

# Working Group on Disasters 26 (WGD-26)

## ASSESSING THE CONTRIBUTION OF MT-DINSAR SAOCOM-1 L-BAND OBSERVATIONS TO THE ITALIAN LANDSLIDE MONITORING SCENARIO

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# MT-DInSAR analysis in several hazard contexts



**SEISMIC**



**VOLCANIC**



**BUILT-UP ENVIRONMENT**



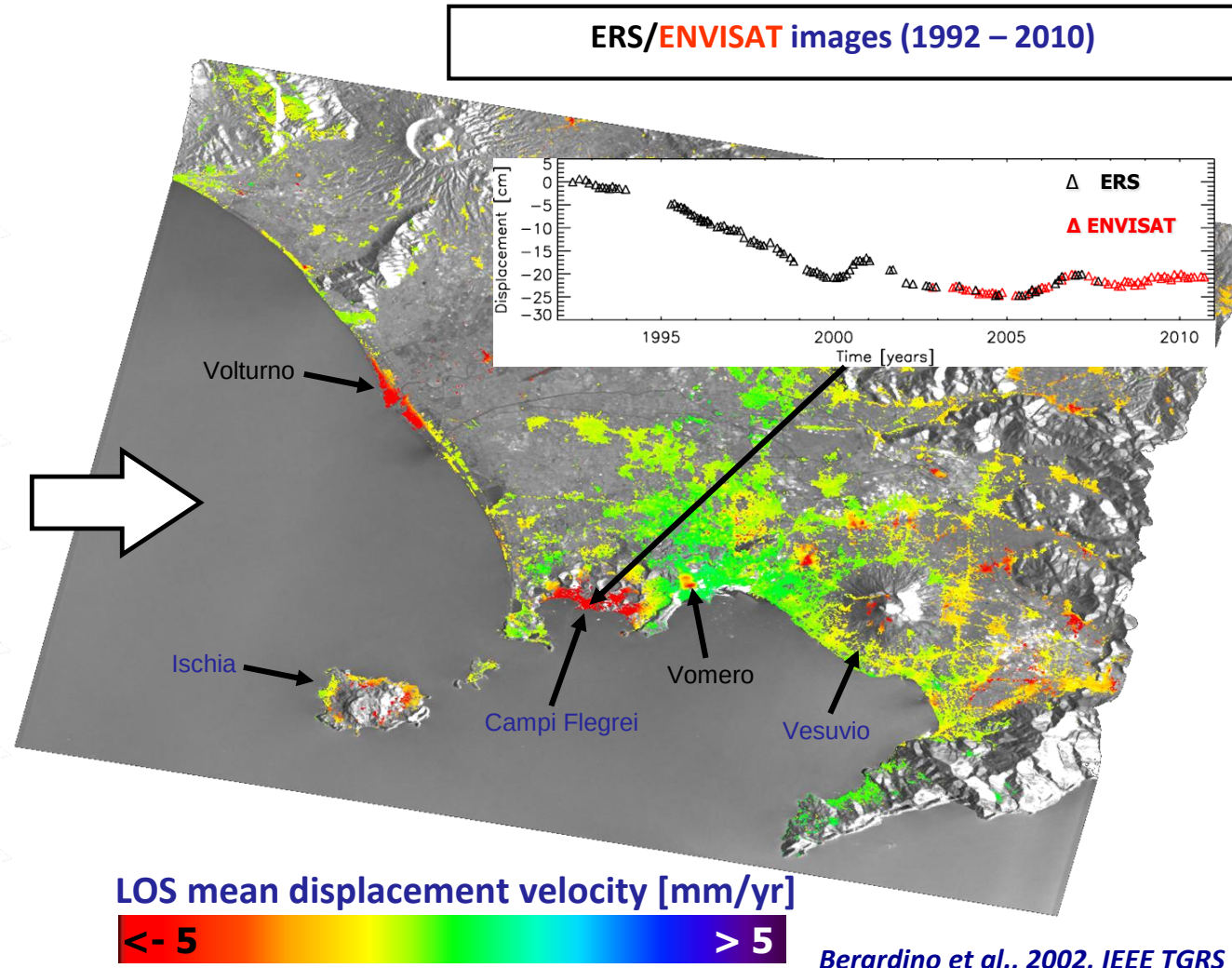
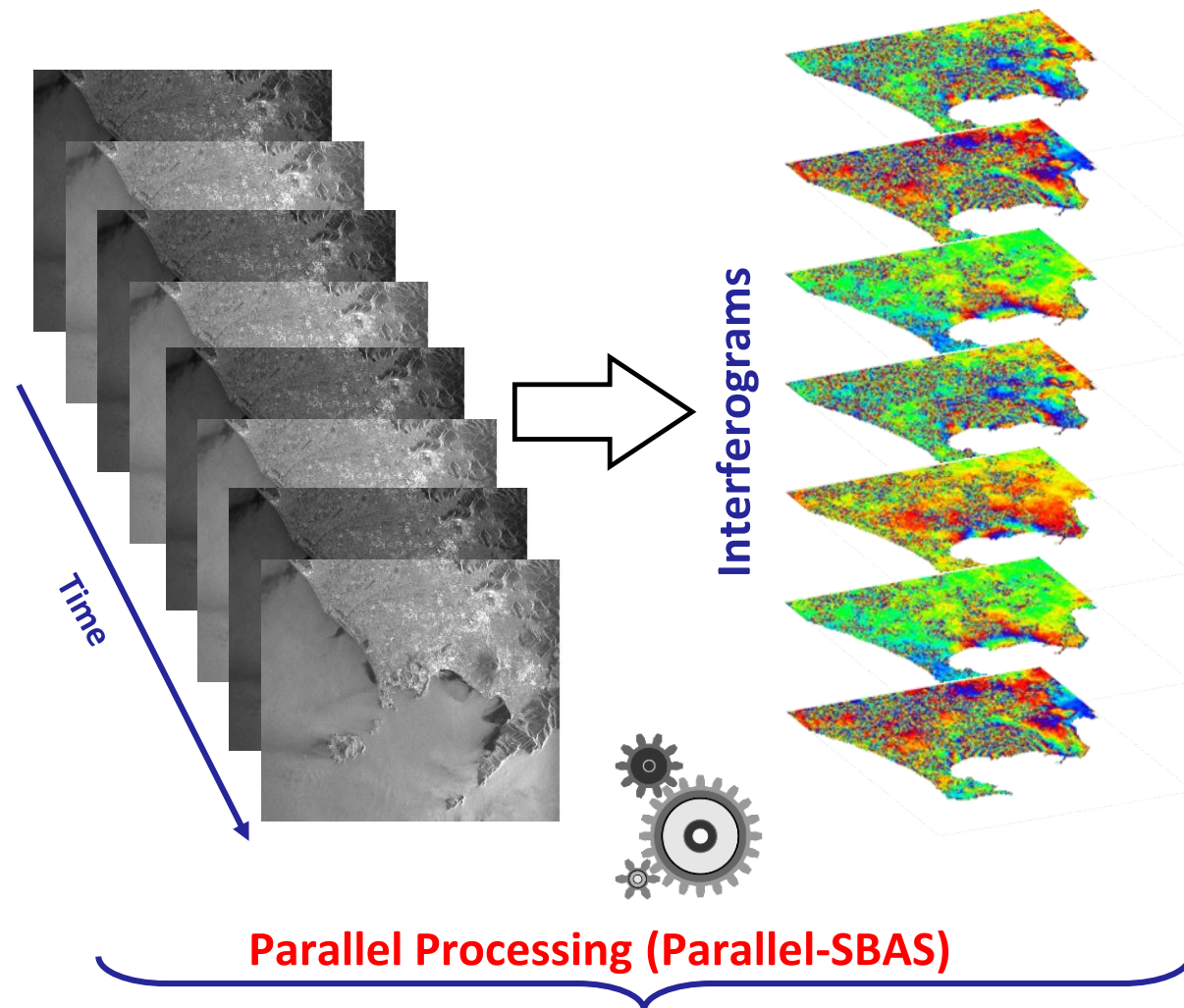
**LANDSLIDE**



