

### The Geohazards Exploitation Platform

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### Thematic Exploitation Platforms



- ➤ TEPs are an ESA originated **R&D activity on the EO ground segment** to demonstrate the benefit of new technologies for large scale processing of EO data
- > TEPs are technology R&D, but still fully user driven















- ➤ The geohazards TEP design started from the International Forum on Satellite EO and Geohazards organised by ESA and GEO in Santorini in 2012
- ➤ The geohazards TEP is an enhancement of the precursor SSEP platform (GPOD) designed to support the Geohazard Supersites (GSNL) and the Geohazards community via the CEOS WG Disasters



### The Geohazards Exploitation Platform (GEP)

A 27 months Contract started on Nov 2015; Team: Terradue (IT), CNR IREA (IT), INGV (IT), DLR (DE), TRE ALTAMIRA (ES), EOST-CNRS (F), ENS-CNRS (F)

Tuesday: S1 - TOPS InSAR

3:00pm - 3:20pm

"DLRs Sentinel-1 InSAR Browse Service on the Geohazards Exploitation Platform"
Ramon Brcic et al.

Tuesday: Poster Session 1

4:00pm - 7:00pm

"The SBAS Sentinel-1 Surveillance service for systematic generation of Earth surface displacement within the GEP: characteristics and first results"

Francesco Casu et al.

Thursday: Terrain subsidence and landslides II

3:00pm - 3:20pm

"FASTVEL: a PSI GEP service for terrain motion velocity map generation"

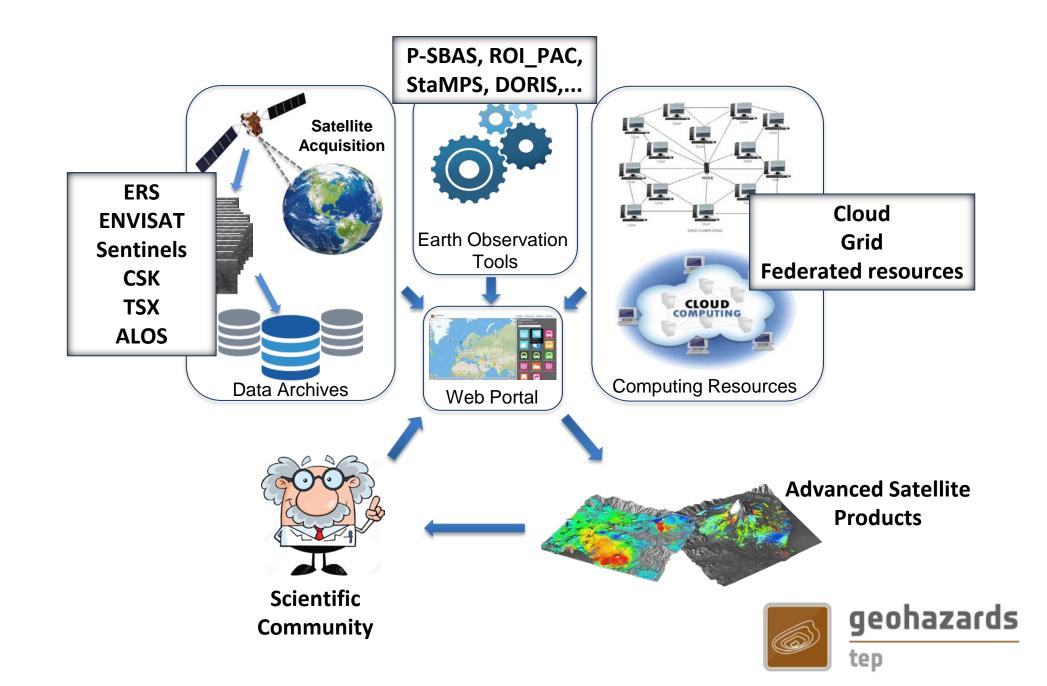
Ruben Iglesias et al.







### The Geohazards Exploitation Platform (GEP)



### Available ERS, Envisat & Third Party Mission data

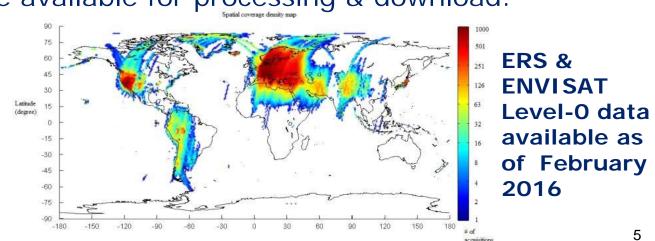
GEP has taken commitments about data access as per some recommendations associated to Fringe

- The GEP provides on line access to ESA heritage EO missions data:
  - ERS (SAR IM Level-0)
  - **ENVISAT (ASAR IM Level-0)**

global coverage synchronized with the ESA VA4 (70+ terabytes)

Through agreements with CEOS partners and project partners (CEOS) Pilots and Geohazards Supersites), limited private collections of the following missions are made available for processing & download:

- ALOS-2
- TerraSAR-X
- **COSMO SkyMed**
- **RADARSAT-2**



# Copernicus Sentinel-1, Sentinel-2, Sentinel-3 and Landsat-8 data available globally:

Via the GEP Data Agency Catalogue, the Platform currently makes available for processing the **global coverage** of the following data collections:

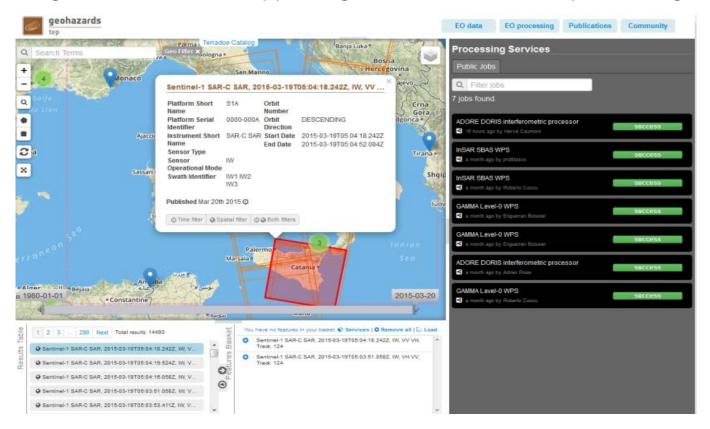
- Sentinel-1A/B: (RAW, SLC, GRD and OCN) synchronized\* with the Copernicus Open Access Hub
- Sentinel-2: (MSI L1C) synchronized\* with the Copernicus Open Access Hub
- Sentinel-3: (OLCI, SLSTR) synchronized\* with the Copernicus Pre-Operations
   Data Hub
- Landsat-8: (OLI and TIRS) synchronized\* with the USGS EarthExplorer



- about metadata: complete catalogues published in NRT.
- about data: different solutions according to use case incl. colocated data & processing, on-demand data fetching, data caching, etc.

# Improving access to data collections relevant to geohazards community:

- Provide a cache of last 30-days of Sentinel-1 SLC data of about 48TB over the World Tectonic Mask in support of systematic processing services performing InSAR production at global scale
- Provide a dynamic fast access cache (LRU 1TB) of latest, most requested input datasets in support of on-demand processing
- GEP federates external data centres (e.g. IPT-PL, EGI, PSNC) & computing centres (e.g. CNR IREA) for supporting "local (to the data) processing"



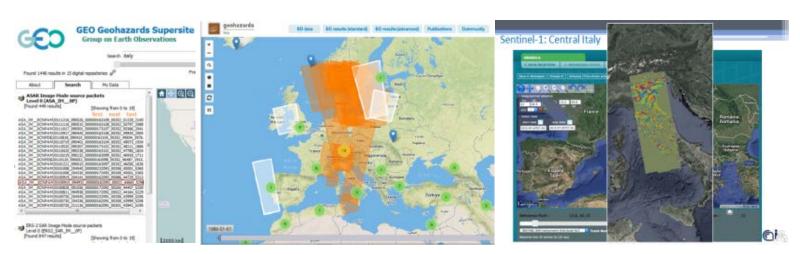


### Supported Scenarios for Users

Scenario 1) EO Data Exploitation which allows a user to discover/select data and preexisting processing service, process data, and visualize/analyse or select and apply data manipulation tools to the result

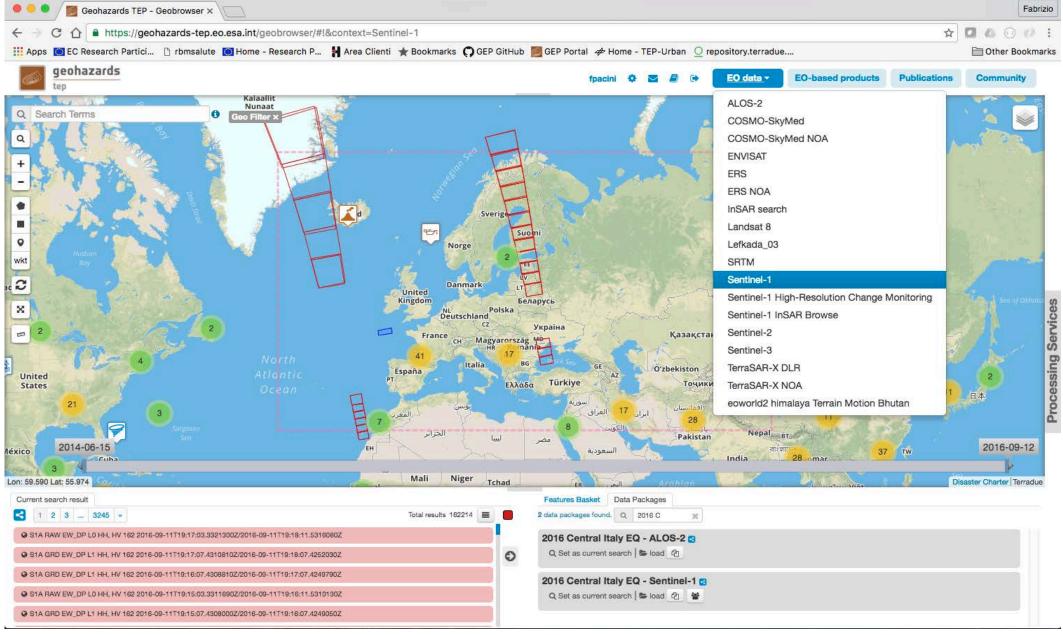
Scenario 2) New EO Service Development which allows a user to discover/select a data sample and software components, engineer (or upload) and validate an application (such as a processor); and deploy the application on the platform for use also by other users.

