



Space-based services for civil protection

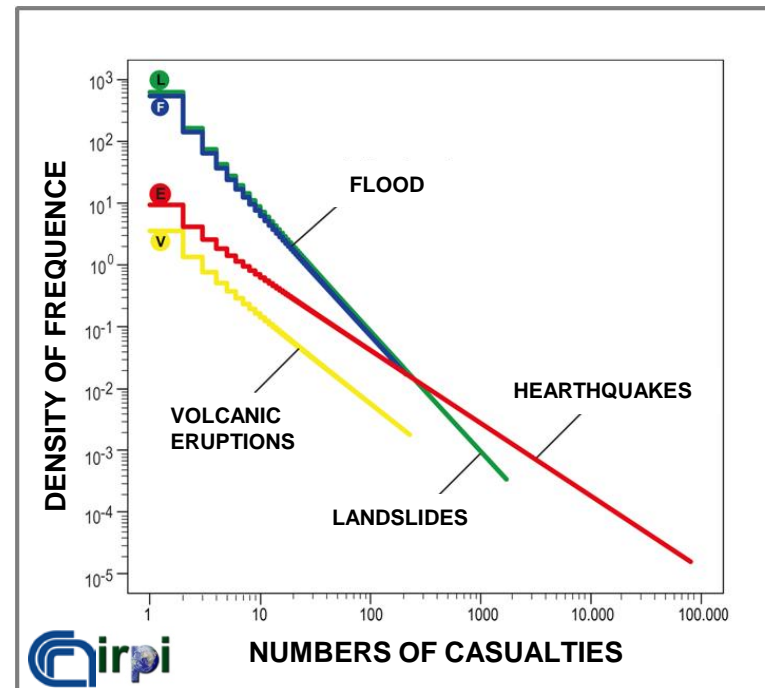
ARTES Applications Workshop – CASD Rome, 19th April 2013

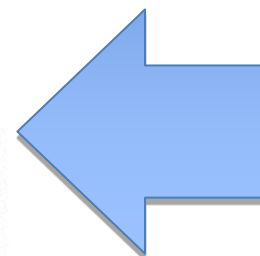
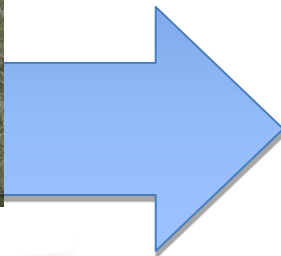
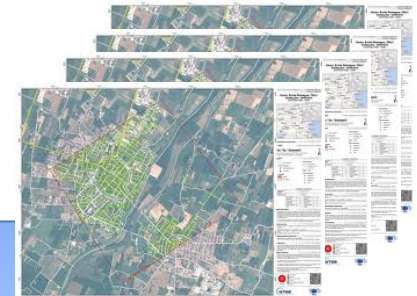
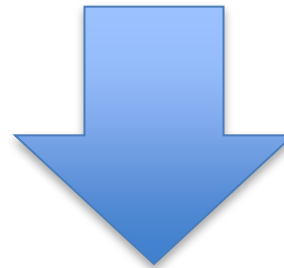
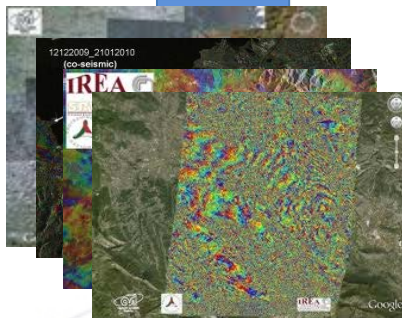
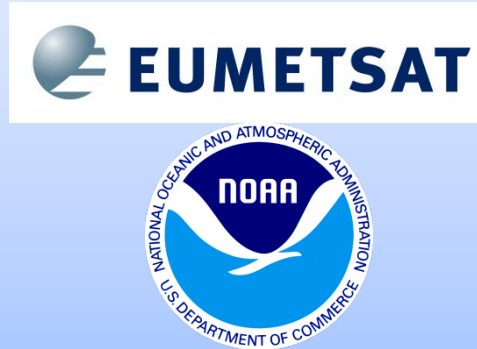


PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

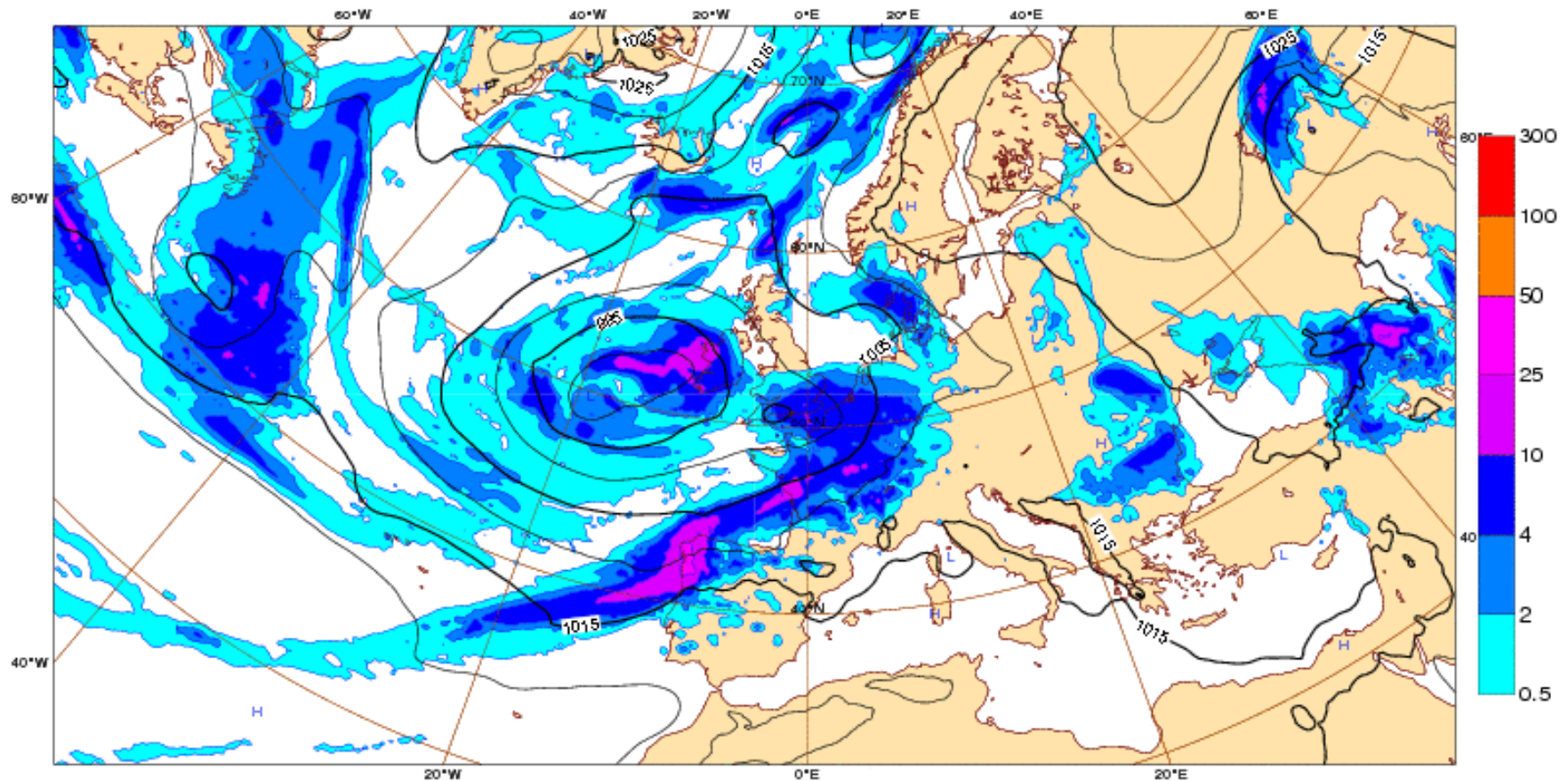
luigi.dangelo@protezionecivile.it

Risks in Italian Territory



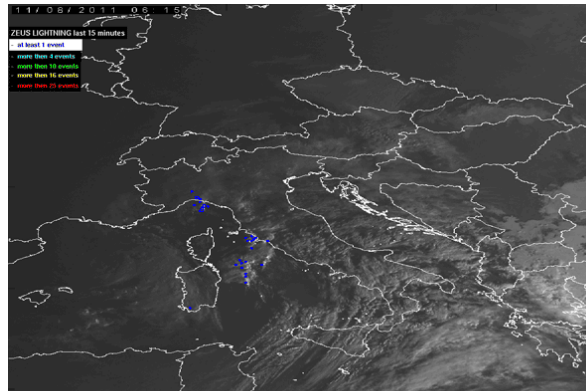
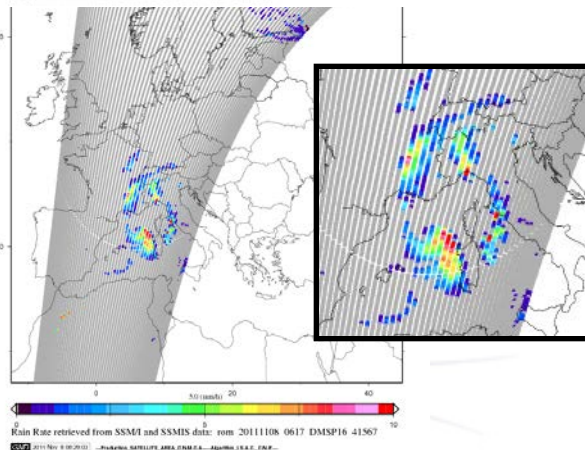
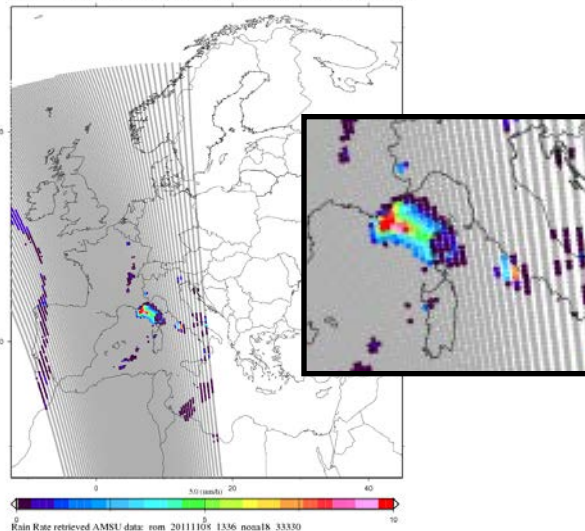


Assimilation of meteorological satellite data in the numerical weather prediction

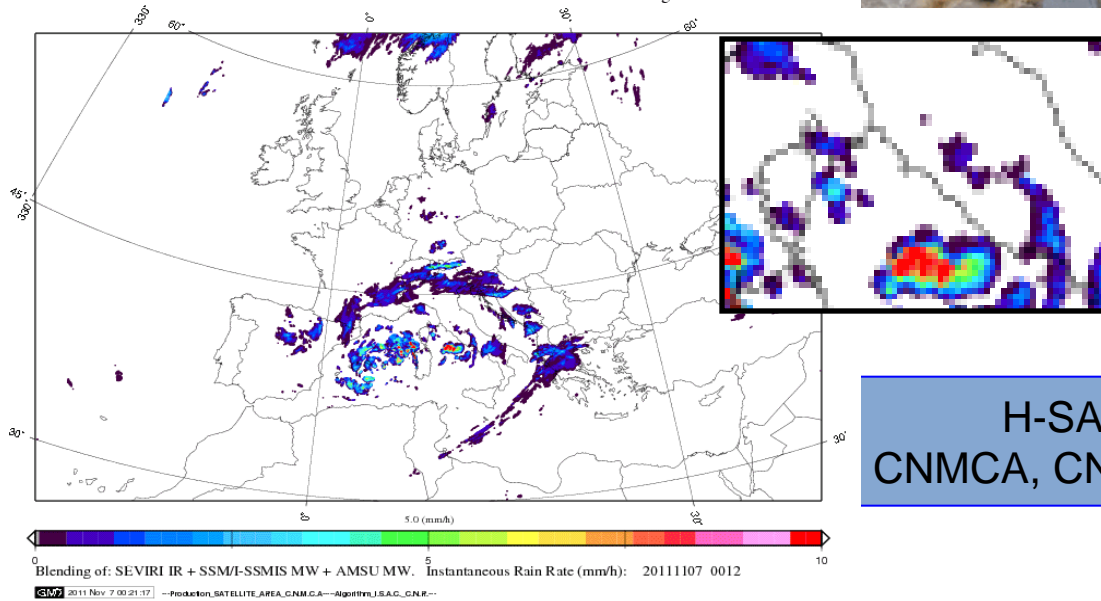


Precipitation estimation derived by European Geostationary and Polar meteorological satellites

EUMETSAT H-SAF PR-OBS-2 Instantaneous Rain Rate from Cross-track MW Scan



EUMETSAT H-SAF PR-OBS-3 Instantaneous Rain Rate retrieved from IR-MW blending data

