

# Earthquake in Van area – TURKEY

## Preliminary analysis with COSMO-SkyMed images

### e-GEOS

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# Van city area



On October 23rd, 2011 a violent earthquake hit a large region in the eastern Anatolian peninsula, causing serious damage and victims in the cities and villages.

## Autoactivation of e-GEOS Emergency Team

- e-GEOS started acquiring COSMO-SkyMed Stripmap mode images over the city of Van according to the existing interferometric stack of images over the region.
- Thanks to COSMO-SkyMed's frequent revisit and to the background mission, a dataset of pre seismic images was available and an image was acquired just **4 hours after the event**.
- Preliminary analysis of ground movements and deformations was derived from the analysis of co-seismic (pre & post) interferometric coherence

# Van city area



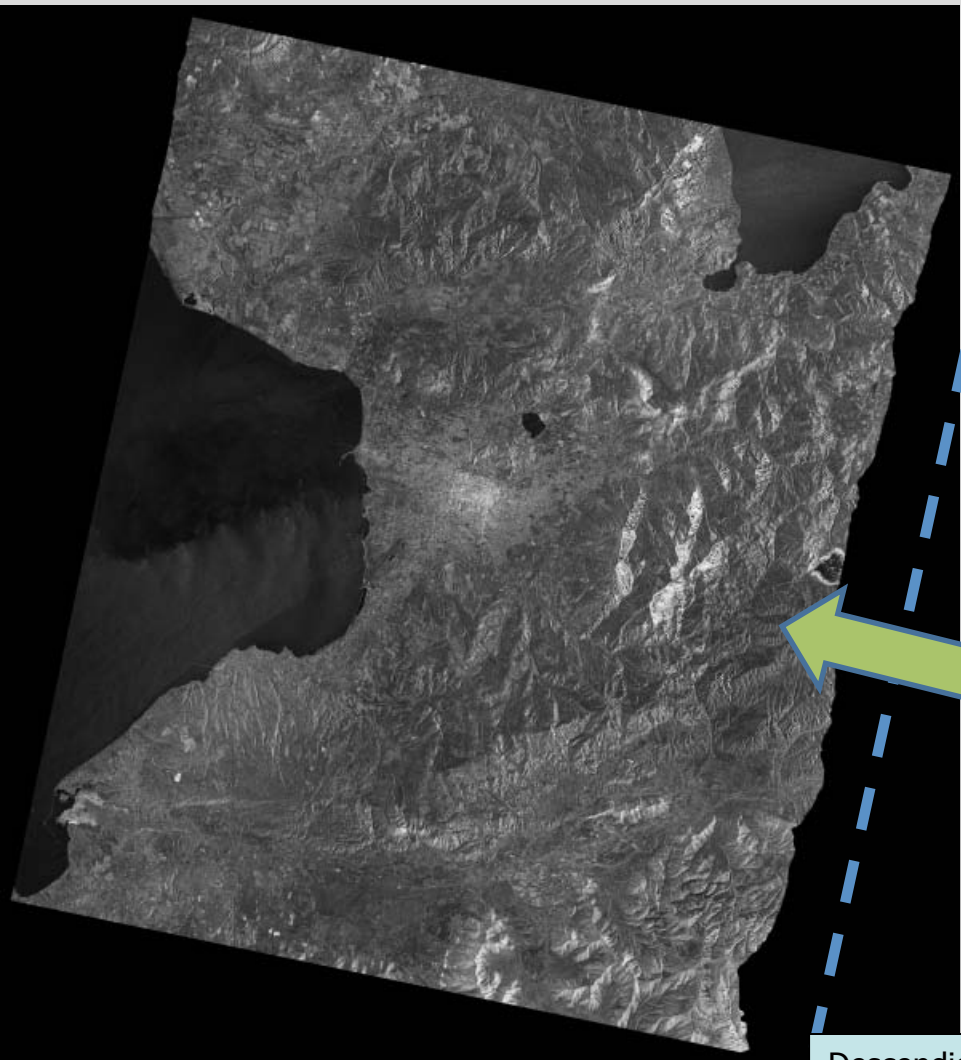
- Preliminary analysis gives a general overview of the affected area
- Ground deformation and movement is identifiable
- Damage to main infrastructure have been highlighted
- Updates and more detailed analysis are possible integrating more data



# Area of interest



# COSMO – SkyMed VHR Dataset



- Cosmo-SkyMed
- Stripmap mode
- Incidence angle 27.65°
- Descending orbit
- Right looking
- Polarization: HH
- Resolution: 3 meters
- Acquisition dates:
  - 28/09/2011 15:13 UTC (Pre – seismic)
  - 10/10/2011 15:12 (Pre – seismic)
  - Earthquake (23/10/2011 10:41 UTC)
  - 23/10/2011 15:12 UTC (Post – seismic)

