PROGRAMME OF THE EUROPEAN UNION

Copernicus Europe's eyes on Earth

Implemented by European Commission

Emergency Management

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CEMS On-Demand Mapping

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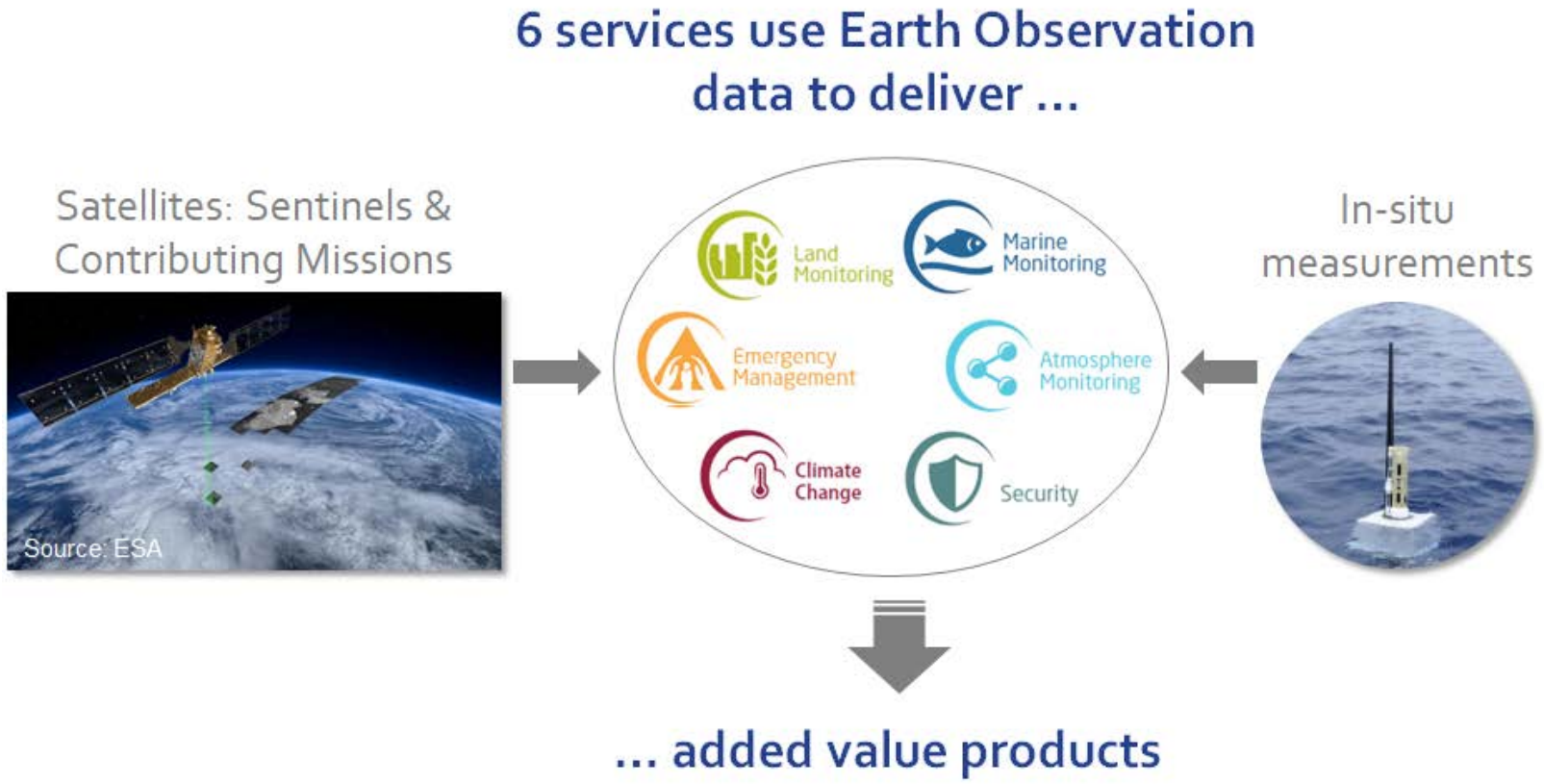
Copernicus
Europe's eyes on Earth

