

Analisi satellitare del campo di deformazione indotto dalla sequenza sismica in Turchia e Siria del 6 febbraio 2023

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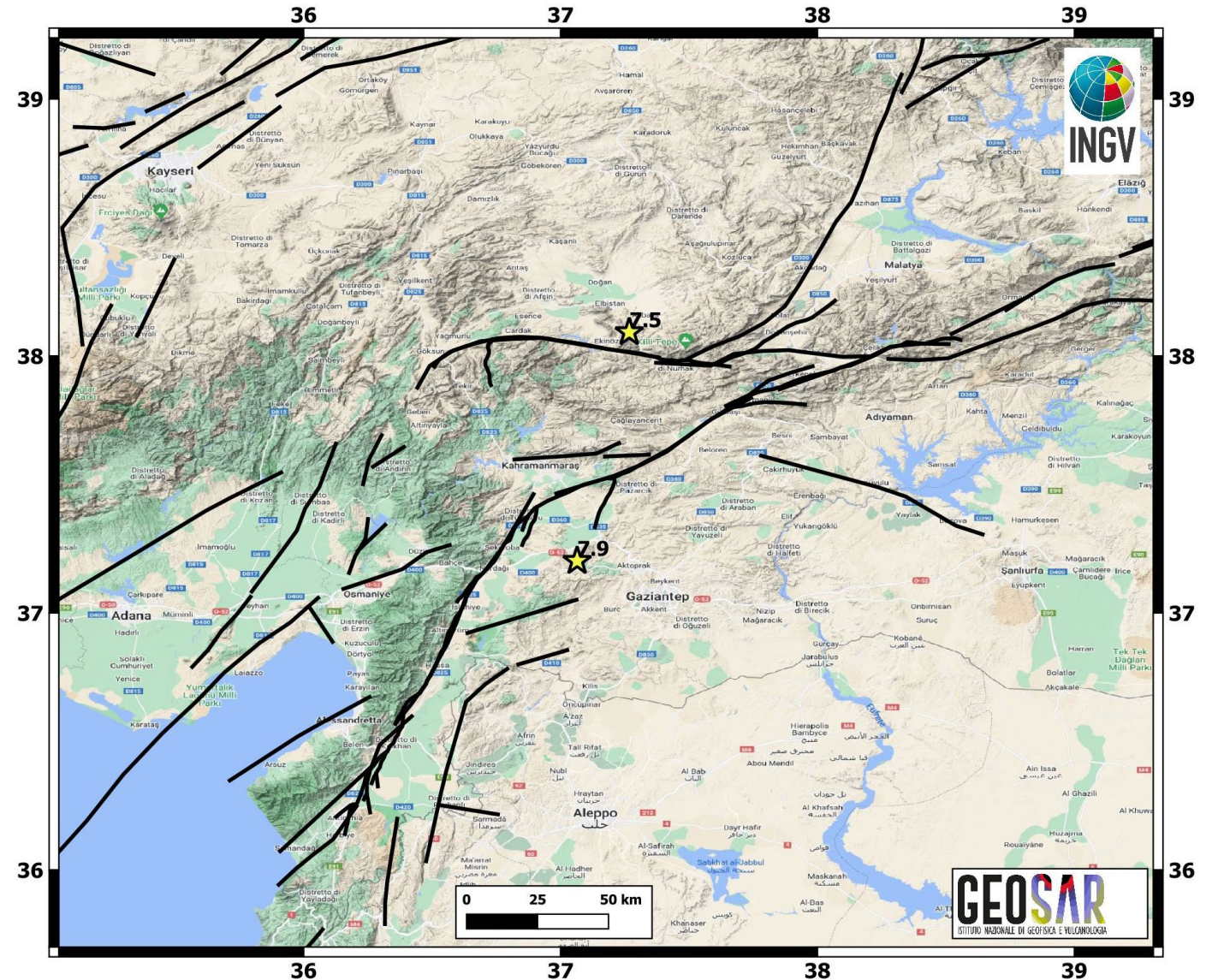
ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA 

- SCIENTIFIC RATIONALE

- The February 6 2023 Mw 7.8 and Mw 7.6 events
- The EAF: geodynamics and seismicity
- SAR satellite data available: S1, ALOS2, SAOCOM, ...
- Coseismic analysis from InSAR and pixel offset tracking techniques
- Conclusions

