CEOS Disaster Risk Management

CEOS WG Disasters

The Geohazards Lab

CEOS WG Disasters 11th meeting

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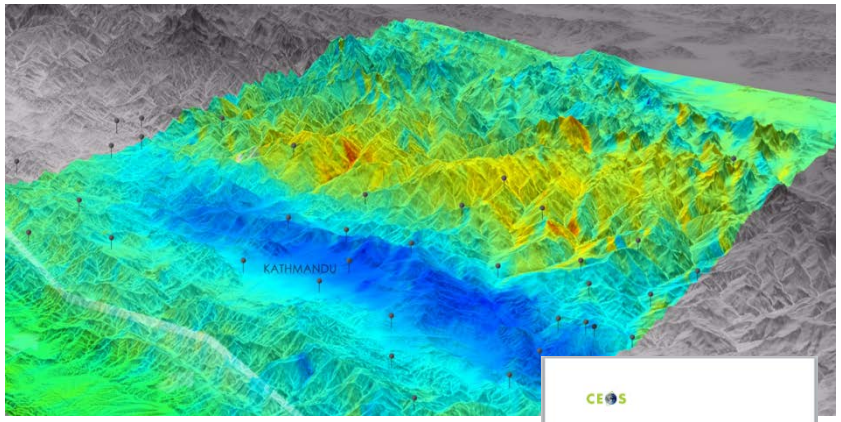
Committee on Earth Observation Satellites

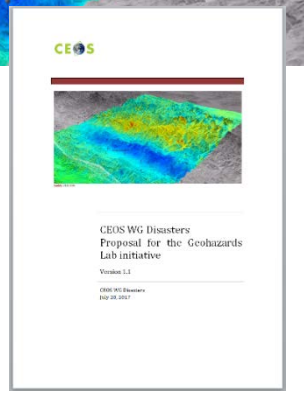
GeoHazards Lab | Initiative

Definition: *A platform with federated resources to access, process and publish satellite EO data and derived products*

Goal: *Provide data access and a processing and e-collaboration environment to exploit EO data to assess geohazards and their impact*



Credits: DLR, ESA, Copernicus programme.



- ✓ Aims to **address priorities of the Sendai Framework for Disaster Risk Reduction 2015-2030** using satellite EO (focus: better understanding hazards & risks)
- ✓ Supports and complements the **CEOS WG Disasters activities** (on-going pilots, follow-on activities and the RO), **GSNL**, **GEODARMA** and other relevant initiatives**.**

GeoHazards Lab | Who is behind so far?

- Access to the **Geohazards Exploitation Platform** including: data storage, processing software (InSAR and stereo-optical processing chains), e-collaboration environment;
- **Man-power (staff & support under consultancy contract)**: scientific animation and promotion of information and results; support to coordination/governance.

- **Processing services** developed by the French Solid Earth community within the forM@Ter data centre including systematic InSAR processing, DEM processing and optical image correlation;

- **Cosmo-SkyMed collections** for CEOS WG Disasters and GSNL are made available through the GEP;

(on a voluntary basis)

- **Higher level science products** derived from Sentinel-1 and TerraSAR-X data
- Access to the **automated Sentinel-1 interferometric chain**

GeoHazards Lab | Contributions from the Geohazards Community

Geoscience centers with EO expertise **actively involved**:

- **BRGM** [FR] provides in-kind contribution (labor) and leads the Geohazards Office
- **CNR-IREA** [IT] (via platform federation activities about InSAR data processing)
- **CNRS EOST** [FR]
- **COMET** [UK]
- **IGME** [ES]
- **INGV** [IT] (via the responsible of the Geohazards Supersites and Natural Laboratories initiatives)
- **ISTerre** / Institut de Recherche pour le Développement (IRD) [FR]
- **NOA** [GR]

Geoscience centres **following closely the GLab activities**:

- **BGR** [DE] (via SNGMS)
- **NGU** [NO]

Thematic users are proposing to take part to the Geohazards Lab activity about platform specific issues.

The idea of the Geohazards Lab

CEOS WG Disasters

Seismic Demonstrator

Volcano Demonstrator

Landslide Pilot

Recovery Observatory

Submission of data requests

Data provision

DCT

- Upload data collections on GEP
- Integrate processing tools and services

Geohazards Lab

Geohazards Office

Access and visualize open data and dedicated data collections

Access online processing tools and services

Share results

GEO

GEO-DARMA

GSNL

Geohazards community users

- Upload data collections on GEP
- Integrate processing tools and services

- Integrate processing tools and services
- Access and links to federated resources
- Man-power support

Space agencies

Concrete objectives

Not on an emergency basis

Support the CEOS activities, the GSNL, GEO-DARMA and the broader geohazards community by (i) providing data delivery, access to tools and hosted processing for geohazards assessment and (ii) working on the standardization of EO products

On an emergency basis

Pursue and support the generation and distribution of advanced science products based on terrain motion mapping, landslide monitoring, thermal signatures of volcanic eruptions etc.

Geohazards Exploitation Platform | GEP

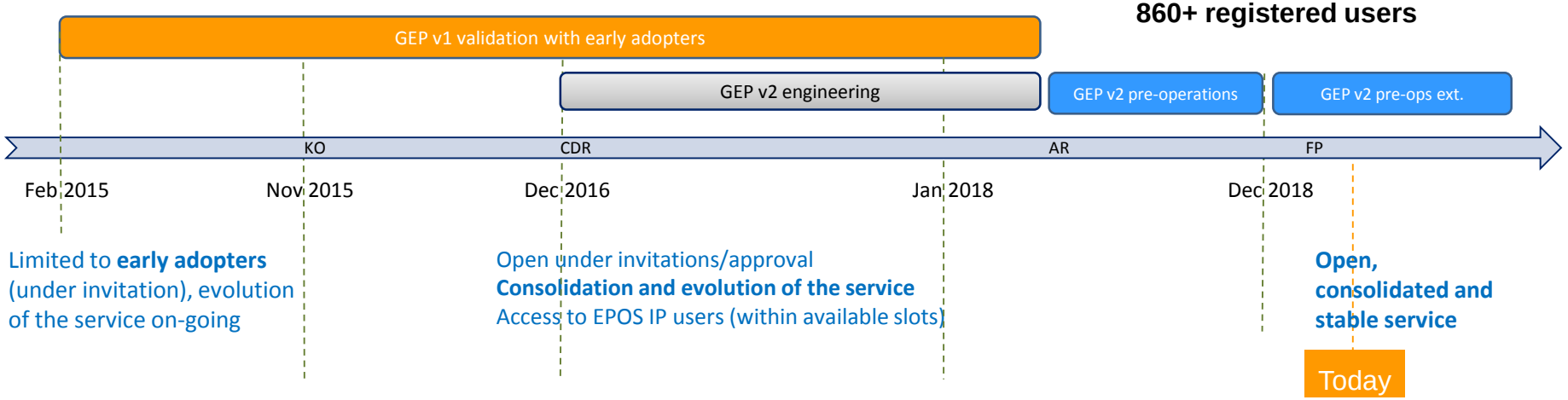
Consortium: **Terradue** [lead] (IT), **TRE ALTAMIRA** (ES), **CNR IREA** (IT), **DLR** (DE), **EOST-CNRS** (F), **ENS-CNRS** (F), **INGV** (IT)

- Develop a Platform based on **virtualization & federation of satellite EO data and methods**
- Provide innovative responses to the **geohazards** community needs (services & support)

  ➔ **On-demand processing** services to address AOI-specific analysis
  ➔ **Systematic processing** services to address needs for “common information layers”
  ➔ **Massive Cloud Compute** power, managing multi-tenant resources
  ➔ **Access to Copernicus Sentinels-1/2/3 repositories**
  ➔ **Access to 70+ TB of EO data archives** (**ERS** and **ENVISAT**), 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 f the **CEOS WG Disaster** and the **GSNL**

