

SAR Products

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• SCIENTIFIC RATIONALE

Thematic area: **Earth Observation - Space Geodesy**

The activity aims at provide two class of scientific products of soil deformation measurements derived from processing of single pair or large datasets of SAR images.

The application fields of such products are the following:

- Seismic cycle investigation: coseismic, postseismic and interseismic phases
- Volcanic eruptions, volcanoes inflation/deflation movements, landslides and urban or coastal subsidence.
- Natural and anthropogenic phenomena: source constrains
- Emergencies management: rapid mapping for post crisis scenarios
- Hazard assessment and risk mitigation

• OBSERVATIONAL INFRASTRUCTURE

Observational infrastructure consists of EO satellite space missions promoted by several agencies:

- X-band Cosmo-SkyMed - ASI
- X-Band TerraSAR-X - DLR
- C-Band Radarsat-2 - CSA
- C-band Sentinel-1 - ESA
- L-Band ALOS-2 - JAXA

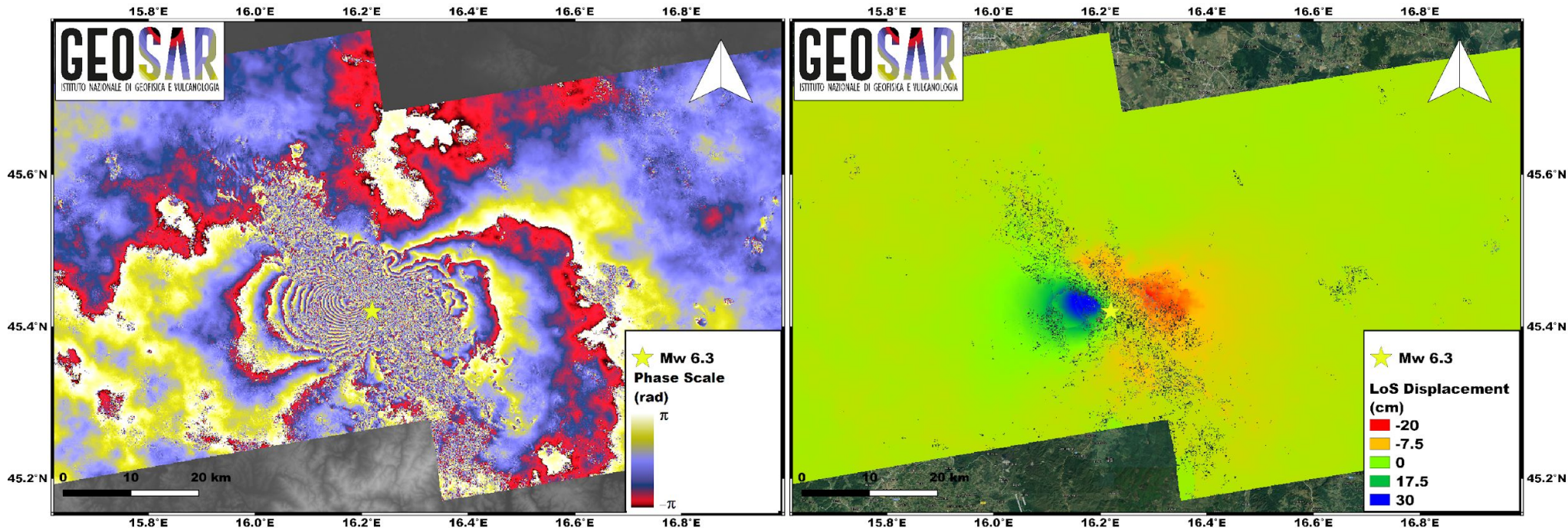
They provide SAR images with different resolution, spatial coverage and revisit time.
Such characteristics can be exploited according to the users requirements

• TECHNOLOGICAL LABORATORIES

Decreto Direttoriale n. 16/2018



GEOSAR Laboratory is an INGV infrastructure specifically devoted to the analysis, interpretation and modelling of SAR (Synthetic Aperture Radar) data acquired by space missions worldwide. The Laboratory mainly focuses on the study of ground displacements induced by natural and anthropogenic phenomena.

