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)

The consortium is developing an Exploitation Platform based upon the virtualization & federation of satellite EO data and methods.

The GEP Platform

- allows on-demand processing for specific user needs and systematic processing to address common information needs of the community;
- allows massive processing on multi-tenant computing resources on the Cloud that will address the challenges of monitoring tectonic areas on a global basis;
- connects to the full Copernicus S-1/2 and 3 repositories. It also provides access to 70+ TB of EO data (ERS and ENVISAT archive), and specific data collections from EO missions, such as JAXA's ALOS-2, ASI's Cosmo-Skymed and DLR's TerraSAR-X, provided under special arrangements in the framework of CEOS WG Disaster and the GSNL.

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**Tuesday: S1 - TOPS InSAR**
3:00pm - 3:20pm

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

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**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.

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**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)

- Satellite Acquisition
  - ERS
  - ENVISAT
  - Sentinels
  - CSK
  - TSX
  - ALOS

- Data Archives

- Earth Observation Tools
  - P-SBAS
  - ROI_PAC
  - StaMPS
  - DORIS...

- Web Portal

- Cloud Grid
  - Federated resources

- Computing Resources

- Advanced Satellite Products

- Scientific Community

- The Geohazards Exploitation Platform (GEP)
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

ERS & ENVISAT Level-0 data available as of February 2016
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

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  - **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 pre-existing 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

The Cloud dashboard allows to:
- Browse the Virtual Machines created on GEP
- Create a new Virtual Machine
- Create a new Developer Cloud Sandbox for processor integration

Getting access to the Developer Cloud Sandbox environment
TEP Scenario #3 New EO Product Development

DEM corrected interferograms

S-1A 12-day Coherence Map over Europe
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).


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).
30th October 2016 Earthquake in Central Italy: S-1 unwrapped Interferogram, 26th October (S-1B) and 1st November (s1-A) 2016, T22, processed on GEP with the on-demand 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
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.
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.

The 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 Exploitation Platform)

Data Products Level 1:
- Displacement Maps
- Interferograms
- Displacement Time Series

Data Products Level 2/3:
- Models
- 3D Displacement
- Strain Maps
- Stress Field

Services:
- GDM (FR) - On-demand
- COMET (UK) - Systematic
- EPOSAR (IT) - On-d./Syst.
- 3D-Def (ES) - On-demand
- MOD (DE) - On-demand

Software:
- TCS Access Point
- TCS Satellite Data

Systematic
EPOSAR Processing Service

Drag & Drop

CNR-IREA P-SBAS Sentinel-1 processing on-demand

P-SBAS stands for Parallel Small Baseline Subset and it is a DisSAR processing chain for the generation of Earth deformation time series and mean velocity maps. Input: SLC (Level-1) Sentinel-1 data. Output: LOS Displacement time series; Mean LOS Velocity; Temporal Coherence; Average scatterer elevation (Topography). Output Format: GSV. (The service can also generate wrapped and unwrapped interferograms that are delivered in geoTiff format)
Thank you!

Short Training Course on

GEP: Geohazards Exploitation Platform

2.04.c Location: SOK-Sali

*Tue, 6 Jun, 16:30–19:00*