GEP | Roadmap

As of May 2018:
860+ registered users



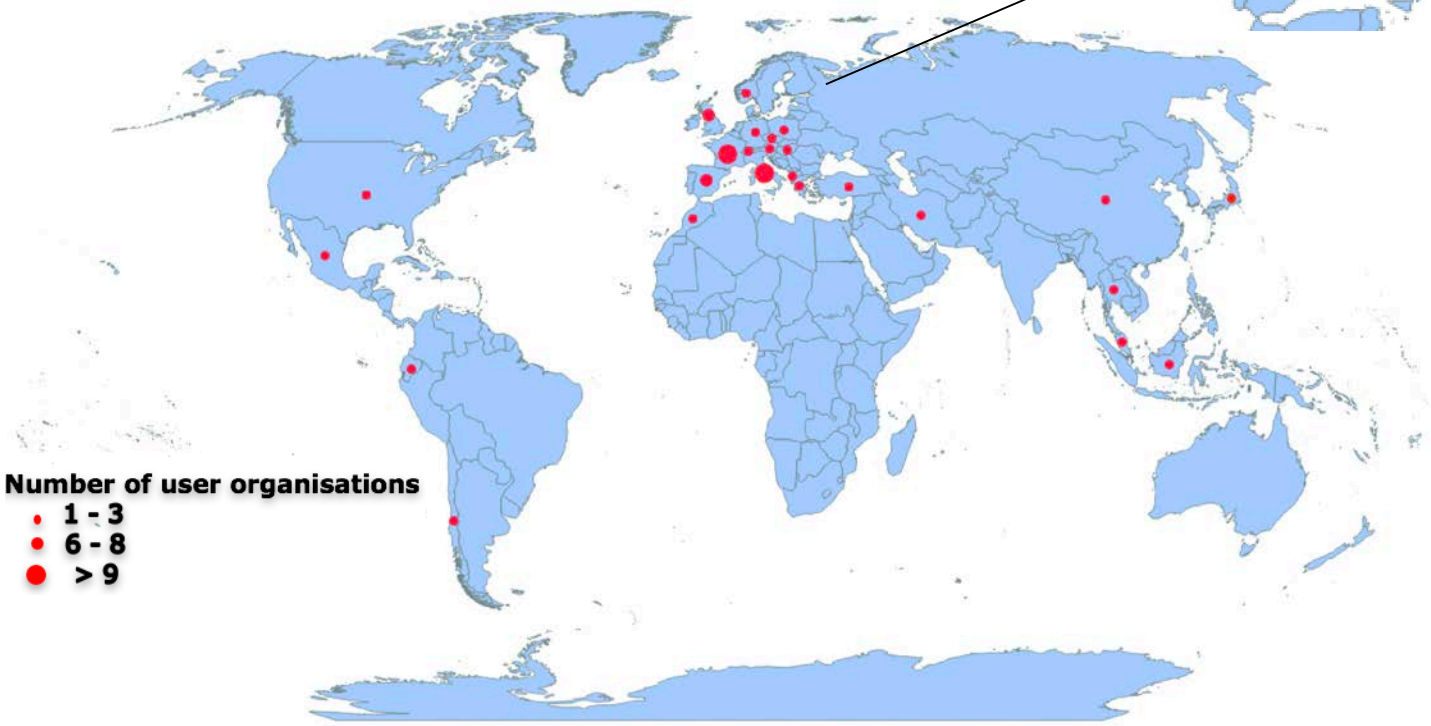
22 platform early adopters
integrating application or exploiting on demand processing

50 platform early adopters
28 new users in the period

100 platform early adopters
40+ new users in the period

GEP | February 2019 → 89 users

Geographic Distribution of GEP Early Adopters



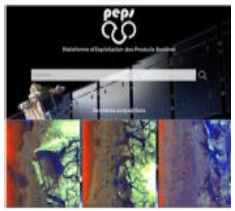
Country	Number of User organisations
FR	12
IT	10
ES	8
UK	6
GR	3
DE	4
CA	2
CH	2
TR	2
US	2
AT	1
CL	1
CN	1
CZ	1
DK	1
DZ	1
EC	1
HU	1
JP	1
ID	1
IR	1
MA	1
ML	1
MX	1
NG	1
NO	1
PL	1
TH	1
Total	63

- That is 21 users from the GEP Consortium and 67 users from the community via the **early adopters programme** in **33 countries**
- Mainly European users, but also users from the rest of the world: Asia (Turkey, Thailand, Indonesia, China, Malaysia, Japan, Iran & South Korea), Africa (Morocco, Algeria, Nigeria), Latin America (Ecuador, Mexico and Chile) and North America (Canada, USA).

What is PEPS?

- PEPS – Satellite data distribution platform for COPERNICUS Sentinel-1, Sentinel-2 et Sentinel-3 missions.
  - Full temporal and geographical coverage (all the globe since the beginning of life of the satellites)
- Data volume : +4 Po (5 millions of products)
- Data download via dedicated interface or automated scripts
- PEPS online processing (e.g. S-2 atmospheric correction , S-1 rectification on S-2)
- PEPS also offers a capacity to host processing chains on a high performance 'cluster'

PEPS | FRENCH ACCESS TO THE SENTINEL PRODUCTS

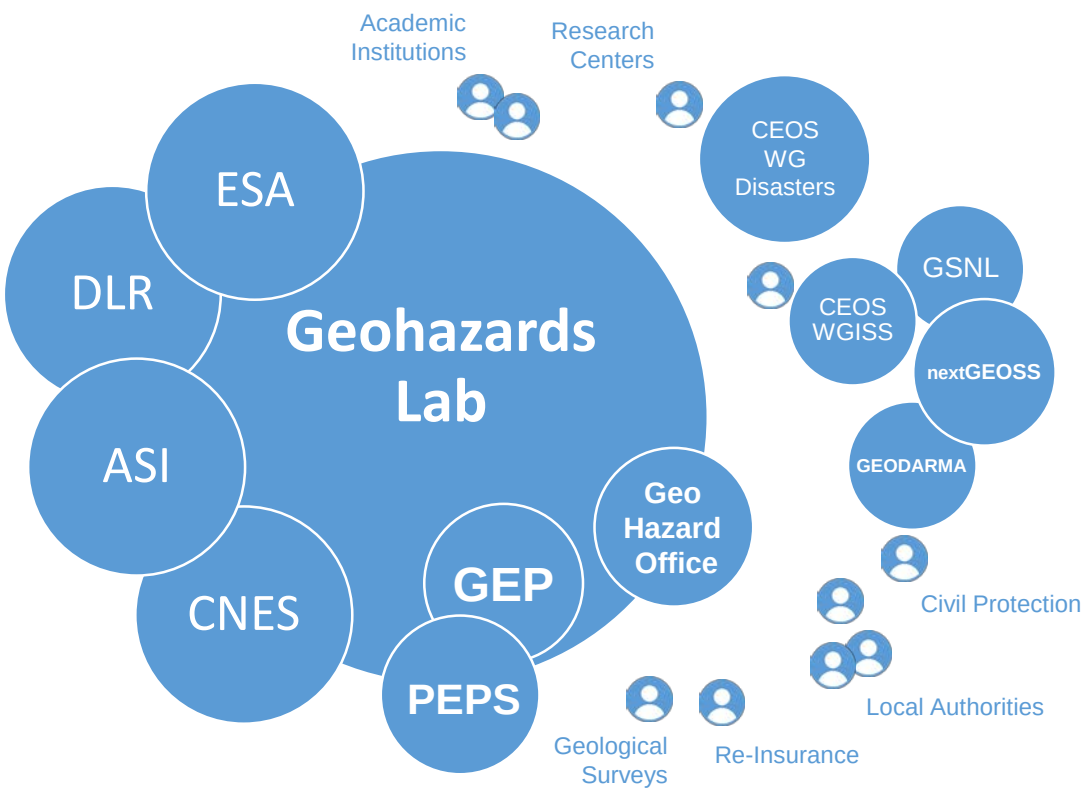


PEPS offers the possibility of experimenting with a service or a processing chain as close as possible to the storage archive using the CNES computing cluster

- Quick and direct access to the entire archive of Sentinels 1, 2, 3
- Access to data as soon as they are made available by ESA
- Provision of high computing power: High Performance Computing Cluster (HPC), 8000 cores
- Treatment hosting infrastructure based on the WPS standard, open to the docker technology and offering an orchestrator to parallelize and distribute the treatments on the resources
- Supervision and technical support - thematic and computer

GeoHazards Office

An activity of scientific animation within the Geohazards Lab



GeoHazards Office Goals:

- Full in line with the Geohazards Lab Implementation Plan
- Liaise with the geohazards community to promote their results when using the Geohazards Lab resources
- Develop collaboration with experts to harmonize and improve acceptance of platform based EO techniques
- Demonstrate and showcase hosted processing services for terrain motion mapping