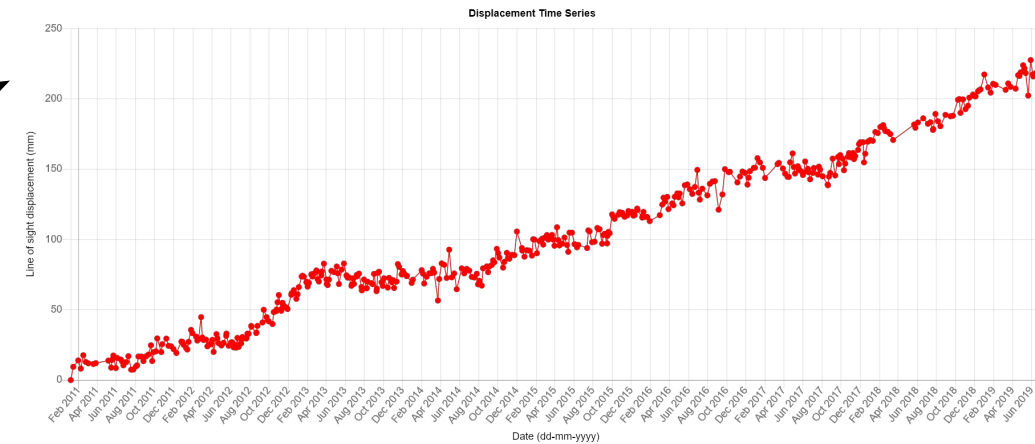
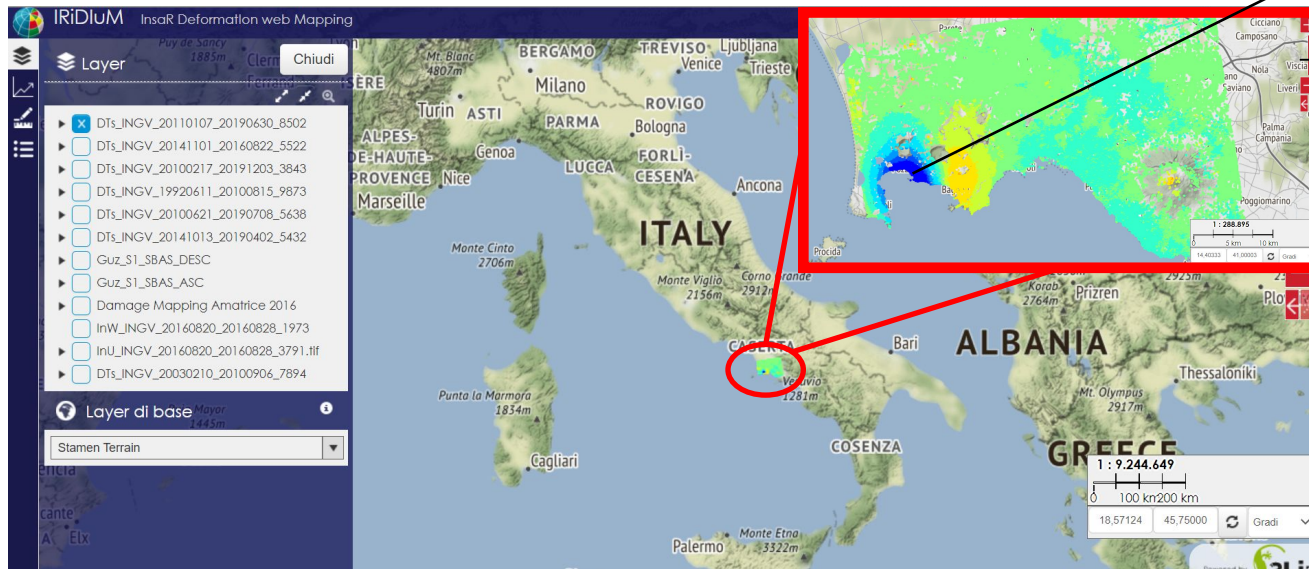