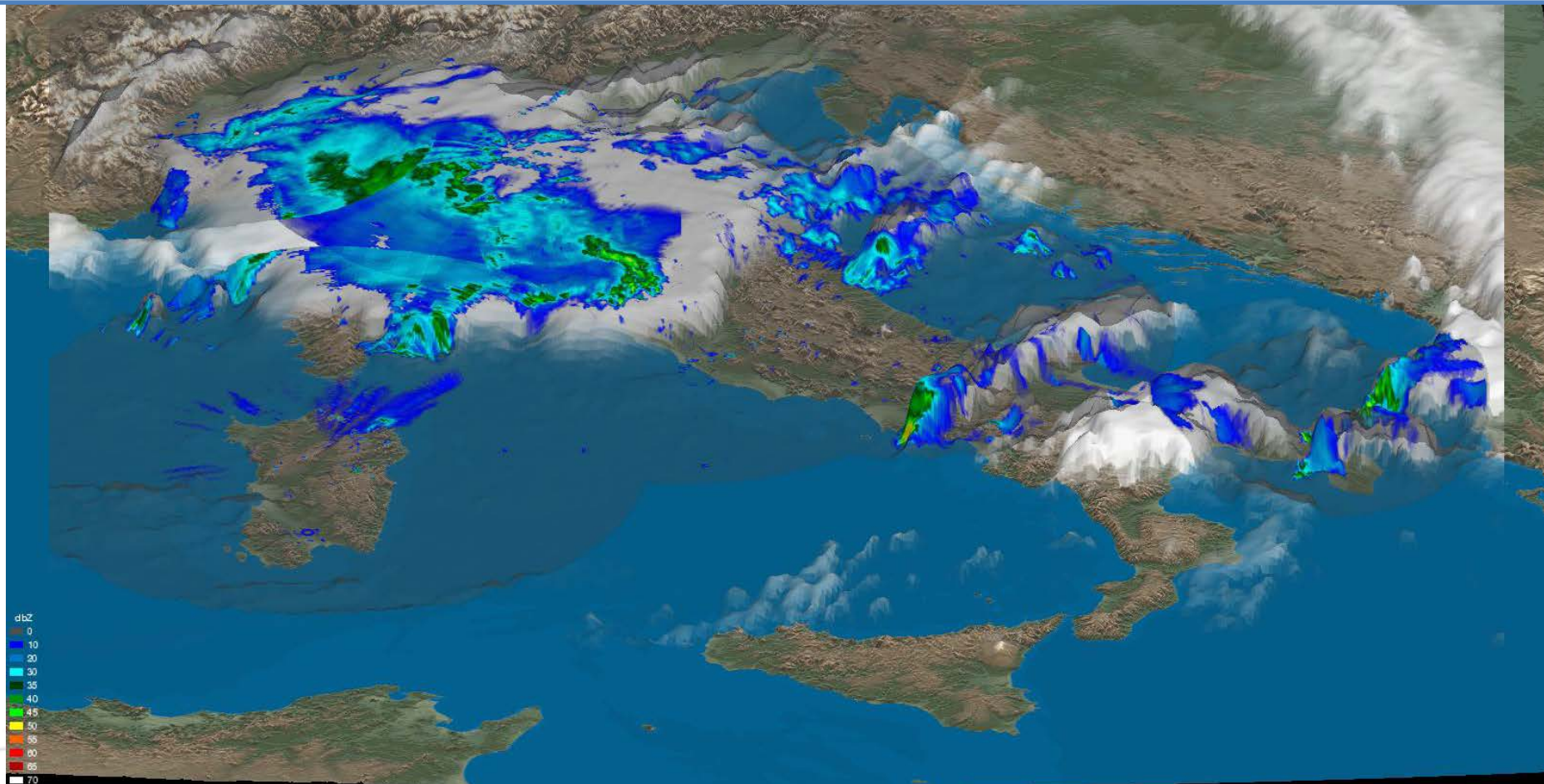


Elba, 7 Nov. 2011

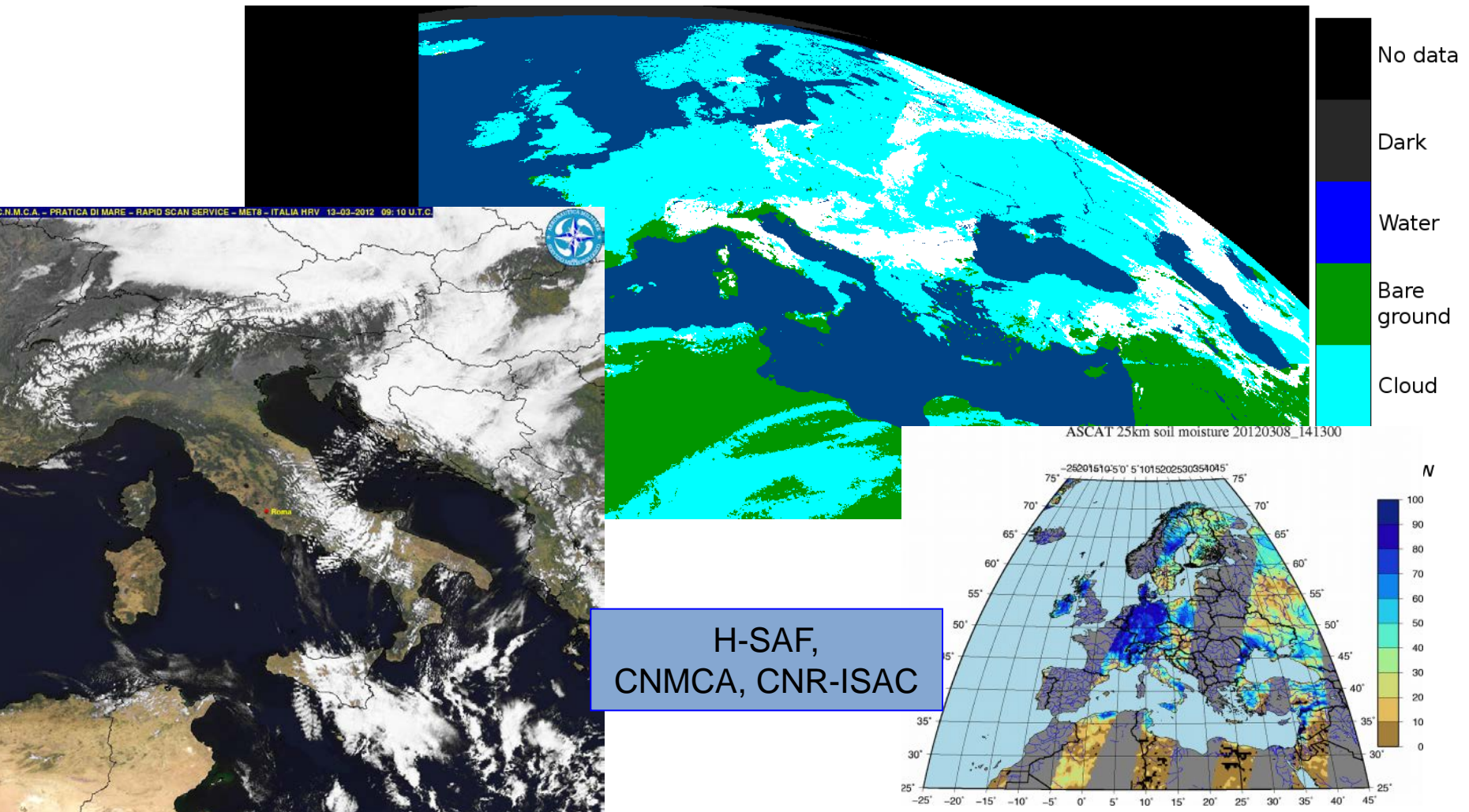


H-SAF
CNMCA, CNR-ISAC

Meteorological satellite (MSG) and radar data integration for the precipitation monitoring

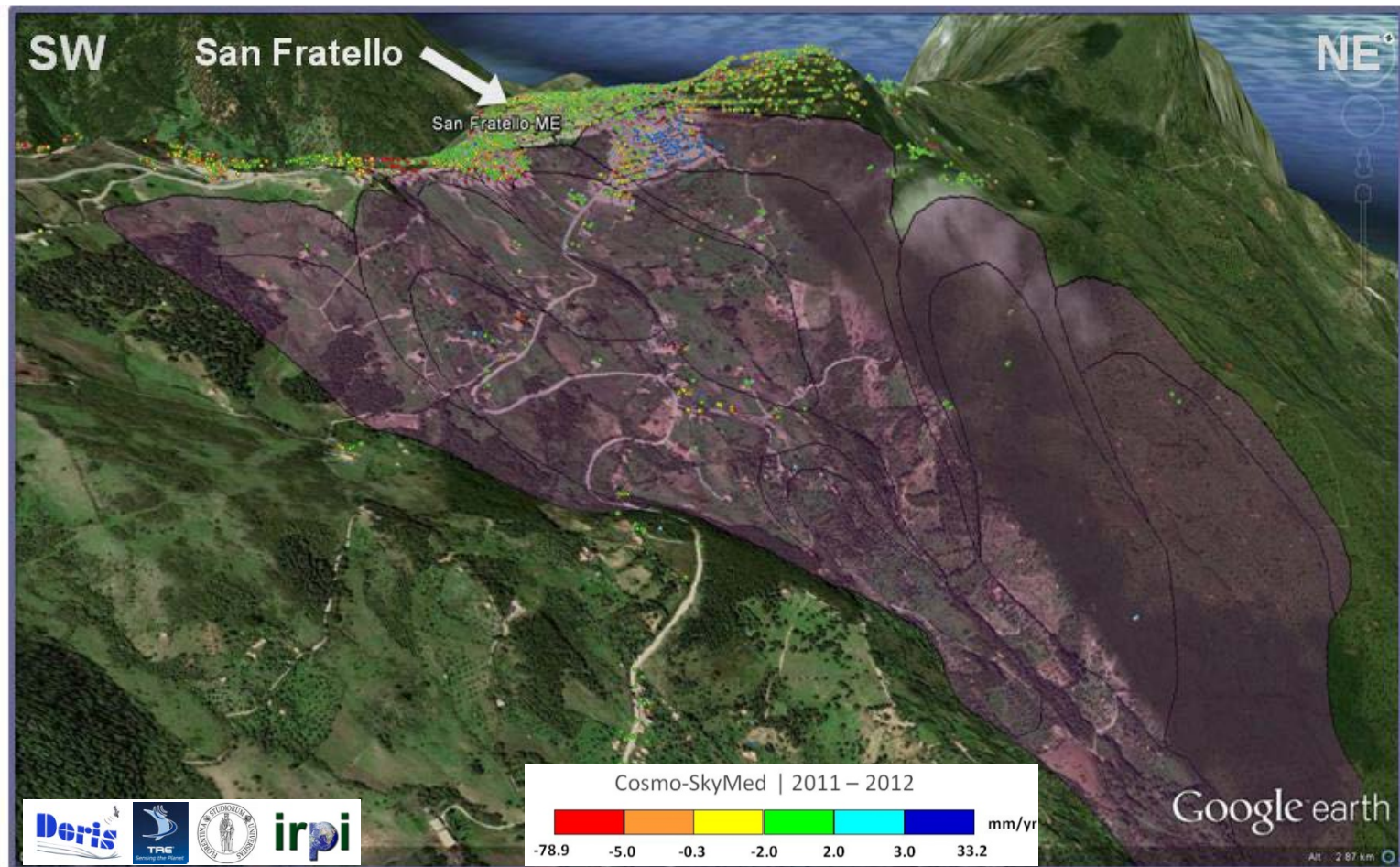


Snow and Soil Moisture products derived by European Geostationary and Polar meteorological satellites