GLab | Overview of Activities

Q4 2018 – Q1 2019

Support CEOS activities, the GSNL and GEO-DARMA

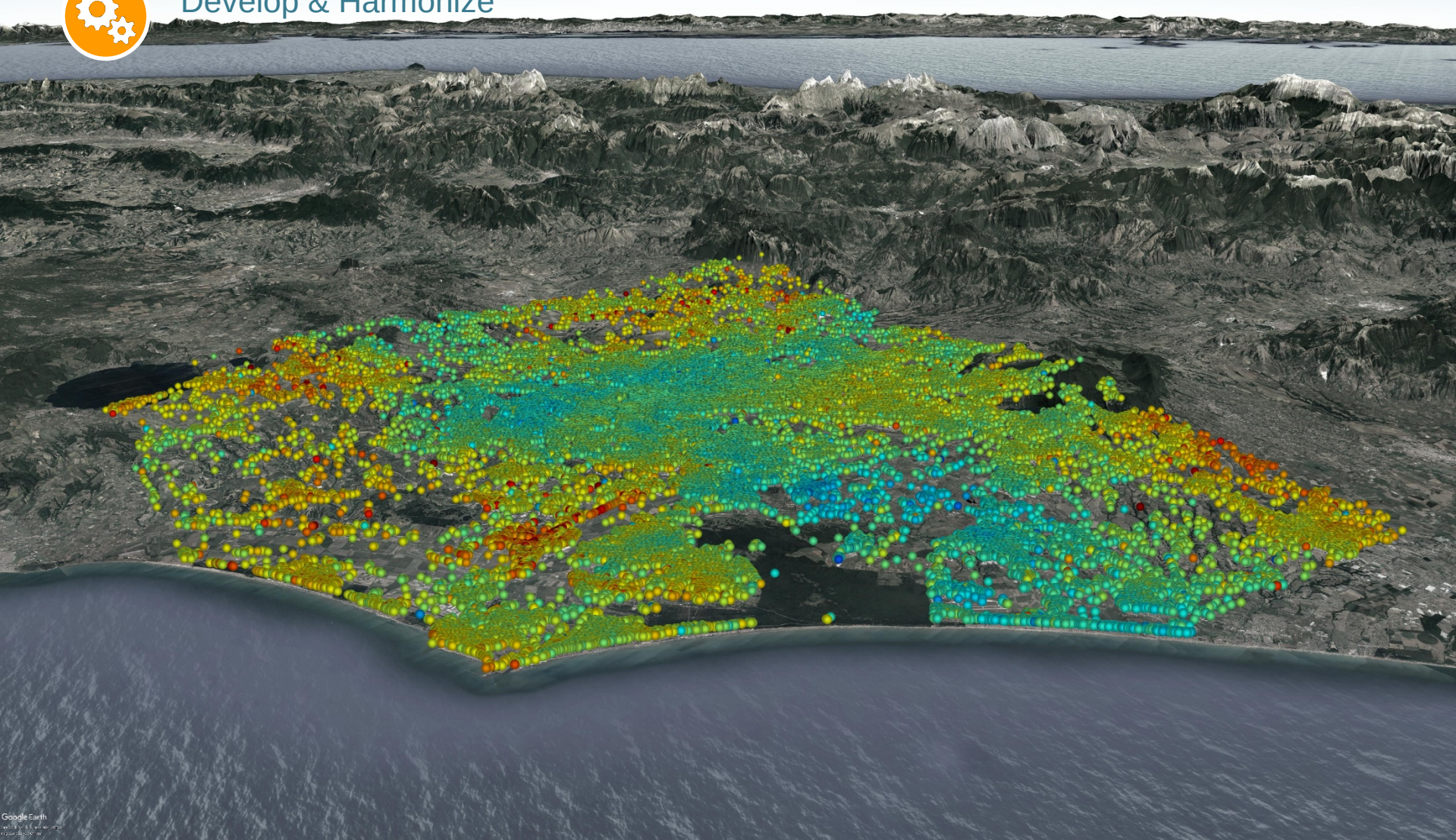
- ✓ **Agreement** with CNES to bring **Pleiades data on GEP for on-line processing**.
  - **First dataset under integration** (by authorized user) **ONLY** for online processing
  - **License signed by GEP operator**. FTP under preparation by Airbus.

Pursue and support the generation and distribution of advanced science products

- ✓ **Integration of SNAP-StaMPS** on GEP **started** (BRGM, University of Leeds)
- ✓ **SBAS Sentinel-1 Surveillance service for ground deformation monitoring** (generates updated surface displacement time series via the P-SBAS-InSAR algorithm) **fully integrat**ed (CNR-IREA).
- ✓ **Integration of Volcanic Plume Elevation Model (VPEM)** on GEP **to start shortly** (BRGM)
- ✓ **CSK DInSAR chain** under integration (BRGM)
- ✓ **MPIC-OPT** (measuring horizontal displacement-series of optical satellite images) **available** on GEP by University of Strasburg/CNRS-EOST
- ✓ DSM-OPT **available** on GEP by University of Strasburg/CNRS-EOST
- ✓ **Terrain Motion Demo** is under preparation by ESA and BRGM
- ✓ **Federation** between GEP and CNRS EOST's HPC to start shortly

Example of activity | SNAP-StaMPS integrated Sentinel-1 PSI processing

Develop & Harmonize



Example of activity:
SNAP COSMO-SkyMED DInSAR service

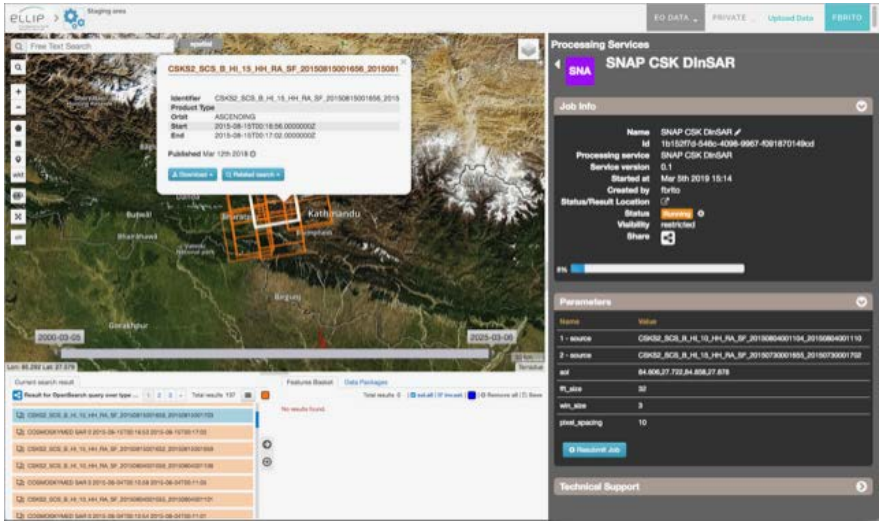
Develop & Harmonize

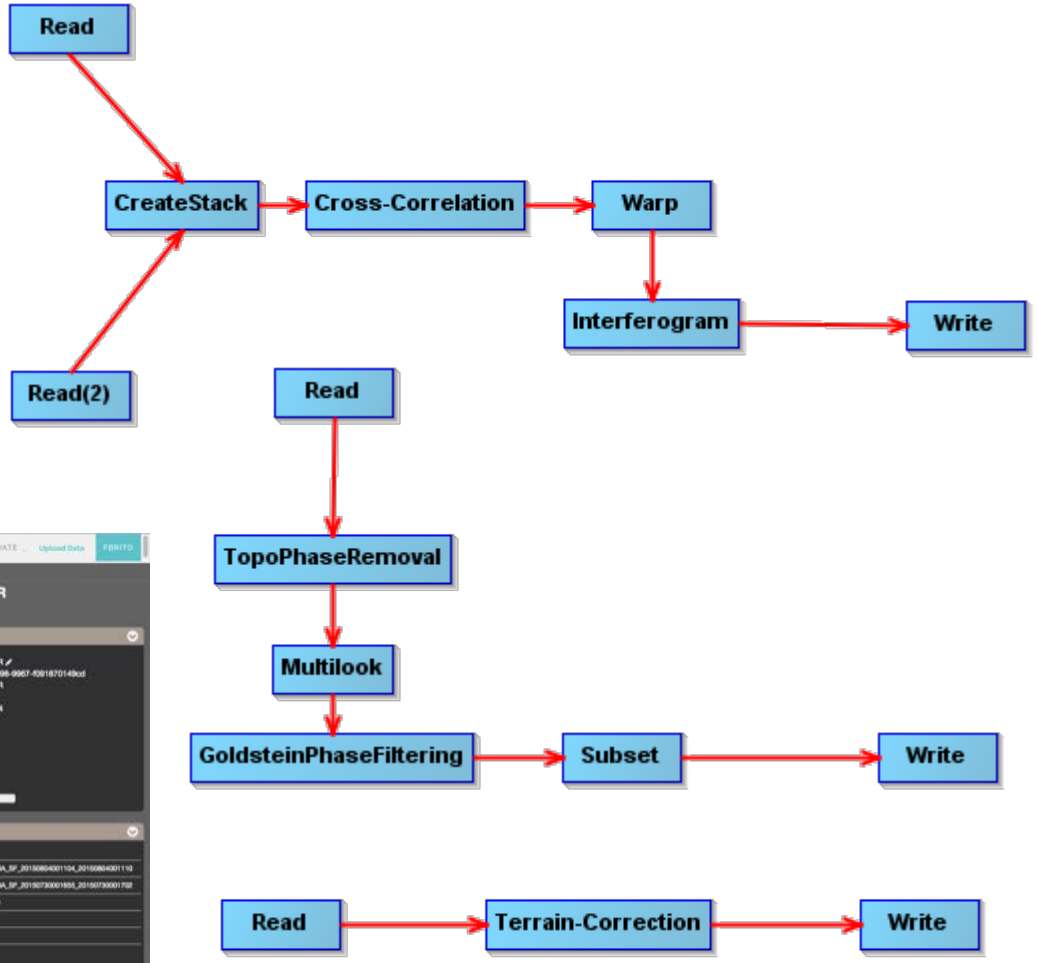
Expansion of SNAP services on GEP to support TPM interferometric processing (on-going)