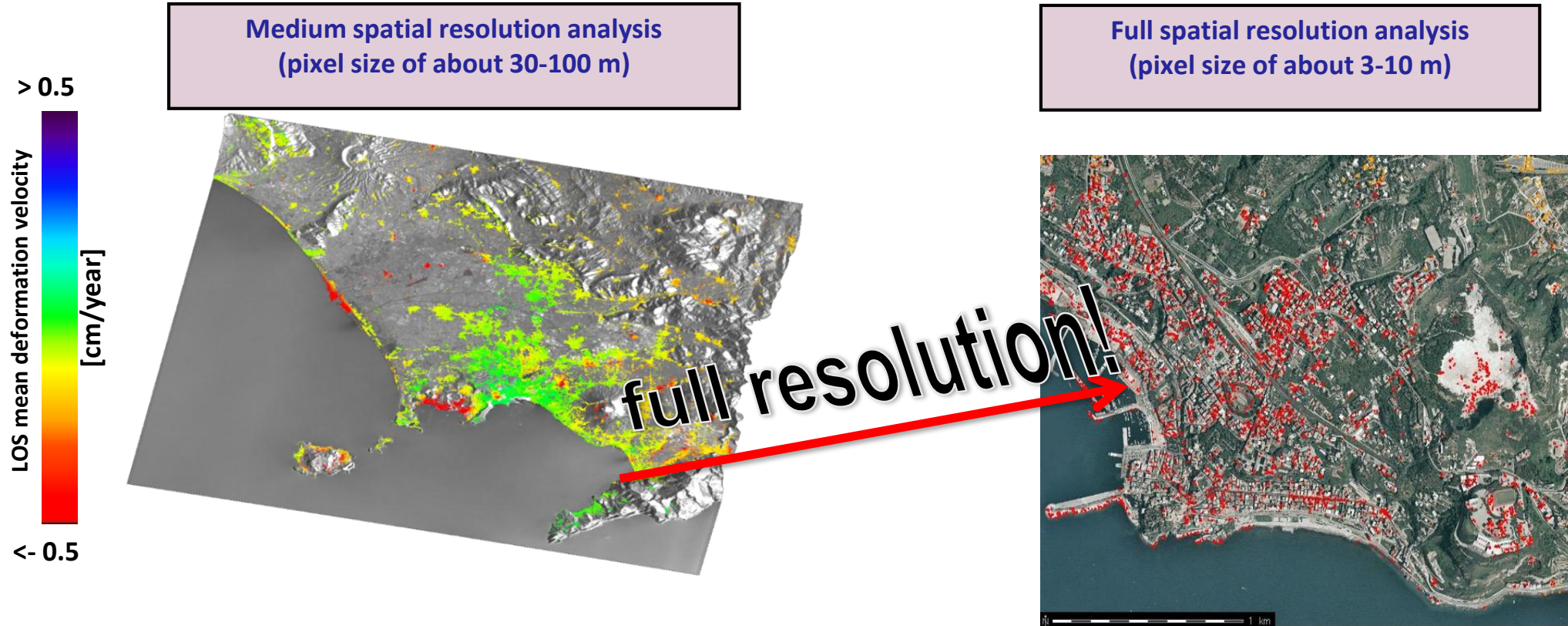
# DInSAR analysis of the ground displacements temporal evolution



## Small BAseline Subset (SBAS) technique



Berardino et al., 2002, IEEE TGRS  
Casu et al., 2014, IEEE JSTARS  
Manunta et al., 2019, IEEE TGRS

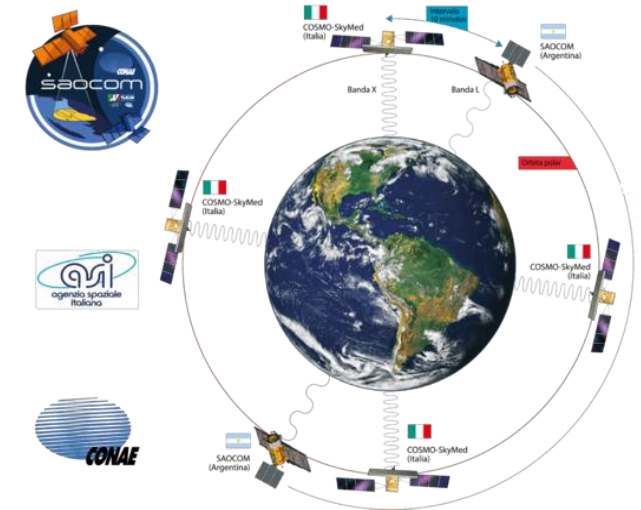
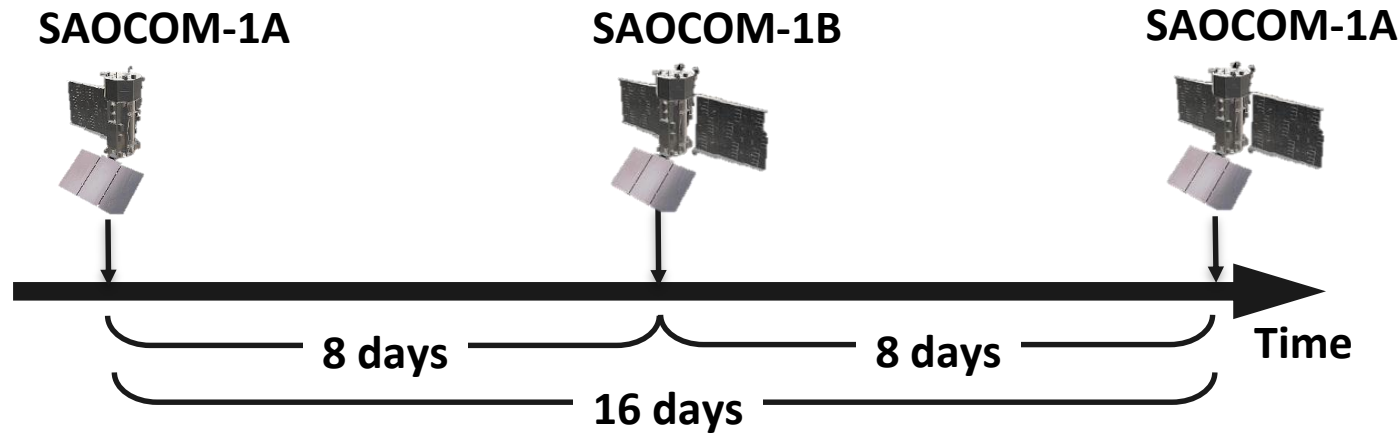


*Lanari et al., 2004, IEEE TGRS*  
*Bonano et al. 2025, IEEE JSTARSS*

To speed-up the overall processing time and achieve high scalability and computing performance, GPU-based parallel solutions are adopted.