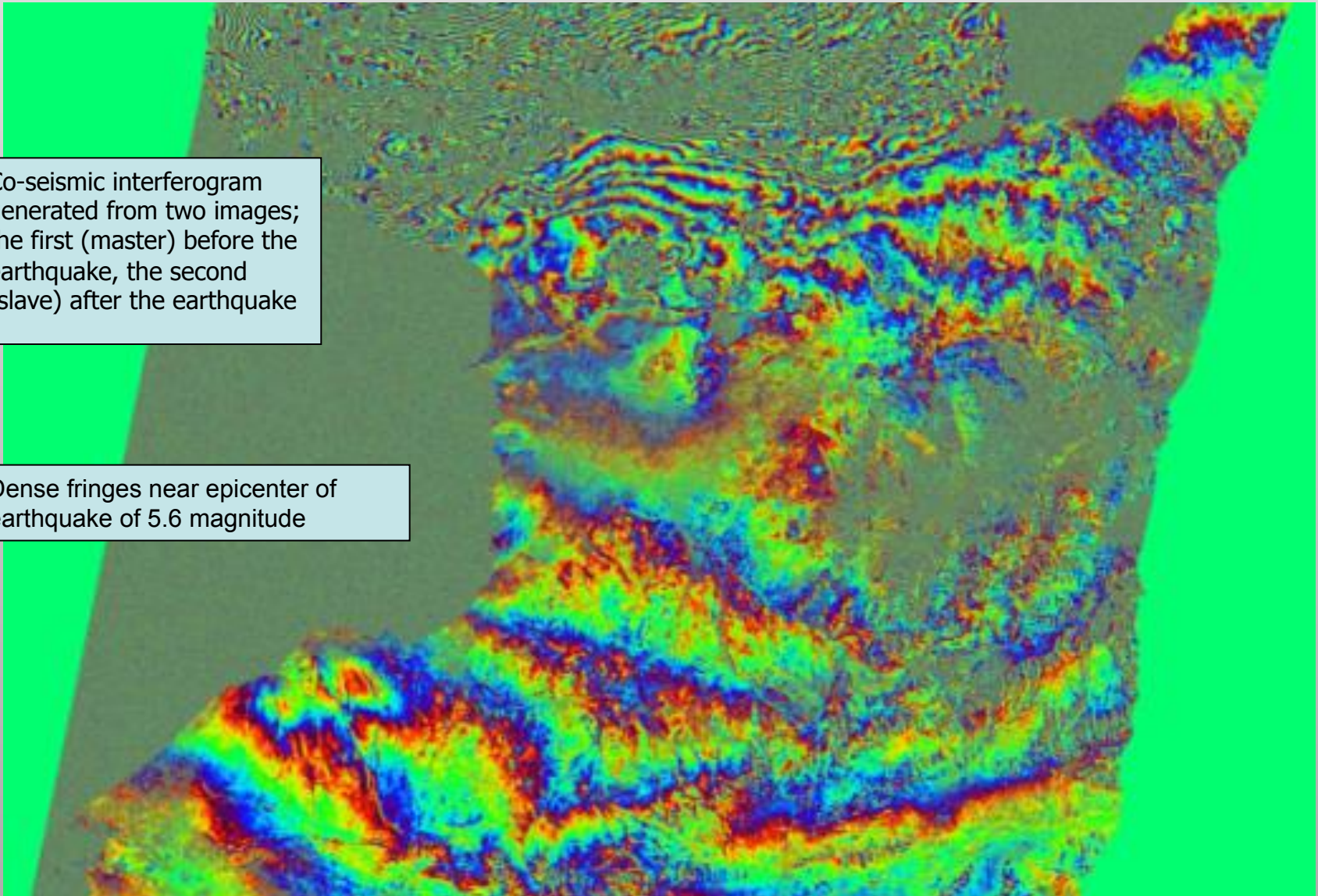
Descendig orbit  
Right looking



# Co-seismic interferogram (10/10 – 23/10 2011)

Co-seismic interferogram generated from two images; the first (master) before the earthquake, the second (slave) after the earthquake

