OUR PLANET FROM SPACE

SAR SENSORS: EARTH'S SURFACE MONITORING FROM SPACE

Since 1992 several space agencies included in their satellite missions an active sensor, known as Synthetic Aperture Radar (SAR), able to observe the Earth's surface in any atmospheric conditions. Thanks to the development of advanced data processing techniques, SAR images allow to estimate the soil deformation induced by natural events such as earthquakes, volcanic eruptions, landslides or coastal erosions.
SAR products are presently available worldwide and are largely used to support national agencies in risk mitigation and emergency management and to improve the knowledge of our living planet.
Currently, the main space missions equipped with a SAR sensor are:

Sentinel-1
Cosmo-SkyMed
Radarsat-2
SAOCOM
TerraSAR-X
PAZ
ALOS-2

graphic design Laboratorio Grafica e Immagini | INGV

COS CENTRO OSSERVAZIONI SPAZIALI DELLA TERRA

ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA

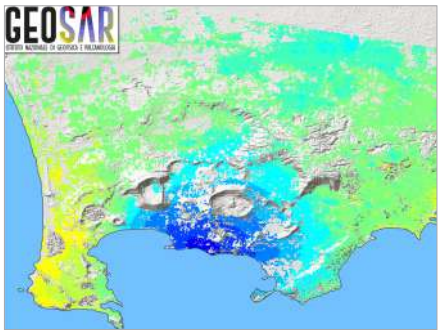
INGV GeoSAR Laboratory

An infrastructure dedicated to the study of our planet by satellite SAR data

In 2018, INGV established the GeoSAR laboratory, with the aim of collecting the INGV researchers and technologists with long experience in the use of satellite SAR data.
The activities of the GeoSAR Laboratory are focused on the analysis, modelling and interpretation of SAR data for the study of natural and anthropogenic deformation phenomena characterizing the Earth's surface.
The main tool exploited for such purposes is a data processing technique known as SAR Interferometry (InSAR) which combine the images acquired by SAR sensors before and after an event to evaluate how and how much the soil has deformed. The output produced by InSAR analysis is a 2D map, called interferogram, consisting of a color cycle image where every cycle is known as interferometric fringe and represents a soil deformation of some cm.

There are also advanced multi-temporal version working on more SAR images acquired over long time spans. They allow to measure the linear velocity and to observe the temporal evolution of a deformation phenomena by displacement time series analysis. SAR products performed by the GeoSAR Laboratory can be exploited for several purposes and are applied in many application fields such as:

- Seismic cycle investigation
- Urban or coastal subsidence evaluation
- Rapid mapping
- Volcanoes inflation/deflation movements
- Infrastructures monitoring
- Emergencies management
- Landslides analysis
- Seismic or volcanic source constrain
- Wildfires monitoring



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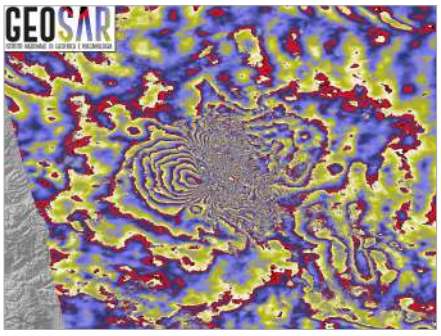

CENTRAL ITALY SEISMIC SEQUENCE

NORTHERN ADRIATIC COASTAL SUBSIDENCE

IRIDIUM

SAR products are collected in an INGV platform called IRiDIuM (InsaR DeformatIon web Mapping) reacheble online through the following link: http://www.geosar-iridium.ct.ingv.it/. They are organized in two main folders:

- InSAR ground displacement maps: products retrieved by single pair of SAR images
- InSAR ground displacement time series: products retrieved by multi-temporal SAR dataset

Each product is provided with two metadata to guarantee the reproducibility and they can be downloaded free of charge.
IRiDIuM also includes a webGIS tool where any users can visualize and interrogate the products and also perform simple post-processing analysis.

All the space-related INGV flyers are here!

SAR products perfomed by INGV GeoSAR Laboratory constitute one of the operating module of the Centro di Osservazione Spaziale della Terra (COS) in the thematic area "Earth Observation - Space Geodesy". The COS has been established by INGV in 2020 with the aim to coordinate the activities and represent the INGV in working groups operating in the Space and Aerospace sector at national and international level and to encourage the generation of services and products based on Earth Observation data