Study of coseismic deformation due to the Mw 6.3 earthquake occurred in Croatia on 29-12-2020

• INFRASTRUCTURE FOR DATA MANAGEMENT



- IRiDiuM is an INGV webgis. It is a database of SAR products. It allows to search, display and also perform simple post processing analysis of any available products of ground deformation
- <http://tsd.ct.ingv.it/tsdws/sar/> - Online platform of interactive Sentinel-1 InSAR products related to Mt. Etna Volcano Supersite, in the frame of GEO-GSNL initiative



• INFRASTRUCTURE FOR DATA PROCESSING

INGV is equipped with several infrastructures specifically dedicated to SAR data processing and licensed and open source softwares are exploited for the aim

INFRASTRUCTURES:

Name	CPU	RAM	HD
INGV Workstations	1-2 CPU 2.4-3.4GHz	24GB-62GB	2TB-4TB
Server ReCaS – INFN Bari	4 CPU 2.3GHz	16GB	10TB+ RECAS file system
INGV Linux Processing Server	4x Intel Xeon-Gold 2.3GHz/24-core	256GB	16TB
Virtual Machines on OE CED	4x Intel Xeon-Gold 2.3GHz/24-core	64 GB	10Tb
PSNC Virtual Machines	Intel CPU 2.6GHz	32GB	3TB-10TB

SOFTWARES:

- ENVI+SARSCAPE
- GAMMA
- LICSBAS
- ISCE + MintPy
- HyP3 + MintPy
- STaMPS
- Online GEP services from ESA

• PRODUCTS AVAILABLE

SAR output products can be classified in two classes:

CLASS 1: products retrieved by single pair data processing by InSAR, POT and MAI techniques

- SAR Line-of-Sight (LoS) and Line-of-Flight (LoF) displacement maps
- East-West and Vertical deformation component maps (if possible)
- Interferometric fringes (Wrapped phase maps)
- Interferometric coherence maps

CLASS 2: products retrieved by multi-temporal InSAR analysis

- Ground deformation velocity maps
- Ground acceleration maps
- Time series from PS, SBAS and IPTA processing