EU's Earth Observation Programmes



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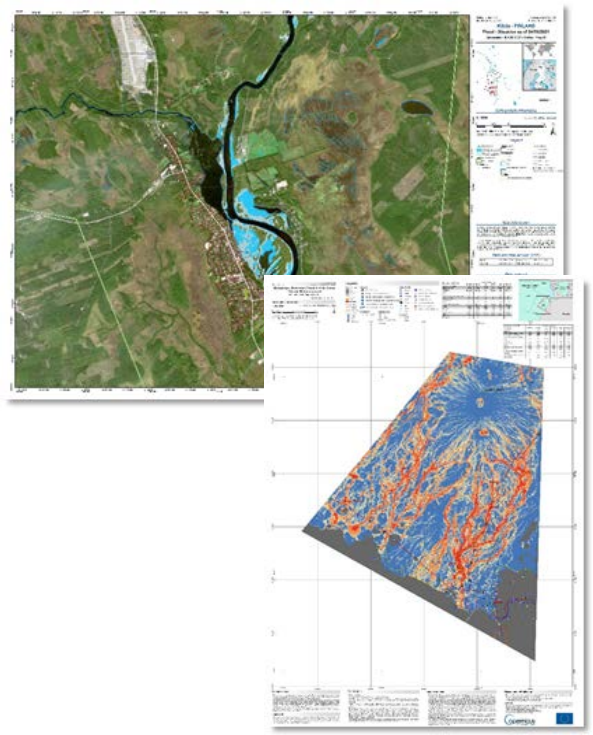
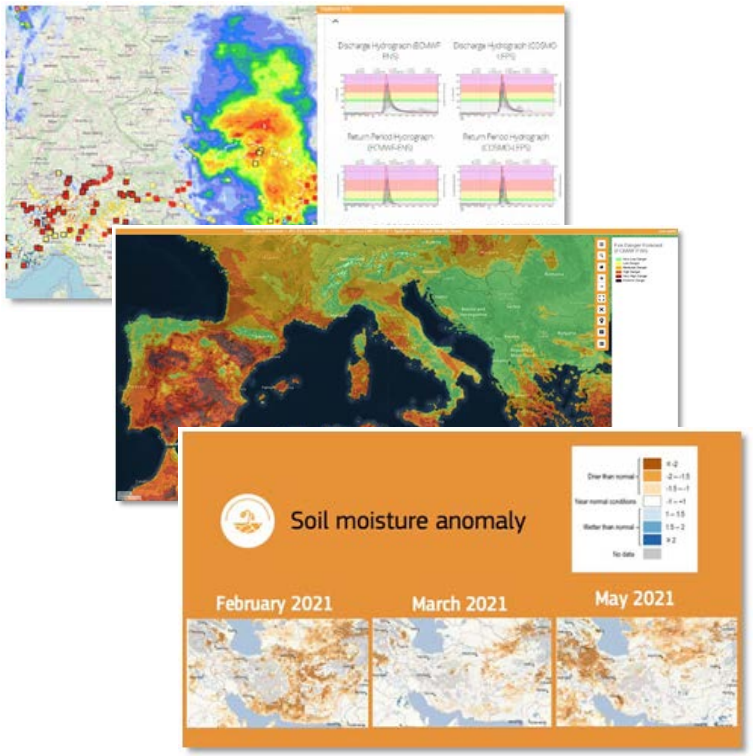
THE COPERNICUS EMERGENCY MANAGEMENT SERVICE

