**European Ground Motion Service at a glance**

- The first continental-scale InSAR ground deformation monitoring service. Based on full-resolution processing of all past and future Sentinel-1 (S1) satellite data, for high spatio-temporal resolution and millimetric precision.
- Typical ground displacements include: landslides, subsidence and uplift, volcanic and tectonic deformations. Enabling monitoring of the stability of slopes, mining areas, buildings, infrastructures, ...
- A new European geospatial dataset of unique value, from which other products/services can be developed.
- Exploiting advanced PS and DS InSAR processing algorithms, and ensuring seamless harmonization between the S-1 tracks.
- A 50 km grid GNSS model will also be realized to tie the InSAR products to the geodetic reference frame ETRF2014.
- Tools for visualization, exploration, analysis and download of the ground deformation measurements, as well as elements to promote best practices and user uptake will be provided.
- The first product, based on S1 data from 2015-2020, will be released in Q1 2022. Annual updates will follow.
Background
What is EGMS?
Implementation
What is InSAR?
EGMS products
Service delivery
User Uptake
Documentation
EGMS validation
Contacts
Next Events

ESA Sentinel-1 radar vision
Background

Sentinel-1

High performance computers

Reliable algorithms

Past and present experiences
EGMS is the newest addition to the Copernicus Land Monitoring Service, managed by European Environmental Agency (EEA).

EGMS will provide continental-scale, homogeneous maps of ground motion.

Millimetre-per-year precision with full time-series included.
The European Ground Motion Service

- Typical ground displacements include: landslides, subsidence and uplift, volcanic and tectonic deformations.

- Products made by mass-InSAR-processing Sentinel-1 satellite data.

- Initial service coverage includes all Copernicus Participating States

- A new European geospatial dataset of unique value, and from which other products and services can be made.
Framework Service Contract between:
European Environment Agency and the ORIGINAL Consortium, comprising:

In collaboration with:

Contract duration: January 2021 to December 2024.
EGMS is based on ‘InSAR’

- InSAR = Synthetic Aperture Radar (SAR) Interferometry.
- Multitemporal analysis using Persistent Scatterer (PS) and Distributed Scatterer (DS) interferometry techniques.

- Multiple image-acquisition approach, e.g. entire archives.
- Removal of atmospheric noise allows mm/year precision.
- Produces high-density data cloud with measurements from both ‘point’ and ‘distributed’ scatterers (PS+DS technique).
- Every point has an associated time-series of displacement.
Based on:

- Maps of average annual velocity (mm/year).
- Time-series data for every measurement point.
- Ascending and descending satellite look-angles.
**EGMS Products**

**Basic**
- L2a product
- Displacement data in the satellite line-of-sight.
  - Relative to InSAR point.
- Two look-angles.
- Captured at 20 m x 5 m resolution.
- For expert use.

**Calibrated**
- L2b product
- Displacement data in the satellite line-of-sight.
  - Anchored to a GNSS reference frame.
- Two look-angles.
- Captured at 20 m x 5 m resolution.
- For regular use

**Ortho**
- L3 product
  - Vertical and east-west displacement data.
- Made from multi-look Calibrated product.
- Plotted to 100 m grid to coincide with other CLMS datasets.
- A useful aid to interpretation.

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Service delivery

- EGMS products and services will be made freely available to all, globally.
- Visualisation and analysis via a dedicated webGIS.
- Data download available after registration via search interface.
- Accessible via the main Copernicus Land Monitoring Services site.

Delivery schedule:

**EGMS Dissemination & Archive System: a webGIS with added functionality.**

- Plot the time-series of individual InSAR points to show displacement evolution and trends.
- Plot the average time-series for many InSAR points.
- After registration, freely download the data in various user-friendly formats.
- More features to be developed...

Standard map will display InSAR points colour-coded by mm/year velocity

3D viewing for analysis in areas of relief
raise awareness... educate... stimulate...
EGMS documentation to be made available:

- End user requirements
- Algorithm theoretical basis
- Product description & format specification
- GNSS calibration
- Product user manual
- End user interface manual
- Quality assurance & control
- User uptake & communication plan

References:

- EGMS White Paper (Sep 2017)

- EGMS Specification & Implementation Plan (Jan 2020)

- Copernicus introduction to EGMS (current)
EGMS products will be independently validated.

Based on ‘Validation of the EGMS Product Portfolio’ drafted by the EGMS Advisory Board.

Validation will certify the quality of all EGMS products.

An ITT for EGMS validation was launched in April 2021.

Preliminary results on a test area
Test Area – S1 tracks coverage

- Roughly 40,000 Km²
- Well covered by S1 tracks
- Interesting from a CORINE perspective (Mountains, vegetation, towns, villages...)
- GNSS Availability
Test Area – CORINE land cover

- Roughly 40,000 Km²
- Well covered by S1 tracks
- Interesting from a CORINE perspective (Mountains, vegetation, towns, villages...)
- GNSS Availability
Land Monitoring

Test Area – GNSS availability

» Roughly 40,000 Km²
» Well covered by S1 tracks
» Interesting from a CORINE perspective (Mountains, vegetation, towns, villages...)
» GNSS Availability
Test Area – A stable area

http://dev.insar.no/#llh=5.83255367,48.49051799,93394.81268972&look=-0.06734907,-0.74884605,-0.65931305&right=0.99482313,-0.00000000,-0.10162154&up=-0.07609895,0.66274333,-0.74496995&layers=aerial,maptiler-streets,TREA-ASCENDING-ORR-v2

Dataset: TREA-ASCENDING-ORR-v2
Point ID: Average series 1 of 1 (634 total all series)
Position: 48.476380 N 6.313427 E 290.33 m
Mean velocity: -0.11
Coherence: 0.77

Legend

Legend across all datasets.
Limits are in mm/year.

Powered by NORCE Geo Viz | About data...
EUROPEAN COMMISSION
European Environment Agency
Copernicus

Test Area - Strong and extensive subsidence

http://dev.insar.no/#llh=7.22751582,47.83840729,8630.06821017&look=-0.08444645,-0.74125466,-0.66589063&right=0.99617020,-0.07800572,-0.03949737&up=0.02266567,0.66667581,-0.74500311&layers=aerial,mapbox.satellite,EGEOS-088A-ORR-v2
Test Area – S1 PS on electric pylons

http://dev.insar.no/#llh=7.94936443,48.53761804,240.44984727&look=-0.09873304,0.21753677,-0.97104559&right=0.99385286,-0.02755517,-0.10722501&up=0.05008263,0.97566328,0.21347808&layers=aerial,mapbox.satellite,TREA-ASCENDING-ORR-v2

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Test Area – Electric pylon thermal expansion

http://dev.insar.no/#llh=7.54926764,48.25236662,574.86485801&look=0.39012283,-0.88094340,0.26784865&right=-0.87309042,0.26153734,0.41147460&up=0.29243375,0.39438096,0.87117516&layers=aerial,mapbox.satellite,TREA-ASCENDING-ORR-v2
Test Area – An abrupt deformation

http://dev.insar.no/#llh=7.74275947,48.57871040,2435.67075325&look=-0.08913326,-0.74986529,-0.65555877&right=0.99088293,-0.00000000,-0.13472571&up=-0.10102621,0.66158989,-0.74302929&layers=aerial,mapbox.satellite,GAF-ASCE_088_86-ORR-v2
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Next events to date at which EGMS updates will be presented:

**ESA FRINGE 2021**
31 May - 04 June 2021

**IGARSS 2021**
12-16 June 2021

Thank you!