• PRODUCTS AVAILABLE

Today

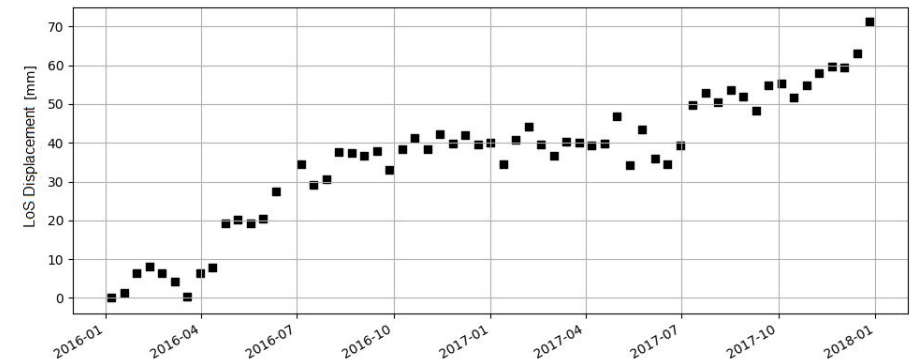
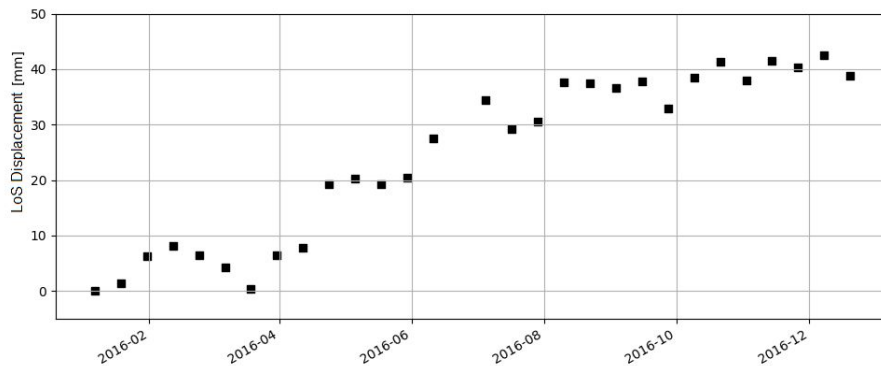
Product	Format	Spatial coverage	Temporal coverage	Provision
SAR Interferometry (InSAR) deformation maps	GeoTiff	Depending on sensor and users requirements	-	On demand*
Multiple Aperture Interferometry (MAI) deformation maps	GeoTIFF	Depending on sensor and users requirements	-	On demand
Pixel Offset Tracking (POT) deformation maps	GeoTIFF	Depending on sensor and users requirements	-	On demand
InSAR Displacement Time Series	Shapefile	Depending on sensor and users requirements	Best case: 6 days (Sentinel-1)	On demand
InSAR velocity maps	GeoTIFF	Depending on sensor and users requirements	-	On demand
InSAR Acceleration maps	GeoTIFF	Depending on sensor and users requirements	-	On demand

* In case of seismic event in Italy ($M_w > 5$) the GEOSAR Lab is activated by INGV crisis unit to provide InSAR deformation maps and relative interpretation

• PRODUCTS AVAILABLE

Tomorrow

- InSAR time series updating
CSK -> Campi Flegrei
S1



- Automatic Processing of S1 pair
- SAR in Sala project

• CURRENT DISTRIBUTION OF PRODUCTS

SAR products produced by the GEOSAR Laboratory and any other INGV remote sensing groups are made available depending on the activities:

Services:

Such products are provided in the framework of a collaboration agreement between INGV and DPC

Projects

Such products are available as outcomes within the end of the project

Scientific purposes:

Such products are currently available on-demand inside and outside INGV. All the products on IRiDiUM webgis will be freely accessible by all the INGV staff

• PROGRAMS/PROJECTS OF REFERENCE

PROJECT	FINANCING	DURATION
Harmonia	EU	3.5 years
LOVE-CF	FOE	3 years
Reliance	EU	2 years (31-12-2022)
PON-GRINT	MUR	3 years (31-1-2022)
Allegato A	DPC	-
Ricerca Libera	FOE	-

• TEAM AND AFFILIATIONS

- Matteo Albano – Sezione ONT
- Andrea Antonioli – Sezione ONT
- Simone Atzori – Sezione ONT
- Lisa Beccaro – Sezione ONT
- Christian Bignami – Sezione ONT
- Alessandro Bonforte – Sezione OE
- Sven Borgstrom – Sezione OV
- Erica De Paolo – Sezione ONT
- Girolamo Dixit Dominus – Sezione ONT
- Fawzi Doumaz – Sezione ONT
- Nicola Famiglietti – Sezione ONT (Grottaminarda)
- Francesco Guglielmino – Sezione OE
- Marco Moro – Sezione ONT
- Giuseppe Pezzo – Sezione ONT
- Marco Polcari – Sezione ONT
- Giuseppe Puglisi – Sezione OE
- Stefano Salvi – Sezione ONT
- Michele Saroli – Sezione ONT
- Valeria Secreti – Sezione ONT
- Valeria Siniscalchi – Sezione OV
- Salvatore Stramondo – Sezione ONT
- Nikos Svigkas – Sezione ONT
- Cristiano Tolomei – Sezione ONT
- Elisa Trasatti – Sezione ONT