• The February 6 Mw 7.8 and Mw 7.6

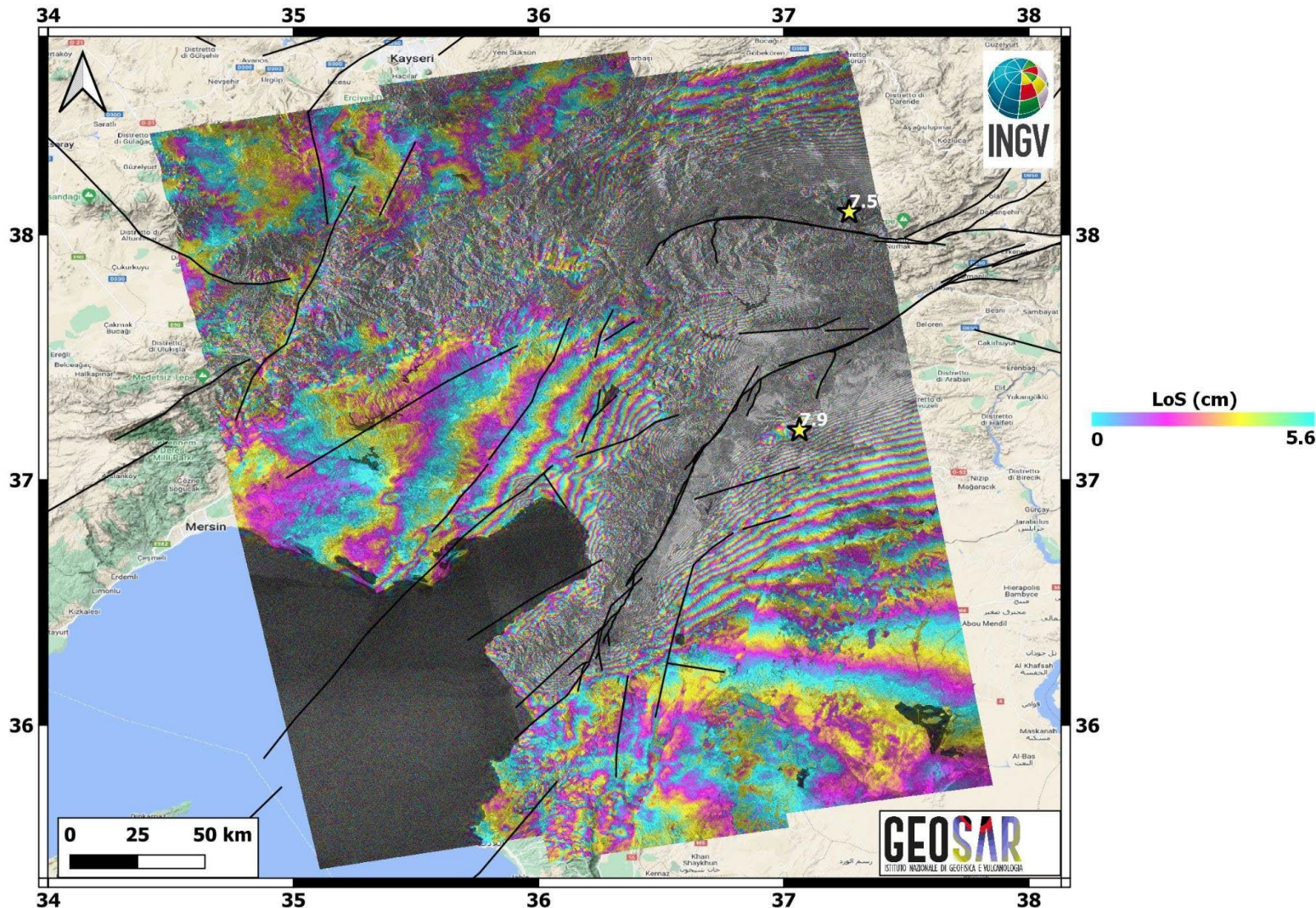
- The February 6th, 2023 at 01:17:35 UTC, Mw 7.8 earthquake, occurred about 15 km southeast of the mapped trace of the East Anatolian Fault Zone (EAFZ)
- About 9 hours later, at 10:24:49 UTC, a Mw 7.6 earthquake occurred along a separate structure to the north.
- The EAF is a major tectonic structure in the eastern Mediterranean, between the Arabian and Anatolian tectonic plates along a boundary of about 600 km.



- Used SAR satellite data : S1, ALOS-2, SAOCOM

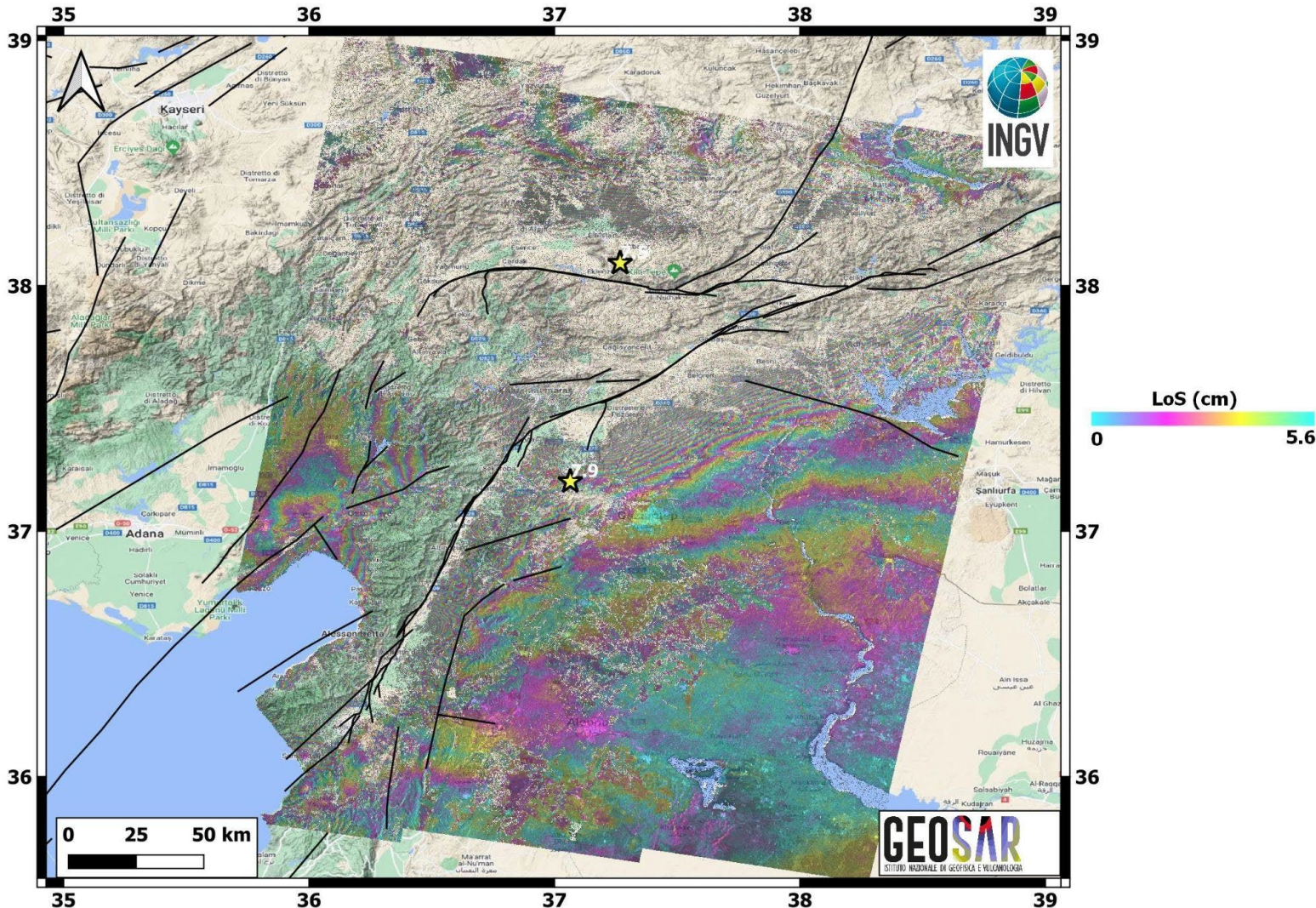
Pre-event data	Post-event date	Orbit	Mission	Band/wavelength	Technique
2023-01-28	2023-02-09	Ascending	Sentinel-1	C - 5.6 cm	InSAR
2023-01-29	2023-02-10	Descending	Sentinel-1	C - 5.6 cm	InSAR, POT
2023-01-30	2023-02-11	Ascending	Sentinel-1	C - 5.6 cm	InSAR
2002-09-16	2023-02-17	Descending	ALOS-2 WD	L - 24 cm	InSAR
2022-09-05	2023-02-20	Ascending	ALOS-2 WD	L - 24 cm	InSAR
2022-08-06	2023-02-14	Ascending	SAOCOM	L - 24 cm	InSAR
2022-05-09	2023-02-13	Descending	SAOCOM	L - 24 cm	InSAR