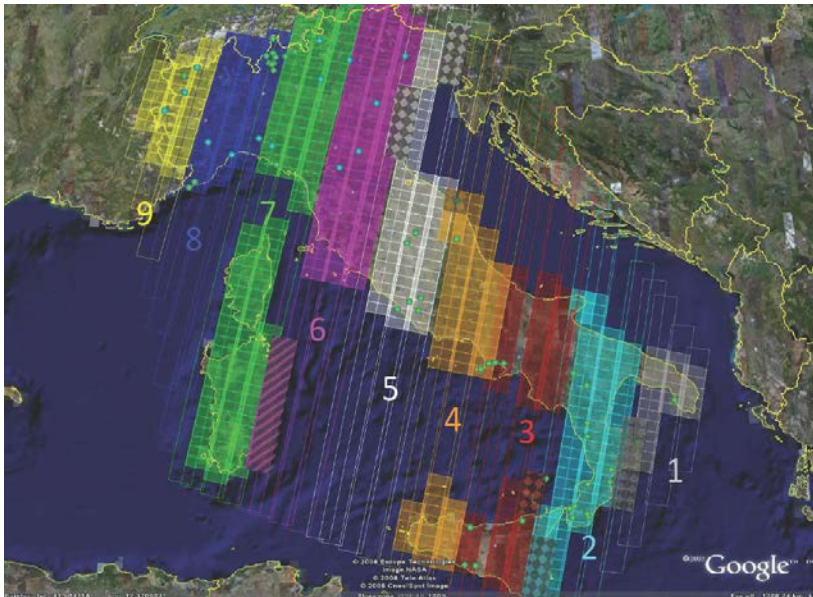


Forecasting, Monitoring & Surveillance

Integration of Satellite and Ground Based InSAR data for the detection and the evaluation of ground movements



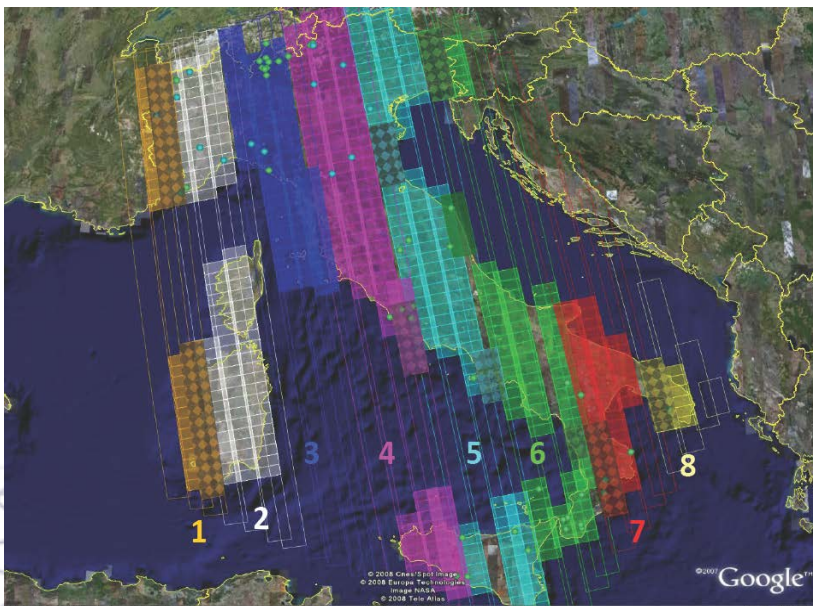
Seismic Risk - Prevention

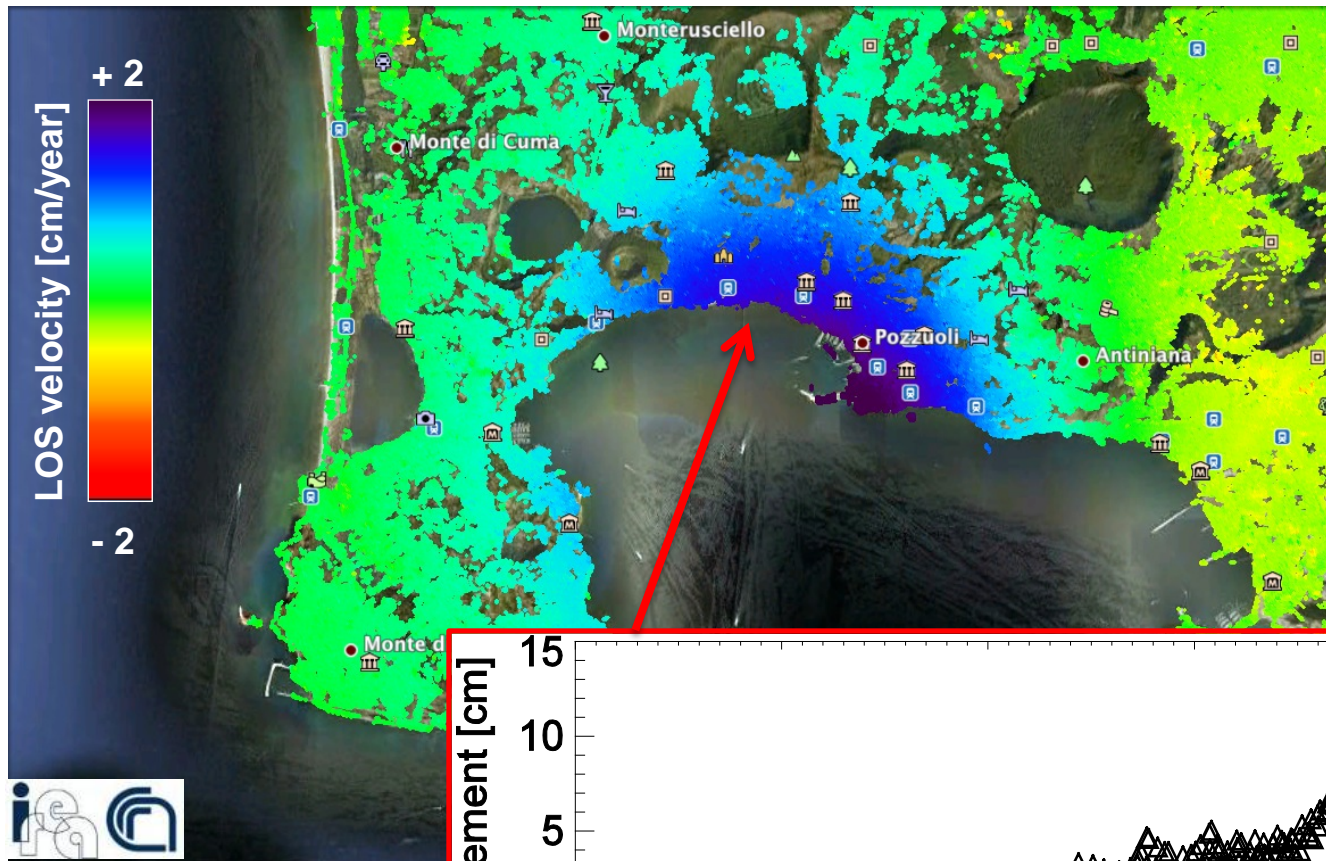


MapItaly acquires temporary series of satellite images on the national territory.

These are devoted to interferometric analyses aimed at civil protection purposes, along with interseismic, co-seismic and post-seismic ground deformation.

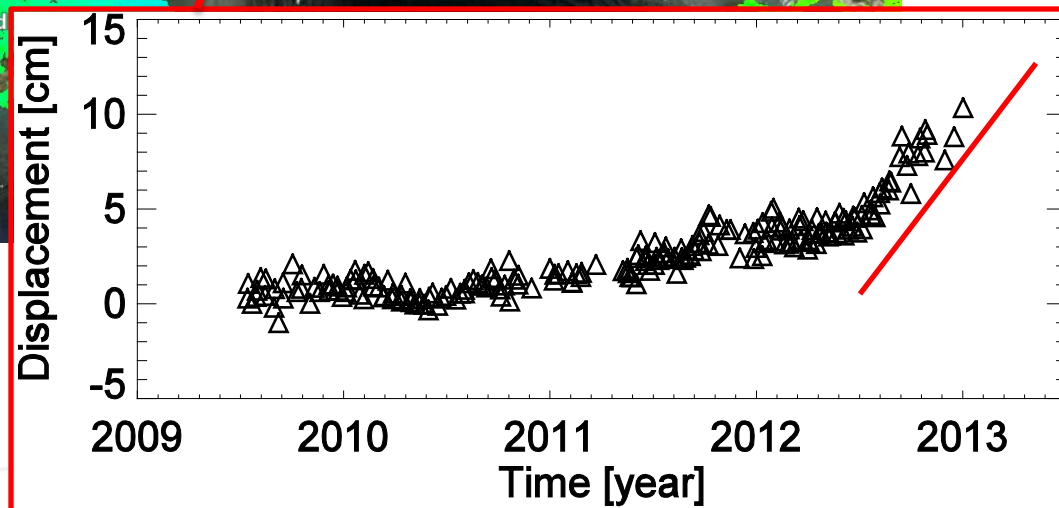
These acquisitions monitor the entire Italian territory and populate an interferometric archive.