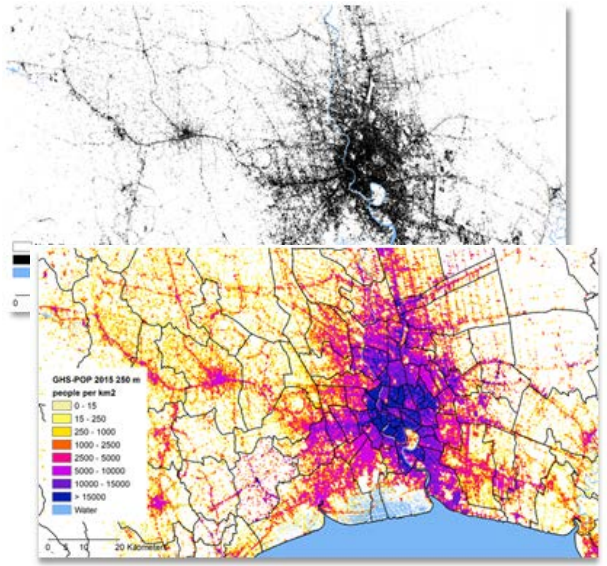
On-demand mapping
- Rapid Mapping
- Risk & Recovery Mapping

Early warning and monitoring
- Floods
- Fires
- Droughts

Exposure Mapping
- Population
- Built-up areas







CEMS
On-Demand
Mapping

CEMS supports actors involved in the management of **natural and man-made disasters**.

CEMS is managed by the **Joint Research Center** of the European Commission.

CEMS is a **fully operational** service (i.e. 24/7/365).

It addresses **all phases of the disaster management cycle**:

- **Pre-disaster**:
  - Risk & vulnerability assessments, prevention, mitigation
  - Preparedness and early warning
- **Immediate response**
  - Event mapping and monitoring & Damage assessment
- **Post-disaster**
  - Recovery assessment, reconstruction and monitoring
  - Associated risk assessment

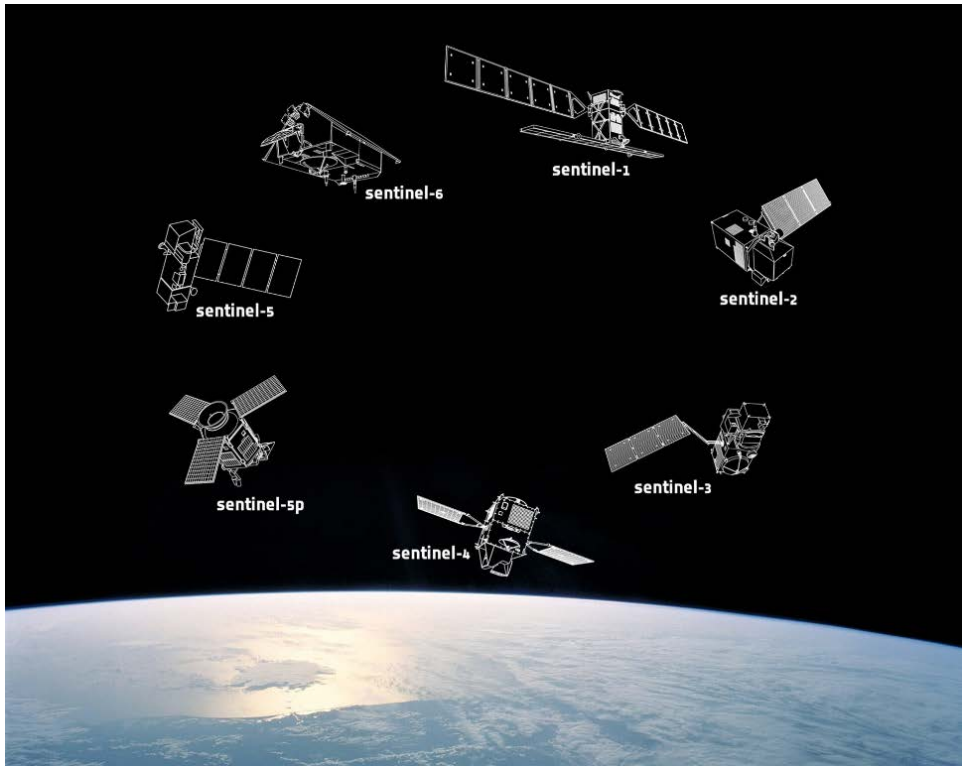
Rapid Mapping

- 24/7/365
- Emergency response support
- Highly standardised workflow and products
- Rapid request of satellite imagery and aerial component
- Delivery in 24-48h (avg.), max. 5 days
- Mostly based on EO