Coseismic analysis from InSAR technique



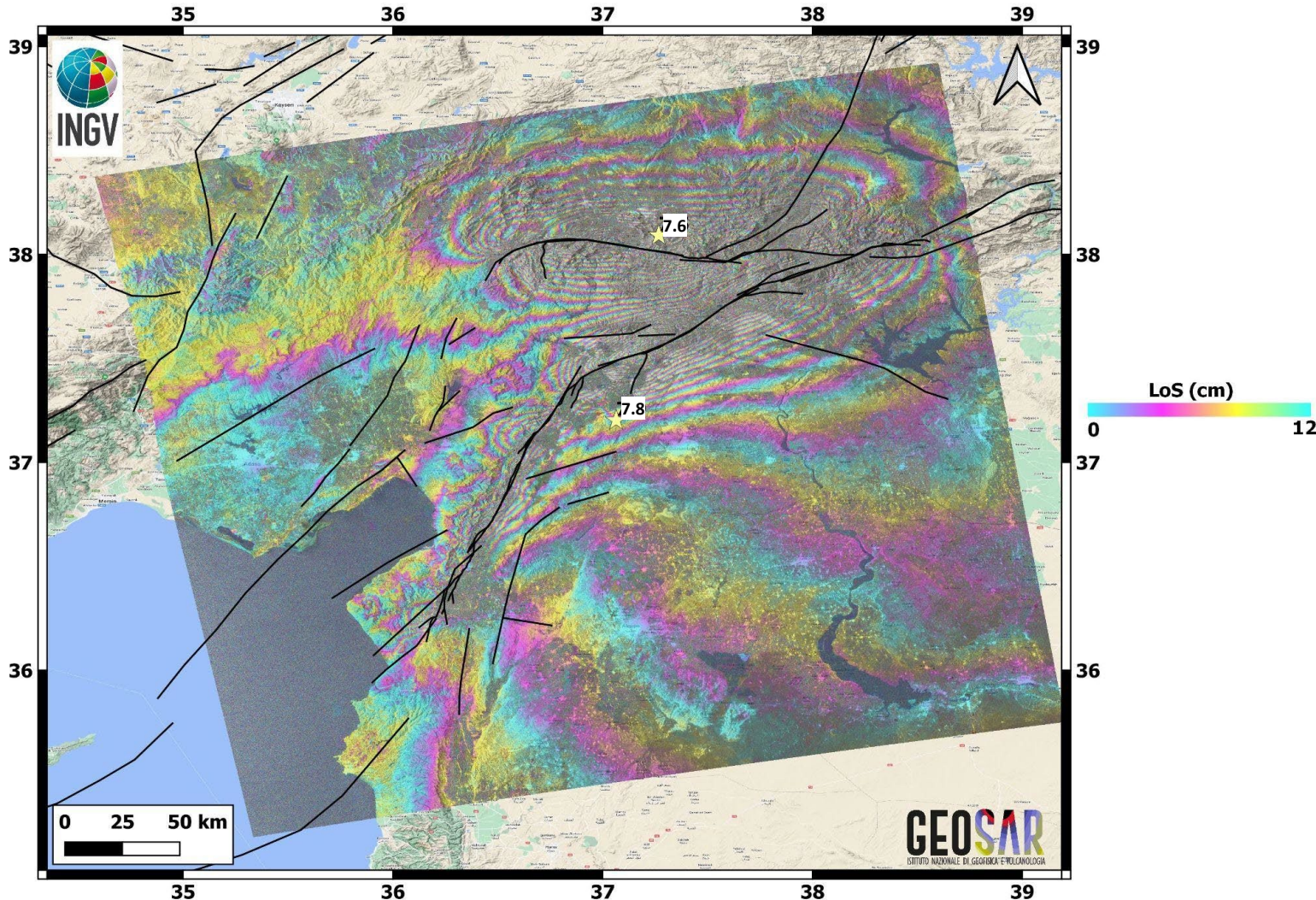
- S-1 TOPSAR data (C-Band)
- Filtered wrapped interferogram along the ascending orbit (T14)
- Pre- and post-acquisition: 20230128-20230209
- Ground resolution pixel: 45 meter
- DEM ALOS World 3D 30 meters

Coseismic analysis from InSAR technique



- S-1 TOPSAR data (C-Band)
- Filtered wrapped interferogram along the descending orbit (T21)
- Pre- and post-acquisition: 20230129-20230210
- Ground resolution pixel: 45 meters
- DEM ALOS World 3D 30 meters