Cumulative displacement of the Campi Flegrei area obtained by processing COSMO-SkyMed images acquired between 2009 and 2011 with a SBAS technique.

Deformation time series of a point in the Pozzuoli Harbour.



FLASH FLOOD OCT. 25TH, 2011 - CINQUE TERRE, VARA AND MAGRA BASINS

- Several landslides → Brugnato, Borghetto Vara, Pignone Monterosso, Vernazza;
- Damages →
 - houses, shops, businesses, essential services such as power lines, gas pipes, telephone lines, public transport and private;
 - 23 interrupted roads (250 km) and block of 4 days of the highway between La Spezia and Sestri Levante.
 - Closing of the railway line for 4 days.
 - Collapse of the arch of the Colombiera bridge.

10 CASUALTIES

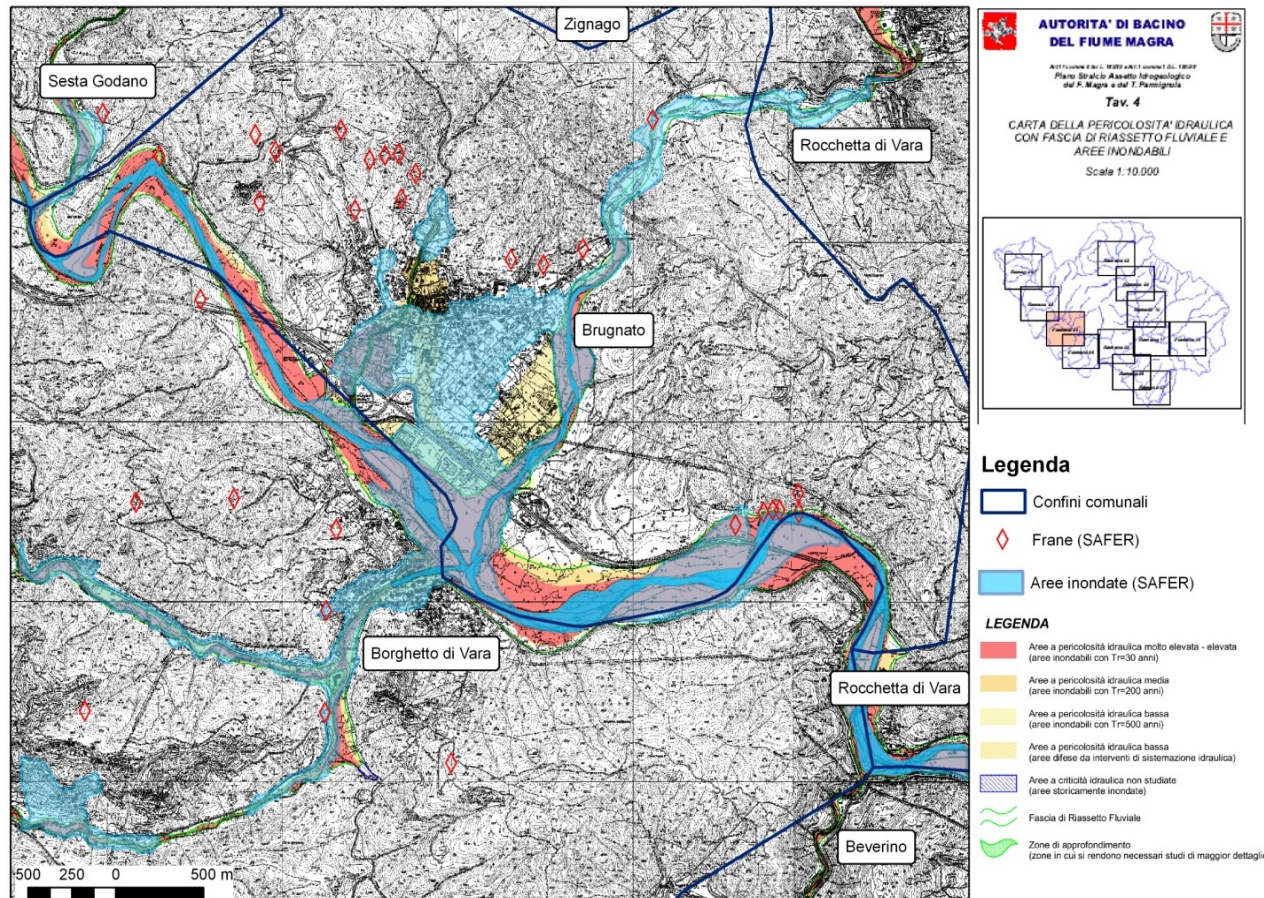
BEFORE



AFTER



FLASH FLOOD OCT. 25TH, 2011 - CINQUE TERRE, VARA AND MAGRA BASINS



Flooded area and debris flows mapped by optical and radar satellite images

Provided by



now



LANDSLIDE MAR. 7TH, 2011 – CAVALLERIZZO DI CERZETO



In March 2005 a landslide involved the historical center of Cavallerizzo di Cerzeto (Calabria Region).

329 people were evacuated on a total of 581 abitants.

The village of Cavallerizzo, based on a historical landslide, is characterized by a high hydrogeological and seismic risk.

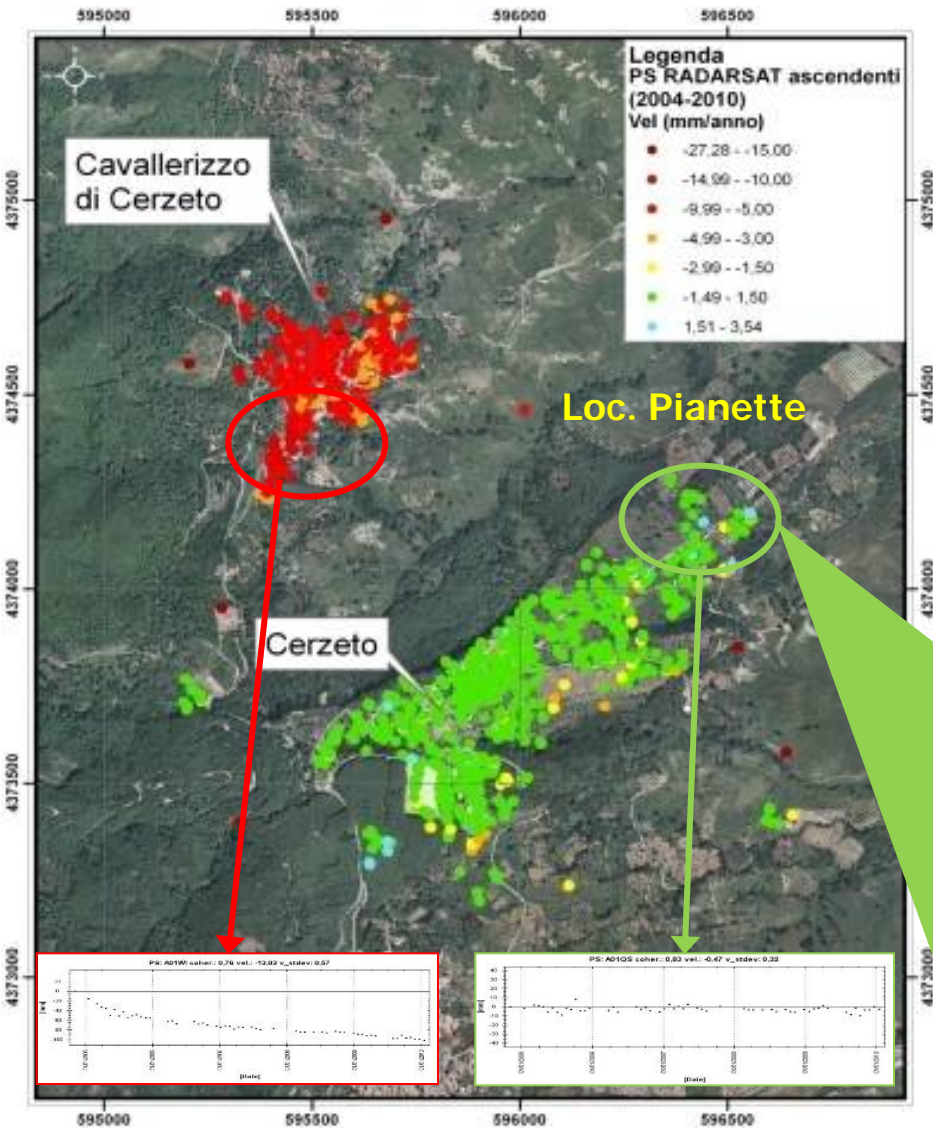
Due to the event and the numerous analyses performed, the need to re-locate Cavallerizzo in a different area was clear, the area identified is near Cerzeto.