CSK_Stack_CrossCor_Wrap_Ifg.xml

CSK_TopoRem_ML_Flt_Sub.xml

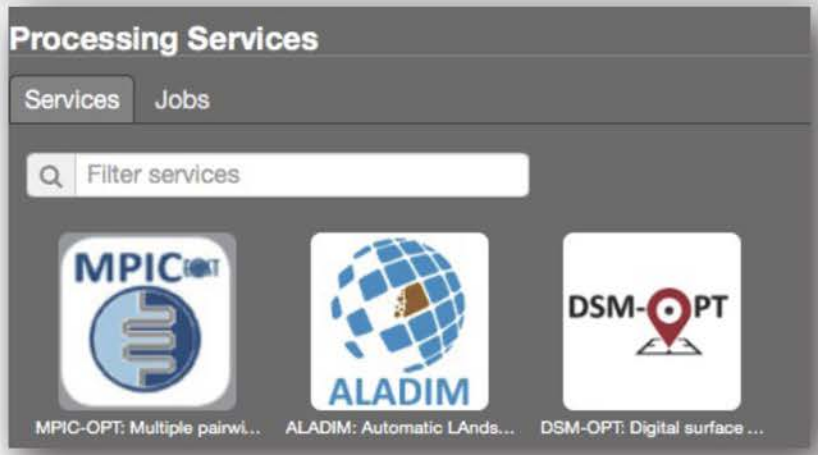
CSK_TC.xml

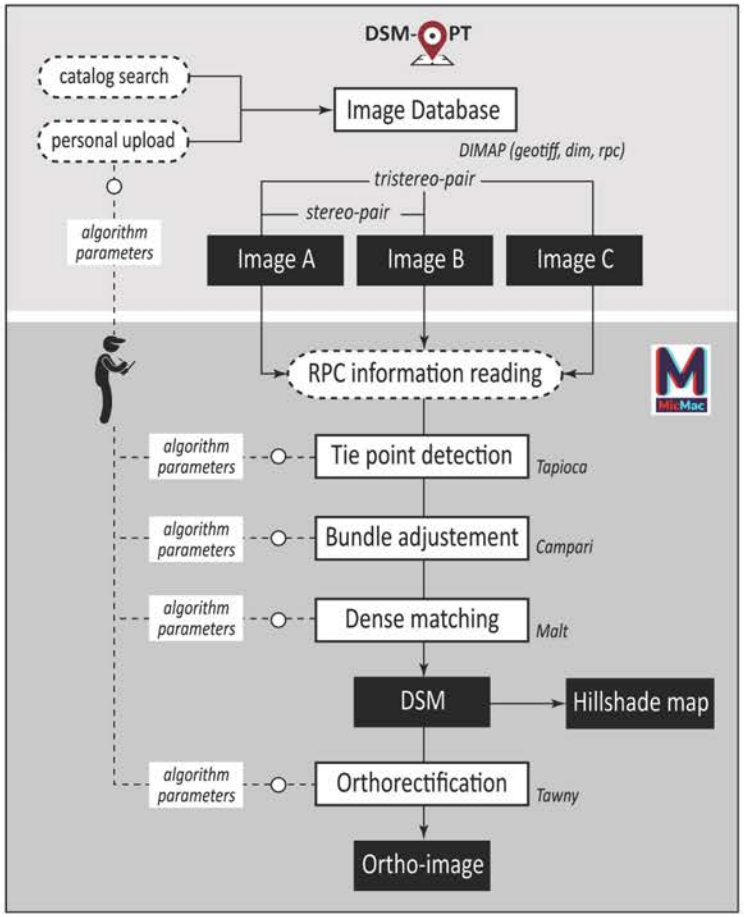




Example of activity: Processing Pléiades on-line

DSM-OPT service on-line on GEP: creation of High-Resolution Digital Surface Models (HR-DSMs) and orthophotos from Pléiades stereo-images





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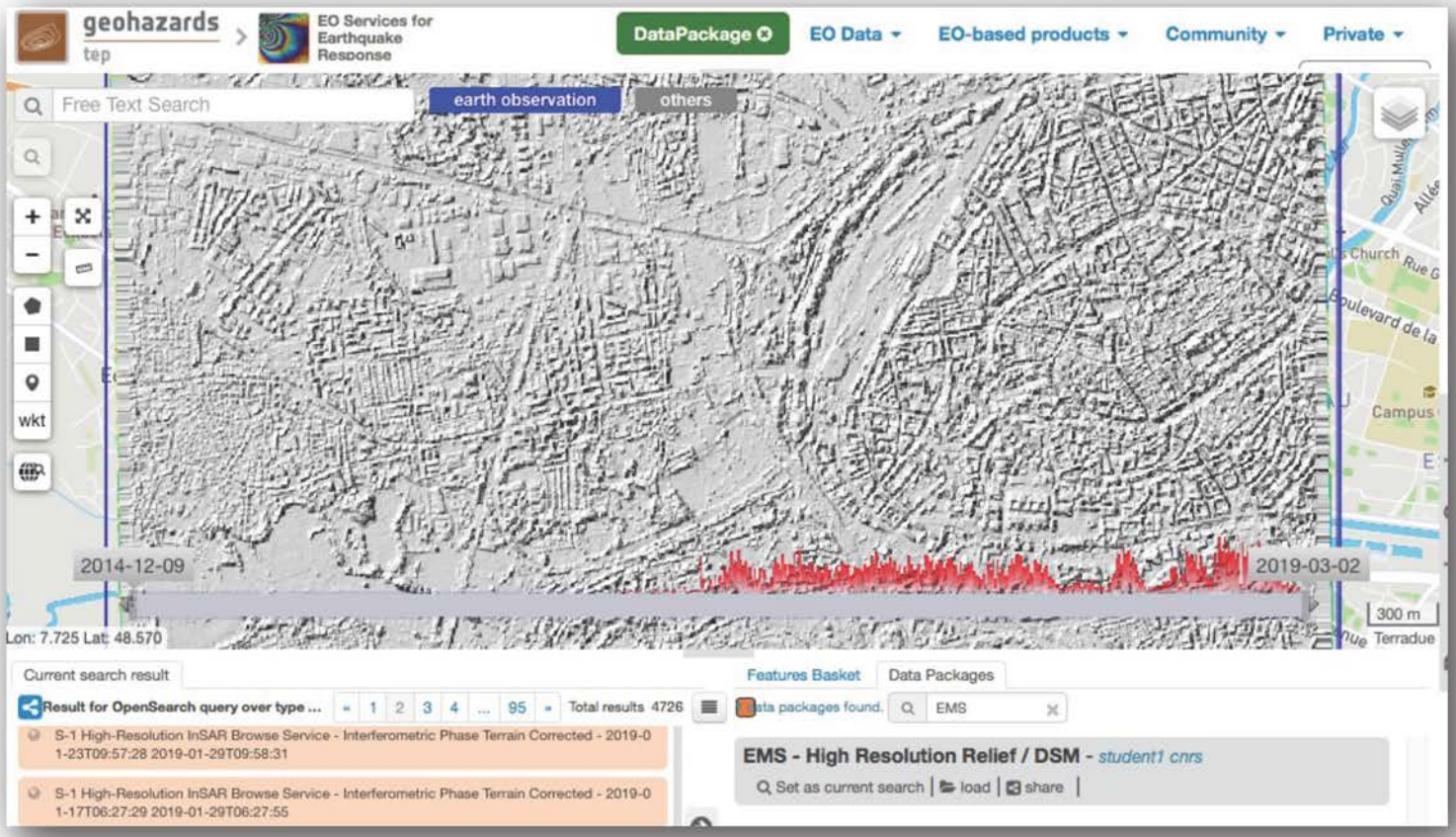


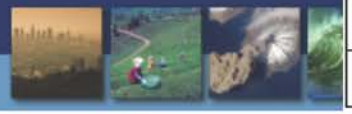
Hillshade of a HR-DSM (0.5m) over the city of Strasbourg / Pléiades stereo of Sept. 2016

Example of activity: Processing Pléiades on-line

DSM-OPT service on-line on GEP: creation of High-Resolution Digital Surface Models (HR-DSMs) and orthophotos from Pléiades stereo-images

Ortho-images of a HR-DSM (0.5m) over the city of Strasbourg / Pléiades stereo of Sept. 2016

Example of activity: Processing Pléiades on-line



Airbus Defense & Space May 2017

LICENCE TO USE PLEIADES PRODUCTS GRANTED AT A PREFERENTIAL PRICE BY CNES TO CATEGORY 1 INSTITUTIONAL USERS AND ASSIMILATED CATEGORY 1 INSTITUTIONAL USERS UNDER THE ISIS - PLEIADES PROGRAMME

Please read the terms and conditions of this User Licence Agreement carefully before placing any orders for Protected Products.

INTRODUCTION

In the framework of the public service delegation agreement concerning the operations of the Pleiades satellites concluded between CNES and Airbus DS (subsequently referred to as the "DSP"), Airbus DS has committed itself to distribute Pleiades products and services for the benefit of AUTHORISED INSTITUTIONAL USERS in order to fulfill their responsibilities in the frame of their institutional mission for NON-COMMERCIAL SERVICES.

CNES and Airbus DS have opened the ISIS programme to Pleiades products allowing eligible users (European scientific community) to obtain Pleiades images under special ISIS programme preferential pricing conditions, based on DSP Category 1 pricing.