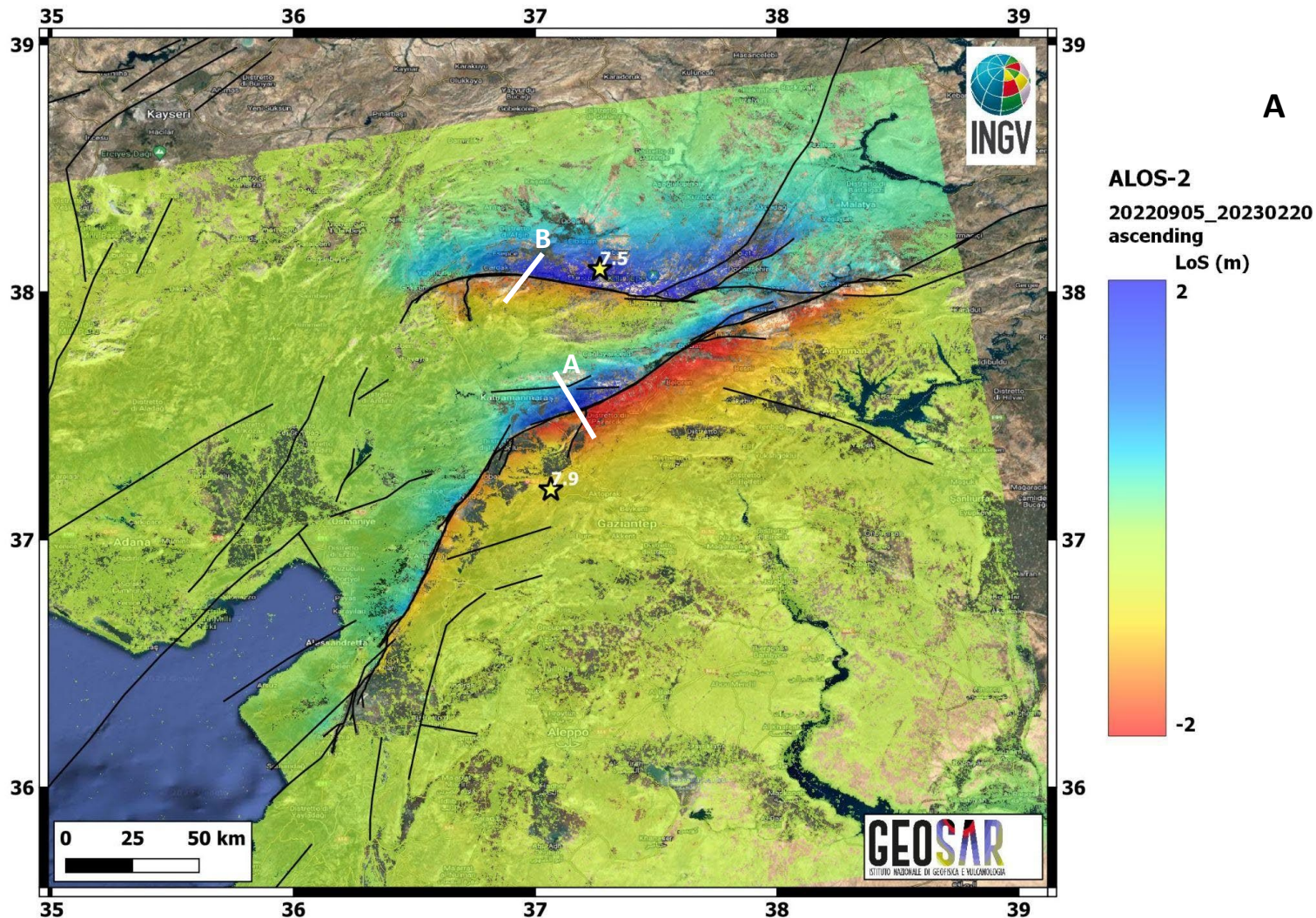
Coseismic analysis from InSAR technique



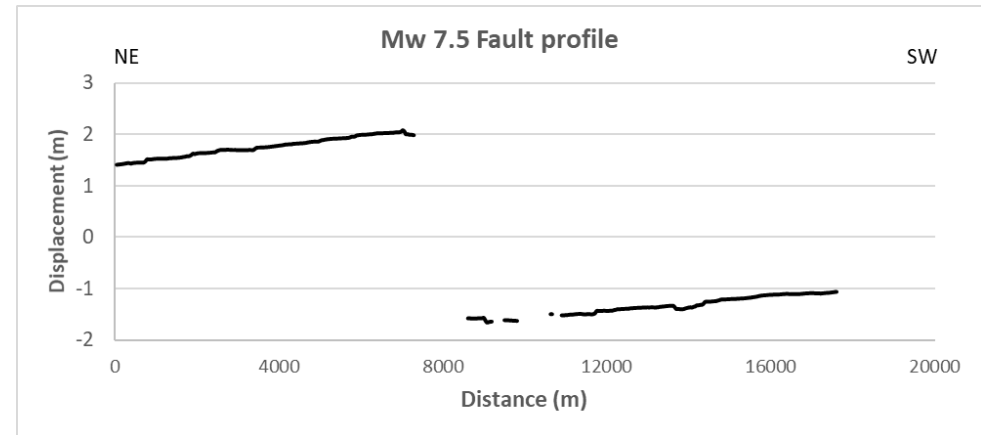
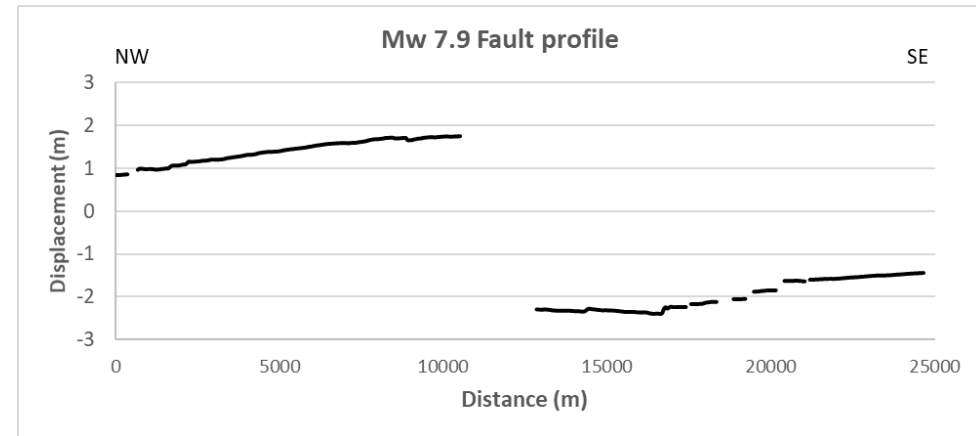
- ALOS-2 ScanSAR data (L-Band)
- Filtered wrapped interferogram along the ascending orbit
- Pre- and post- acquisitions: 20220905-20230220
- Ground resolution pixel: 45 meters
- DEM ALOS World 3D 30 meters