The identification of the areas, the design and construction of the new group of houses were the responsibility of the Head of the Civil Protection Department.

The building site was open in October 2007.

The works to build the new town were completed In December 2011.

LANDSLIDE MAR. 7TH, 2011 – CAVALLERIZZO DI CERZETO



SATELLITE DATA:

- ERS1/2 (1992-2000)
- ENVISAT (2002-2005)
- RADARSAT (2002-2005)
- RADARSAT update (2004-2010)

ACTIVITIES:

- Ground deformation assessment
- Detection and mapping of unstable area
- Residual risk assessment
- Detection of an area for the new town



Emergency & Post Emergency

EMERGENCY

www.protezionecivile.gov.it

COSTA CONCORDIA JAN. 13TH, 2011 – GIGLIO ISLAND



Friday, January 13, late in the evening the Costa Concordia cruise ship with 4,228 people on board begins to embark water due to a collision with the rock of Sciole and is grounded off the shore of the island of Giglio.

With the OPCM n. 3998 of 20 January 2012, the Council of Ministers appoints the Head of Civil Protection Department emergency response coordinator.

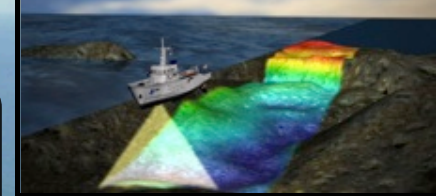
The duties of the Head of Civil Protection include:

- coordinating efforts to overcome the emergency;
- supervising the implementation of interventions for securing the vessel and remediation by the Costa Concordia cruiseline company;
- the power to replace, in the event of default, the persons responsible;
- verify that the removal of the wreck takes place in safety.

COSMO Sky-Med
(ASI / POLIMI / TRE)



Multibeam (OGS)



Accelerometer
(SMIT / Siri Marine)

Benchmarks
(CNR-IRPI / TRIMBLE / LEICA)

GPS
(HERA / CODEVINTEC)

Laser Scanner
(UNIFI)

MIMO SAR
(EC-JRC)

Total station
(CNR-IRPI / LEICA)

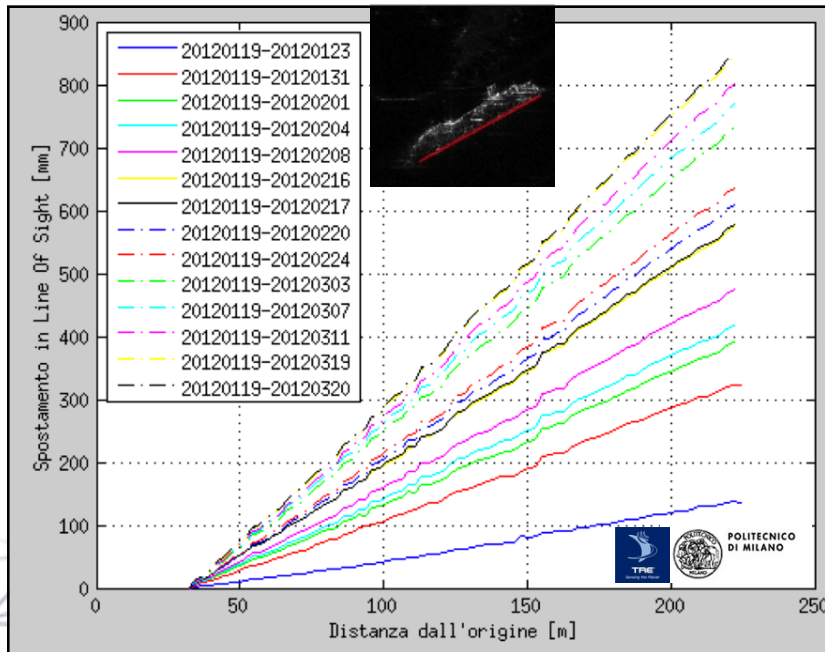
Seismometers
(FPR-IGT / INGV)

Total station
(TRIMBLE)

Extensometer
(UNIFI / HORTUS)

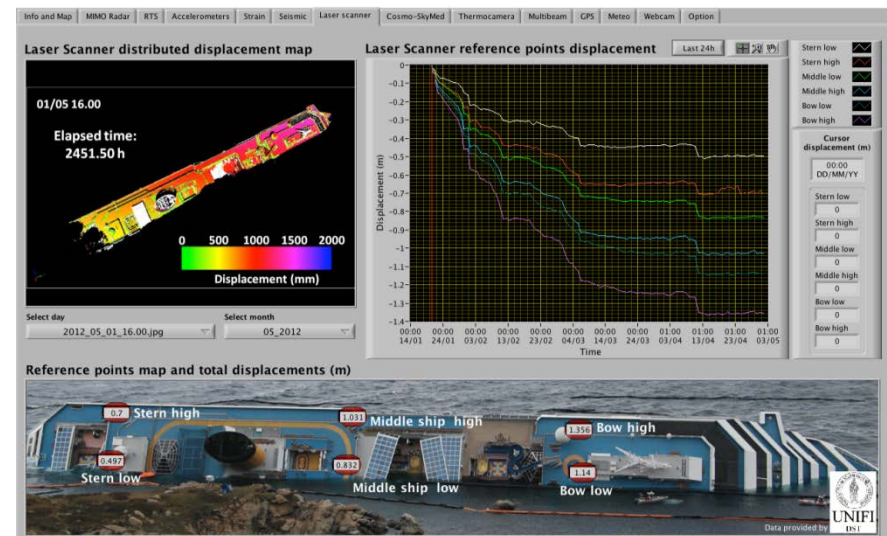
Monitoring network





SATELLITE DATA:

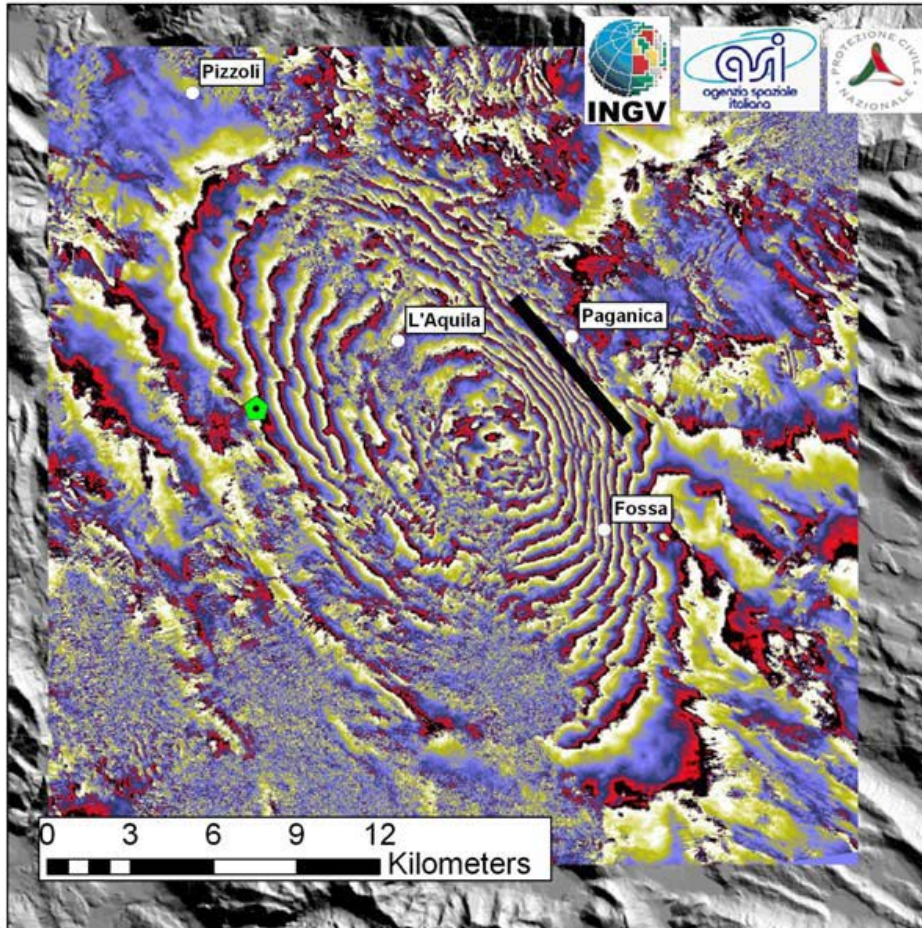
- CosmoSky-Med – Spotlight provided by ASI
- Processed by TRE (Tele Rilevamento Europa) and Politecnico di Milano