Scenario 3) New EO Product Development, which allows a user to Authenticate, alternatively upload and deploy a new processor, discover/select data, process the data, and publish the resulting product.





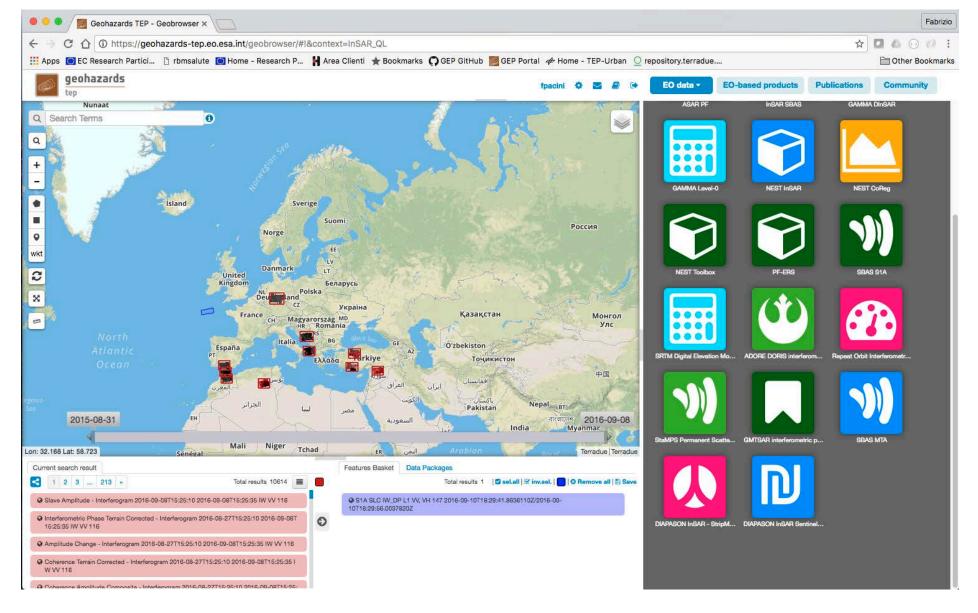
### EO Data Discovery and selection







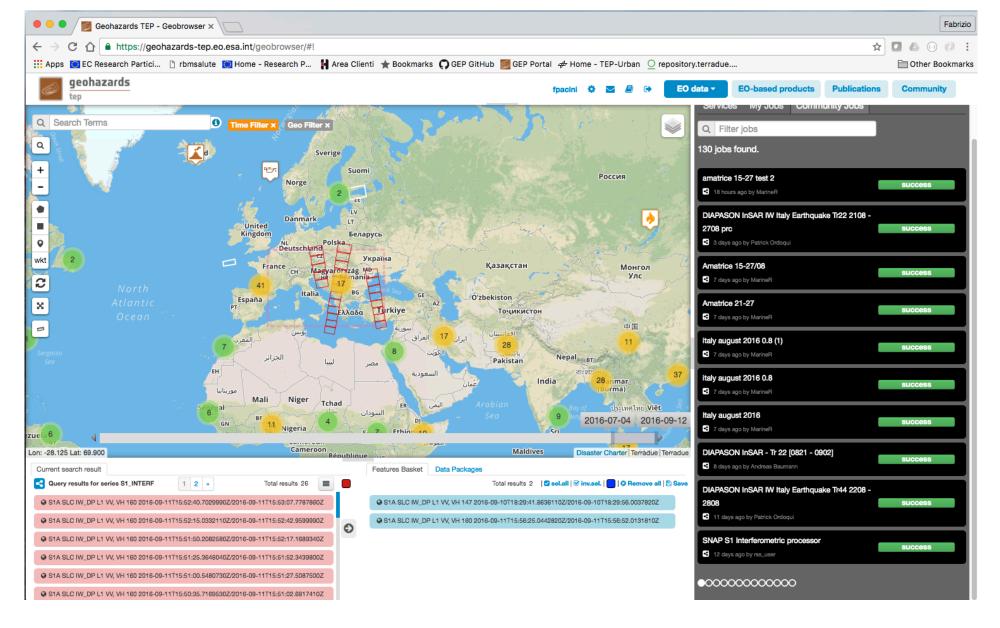