Coseismic analysis from InSAR technique

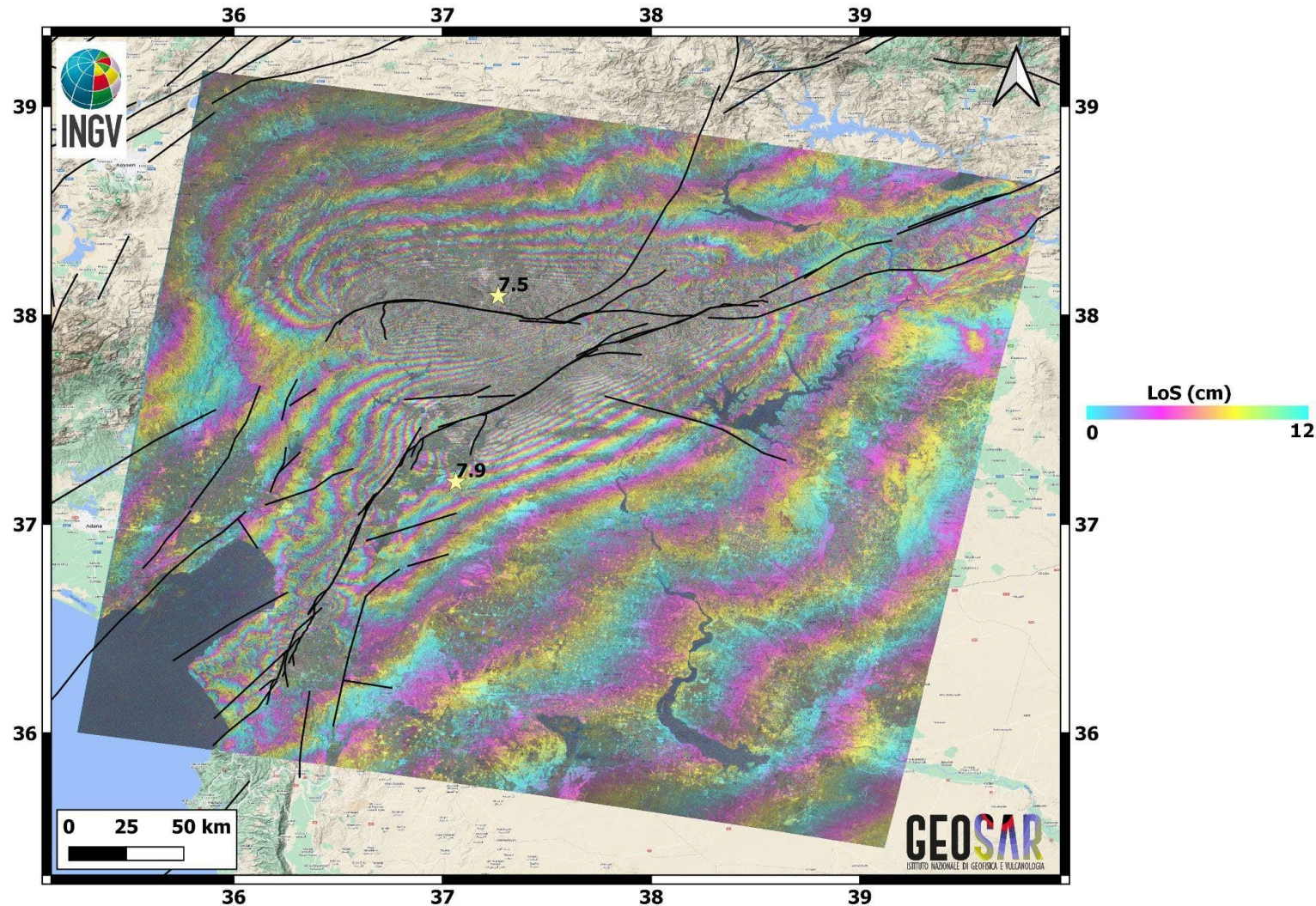
ALOS-2 asc displacement map



A



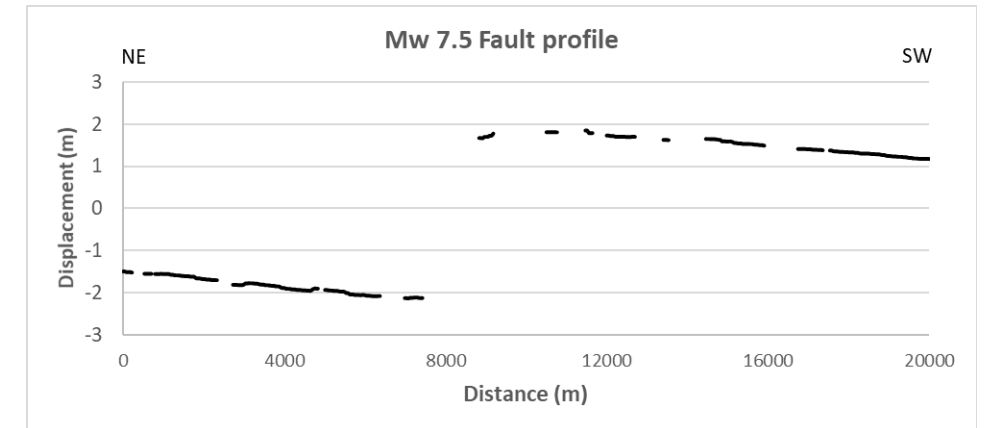
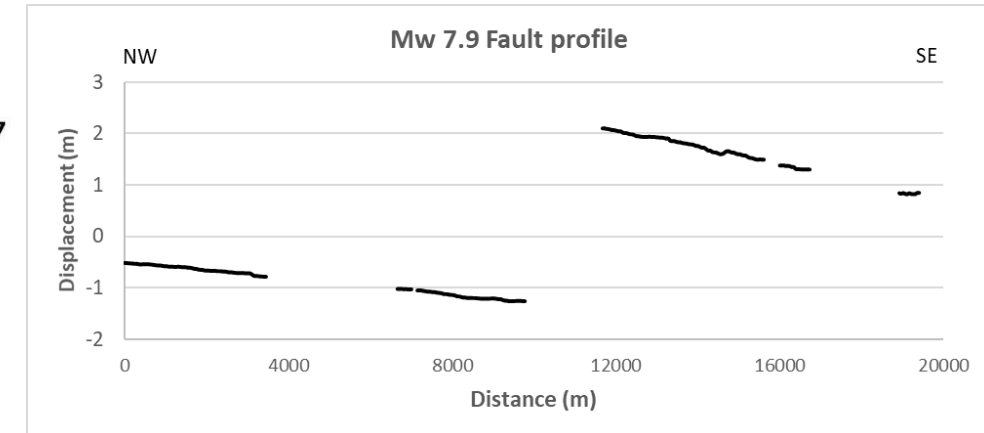
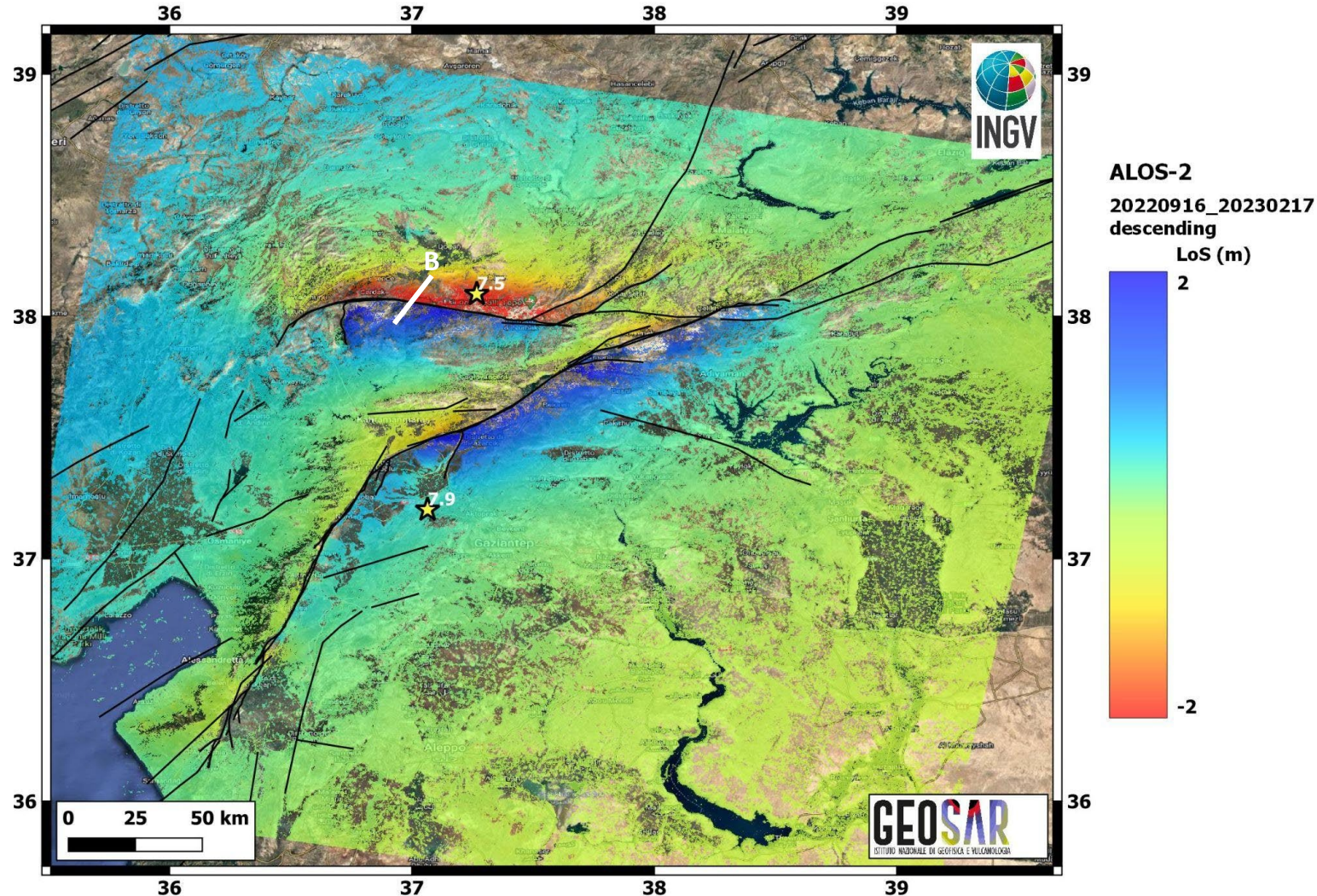
Coseismic analysis from InSAR technique