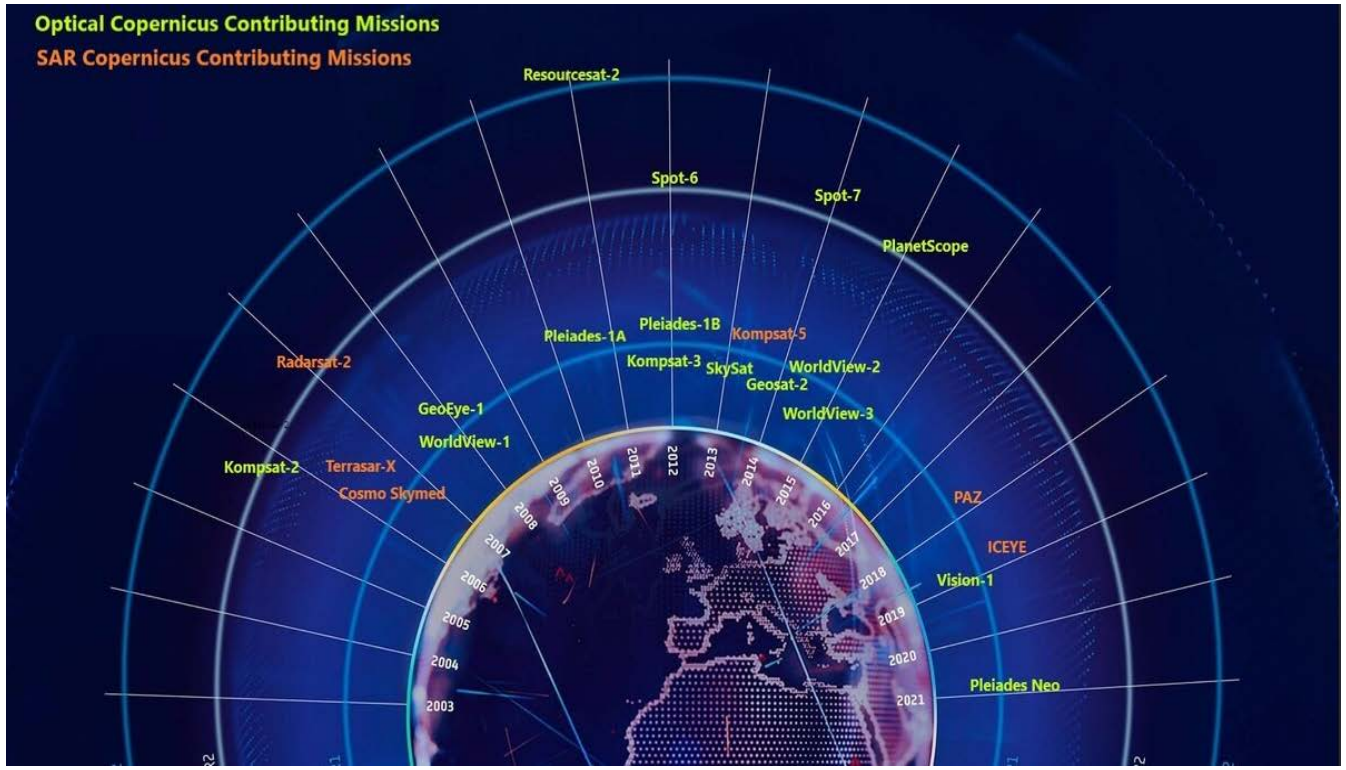
Risk & Recovery Mapping

- Operational during normal working hours
- Support for prevention, preparedness, mitigation and recovery activities
- Delivery in days or several weeks (customised projects, FLEX products)
- Use of EO data + aerial component +other data

