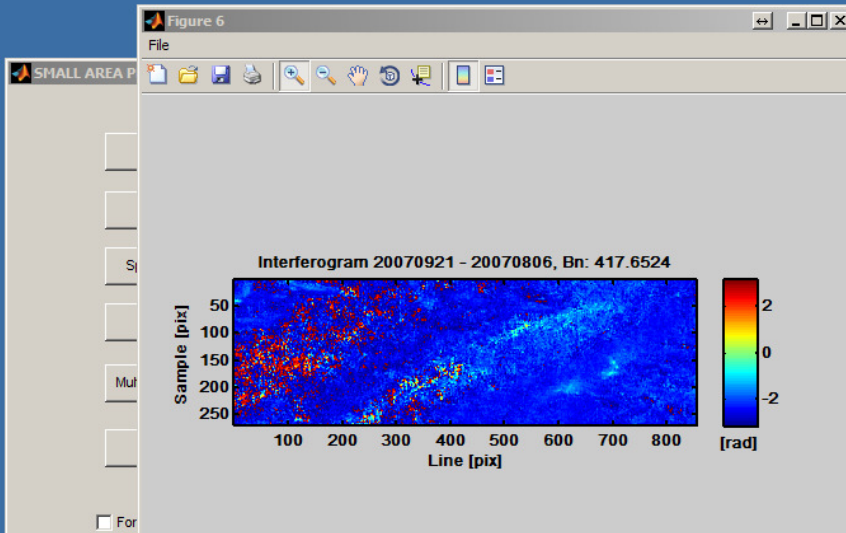




"Flattening" plus "Goldstein" filtering, Unwrap and Height conversion

```

main
one-sensor STAR graph
directories of other sen
one-sensor STAR graph
Entering Help Mode: no
You can browse the tool
Exiting Help Mode
Select an area first!!
processing completed
processing completed
processing completed
to limit processing time
processing completed
  
```



INSAR ANALYSIS - H:\data4dragon\Tibet_Alt

Master: 20070806 0 0.00 0 6 8... Plot DEM

Slave: 20070921 418 -0.01 46 6 ... Plot Images

Interferogram Processing

Flattening

DEM Removal

Filtering: GoldStein 10 10 Window

Unwrap

Conversion: none GO

Plot Results G & Z 6

%1 .5 %2 .5 Plot double OK

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Residuals after
"Flattening" and
"DEM Removal"

What is the residual signal in this interferogram??

```

directories of other ser
one-sensor STAR graph
Entering Help Mode: no p
You can browse the tool
Exiting Help Mode
Select an area first!!
processing completed
processing completed
processing completed
to limit processing time
processing completed
processing completed

```