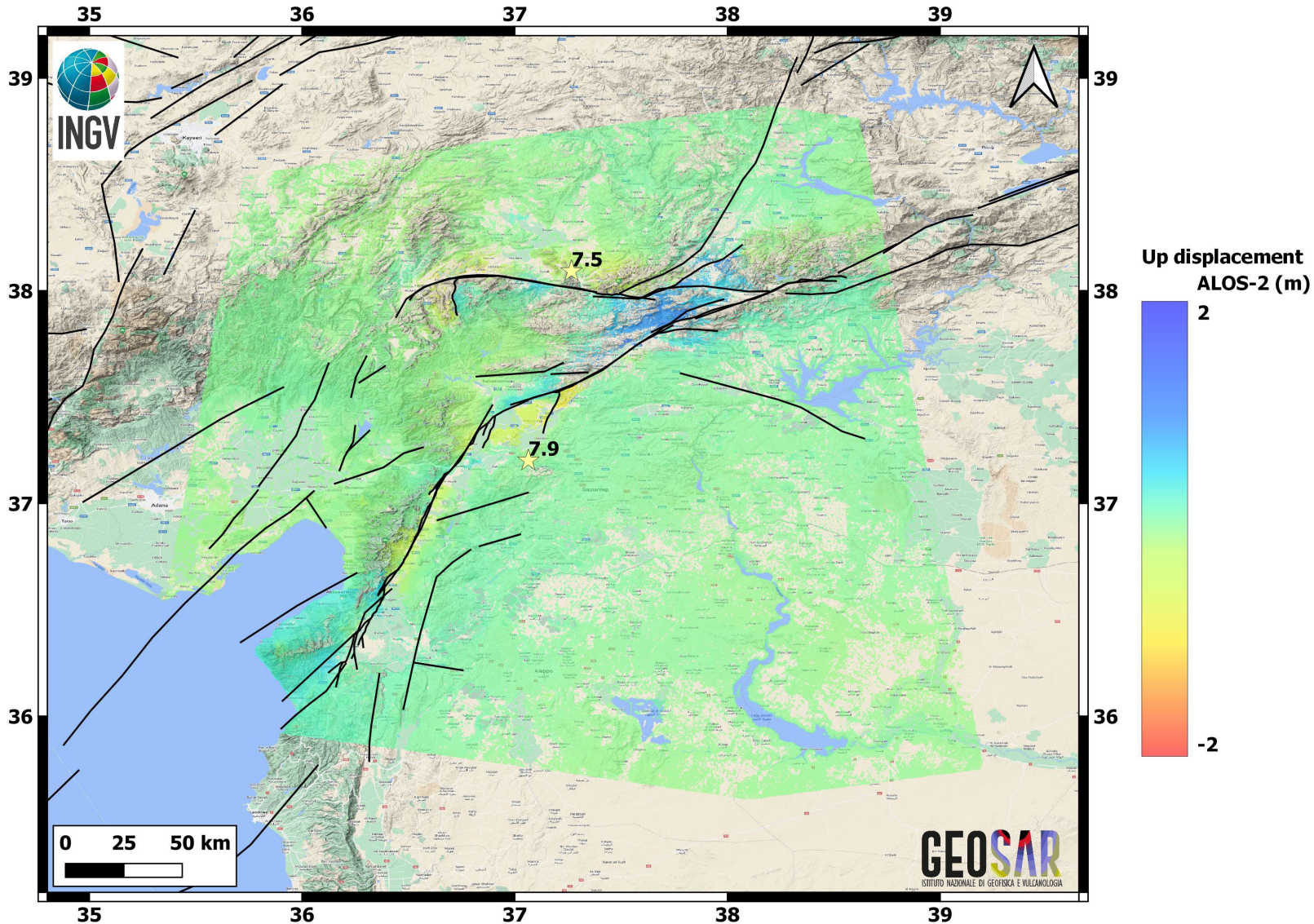
- ALOS-2 ScanSAR data (L-Band)
- Filtered wrapped interferogram along the descending orbit:
- Pre- and post-acquisitions: 20220916-20230217
- Ground resolution pixel: 45 meters
- DEM ALOS World 3D 30 meters