### **EO Processing Tools - Selection**







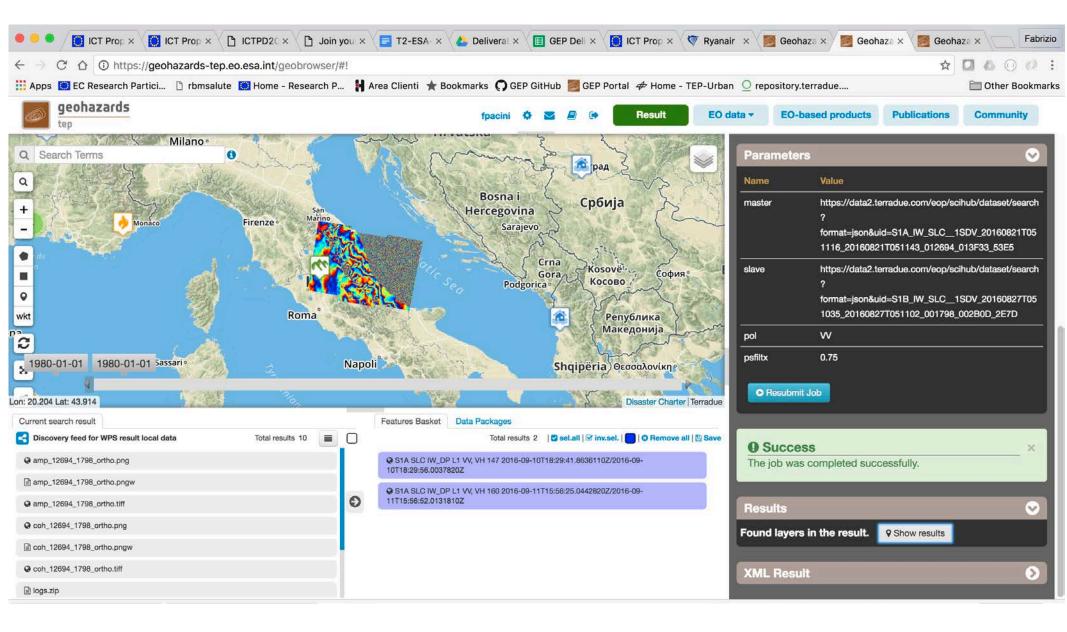
### EO Processing Tools – Activity Monitoring







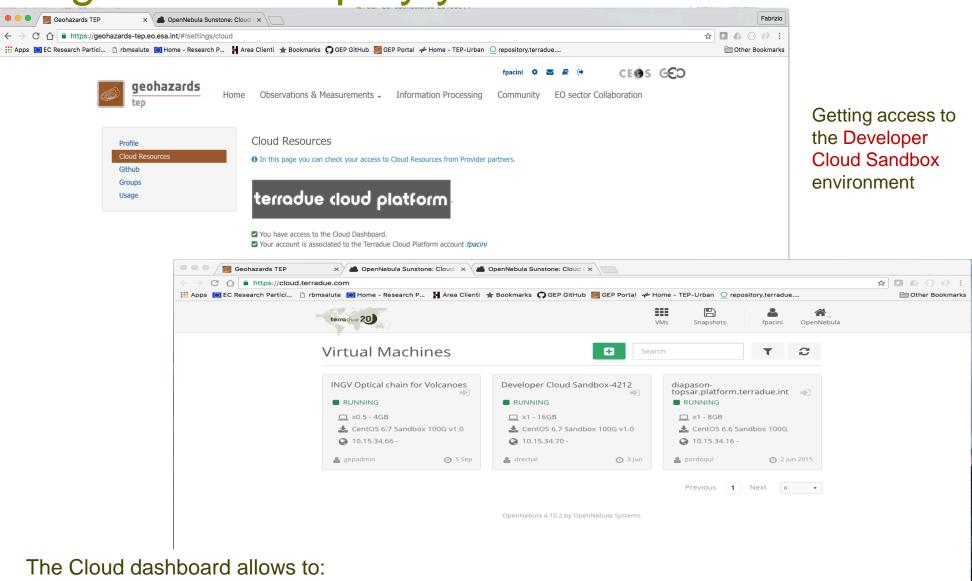
### EO Processing Tools - Result Visualization







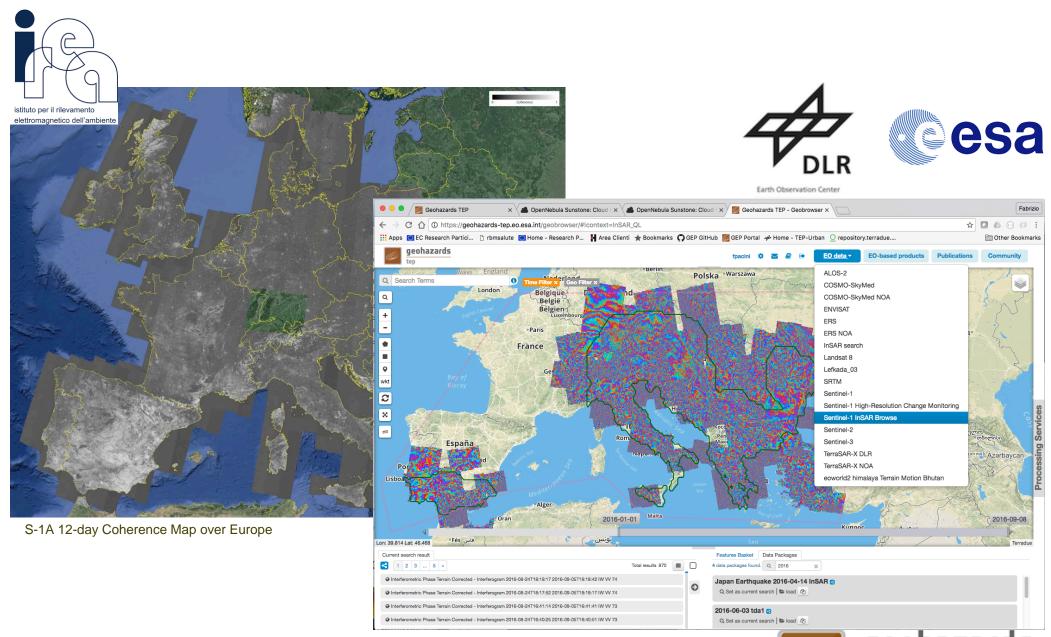
### Integrate and deploy your own service