Satellite Images



Sentinel Family



Copernicus Contributing Missions | Copernicus Data Space Ecosystem

Aerial Images

Risk and Recovery interest in RASTOOL-DOS

Ground deformation analyses in Copernicus EMS

- Inform on Changes in the Earth's Surface
  - Ground deformation analysis provides insights into changes due to natural or anthropogenic processes.
- Predict and Monitor Potential Hazards
  - Crucial for anticipating and tracking various hazards, enhancing preparedness and response efforts.
- Utilize the European Ground Motion Service
  - As a baseline for hazard analyses or to identify areas with significant deformation activity.
  - https://land.copernicus.eu/pan-european/european-ground-motion-service

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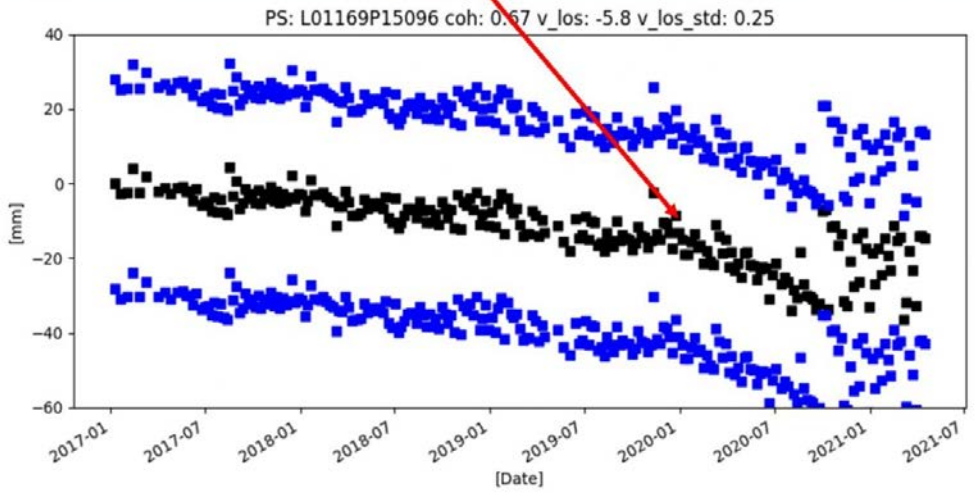
Ground deformation analyses in RRM

Examples of RRM activations, Rockfall event



EMSN093: Rockfall risk analysis in Valle Gran Rey, La Gomera (Spain)

Objective:

- Detect and analyze ground deformation associated with a rockfall event in Valle Gran Rey using satellite-based interferometric techniques.

Methods:

- Differential Interferometry (DInSAR) and Multi-Temporal Interferometry (MTI) using Sentinel-1 SAR data

Outcome:

- No significant wide-area displacements were detected, but localized ground movements were observed.
- Time series analysis revealed pre-event acceleration in the rockfall area, confirming the potential of MTI for early warning.
- Vertical and East-West displacement maps were generated, supporting hazard assessment and future monitoring strategies.

Sensor	Type	Track/ Rel. Orbit	Resolution	Acq. Period	Images
Sentinel 1	SAR	Ascending / 60	5 m x 20 m	2017-2021	239
Sentinel 1	SAR	Descending/ 96	5 m x 20 m	2014-2021	324

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Ground deformation analyses in RRM