Coseismic analysis from InSAR technique

ALOS-2 desc displacement map

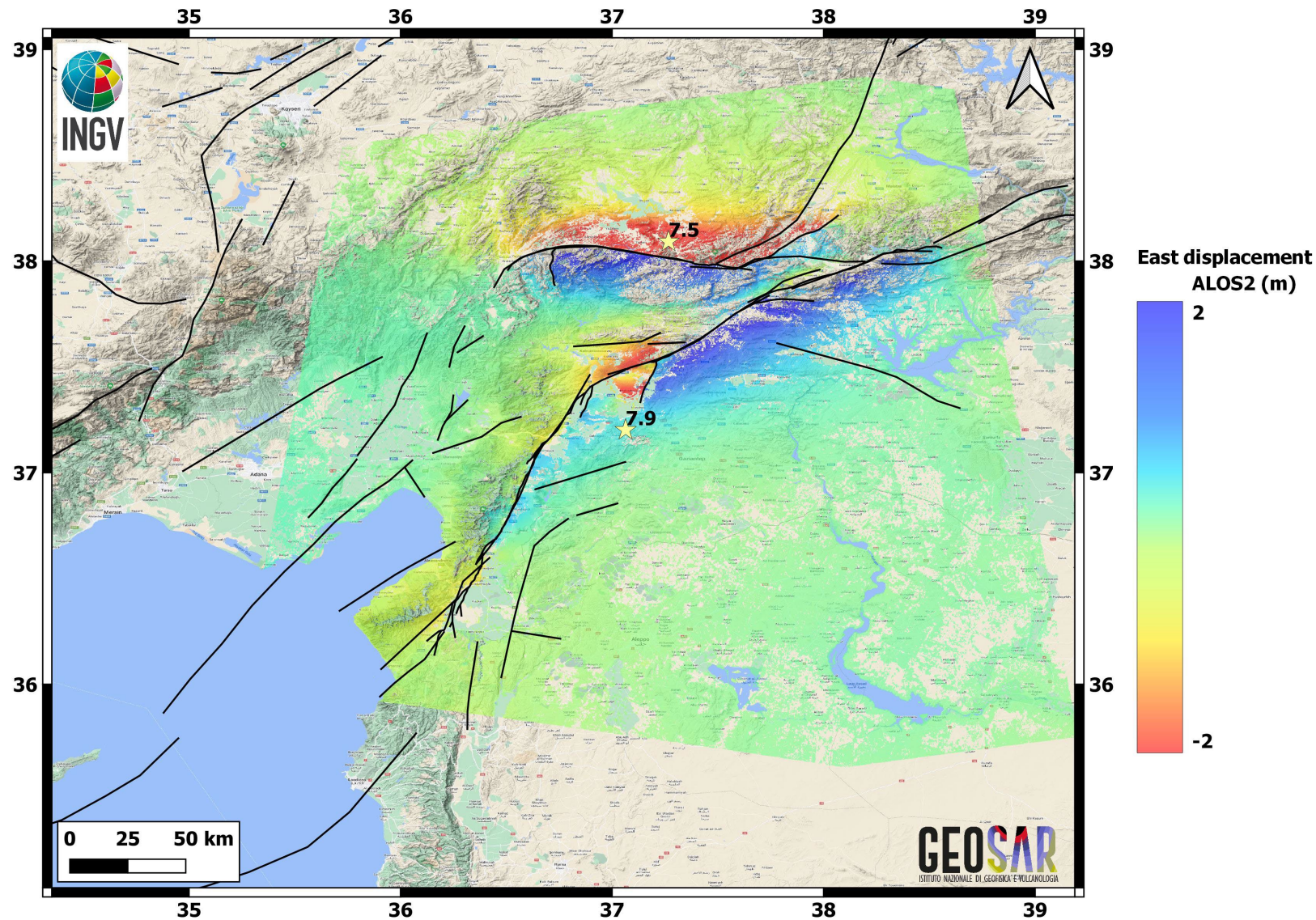


Coseismic analysis from InSAR technique



ALOS-2 Up Component map

Coseismic analysis from InSAR technique



ALOS-2 E-W Component map

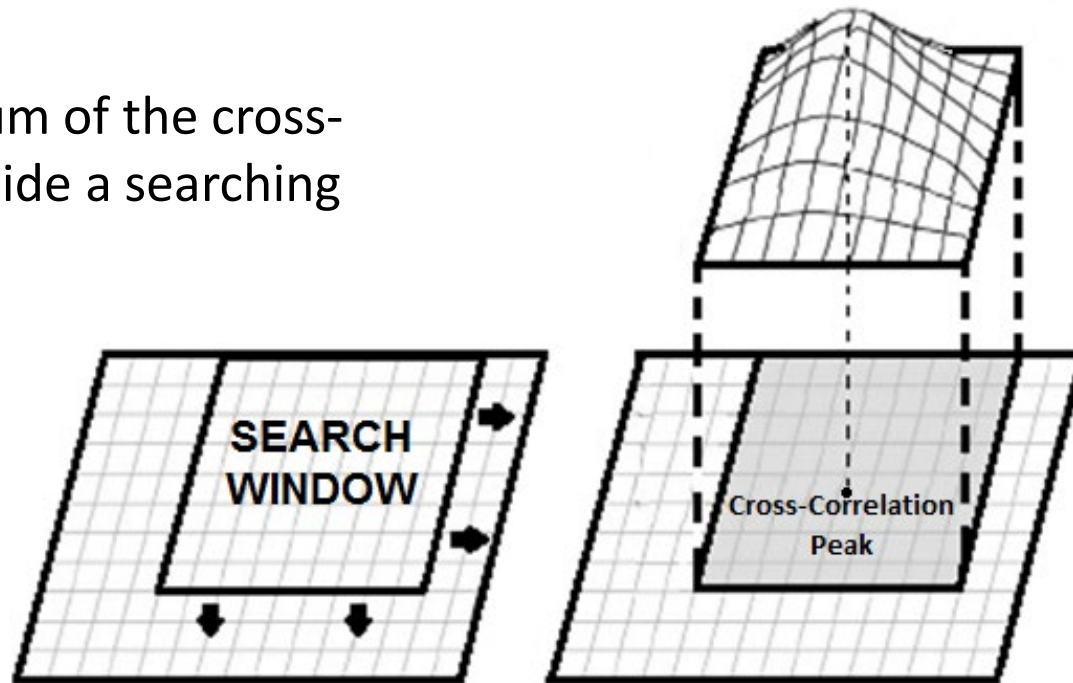
Profiles across the northern fault show surface displacement up to 5 meters (negative to positive values).