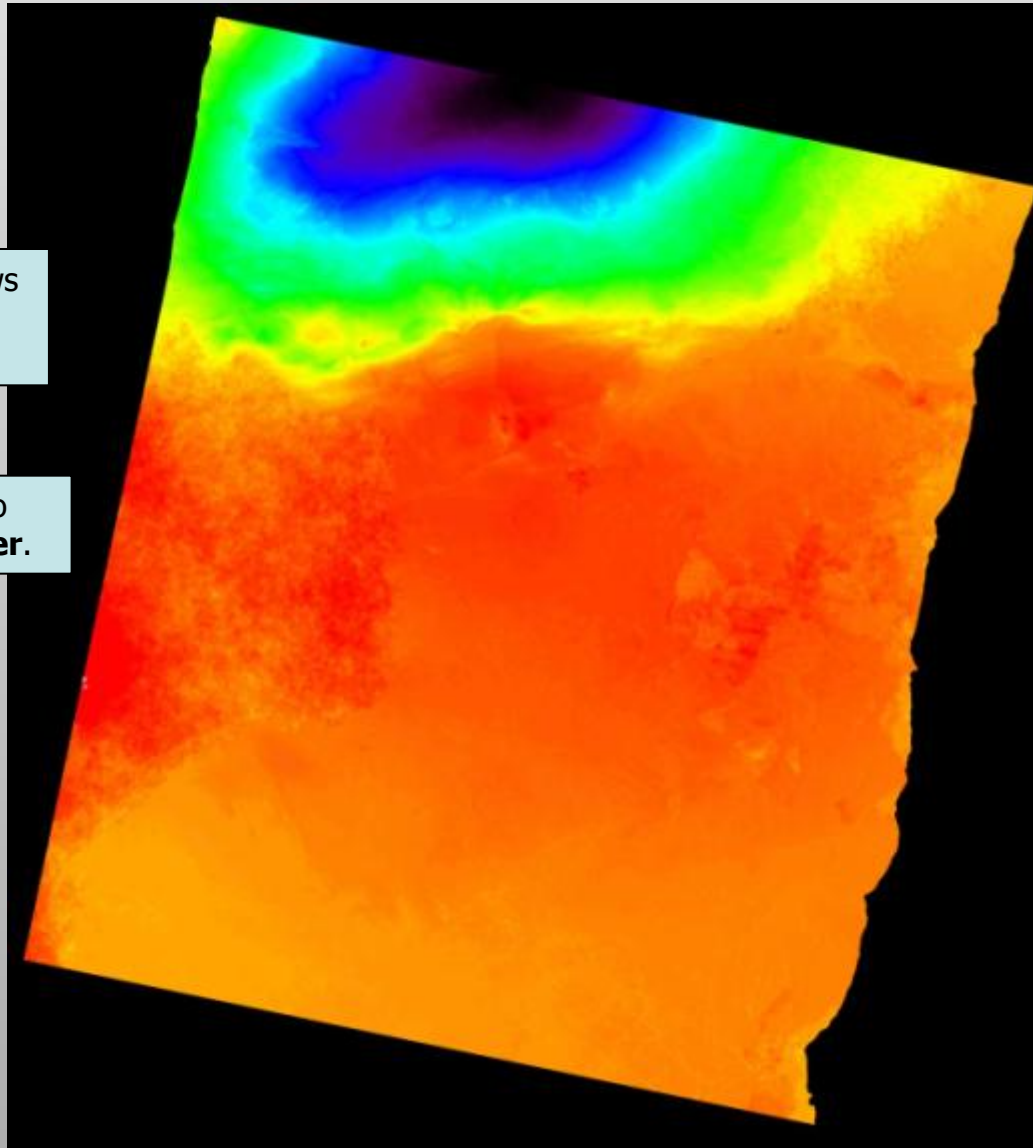
Dense fringes near epicenter of earthquake of 5.6 magnitude