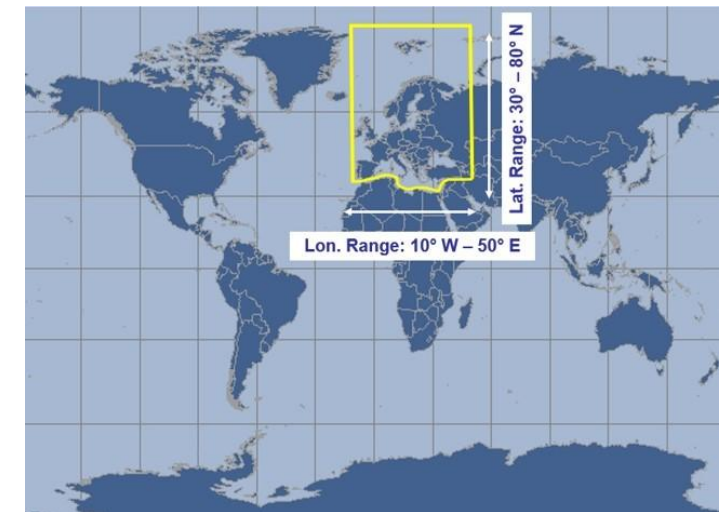


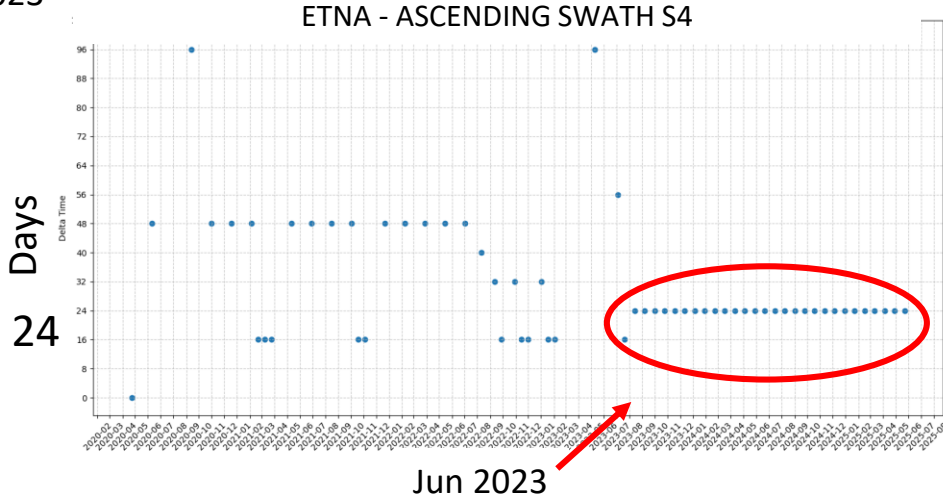
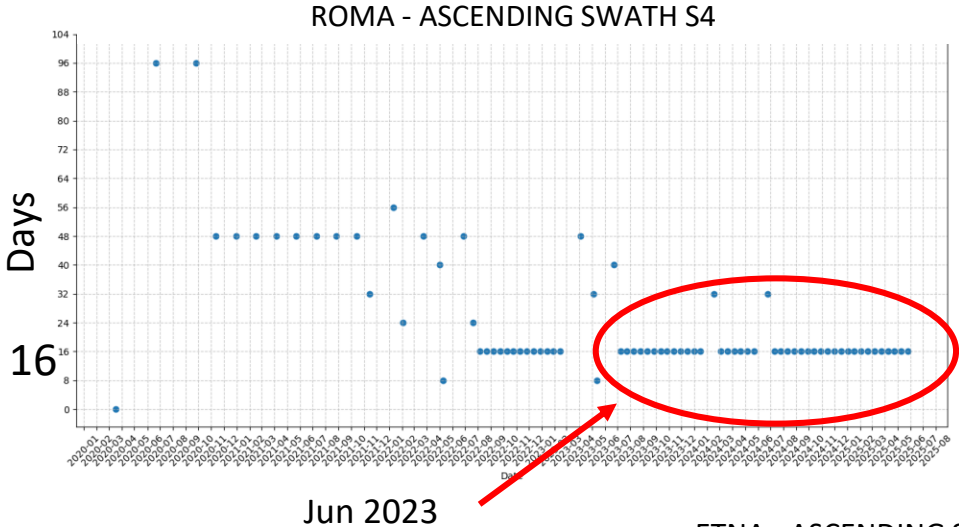
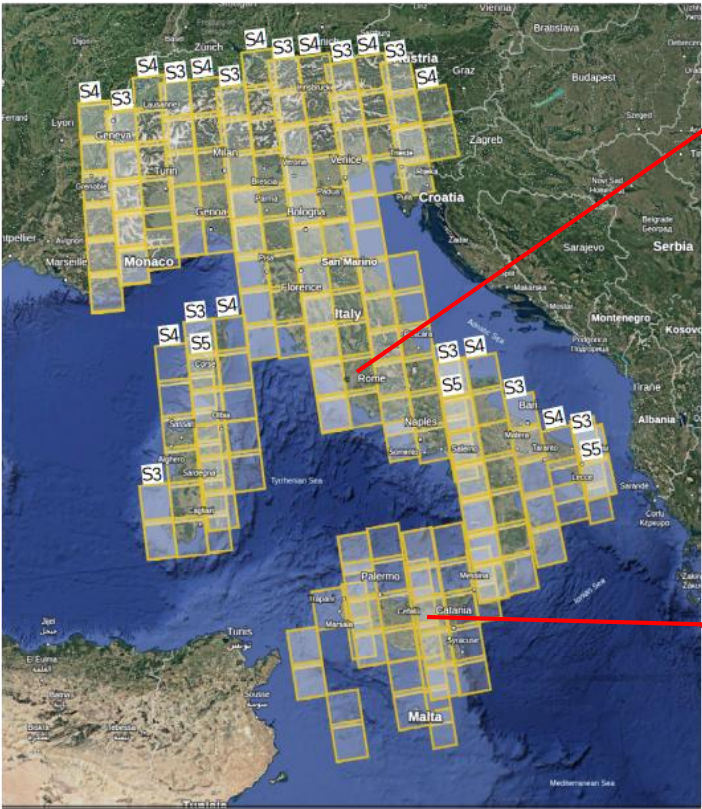
# SAOCOM-1 constellation



The Argentinian L-band SAOCOM-1 and the Italian X-band COSMO-SkyMed constellations share the same orbits, forming the SIASGE system.

- Spatial resolution (Stripmap mode): 5 m x 10 m (Single & Dual Pol), 5m x 6m (Quad Pol)
- Footprint extent: 40-60 km (Single & Dual Pol), 20-30 Km (Quad Pol)
- Frequency: L-band ( $\lambda \cong 23.5$  cm)