Coseismic analysis from POT technique

Instead of InSAR, **Pixel Offset Tracking** (POT) technique uses the amplitude of the backscattered SAR signal thus not suffering of the well-known problems usually affecting the phase.

In fact, POT analysis allows to estimate the shift between pre- and post-event image homologous pixels along both the Line-of-Sight (Look Direction or Range) and the Line-of-Flight (Flight direction or Azimuth) direction of the satellite.

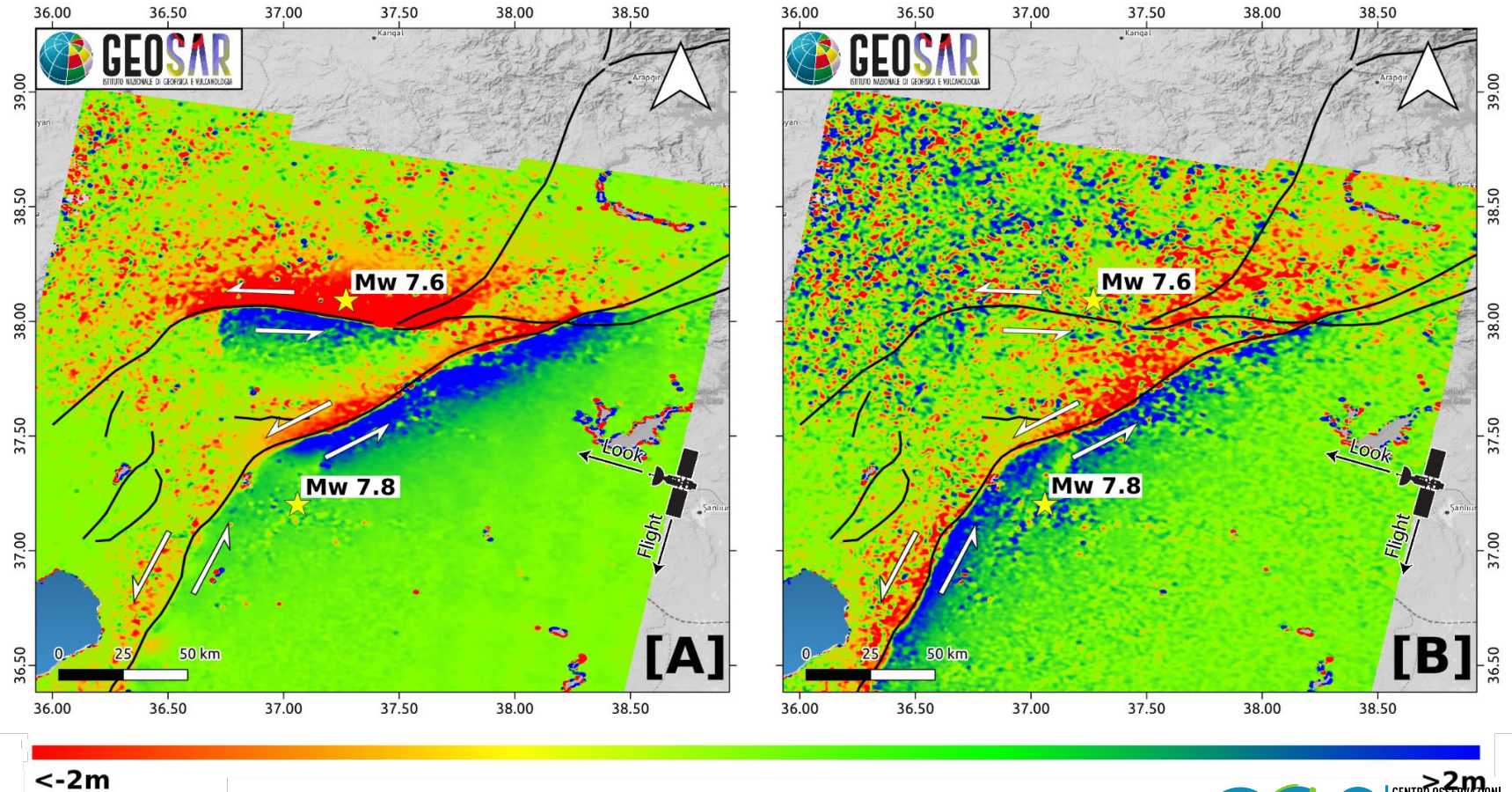
POT technique searches for the maximum of the cross-correlation between the two images inside a searching moving window.



Coseismic analysis from POT technique

The POT analysis was applied to a pair of S1 descending data acquired on January 29th and February 10th 2023 respectively.

The retrieved range and azimuth displacement maps highlight a deformation pattern peaking at more than ± 2 meters and consistent with the left lateral strike-slip fault mechanism of the two structures responsible for the main seismic events occurred on February 6th.



Conclusions

- We have investigated the surface effects due to the M7.8 earthquake occurred along a wide sector of the EAF considered a “seismic gap” till 2023, and a second earthquake, M 7.6, that took place in a further seismic structure toward NW;
- Due to the very wide coseismic field we used a set of C- and L-Band SAR data and we applied InSAR technique;
- A large decorrelated region in the near field is present, mainly in S1 interferograms, less evident in the ALOS2 ones (thanks to the higher wavelength);
- A peak of >4m LoS displacement has been reached across the fault for both the earthquakes;
- Finally, we also used Pixel Offset Tracking (POT) technique able to measure >2m horizontal movements in agreement with the InSAR results and the strike slip mechanism.

Thank you....

and now the sources modelling!