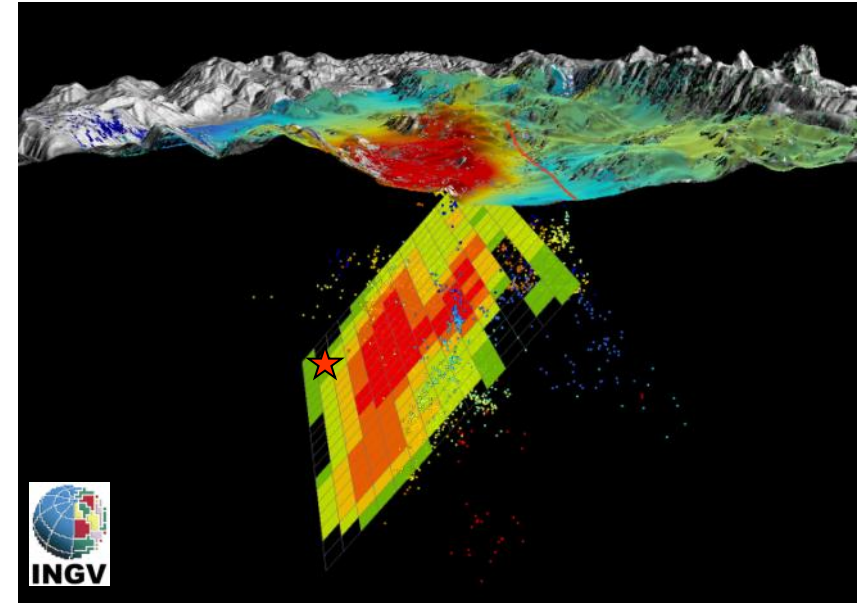
ACTIVITIES:

- Movement assessment of emerged section and integration with the data of monitoring system in real time data (total station, ground based radar and microseismic network)
- Assessment and monitoring of dispersion of fuel and contaminants in the emptying of reservoir

After the Mw 6.3 April, 2009 L'Aquila earthquake, the COSMO-SkyMed interferogram allowed inferring the co-seismic deformation map and modelling the related seismogenic fault.



Co-seismic interferogram on COSMO-SkyMed data:
-25 cm LoS (line of sight) displacement (lowering)

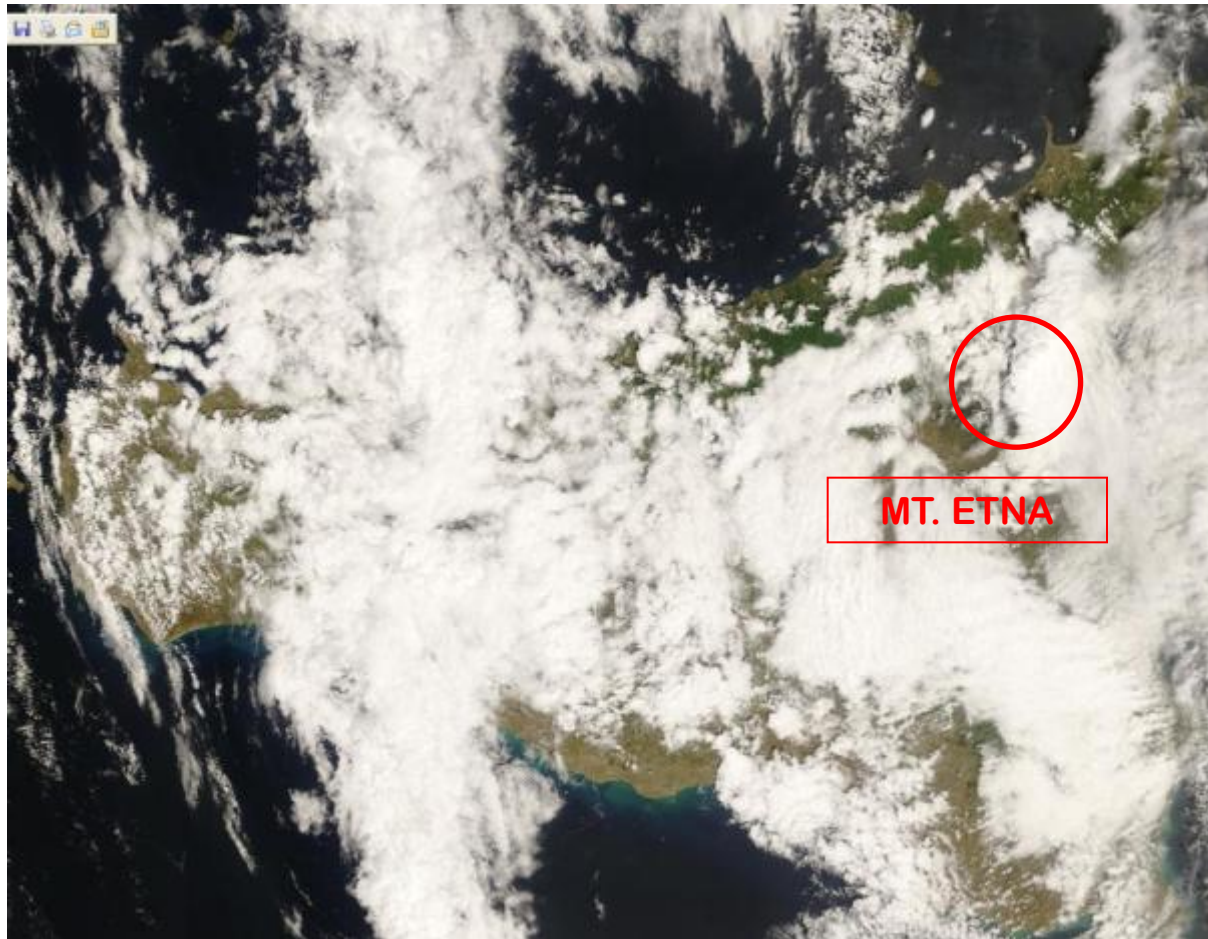


Seismogenic fault plane modelled from interferometric data.

Red patches show the parts of the fault plane where co-seismic displacement was at its peak.

Red star: earthquake epicentre.