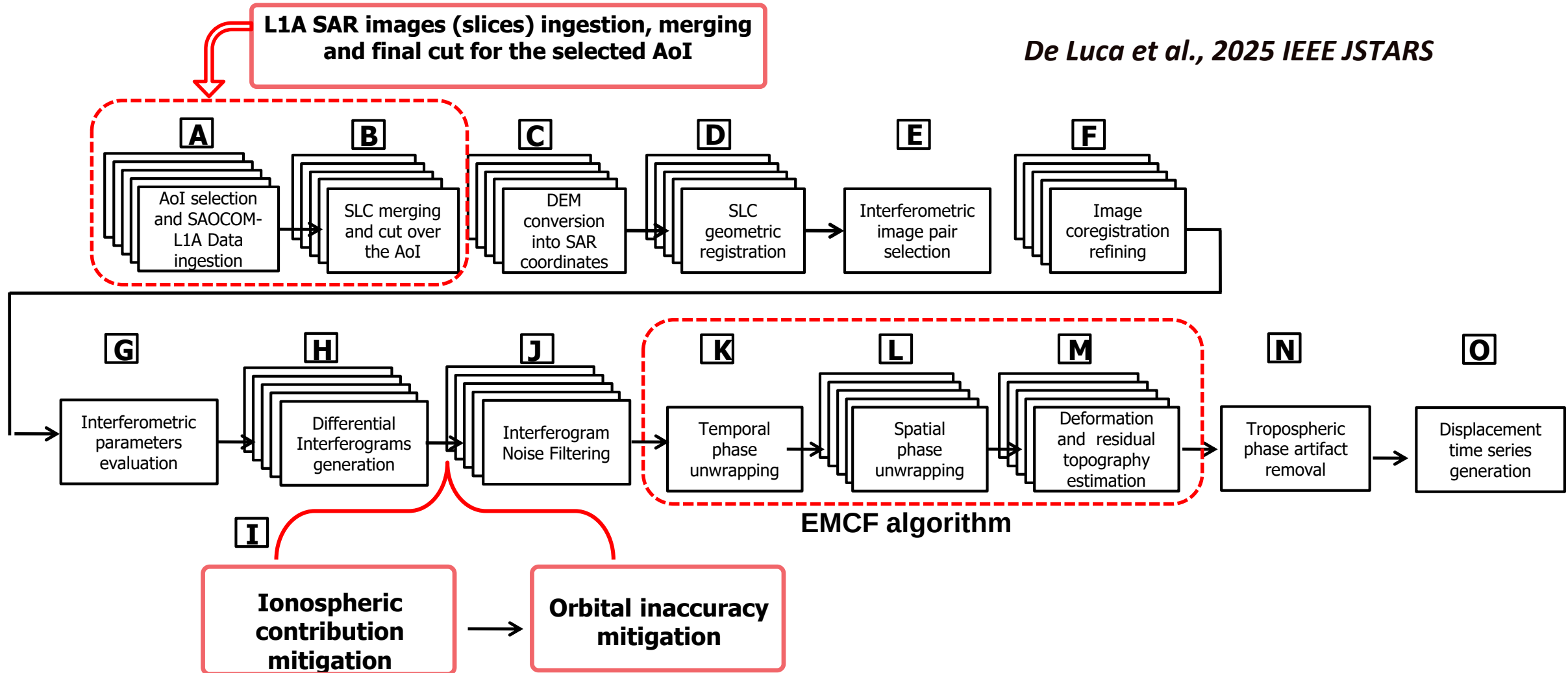


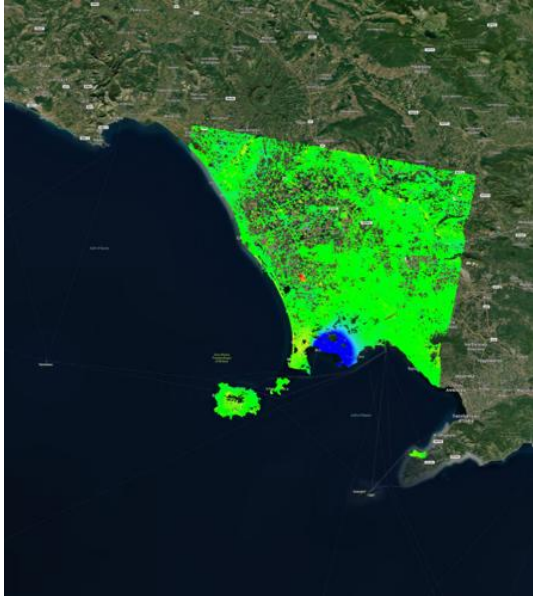


# SAOCOM-1 Stripmap P-SBAS processing chain

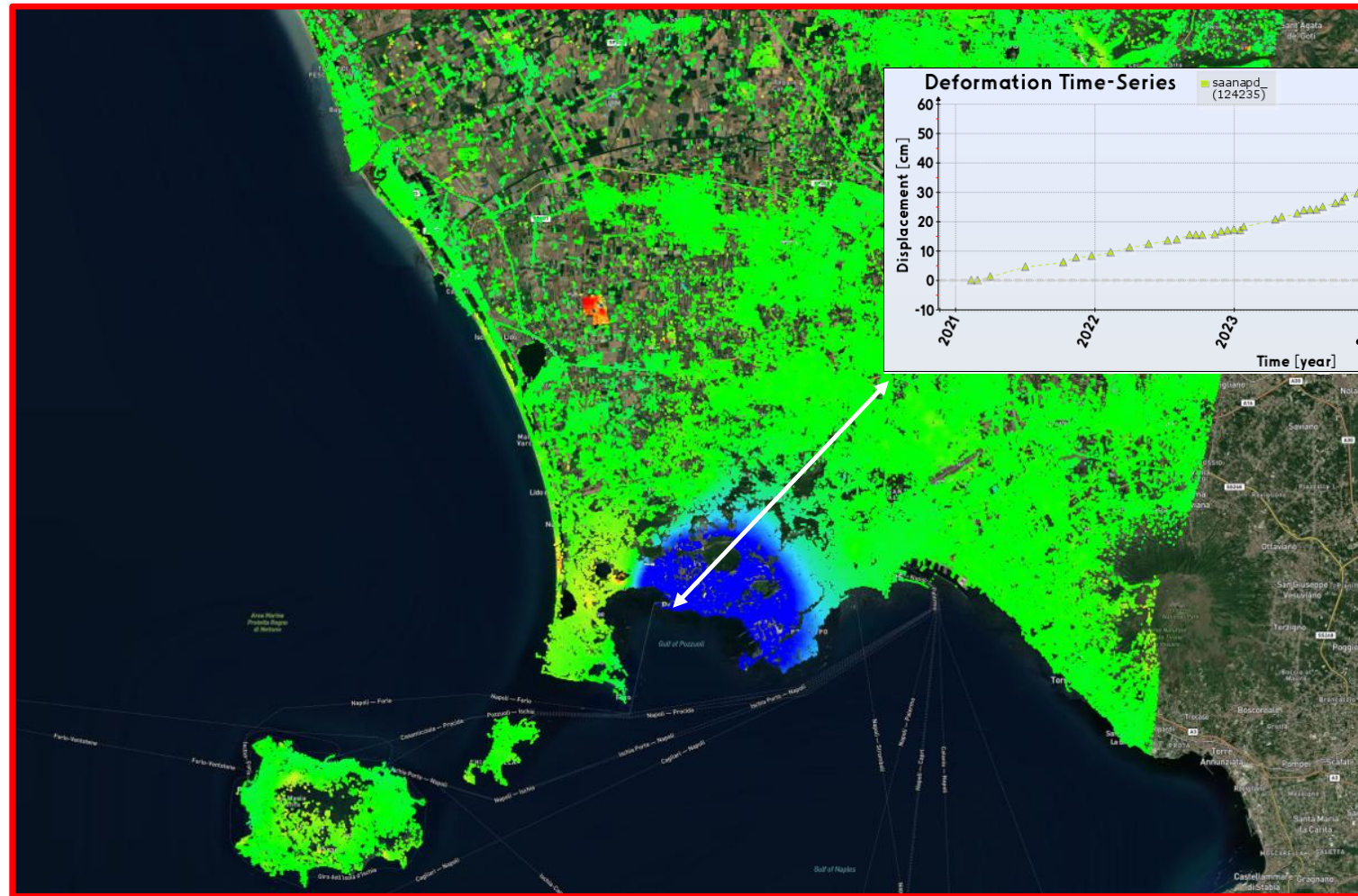


*De Luca et al., 2025 IEEE JSTARS*



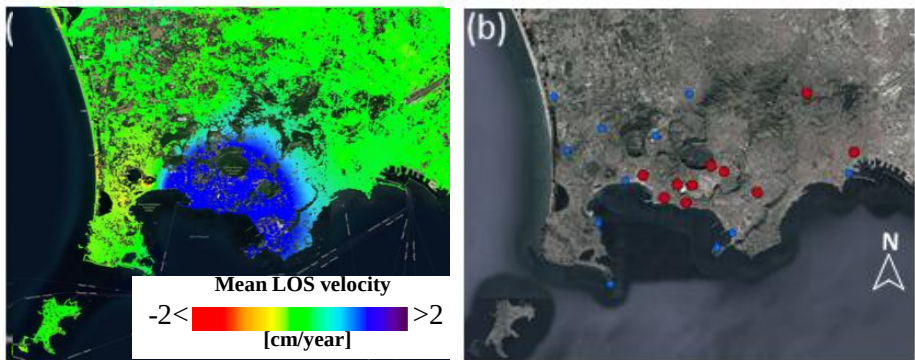


SAOCOM-1 P-SBAS  
results over the  
Napoli area  
(Swath S4, DESC)