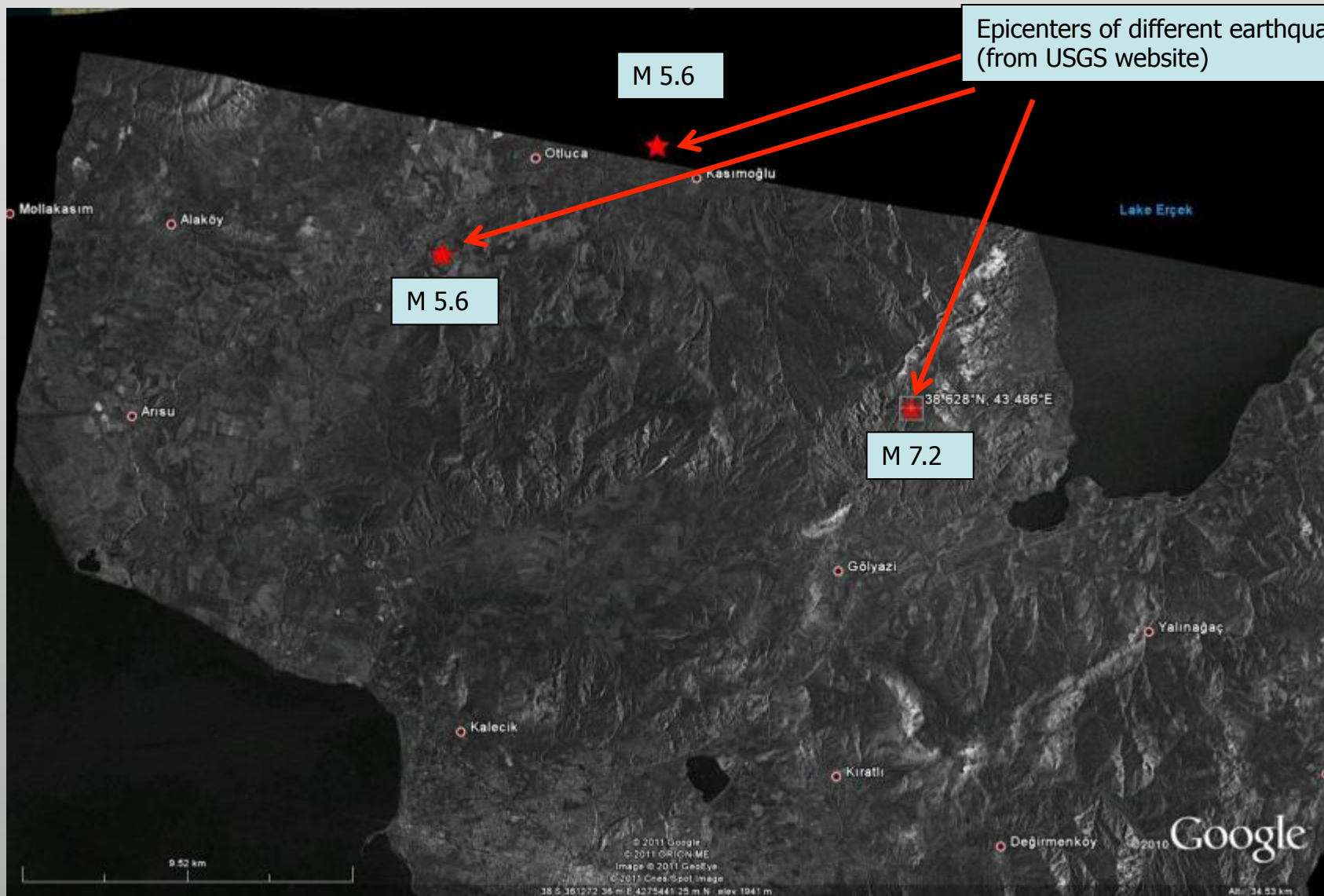
# Co-seismic interferogram (10/10 – 23/10 2011)

Unwrapped phase shows displacements of the terrain.

The range from black to orange is about **1 meter**.