ETNA ERUPTION May 2008

Optical image
acquired by
MODIS satellite
on
May 13, 2008



Pre-Event

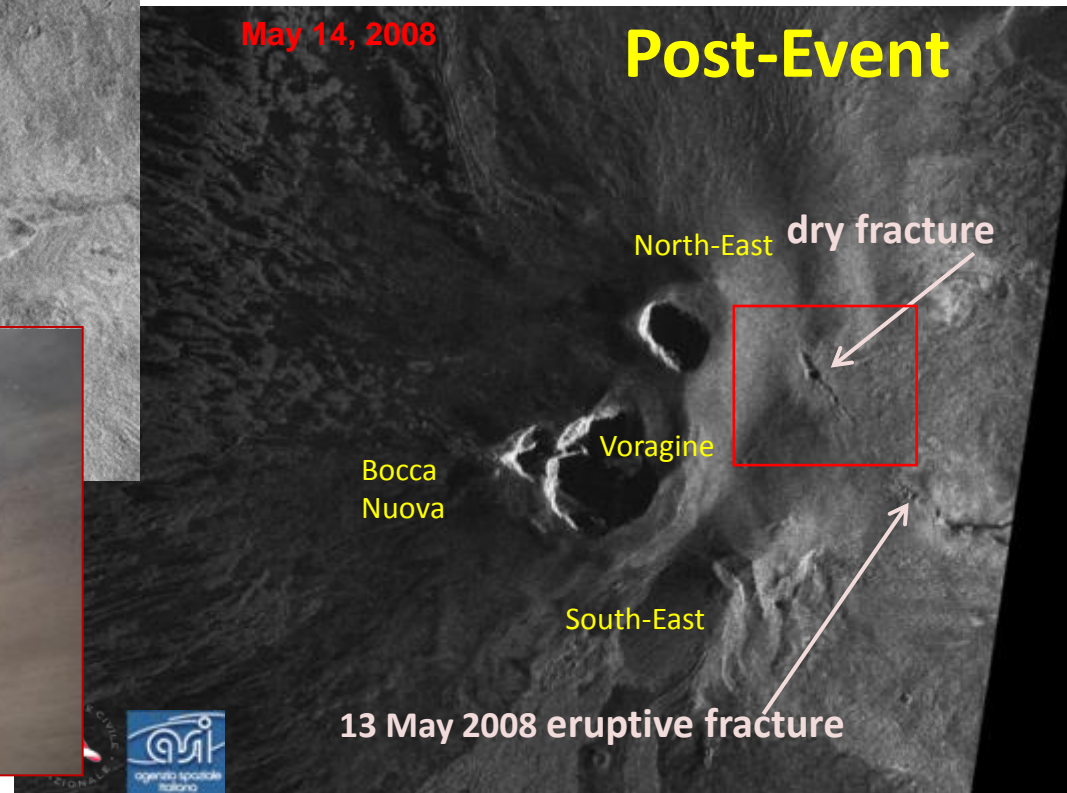


ETNA ERUPTION May 2008

COSMO-SkyMed high-resolution images

May 14, 2008

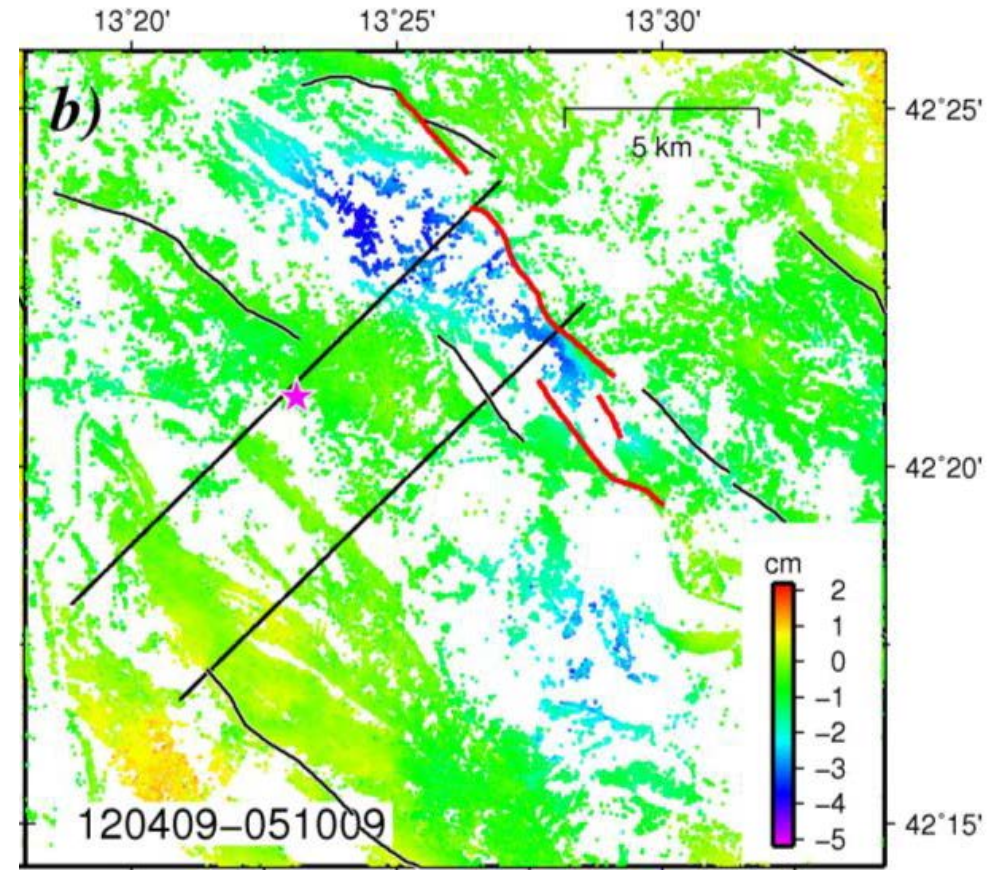
Post-Event



Seismic Risk - Recovery

Example of satellite post-seismic monitoring of an area that experienced a high magnitude earthquake.

After the Mw 6.3, 2009 L'Aquila earthquake, the post-seismic monitoring of the epicentre area was carried out by integrating satellite radar images and continuous GPS time series.



COSMO-SkyMed radar acquisitions for L'Aquila earthquake:

1 acquisition before earthquake (04/04/2009)

32 acquisitions after earthquake (until 10/10/2009)

(D'Agostino et al., JGR, 2012)

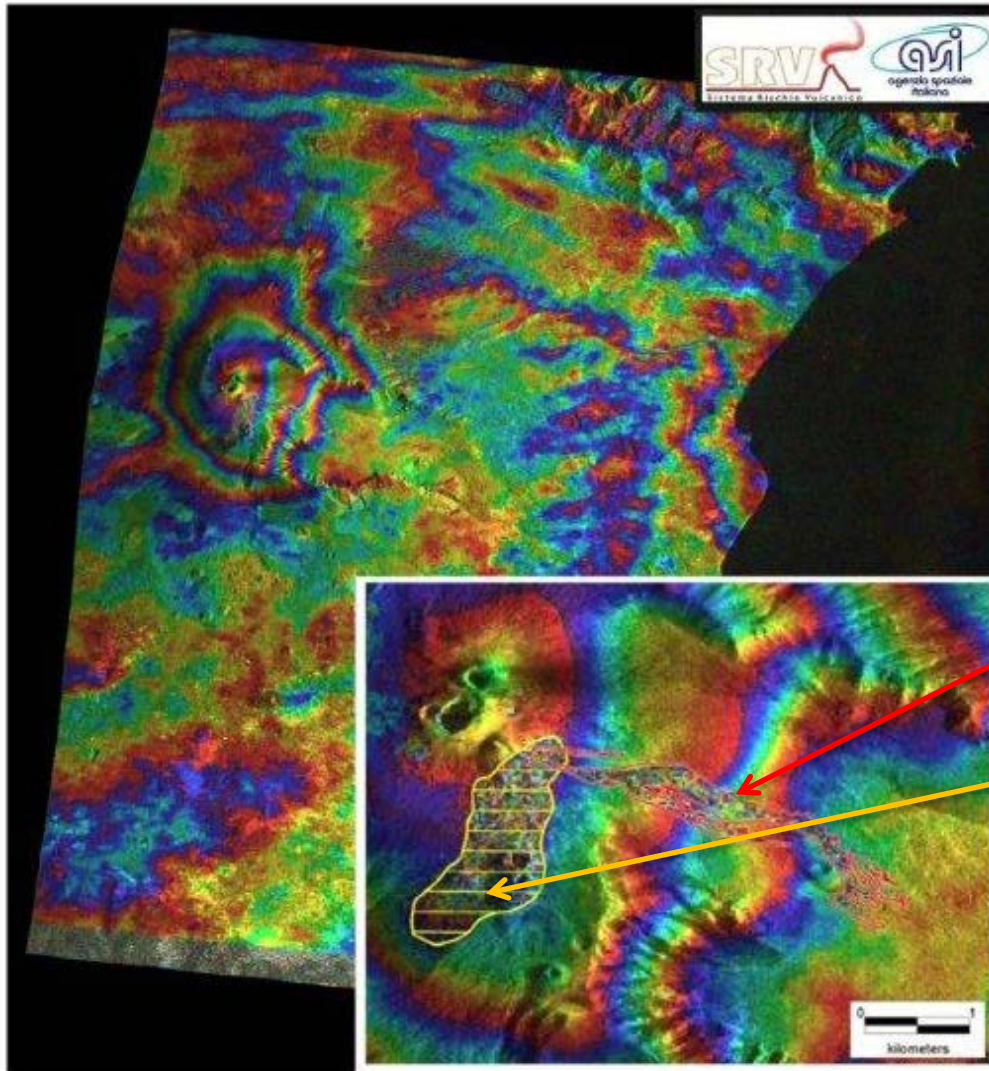
Post-seismic (+6/+180 days) ground displacement in the satellite LOS.

Time span: April 12, 2009-October 05, 2009

Blue: maximum subsidence in cm

Pink star: main shock epicentre





ETNA activity January 2011

Interferograms from COSMO-SkyMed images acquired just few hours before and few hours after the main event.

Red: lava flows

Yellow: pyroclastic deposits near the South-East Crater



Selection and integration of space-based data derived by different data sources for the optimization of the product performances in terms of:

- timely of delivery;
- accuracy;
- spatial and temporal resolution

Close collaboration between Users, Space Agencies, research and technological partners, in order to improve the operational application and the reliability of the products.