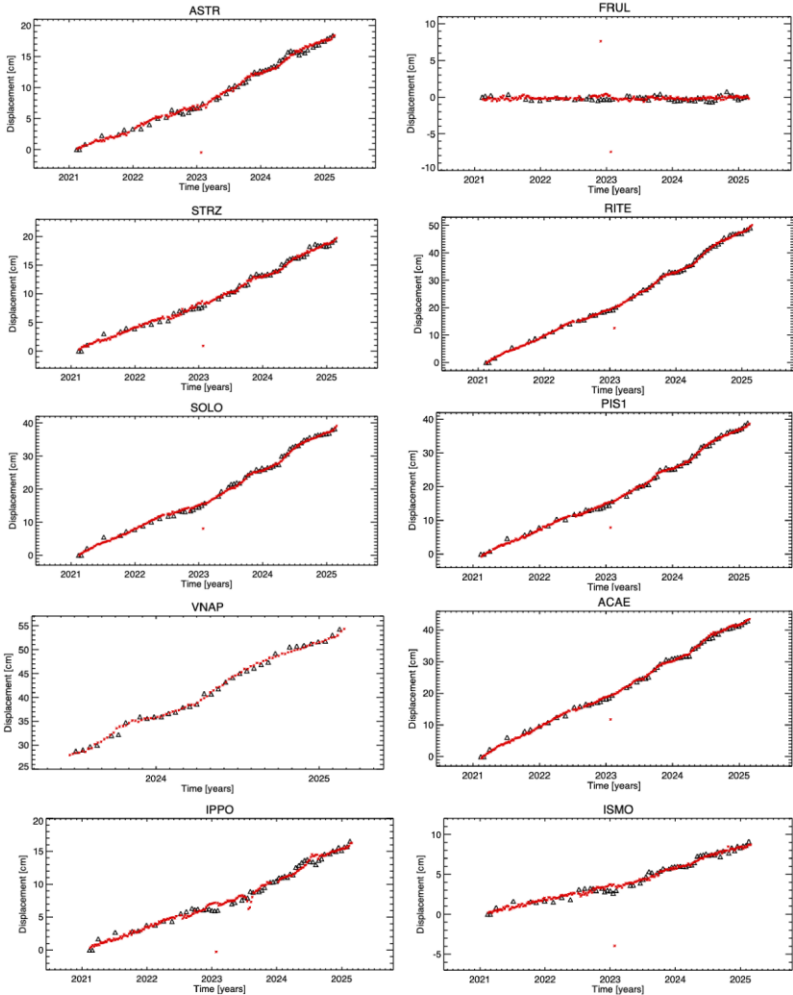
Zoom over the Campi Flegrei caldera

## Campi Flegrei caldera



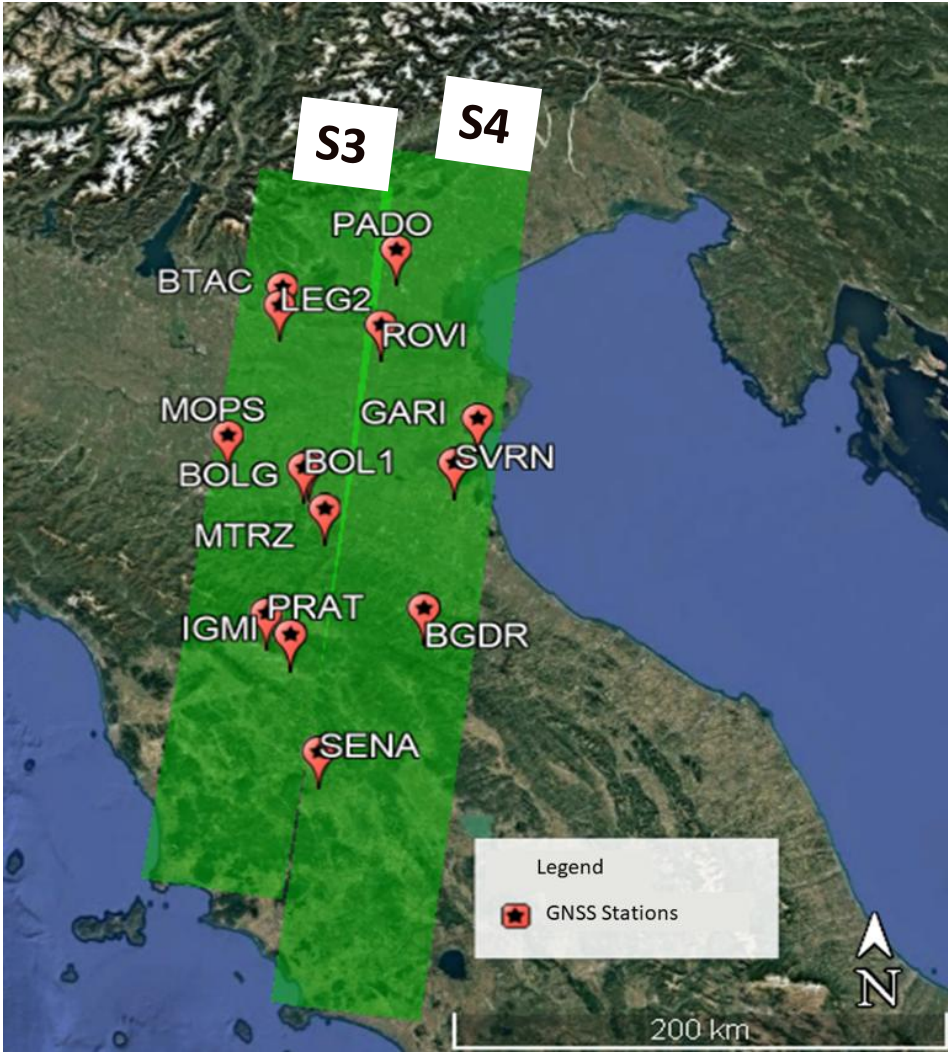
Results of the comparison between the P-SBAS and the LOS-projected GNSS deformation time series relevant to the Neapolitan volcanic area (Campi Flegrei caldera)

| GNSS Station                                         | Standard deviation [cm] | GNSS Station | Standard deviation [cm] |
|------------------------------------------------------|-------------------------|--------------|-------------------------|
| ACAE                                                 | 0.57                    | LICO         | 0.63                    |
| AGR1                                                 | 0.55                    | VNAP         | 0.53                    |
| ARFE                                                 | 0.38                    | MORU         | 0.39                    |
| ASTR                                                 | 0.50                    | NAMM         | 0.29                    |
| BAGN                                                 | 0.42                    | NISI         | 0.57                    |
| BAIA                                                 | 0.50                    | PIS1         | 0.52                    |
| CMIS                                                 | 0.40                    | QUAR         | 0.30                    |
| CUMA                                                 | 0.43                    | RITE         | 0.41                    |
| FRUL                                                 | 0.50                    | SOLO         | 0.61                    |
| IPPO                                                 | 0.52                    | STRZ         | 0.41                    |
| ISMO                                                 | 0.35                    | VICA         | 0.53                    |
| Average standard deviation value for L-band: 0.41 cm |                         |              |                         |

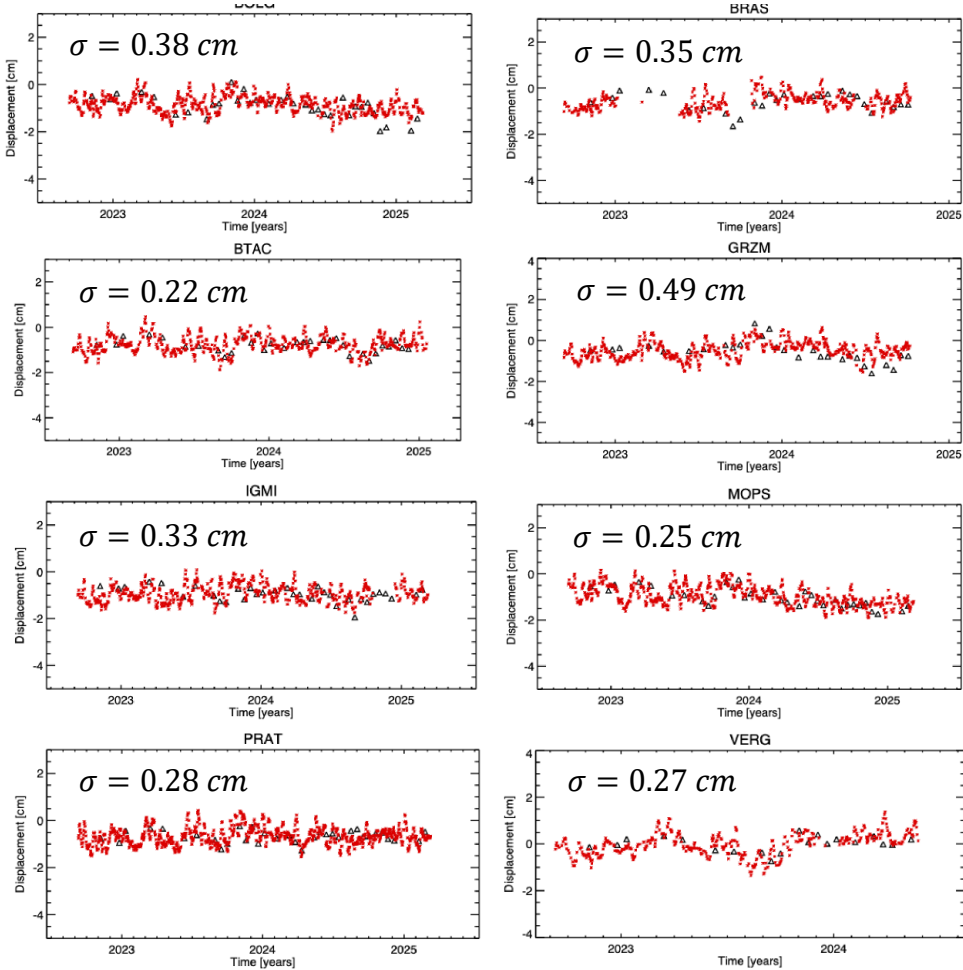


Δ: DInSAR  
\*: GNSS (INGV-OV)