Accomplishing any of the following acts implies acceptance by the USER of the terms of the present Licence Agreement (hereinafter "Licence":

Management of the Pléiades license through GEP (for CEOS-related images)

Example of activity: Terrain Motion Demo

- Promote use of EO for Geohazard applications:

- Demonstration of Ground Motion Services' products on different sites based on different terrain motion techniques using Optical and Radar data.
- Published on GEP

Geohazard

Earthquake, Volcano, Ground subsidence, landslide…

EO satellites

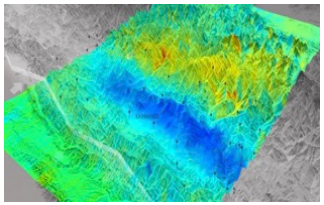
Sentinel-1 & 2, Envisat, ERS-1&2, TSX,CSM, Pléiades…

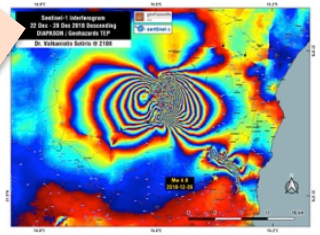
Providers

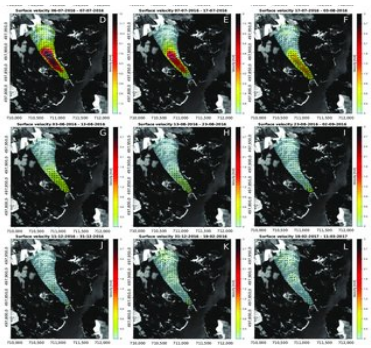
DLR, INGV, TRE-ALTAMIRA, CNR-IREA…

Ground Motion Processing

Diapason, SNAP, MicMac, P-SBAS, MPIC-OPT, PSinSAR®, SqueeSAR®

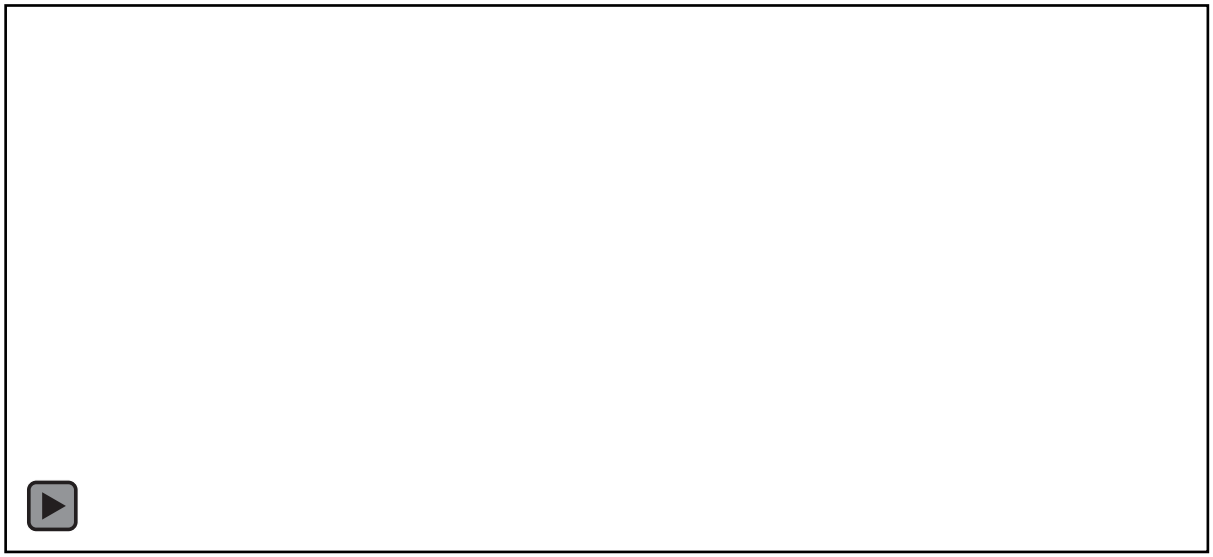






Example of activity: Terrain Motion Demo

- Example for the Sulawesi Earthquake 2018:



- **Co-seismic**

Sentinel-2, MPIC (offset tracking)
Sentinel-1, SNAP (offset tracking)
Sentinel-1, Diapason (InSAR)

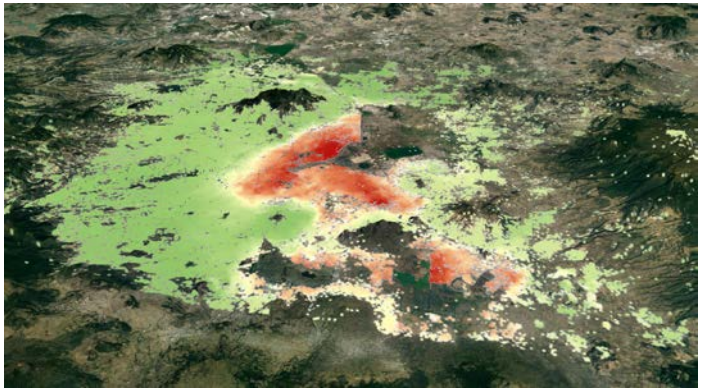
- **Pre-seismic**

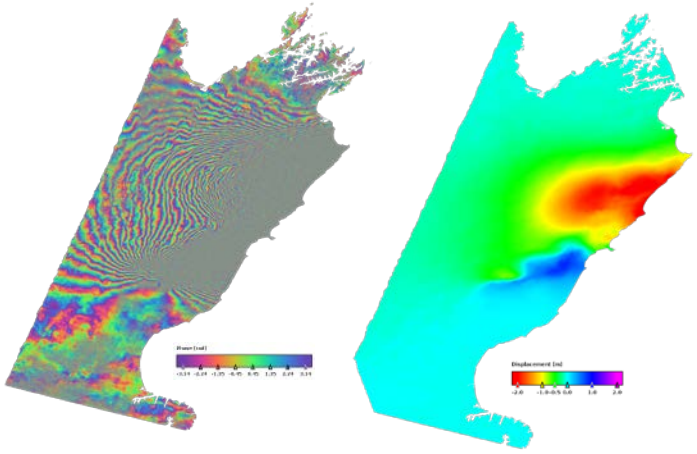
Sentinel-1, FASTVEL (PSInSAR)

GeoHazards Office | Activities

Scientific animation

- Organization of advisory **WG meetings** collocated to other relevant events (CoV 2018, ESA EO Φ-week & Living Planet 2019)
- Revival of the **CIEST** «Cellule D'intervention et d'Expertise Scientifique et Technique» collaborative framework between research institutes → Rapid response to earthquake events by e-collaboration within hosted processing platforms (GEP & PEPS)
- Co-Organization with Univ. of Strasbourg (EOST) of next **MDIS** (Mesure de la Déformation par Imagerie Satellite) conference of the Form@Ter group (Oct 2019)
- Communicate **scientific results** obtained using hosted processing services





GeoHazards Office | Website (not yet online)

Example of activity:
GeoHazards Office | Animate & Communicate Scientific Results

EUROPEAN SPACE AGENCY | ABOUT US | OUR ACTIVITIES | CAREERS AT ESA | FOR MEDIA | FOR EDUCATORS | FOR KIDS

sentinel-2 — esa

ESA | OBSERVING THE EARTH | COPERNICUS | SENTINEL-2

Colour vision
- Introducing Sentinel-2

Applications
- Plant health
- Changing lands
- Water bodies
- Disaster mapping

About the mission
- Facts and figures
- Satellite constellation
- Instrument
- About the launch

Operations and data
- Data flow
- Data products
- Essential groundwork

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- Image gallery
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Sentinel data access

International Charter

Related Links
Disasters charter Indonesia earthquake activation
Geohazards
Satellite Earth Observation for Geohazard Risk Management

SENTINEL-2 MAPS INDONESIA EARTHQUAKE

Fault line land movement

5 October 2018 A 7.5-magnitude earthquake and tsunami hit Indonesia on 28 September, destroying homes and hundreds of lives. As the death toll continues to rise, the effects of this natural disaster are far-reaching, with hundreds of thousands of people seeking access food, water and shelter in the aftermath of this tragedy.

The European Union activated its Emergency Copernicus satellite mapping service a couple of hours after the earthquake to assist authorities. Copernicus has also produced grading maps showing the impact of the damage covering ten areas of interest. The tailor-made service continues to closely monitor the situation and provide assistance in the aftermath of the disaster.

The Copernicus Emergency Management Service is a key tool providing understanding of the situation on the ground, thus assisting the European Union's Civil Protection Mechanism, activated following a request for assistance from the government of Indonesia. The Emergency Response Coordination Centre is working 24/7 to mobilise offers of assistance to the affected areas.


Copernicus grading map

One of the ways in which ESA is contributing to this area is through leading a range of activities in the framework of the Committee on Earth Observation Satellites (CEOS) Working Group on Disasters.

The Geohazards Office, led by the French Geological Survey (BRGM) liaises with practitioners on the exploitation of Earth observation processing services to support hazard mapping and risk assessment. This is in the spirit of the International Forum on Satellite Earth Observation and Geohazards.