# COSMO-SkyMed Amplitude image (28/09/2011)





# Area most affected by earthquake movement

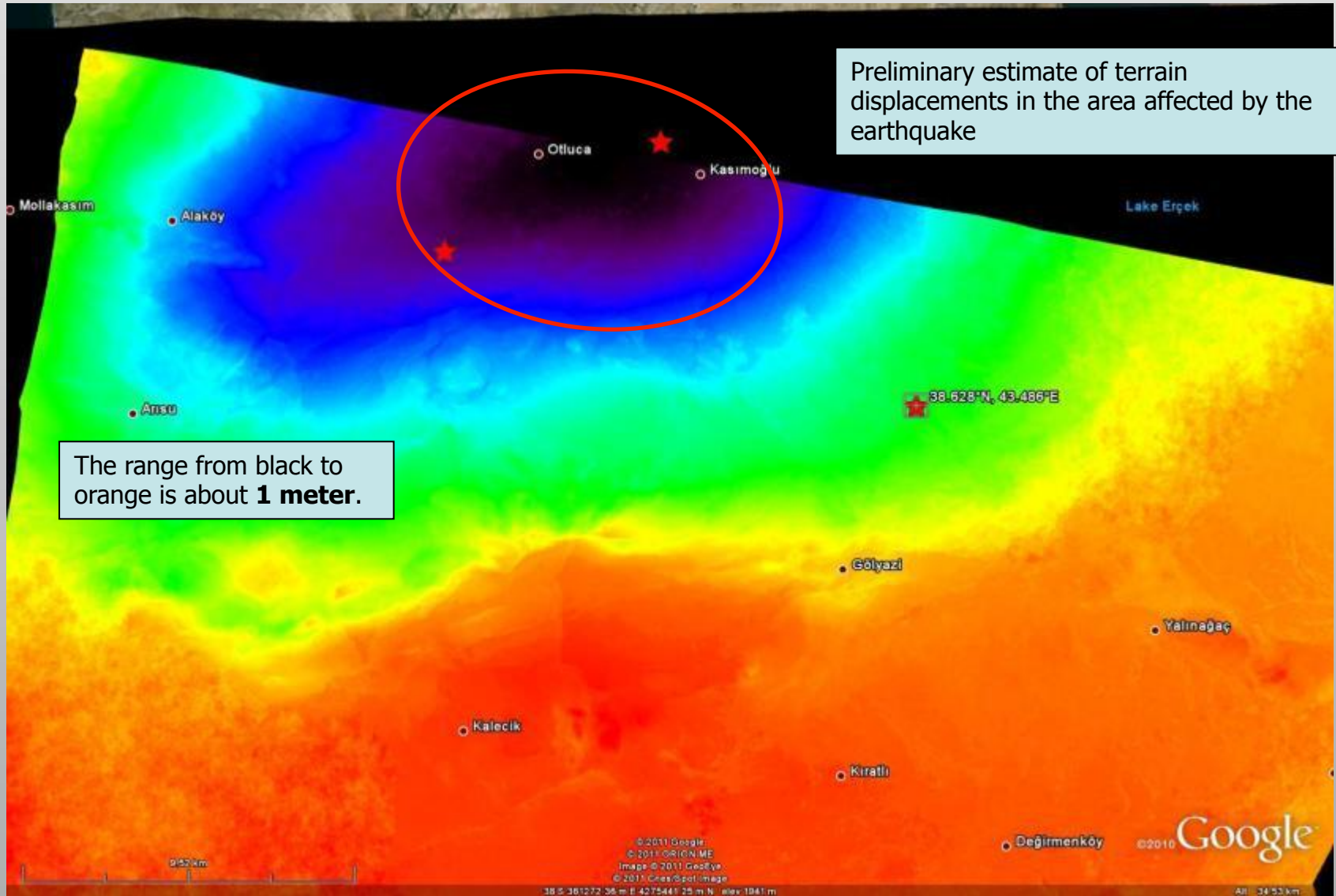








# Co-seismic unwrapped phase (10/10-23/10 2011)





# Area most affected by earthquake (steep fringes)





# Change Detection: 10 - 23/10/2011

COSMO-SkyMed HIMAGE ifsar pair:

October 10th

October 23rd



Example of changes along the road/railway nearby Ercek Golu, possibly indicating damages. Red and cyan targets indicate changes occurred during the time interval between acquisitions.



# Change Detection: 10 - 23/10/2011



False colour composite made up of two COSMO-SkyMed Stripmap images (the oldest in red and the most recent in cyan) of a detail of the city of Van. White targets indicates structures present in both images, while red and cyan targets indicate changes during the time interval between acquisitions.



# Change Detection: 10 - 23/10/2011

COSMO-SkyMed HIMAGE ifsar pair:

October 10th

October 23rd

Possible damaged structures



Possible damaged buildings

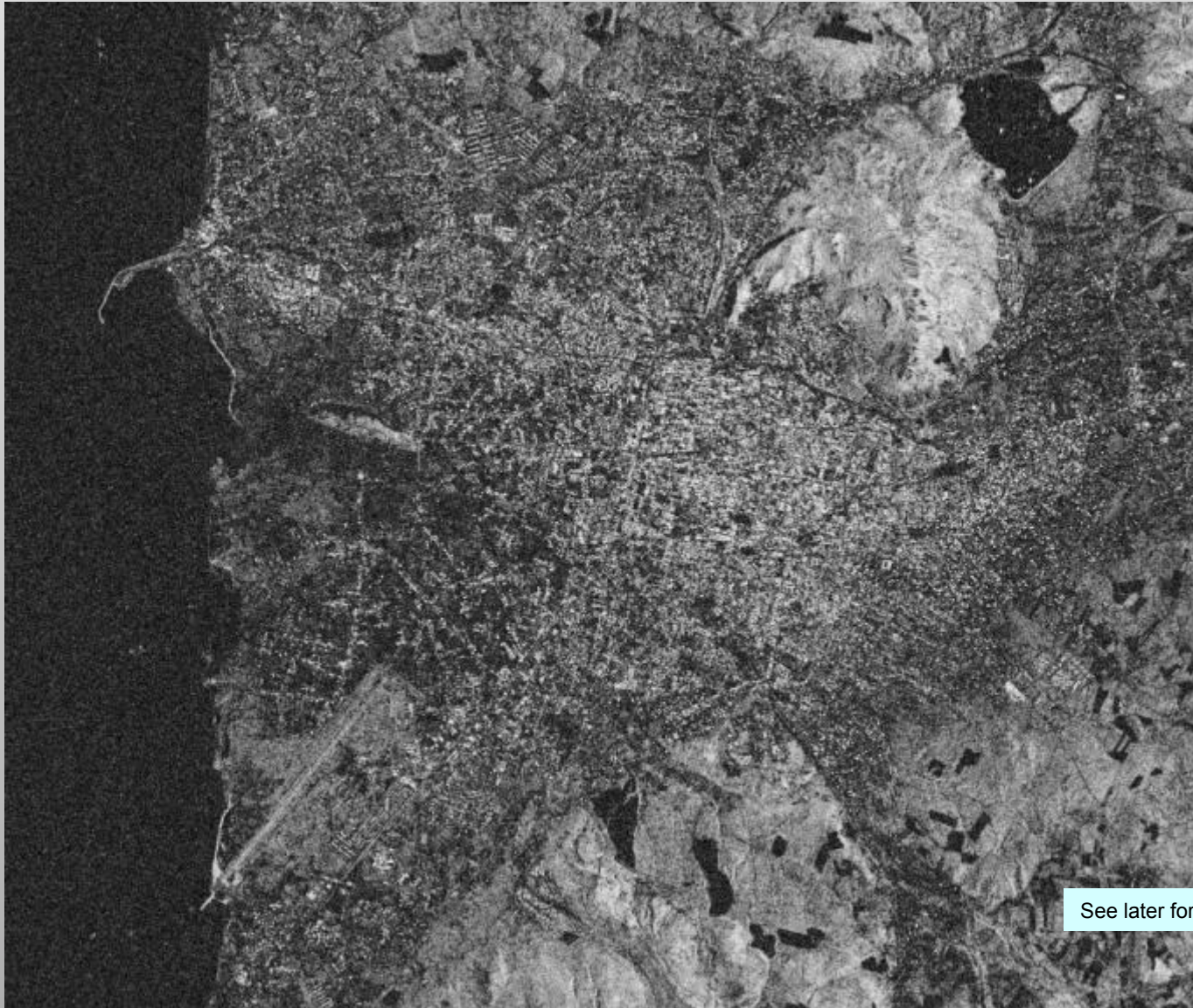