## Northern Apennines

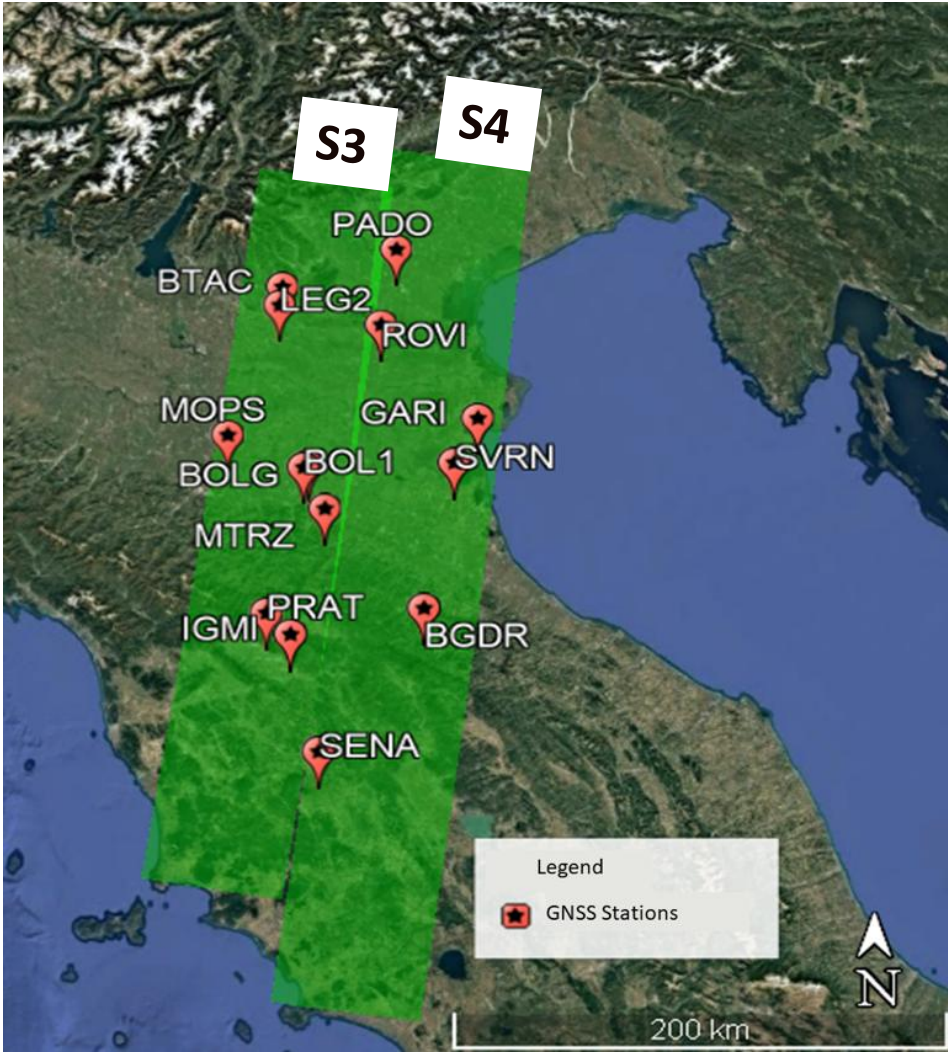


Swath S3

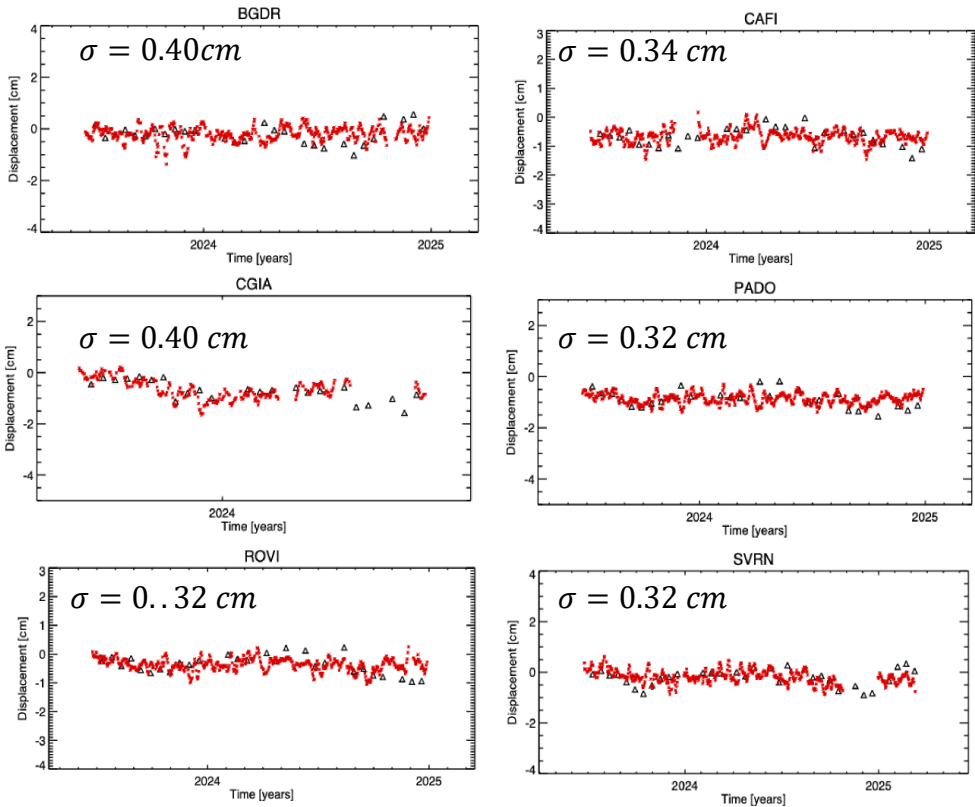


$\Delta$ : DInSAR  
\*: GNSS (UNIBO)

## Northern Apennines



Swath S4



$\Delta$ : DInSAR  
\*: GNSS (UNIBO)

# SAOCOM-1 P-SBAS results: ground coverage improvement



## Comparison with Sentinel-1: the Berceto (Northern Italy) landslide



# SAOCOM-1 P-SBAS results: ground coverage improvement



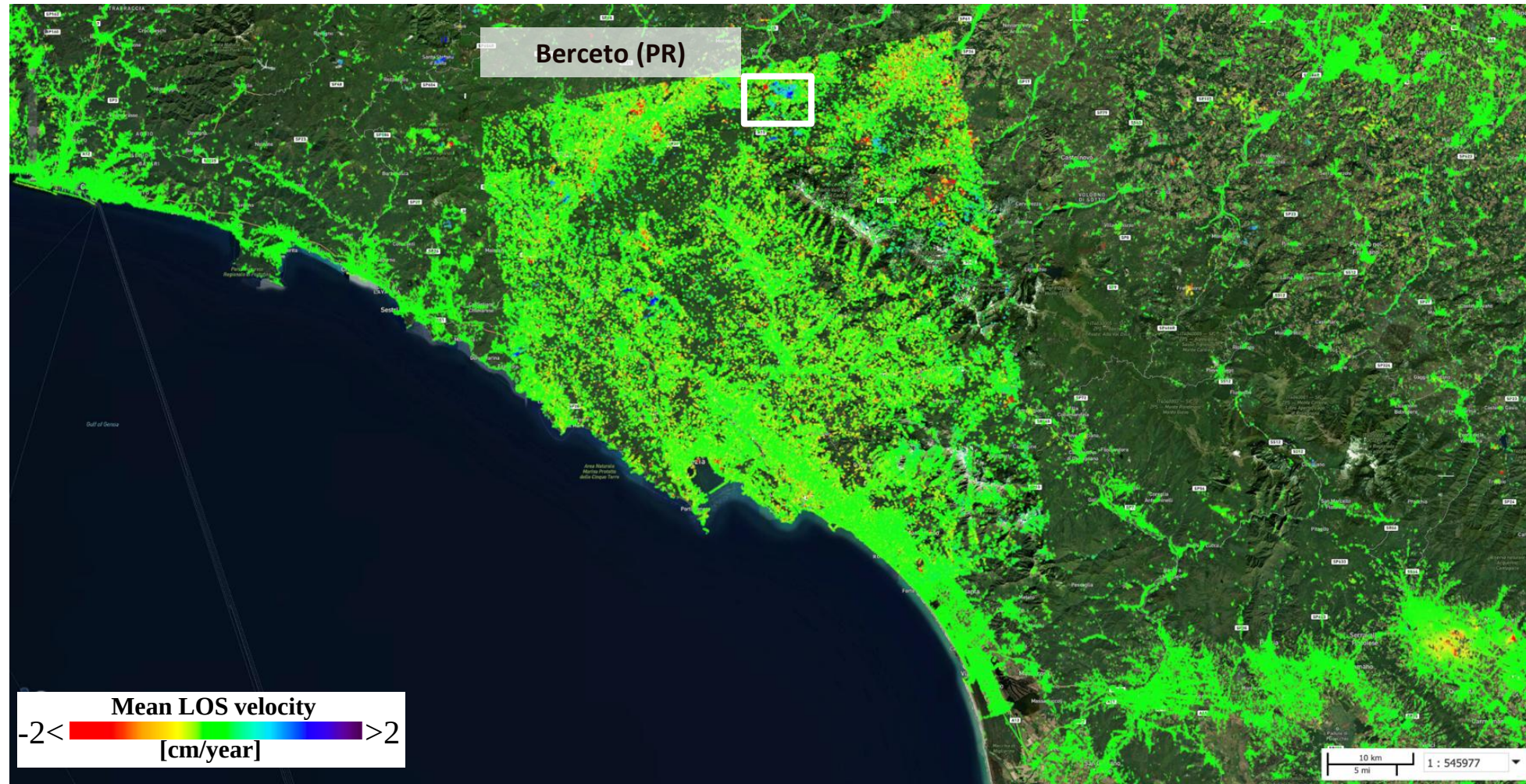
## Comparison with Sentinel-1: the Berceto (Northern Italy) landslide