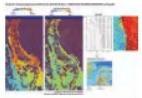

Displacement map

BRGM experts have generated displacement maps using Copernicus Sentinel-2 acquisitions from 17 September and 2 October.

Thematic experts from the Corinth Rift Laboratory in Greece have generated similar results using the Cloud processing platform GEP, which has been designed to rapidly provide automated measurements.

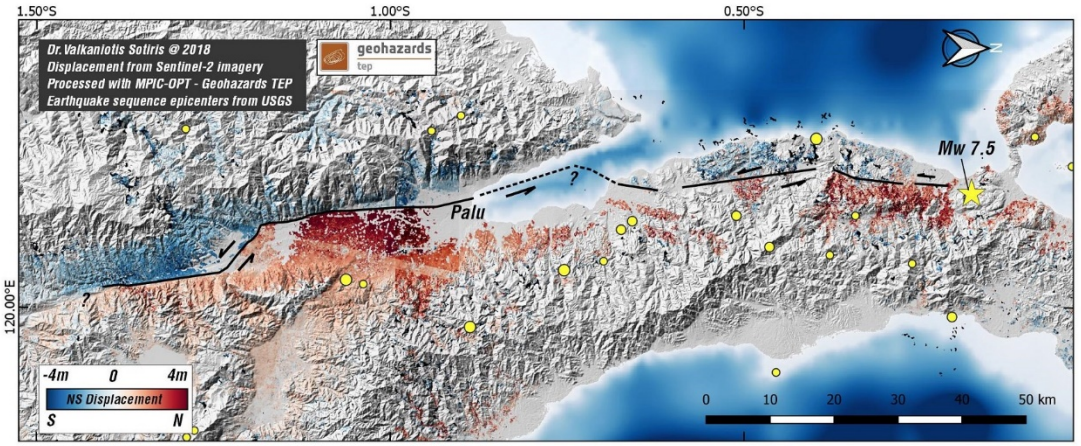
As shown in the images, the earthquake triggered deformations of several metres and a tsunami. Around 1400 people are reported to have lost their lives, hundreds have been hospitalized and many more thousands are thought to have been displaced. It has been estimated that up to 1.5 million people will be affected by these events.

The Vice-President of the country, Jusuf Kalla, has said that the final death toll could reach the thousands. The International Charter Space and Major Disasters was triggered by the Asian Disaster Reduction Centre on 29 September for this event. International collaboration is in place to organise Earth observation-based disaster response activities.


Displacement data

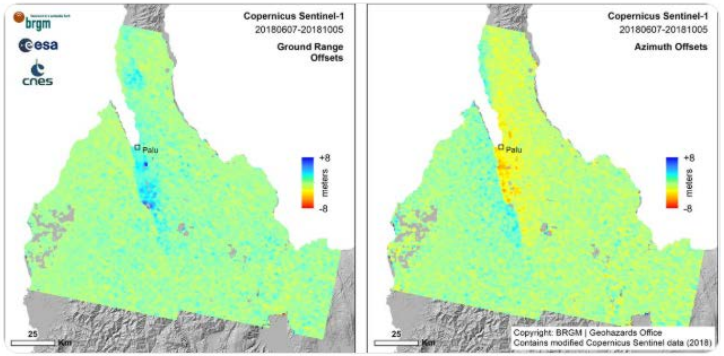
Scientific products such as the map created by BRGM are helping us to better understand hazards. Beyond this example it is foreseen that Earth

Sulawesi Earthquake (Indonesia)



BRGM @BRGM_fr · Oct 12

#PaluEarthquake Mw 7.5 : #Sentinel1 from @CopernicusEU allowed the #BRGM scientists to produce a second map of the displacement field generated by the #earthquake in #Palu (#Indonesia, 2018-09-28) within the frame of the #Geohazard Office with @ESA and @CNES



GeoHazards Office | Revival of the CIEST initiative

“Cellule d’Intervention et d’Expertise Scientifique et Technique (CIEST)”

From satellite platforms to geophysical knowledge: rapid response to geohazards in seismotectonics

Collaborative framework between research institutes of ForM@Ter group

Community building at the French level:

CNES, BRGM, IPGP, CEA, CNRS (ENS Paris), EOST, Uni Grenoble , Uni Clermont Ferrand (other)

Community building at EU level (Mediterranean tectonics):

BRGM, INGV, NOA, KOERI, IGME

For generating geophysical knowledge using EO processing platforms
(but not limited to, e.g. modelling & value added maps)

Geohazards Lab | Scientific Advisory Working Group

A scientific advisory Working Group (WG) is set up

Purpose: ***Work on the definition and harmonization of EO products for geohazards applications (terrain motion mapping, landslide monitoring etc.)***

- Maximize use of EO techniques and cloud processing by the EO expert community
- Achieve acceptance of EO products by the non-EO scientific community and decision makers
- Facilitate interpretation and improve understanding of EO products (and derived information) by end-users

✓ **Preparatory meeting held** on 5 September 2018, Naples, Italy: Introduction to the concept and roadmap of activities

✓ **1st meeting of the WG** held on 16 November 2018 at Frascati, Italy (during the Φ-Lab week)

GLab Working Group | Standardization Viewpoints!

Standardization of EO results & formats

- Requirements based on both the thematic domains and EU legislation for geospatial information

Independent activities cannot achieve wide acceptance

EPOS

SNGMS

Norwegian NGMS

GOffice

INSPIRE OGC

CEOS WG Disasters GLab

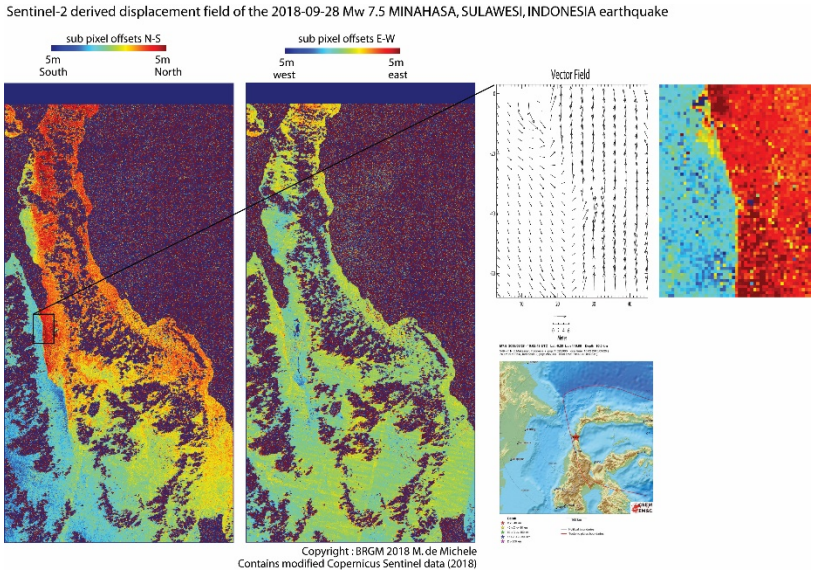
Cartographic & IT requirements

http://inspire.ec.europa.eu
http://www.opengeospatial.org

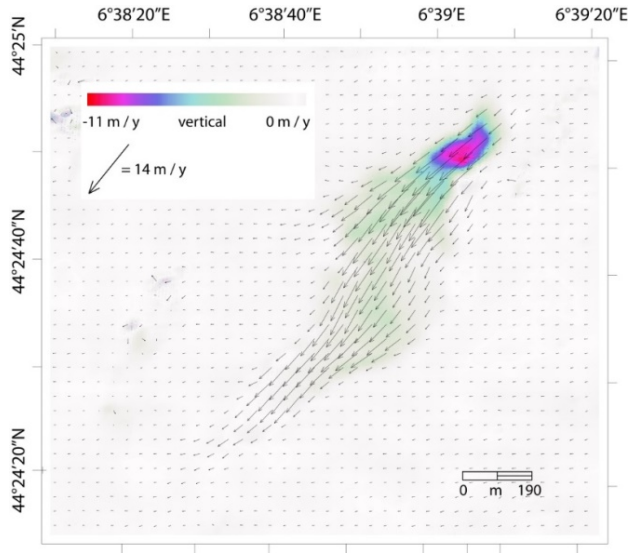
Standardization of EO results & formats → **Earthquakes & Landslides**

- A family of techniques (Image Matching/Correlation or Offset Tracking) not yet properly addressed in terms of standardization

Optical



SAR



Geoscience for a sustainable Earth
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GLab Working Group | Overview of Activities

Q4 2018 – Q3 2019

Standardization of EO products

Completed:

- ❑ Investigate whether standards for SAR and InSAR products are being defined by OGC
- ❑ **Proposition of collaboration between GLab and EPOS** sent to EPOS TCS Satellite data (awaiting response from EPOS)
  - ➢ ***The WG agreed to propose to EPOS to allocate the output of their work under the EPOS framework (at least for Europe) to facilitate acceptance by EO practitioners and decision makers.***
- ❑ Preparation and dissemination of a **brochure describing the GEP services** in view of use by the EPOS community