- Browse the Virtual Machines created on GEP
- Create a new Virtual Machine
- Create a new Developer Cloud Sandbox for processor integration



### Development



DEM corrected interferograms



# during 2016 Central Italy seismic sequence

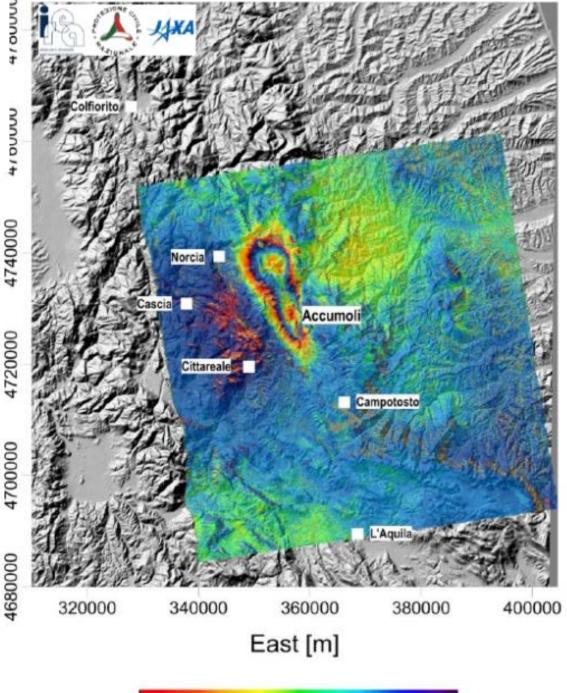
### **ALOS-2 Interferogram:**

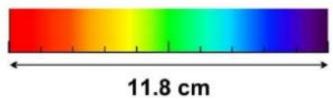
3 pre-event (01/07/15, 09/09/15, 27/01/16) acquisitions and 1 post-event (24/8/16) acquisition (L band SAR data).

North [m]

Credits: Gruppo di lavoro IREA-CNR & INGV, 2016 Sequenza sismica di Amatrice: risultati iniziali delle analisi interferometriche satellitari, DOI: 10.5281/zenodo.60935

Processed off line and Published on GEP



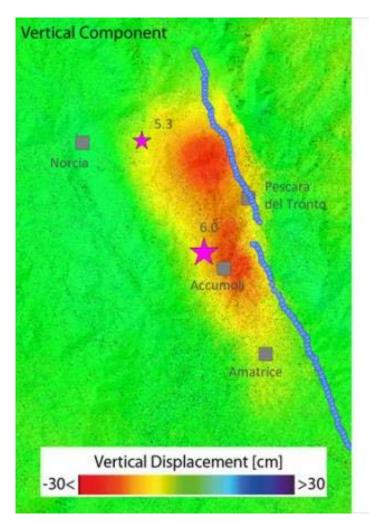


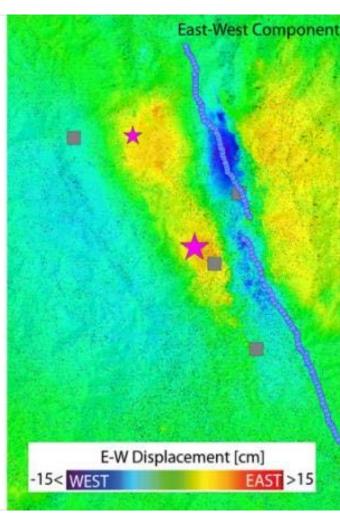
# Sentinel-1 East-West and Up-Down displacement maps

Sentinel-1 ground displacement product generated by CNR-IREA:

Sentinel-1 acquisitions over central Italy: 15, 21 and 27 August 2016.

The result shows vertical ground subsidence, reaching about 20 cm in correspondence to the Accumoli area, and lateral movement of up to 16 cm. The blue line indicates the location of the fault trace.