Possible debris on the road





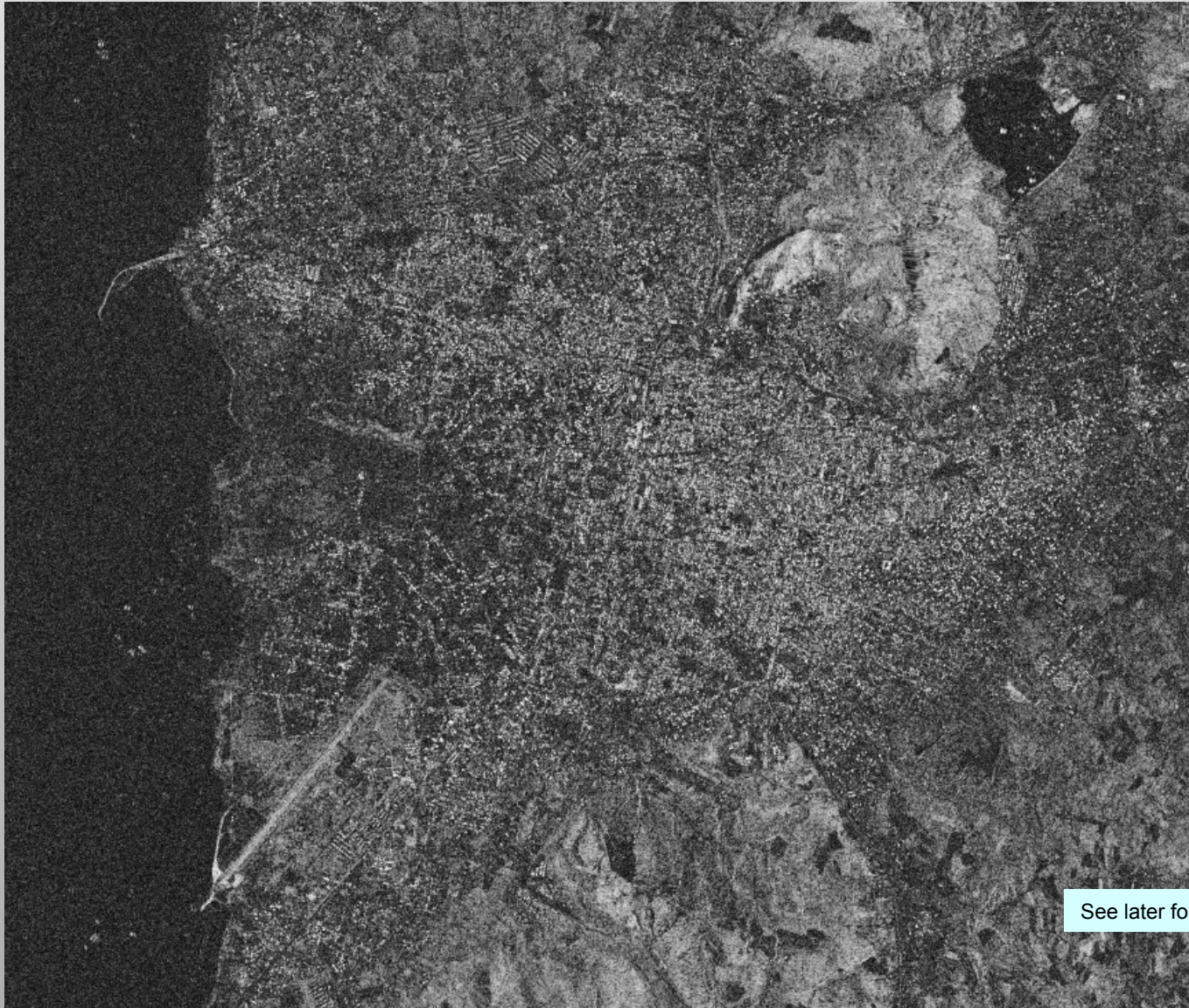
# Pre-Seismic Coherence: 09/28/2011 – 10/10/2011