# SAOCOM-1 P-SBAS results: ground coverage improvement



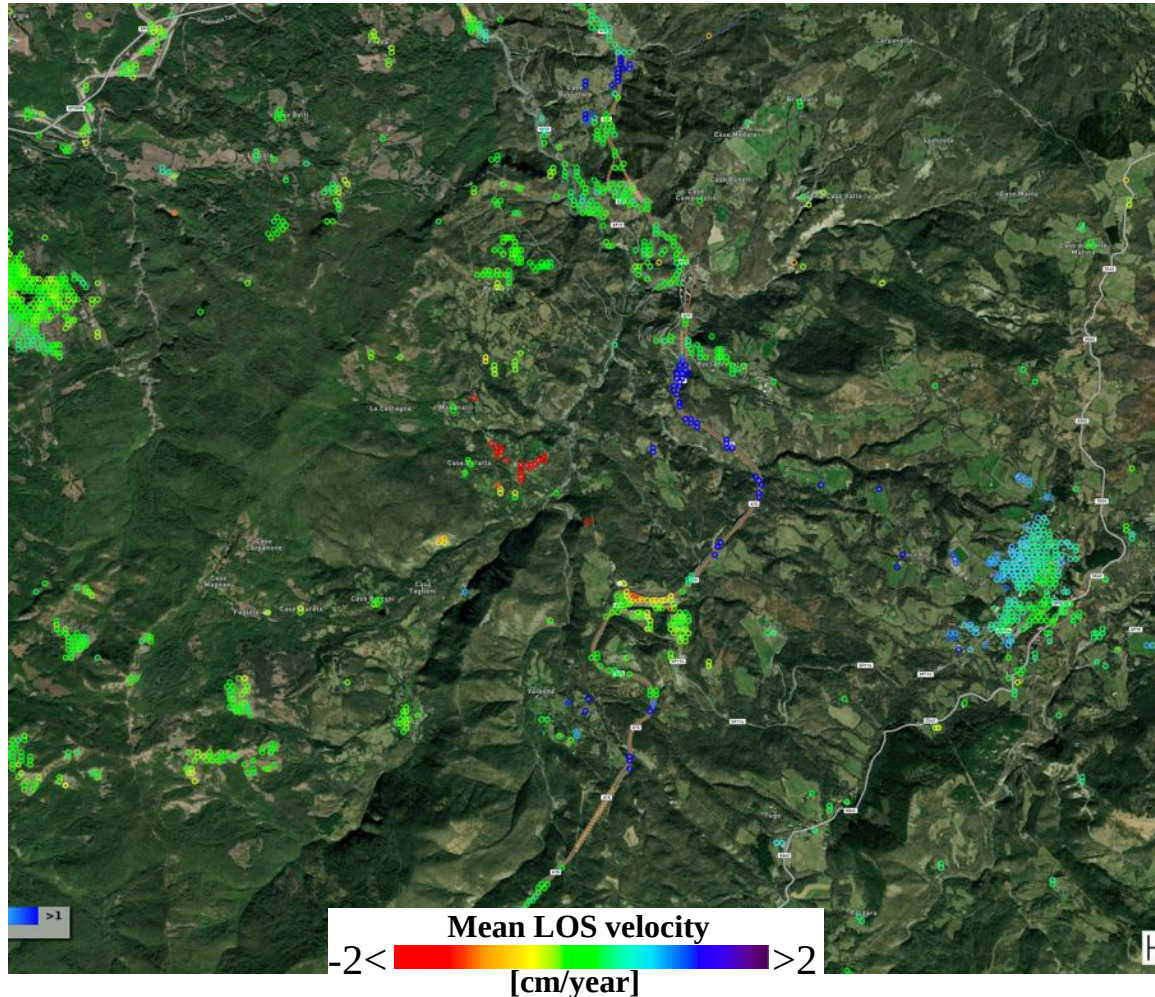
## Comparison with Sentinel-1: the Berceto (Northern Italy) landslide



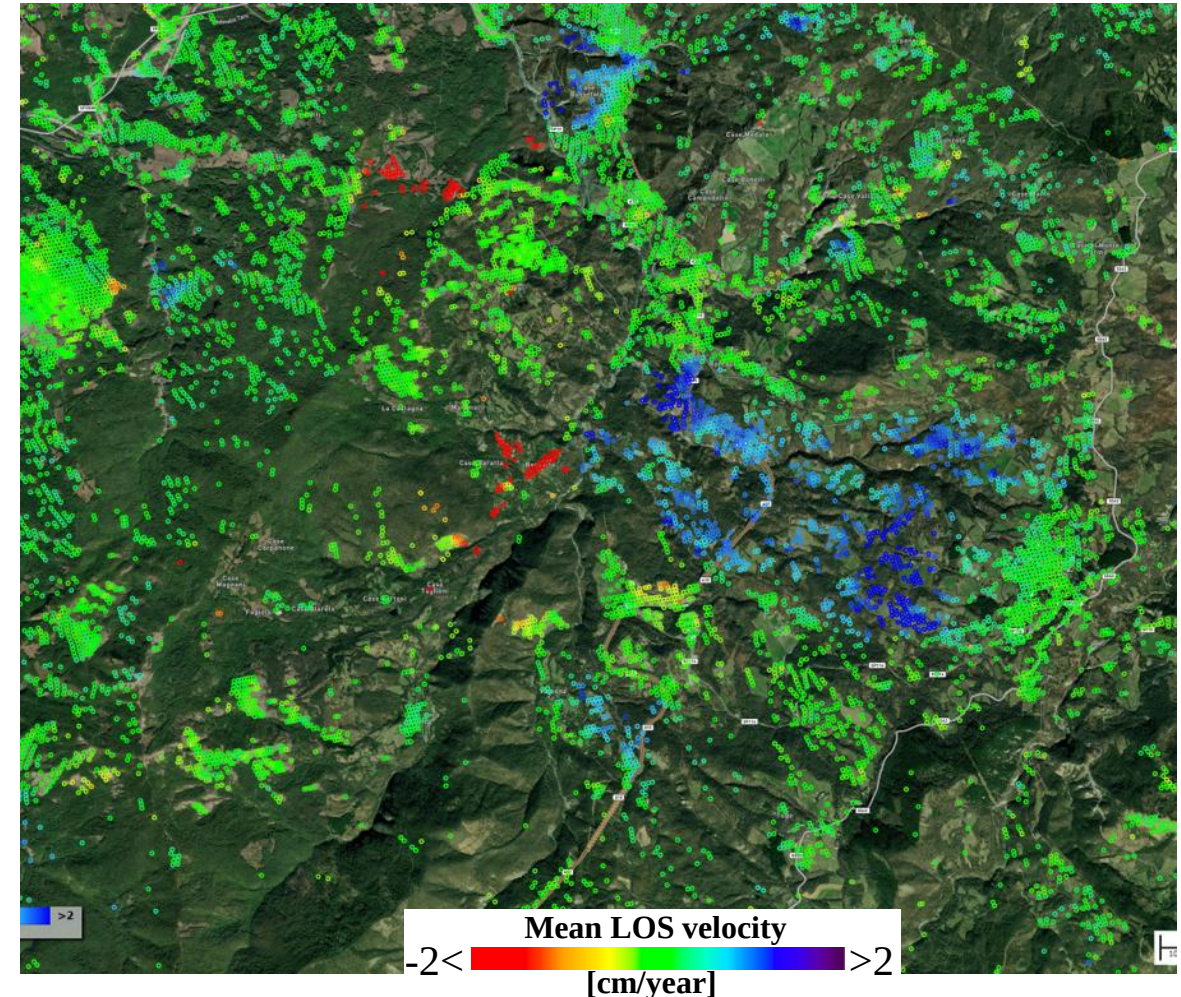
# SAOCOM-1 P-SBAS results: ground coverage improvement