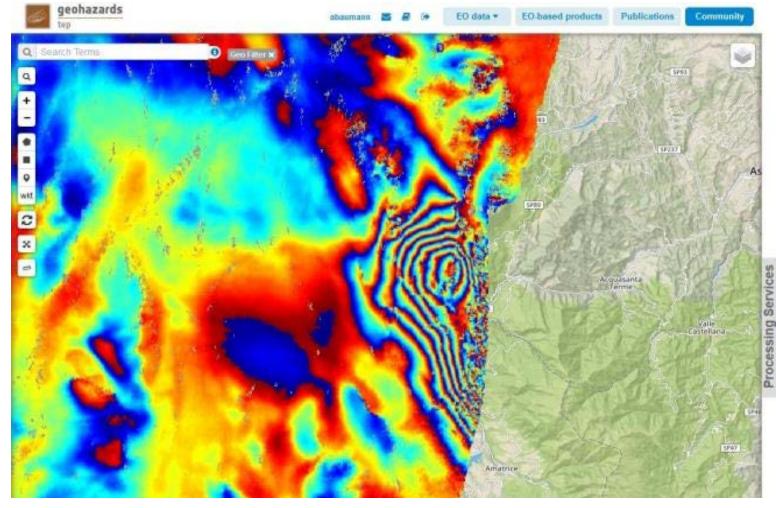


Processed off line and Published on GEP



### First result generated on-line on the GEP

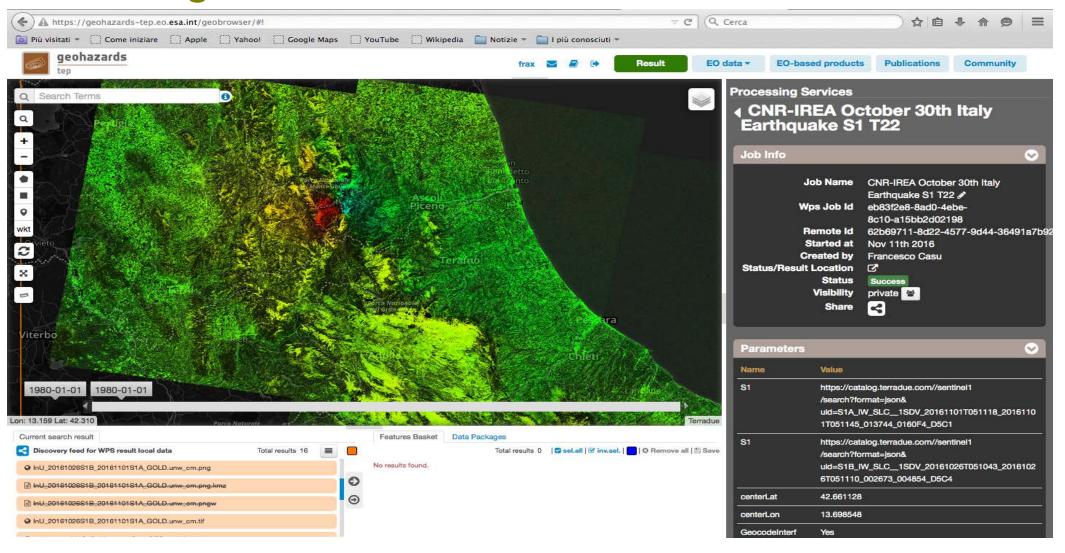
Differential SAR interferogram generated through a 18-days pair of SAR images acquired by the Sentinel-1 constellation on 09/08/2016 and 27/08/2016. This result was generated by INGV by using the CNES' DIAPASON processing chain integrated on the GEP by TRE-ALTAMIRA. Sentinel-1 data are copyright of Copernicus (2015).





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# SBAS S-1 data processed on GEP: unwrapped interferogram



**30**<sup>th</sup> **October 2016 Earthquake in Central Italy**: S-1 unwrapped Interferogram, 26<sup>th</sup> October (S-1B) and 1<sup>st</sup> November (s1-A) 2016, T22, processed on GEP with the ondemand processing service «SBAS InSAR Sentinel-1 TOPS» integrated by CNR IREA. Contains modified Copernicus Sentinel data (2016), Processed by Francesco Casu, CNR IREA





### **GEP and EPOS**

GEP selected as the gateway for the Satellite Data Thematic Core

Service in EPOS









### The European Plate Observing System (EPOS)

**EPOS** is a **long-term plan for the integration** of research infrastructures for solid Earth Science in Europe

**EPOS** integrates the

existing (and future)

advanced European facilities

into

a single, distributed,

sustainable infrastructure

taking full advantage of new

e-science opportunities



Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Grecee, Hungary, Iceland, Ireland, Italy, Netherland, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom

4 INTERNATIONAL ORGANIZATIONS

Orfeus, Emsc, Euref, Intermagnet

**256** NATIONAL RESEARCH INFRASTRUCTURES

4939 SEISMIC STATIONS

**2272** GPS RECEIVERS

**464** TB SEISMIC DATA

118 LABORATORIES

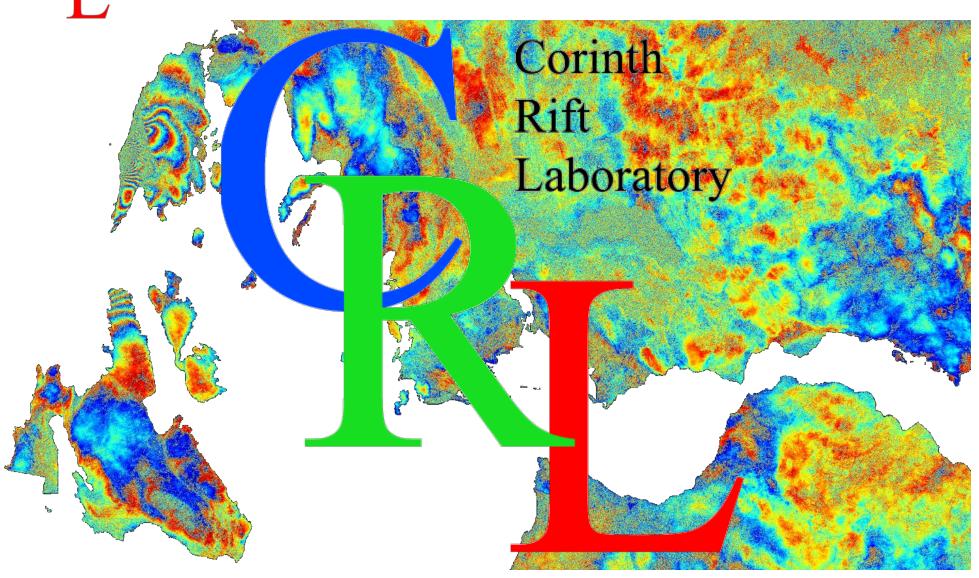
**828** INSTRUMENTS

Several PetaBytes of solid Earth Science data will be available

Several thousands of users expected to access the infrastructure



### **GEP and EPOS: Corinth Rift Lab**









## GEP and EPOS: Corinth Rift Later geohazards tep

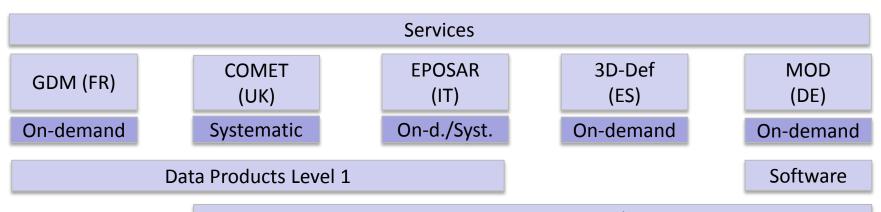


- The **Corinth Rift Laboratory** (CRL) is based on the joint efforts of European institutions to study fault mechanics. It is a mature natural laboratory for tectonic studies in terms of human networking and instrumentation
- Corinth Rift Laboratory
  - is included in Geohazards Natural Laboratories of the GEO Supersites
  - is one of the Near Fault Observatories of EPOS
- A large number of surface networks are operating seismological, strong motion, permanent and repeated GPS, strain, tilt and tide gage networks
- Earth Observation data supported by the in-situ instruments play a crucial role for understanding the geophysical mechanisms underneath



### **GEP and EPOS: TCS Satellite Data**

TCS Access Point **geohazards** (Geohazards Exploitation Platform)



Data Products Level 2/3

**Data Products Level 1** 

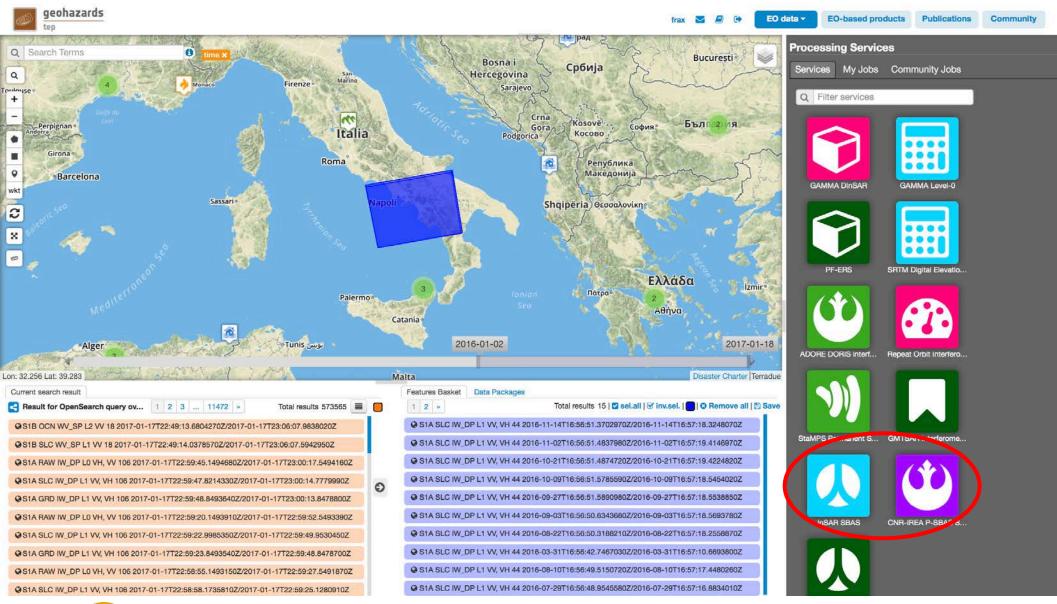
- Displacement Maps
  - Interferograms
- Displacement Time Series