See later for interpretation

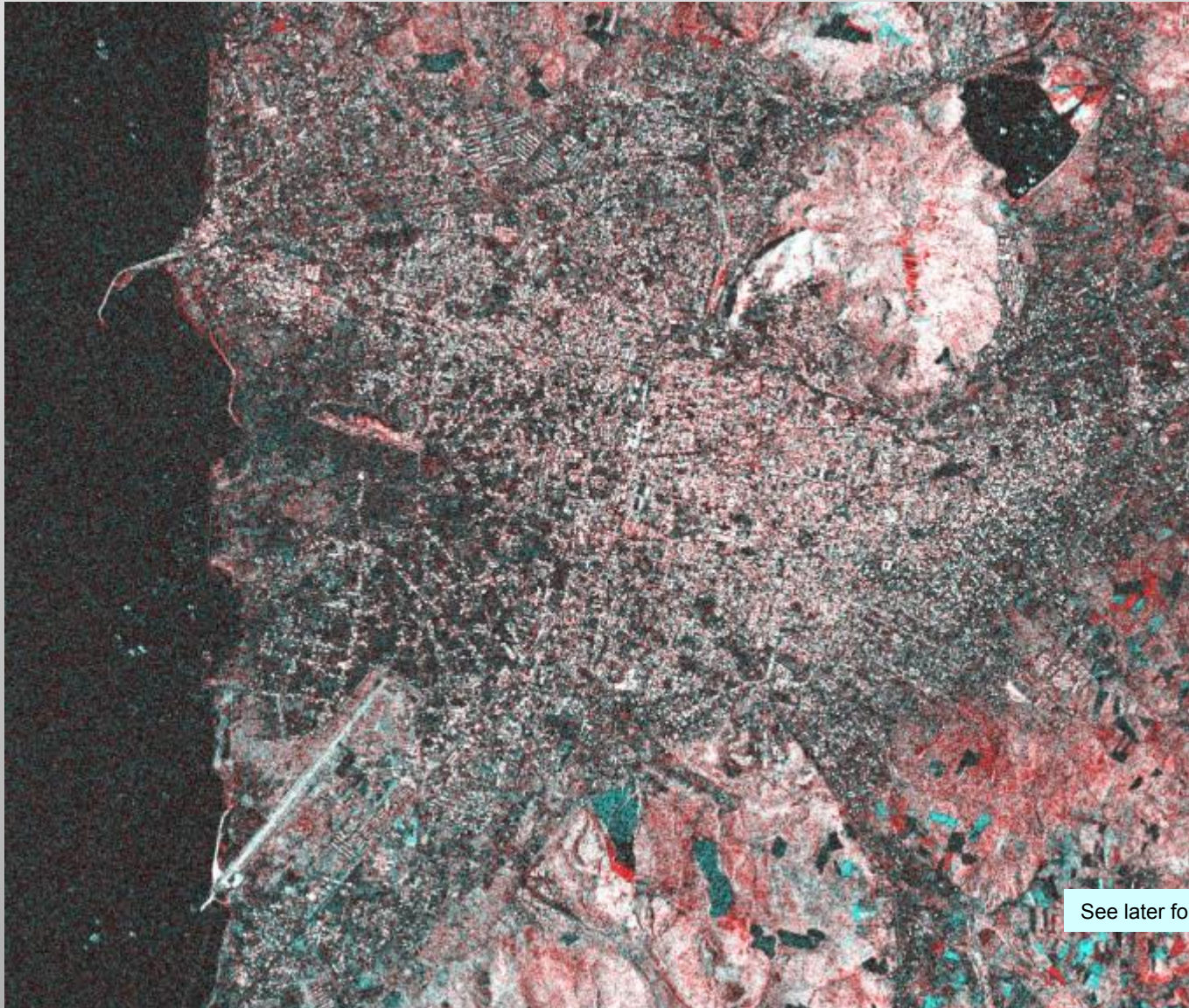


# Co-Seismic Coherence: 10/10/2011 – 23/10/2011





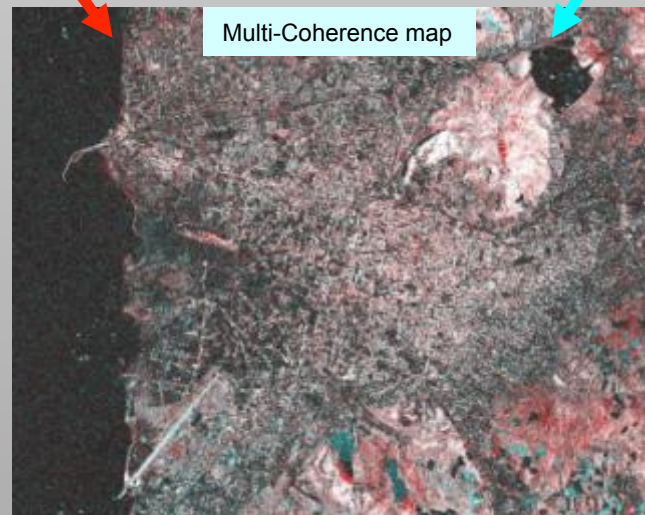
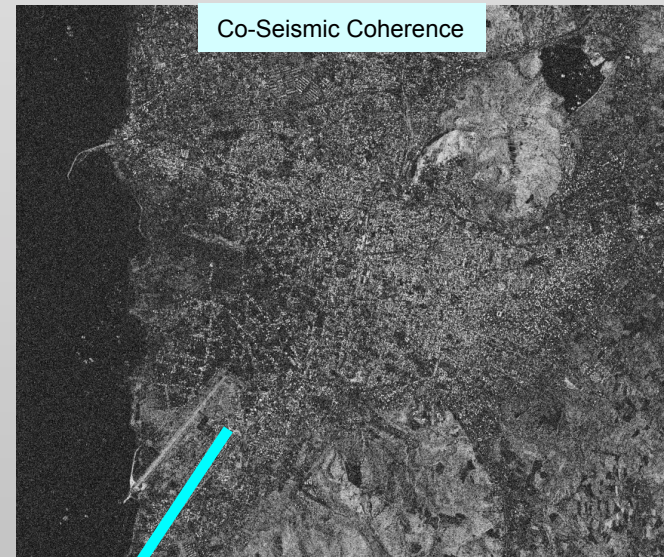
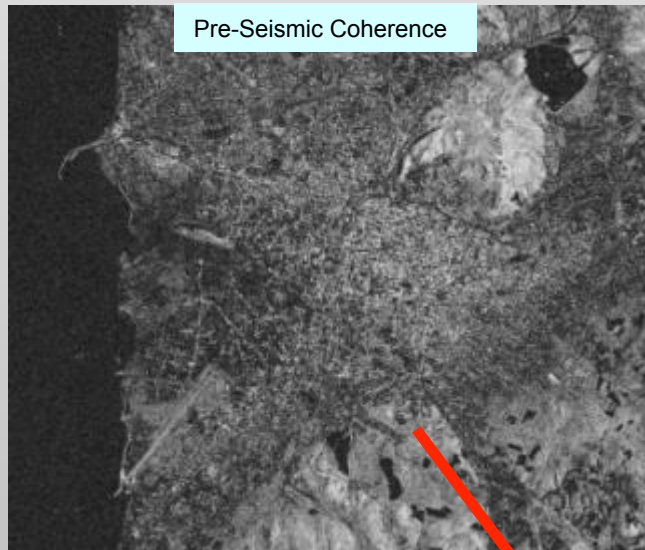
# Multi-Coherence



See later for interpretation



# Multi-Coherence: Interpretation



There is a general decrease of the coherence value in the co-seismic map that might be interpreted as an effect of the earthquake.