## Sentinel-1 P-SBAS analysis



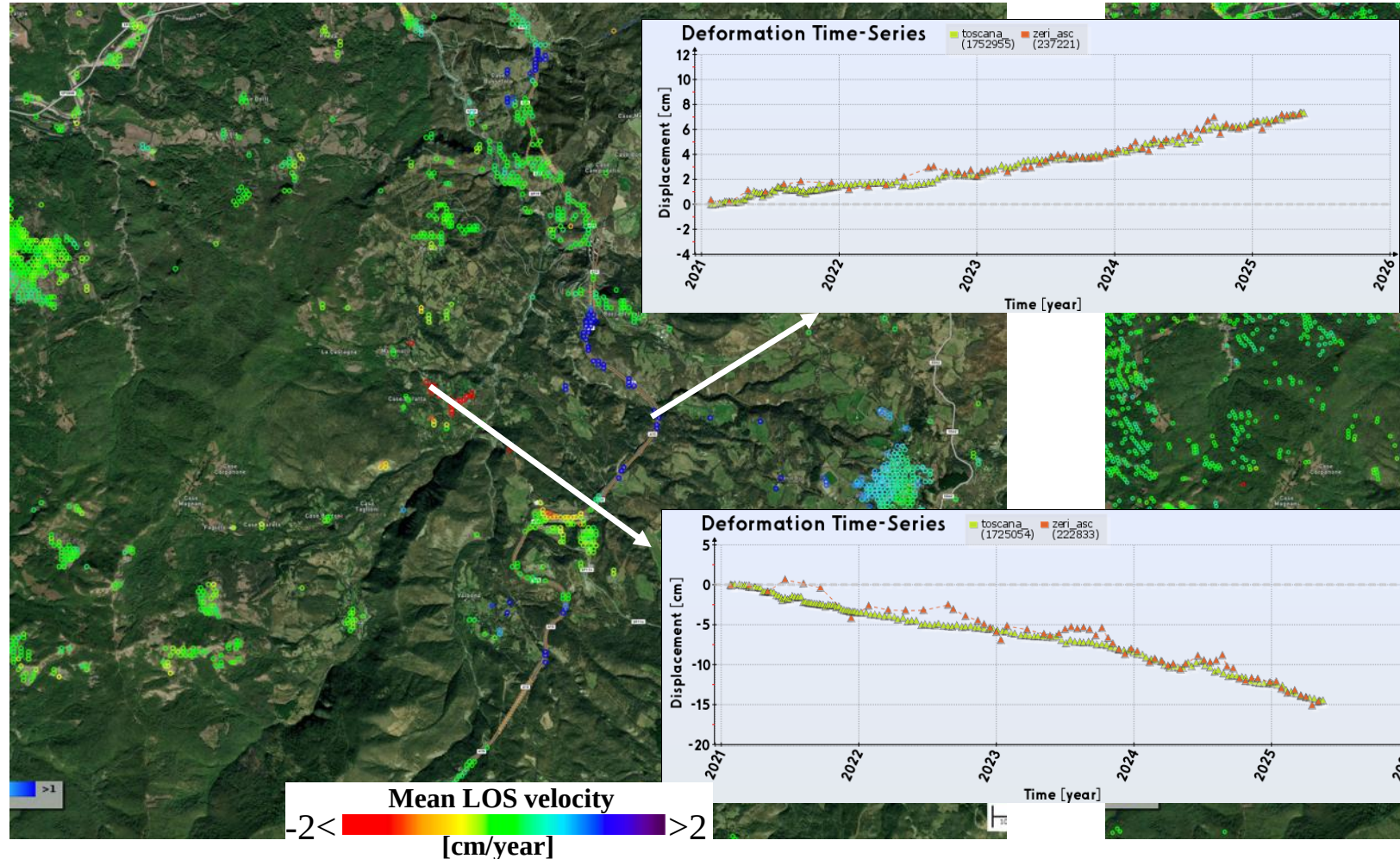
## SAOCOM-1 P-SBAS analysis



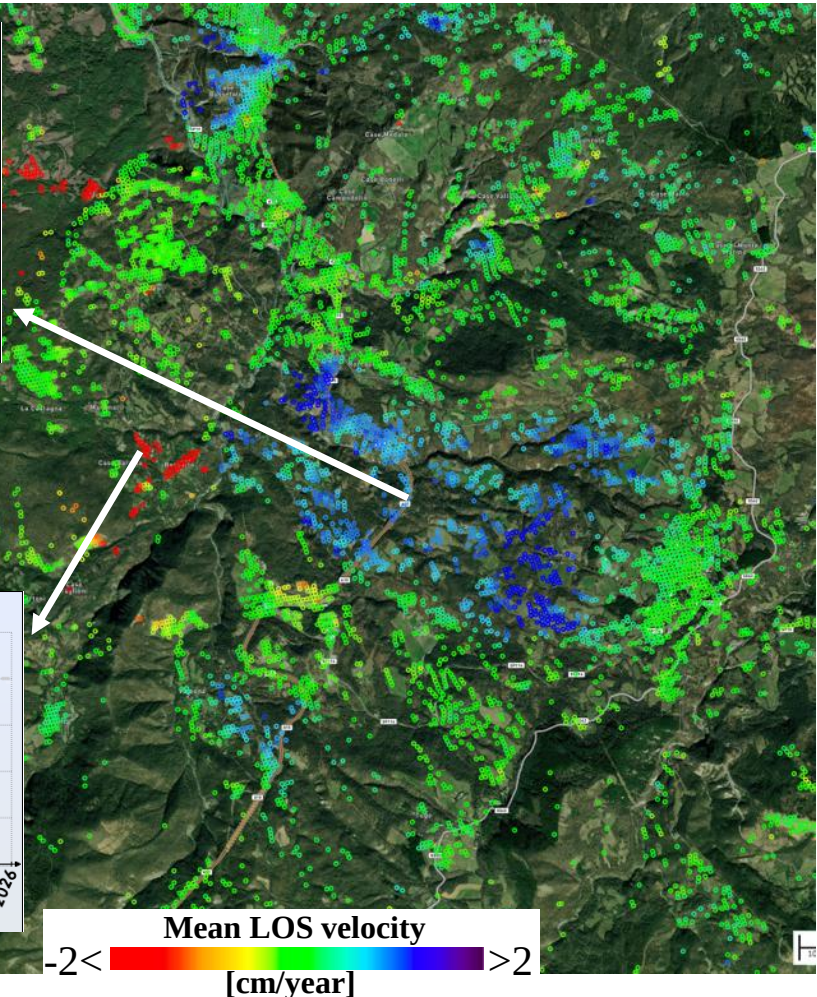
# SAOCOM-1 P-SBAS results: ground coverage improvement



## Sentinel-1 P-SBAS analysis



## SAOCOM-1 P-SBAS analysis



- The **increasing availability of L-band SAR data** provides a valuable opportunity to extend the Italian landslide P-SBAS monitoring capability towards environments that have so far been only partially investigated using shorter-wavelength C- and X-band SAR sensors.
- The performance analysis shows **high accuracy of the SAOCOM-1 P-SBAS time series** across various hazard scenarios, thereby confirming the suitability of L-band SAR systems for operational DInSAR monitoring.
- The presented results highlight the complementary role of SAOCOM-1 SAR observations for **improving deformation monitoring in challenging environments**, thereby strengthening operational landslide hazard assessment and risk management capabilities.



***Thank you***