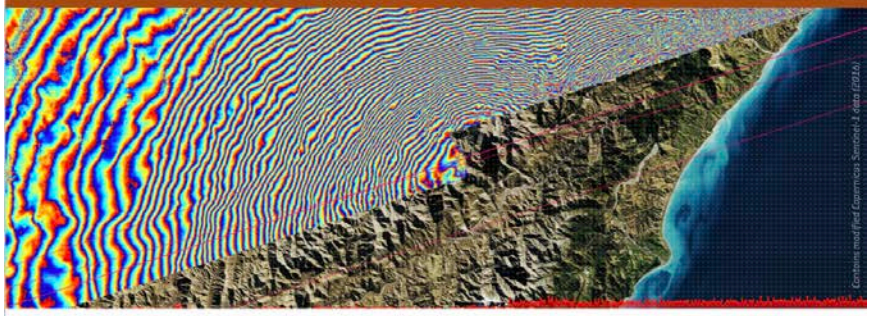
Foreseen for Q3 2019:

- ❑ Organize a **benchmarking activity for a landslide site** in the French Alps and address capabilities, drawbacks and complementarities of EO monitoring (ImCor, DInSAR, PSI, etc.)
- ❑ Gather inputs on EO products, formats and metadata used in their institutes
- ❑ Collect and analyse the variables delivered by different data providers for SAR, InSAR, PSI and ImCor techniques
- ❑ Prepare and circulate a **doc/survey summarizing existing products and formats**, incl. proposed generic standards addressing user needs

Promotional Brochure for EPOS users

SUPPORTING GEOHAZARDS USERS WITH CLOUD-BASED EO SERVICES

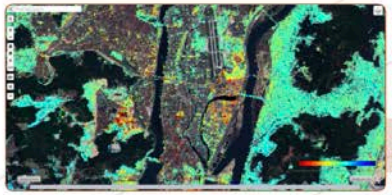
The **Geohazards Exploitation Platform (GEP)** is part of the Thematic Exploitation Platforms (TEP) initiative set up by ESA to provide an environment to process EO data and support the user community concerning data exploitation through cloud-based services. The platform is in pre-operations with an Early Adopter programme, supporting approximately 100 user organisations in 35 countries whose access is sponsored by ESA.



On-demand Advanced Terrain Motion services

Based on Radar data

Advanced services for SAR time series analysis provide surface deformation measurements over point targets, called Persistent Scatterers, using multiple SAR acquisitions. Deformation monitoring is measured in the line of sight of the satellite and accuracy can reach sub-centimetre level depending on the observation period considered.



Services available

The **FASTVEL** service is developed by TRE-Altamira for generating differential interferograms and PSI-based mean displacement velocity maps. Copernicus Sentinel-1, ERS and ENVISAT missions are supported.

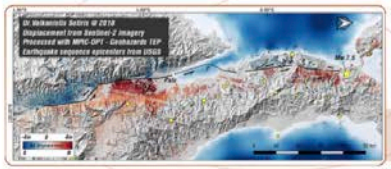
The **P-SBAS** processing chain is developed by CNR-IREA for the generation of ground deformation time series and mean displacement velocity maps. Copernicus Sentinel-1, ERS and ENVISAT missions are supported.

Other services include StaMPS.

Pusan city, South Korea - Mean displacement velocity processed with FASTVEL from 43 Sentinel-1 acquisitions from 01/08/2017 to 18/10/2018. Credits: TRE Altamira. Contains modified Copernicus Sentinel-1 data (2017,2018).

Based on Optical data

Image correlation techniques provide surface deformation information from the combination of pairs or time series of satellite images. This kind of service provides maps of horizontal displacements. They are particularly suitable for monitoring large displacements (cm to m) such as co-seismic slip (especially for strike-slip faults), lava flows from volcanoes or landslides. The techniques require very accurate co-registration of image time series.



Services available

The **MPIC-OPT** service is developed by CNRS EOST for the processing of optical image time series to monitor persistent surface motion. It enables on-demand processing of time series of Sentinel-2 as well as very high resolution imagery from Pleiades and Spot6/7.

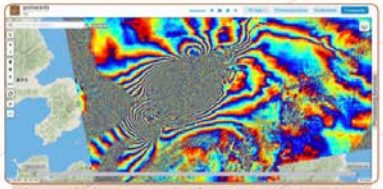
Sulawesi Earthquake, Indonesia – North-South surface motion processed by MPIC-OPT between the Sentinel-2 acquisitions of 17/09/2018 and 02/10/2018. Credits: Dr. Volkaniotis. Contains modified Copernicus Sentinel-2 data (2018).

geohazards tep

To apply, fill in the **User Request Form** and send it at: **contact@geohazards-tep.eu**

On-demand Conventional Terrain Motion services

These services are based on Differential SAR Interferometry (DInSAR) to measure surface displacements occurring between two dates.



Kumamoto Earthquake, Japan – Interferogram processed with DIAPASON between the Copernicus Sentinel-1 acquisitions of 08/04/2016 and 20/04/2016. Credits: TRE-Altamira. Contains modified Copernicus Sentinel-1 data (2016).

Services available

The **DIAPASON** DInSAR service is developed by the French Space Agency (CNES) and maintained by TRE-Altamira. Two versions of DIAPASON are available supporting **stripmap** acquisitions of ERS, Envisat and Sentinel-1 missions and **TOPSAR** acquisitions of Sentinel-1.

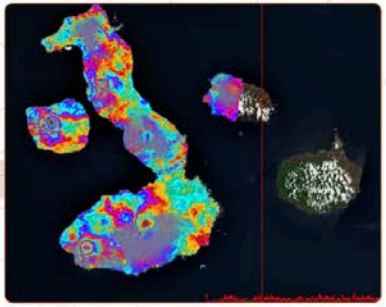
The **SNAP InSAR** service provides an interferometric processor using ESA SNAP toolbox. Copernicus Sentinel-1 mission is supported.

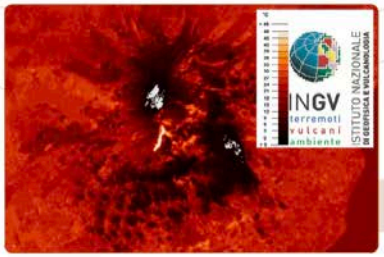
Other services include GMTSAR, GAMMA DInSAR, ADORE DORIS, P-SBAS.

Systematic Services – application example to volcano monitoring

The **Sentinel-1 InSAR Browse** service is developed by DLR. Medium- (50m spacing and 100m resolution) and High- resolution (25m spacing and 50m resolution) InSAR Browse provides interferometric products since 2015 and is updated for every new Copernicus Sentinel-1 acquisition. In particular, the High-Resolution InSAR Browse (25m spacing and 50m resolution) provides interferometric products on-request over target-areas defined by the user through the GEP operator (e.g. the 22 predefined volcanoes of the Volcano-2 Trial Case).

Interferogram generated by the InSAR Browse over the Galapagos Islands, Ecuador. Credits: DLR. Contains modified Copernicus Sentinel-1 data (2017).





The **STEMP** service is developed by INGV in the framework of the Volcanoes Thermal Applications (VOLTAGE) pilot of GEP. It generates surface temperature maps over volcanic areas from Landsat-8, Sentinel-2 and Sentinel-3.

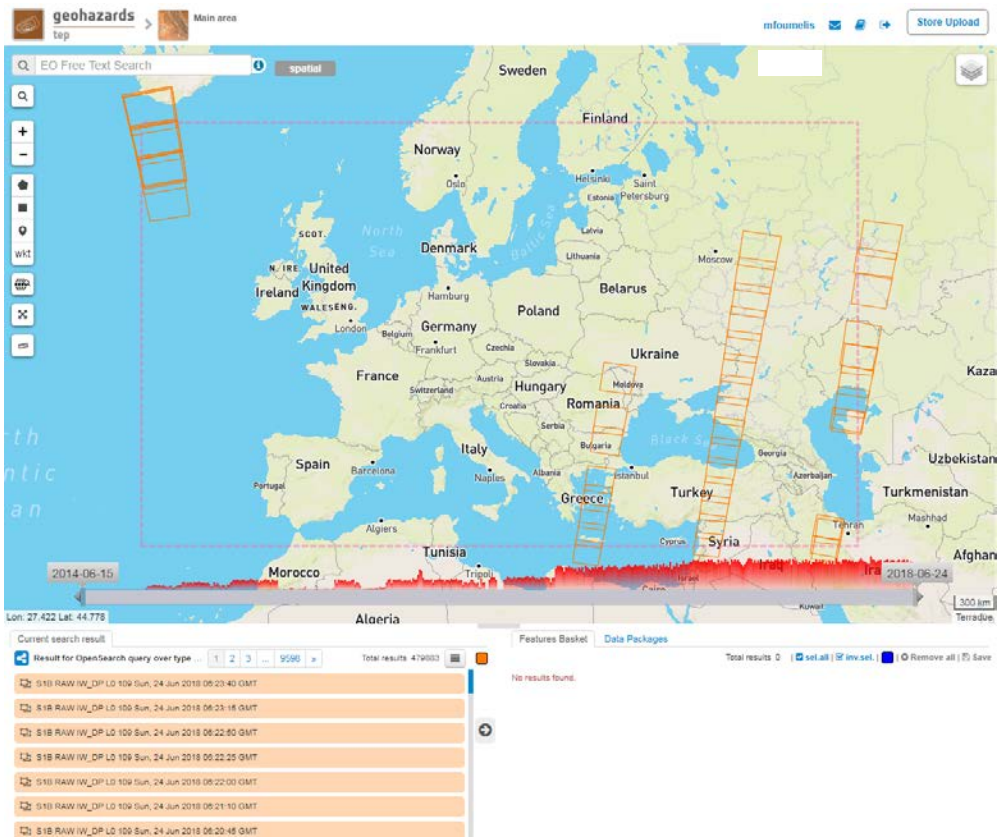
Surface Temperature Map of Etna volcano, Italy, on 27/03/2017. A lava flow in bright white-yellow is clearly visible. Credits: INGV. Contains modified Landsat-8 data from USGS/NASA Landsat Program.