Data Products Level 2/3

- Models
- 3D Displacement
  - Strain Maps
  - Stress Field



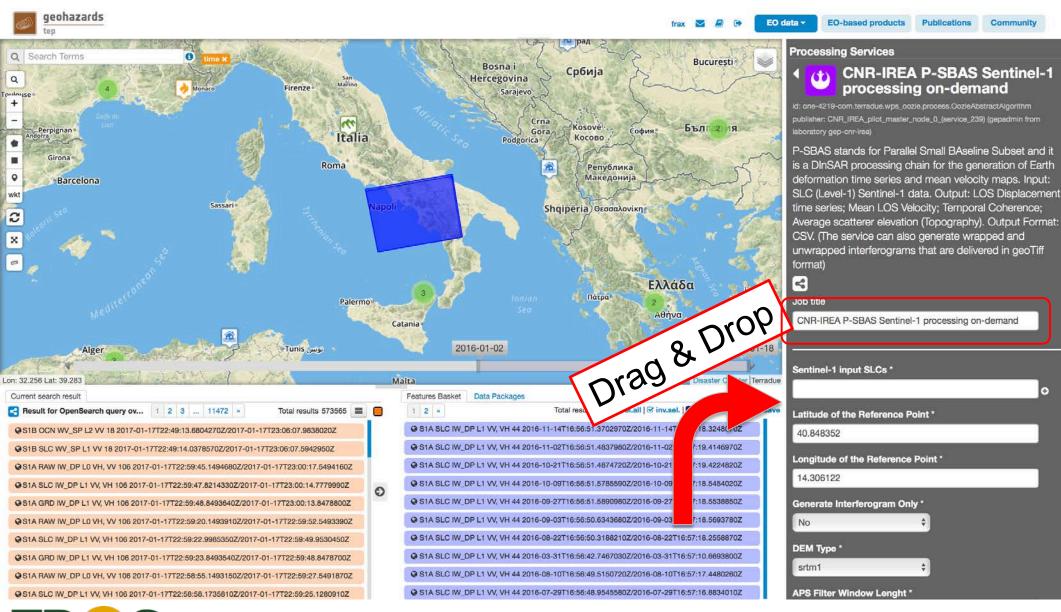






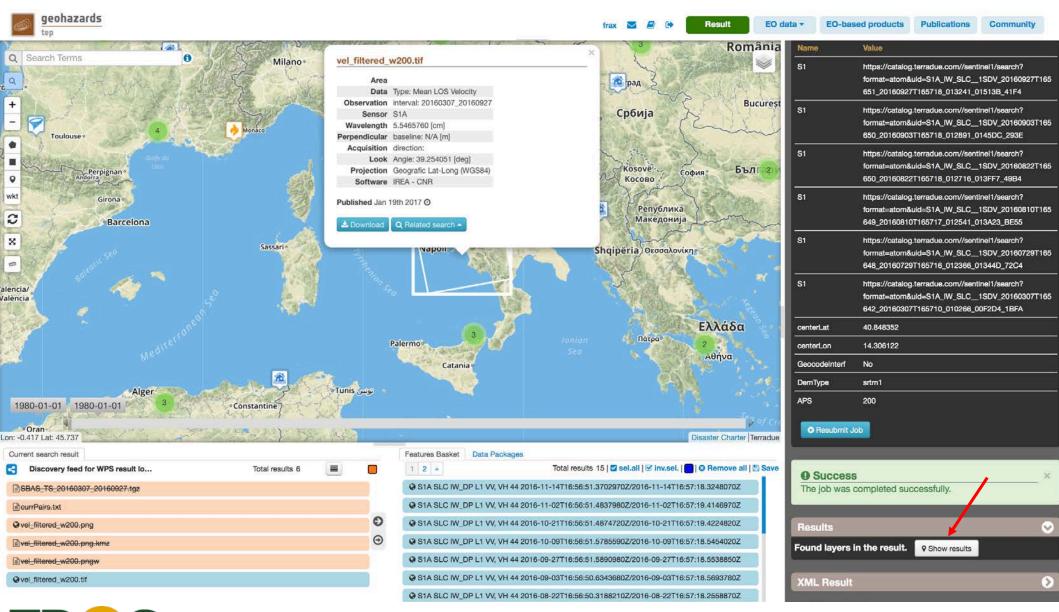






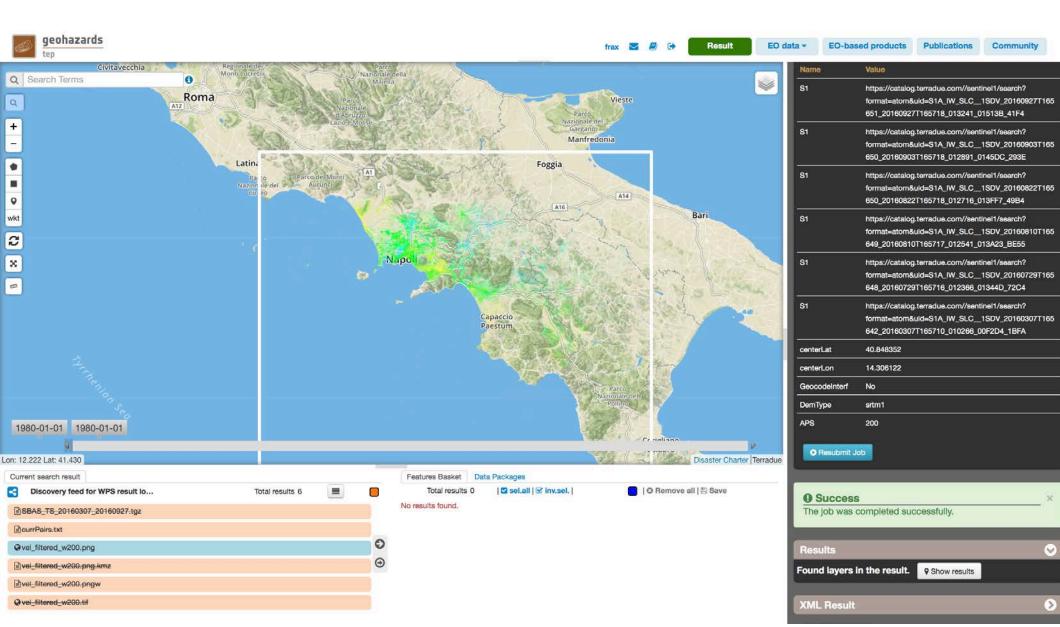






EUROPEANPLATEOBSERVINGSYSTEM









## Thank you!

### Short Training Course on GEP: Geohazards Exploitation Platform

2.04.c Location: SOK-Sali

Tue, 6 Jun, 16:30-19:00