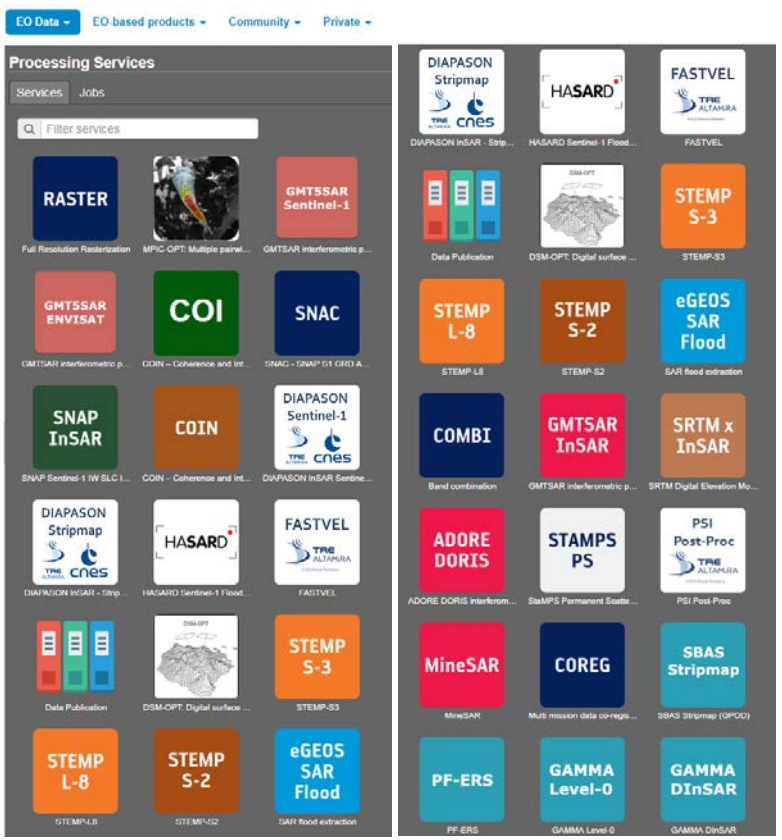
The **VEGAN** Hot Spot and Vegetation Index systematic service is developed by NOVELTIS and INGV within the framework of the VEGAN project. It provides operational monitoring of volcanic eruptions by detecting temperature anomalies and the impact of the eruption on the vegetation through a vigor index. It is based on Sentinel-2 data.

Vegetation Vigor maps of the 20/11/2018 delivered by the VEGAN service over the El Fuego volcano, Guatemala. Credits: NOVELTIS. Contains modified Copernicus Sentinel-2 data (2018).

In the context of the **CEOS Working Group Disasters**, the GEP allows to access EO missions' data from different CEOS space agencies and provides an on-line environment to process imagery and share EO based products within a community of users. It also allows expert users to deploy their processing chains. In addition, external products from third parties can be published on the GEP. In particular, through the **Geohazards Lab initiative**, a **terrain motion mapping demonstration** is available to explain and show full scale results based on different terrain motion techniques using Optical and Radar data. In the spirit of the CEOS WG Disasters, the Geohazards Lab is also collaborating with EO practitioners of the geohazards community working on the standardisation and harmonisation of EO services and using the GEP to support this activity.

GEP | Processing Services





New services (1):
Alerting system for automatic production of deformation maps

- A new platform functionality is being implemented on the GEP in order to be able to **trigger services based on events polled from external systems**
  - **Actuators** are event-based components able to start specific data discovery, ingestion, caching and processing workflows
- The following actuators will be implemented
  - **USGS pager** based on the ATOM Syndication (https://earthquake.usgs.gov/earthquakes/feed/)
  - **@INGVterremoti** twitter feed based on the earthquake magnitude
  - **Copernicus EMS** rapid mapping and risk & recovery feeds
  - **UNOSAT/GDACS** disaster feed

New services (1):
Alerting system for automatic production of deformation maps

- For each new feed/tweet informing about an earthquake with a magnitude > X (configurable threshold), the actuator starts an embedded workflow that:

  - creates an **earthquake event** in a specific index in the GEP catalogue
  - searches for specific **datasets** based on specific sources intersecting the lat/lon point of the event, in the pre- and post-event temporal period
  - for each dataset/pair/stack found, caches and harvests the datasets and starts **automatic production** of **deformation maps** with different GEP processing services
  - **publishes** the generated maps in a specific index in the GEP catalogue linked to the originating event

New services (1):
Alerting system for automatic production of deformation maps

- The following **GEP processing services** will be initially **triggered** by the actuators:

  - CNRS-EOST MPIC-OPT (optical - Sentinel-2 / Pleiades)
  - DLR InSAR Browse (InSAR – Sentinel-1)
  - SAR Pixel Offset Tracking (InSAR – Sentinel-1)
  - SNAP InSAR (InSAR – Sentinel-1 / COSMO SkyMed)
  - DIAPASON TOPSAR (InSAR – Sentinel-1)
  - CNR IREA P-SBAS (InSAR – Sentinel-1)

- The actuators framework is designed to support triggering of any service integrated on the GEP for any type of event

Promotion and Capacity Building

Q3 2018 – Q3 2019

Presentations and posters

- **Oral presentation accepted: Geohazards Lab - Satellite EO exploitation and processing services to support the geohazards community,** LPS 2-019 13-17 May 2019, Milan, Italy
- **Poster accepted: The geohazards Exploitation Platform – An innovative approach for online processing,** LPS 2-019 13-17 May 2019, Milan, Italy
- **Abstract submitted: The Geohazards Lab initiative in support of the geohazards community,** EGU 2019, Vienna, Austria
- **Generating InSAR products with COSMO-SkyMed and TerraSAR-X imagery in the Geohazards Exploitation Platform (GEP) to support the CEOS Recovery Observatory in Haiti,** Φ-week, 12-16 November 2018, Frascati, Italy

Papers

- **Abstract submitted: Monitoring geohazards using on-demand and systematic services on ESA's Geohazards Exploitation Platform,** IGARSS 2019

Training

- **Upcoming training: Capacity building exercise for the Central Sulawesi Earthquake-Tsunami Reconstruction Plan,** Jakarta, Indonesia
- **Hands-on InSAR (ESA software and on-line tools),** 21-25 September 2018, Corinth, Greece

Web articles and social media

- http://www.esa.int/spaceinimages/Images/2018/10/Indonesia_earthquake_displacement_map

Status and milestones

Milestones of the Implementation Phase	Status Q1 2018	Status Q3 2018	Status Q1 2019
Expand integration of services and tools to better meet community needs	Started	On-going	On-going
Document procedures to access and use processing chains	Not started	Not started	Not started
Define protocol with CEOS agencies that contribute to the Geohazards Lab. As a baseline ESA will provide access to the GEP	Not started	Started	On-going
Enhance procedure to make data available in a timely fashion	Not started	Not started	Started
Develop a Website/Webpage	Not started	Started	On-going
Promote hosted processing and raise awareness (capacity building, training courses, workshops)	Started	On-going	On-going
Analyse geohazards community requirements	Not started	Started	On-going
Develop collaborative framework with geoscience centres and other initiatives to define common standards/methodologies	Not started	Not started	Started
Work on harmonization and improvement of EO results	Not started	Not started	Started

Conclusion

- **Glab initiative kick-off** in Q3 2018
- **1st Geohazards Lab meeting** held in November 2018
- Geohazards WG intends to **collaborate with EPOS TCS Satellite Data** to allocate the work on standardization of EO products under the EPOS framework (proposition sent)
- **Pleiades data on GEP** for online processing: license signed by platform operator, first dataset processed online
- **Tools and services**: integration on-going, federation of HPC service on GEP to start shortly, Terrain Motion Demo under preparation
- New service: USGS Pager (and INGV Twitter) **triggering automatic production of deformation maps**
- **Promotion and capacity building**:
  - presentations foreseen for EGU 2019 and LPS 2019
  - paper abstract submitted for IGARSS 2019
  - **Brochure** for EPOS community disseminated
  - hands-on training course held in September 2018 in Greece
  - upcoming training course in Indonesia
  - Website under preparation
  - CEOS webpage available (on http://ceos.org/)

Thank you

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