Examples of RRM activations, Sinkholes detection

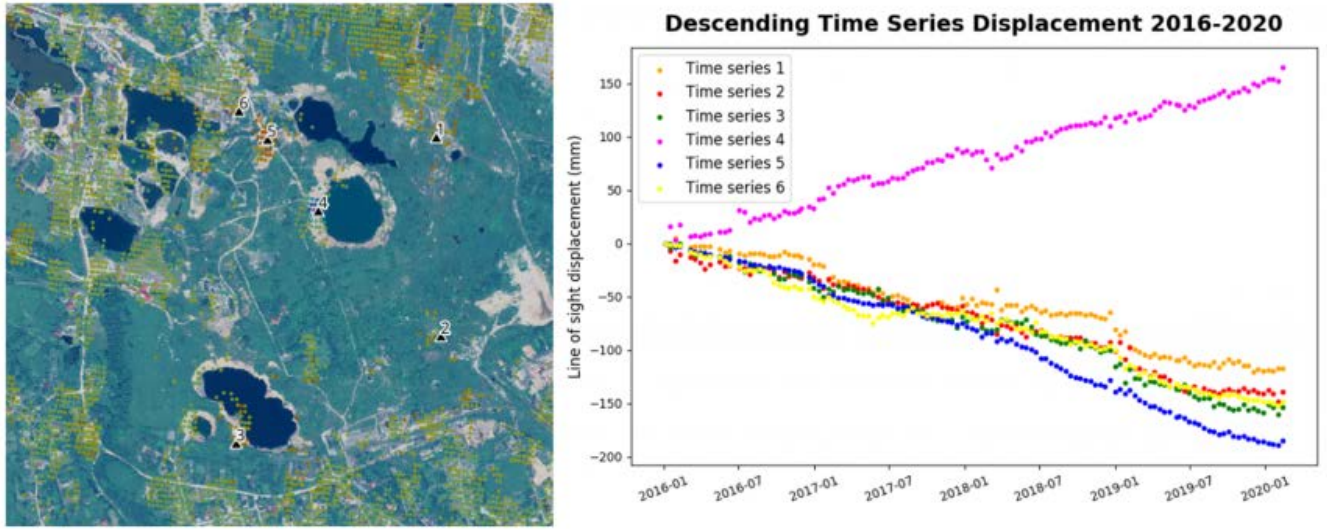
EMSN064: Detection and mapping of ground deformations of anthropogenic sinkholes, Ukraine

Objective:

- Assess ground deformation and sinkhole risk in the Solotvyno mining area using satellite-based interferometry to support early warning and risk mitigation.

Methods:

- DInSAR time series analysis for 2016 -2019 based on Sentinel-1 data applying the SBAS methodology



Time series of displacement covering 2016-2019 in Sentinel-1 descending mode

Outcome:

- Detected significant subsidence and landslide activity, particularly in the core mining zone, with displacements exceeding 500 mm over four years.
- Risk levels were categorized into four classes, revealing widespread instability.
- The results support ongoing monitoring and inform local authorities for hazard preparedness and land-use planning.

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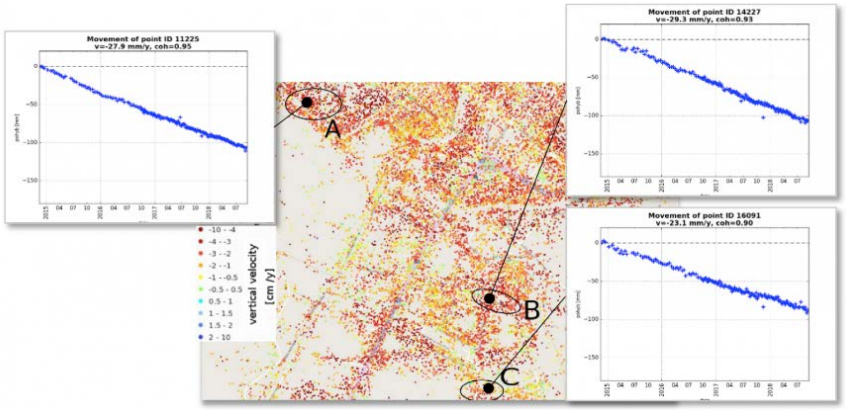
Ground deformation analyses in RRM

Examples of RRM activations, Ground subsidence

Ground subsidence in Mekong delta, Vietnam: EMSN057 and EMSN062



Objective:

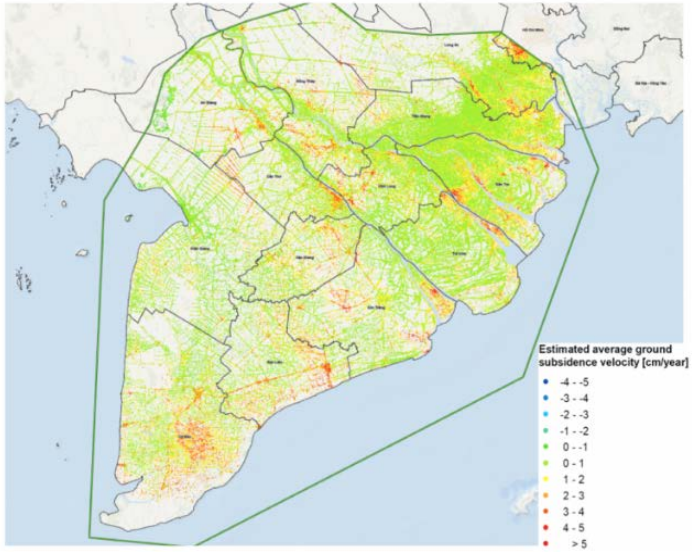
- To facilitate the assessment of drivers of ground subsidence
- Providing insight on the distribution and variance of subsidence phenome in space and its dynamics in time, including average velocity in vertical direction.

Methods:

- The persistent scatterers interferometry (PSI) technique, measuring ground deformations from stacks of archive SAR imagery (Sentinel-1 and TerraSAR-X), was utilized to estimate displacements.

Outcome:

- Identified subsidence hotspots in urban and coastal areas with rates exceeding 3 cm/year.
- Results revealed localized variability even within neighborhoods, highlighting the influence of construction practices and land use.
- Results supported validation with national geodetic data and informed risk mitigation strategies for infrastructure and environmental planning.



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Ground deformation analyses in RRM

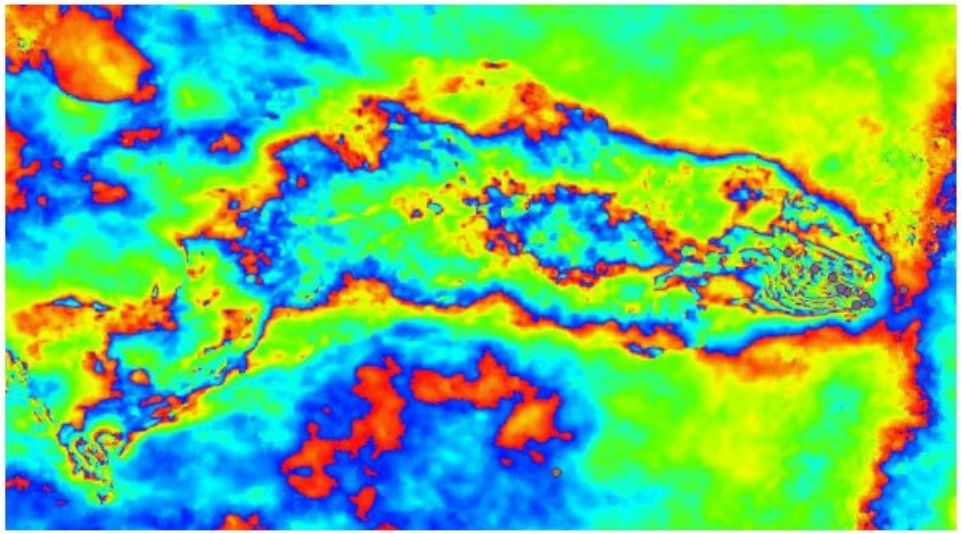
Examples of RRM activations, Volcanic Monitoring

Preparedness & Risk Mitigation
EMSN197 – Terceira, Azores (2024)
InSAR time-series (2017–2024) using Sentinel-1.
Detected horizontal extension across Santa Bárbara volcano.
Supported volcanic alert level decisions during seismic unrest.

Crisis Response
EMSN112 – La Palma, Spain (2021)
Provided rapid InSAR-based displacement maps during active eruption.
Delivered 18 interferometric pairs to support emergency response and situational awareness.

Post-Eruption (Recovery & Risk Assessment)
EMSN124 – La Palma, Spain (2022)
Continued monitoring after eruption ended (Dec 2021).
TerraSAR-X/PAZ-based LOS displacement mapping.

Copernicus Emergency Management Service (2021, European Union), EMSN112



Interferograma TSX-PAZ
Baselínea temporal: 4 días

Ground deformation analyses in RRM

Key insights

Key Insights from Ground Deformation Monitoring

- InSAR enables early detection of geohazards.
- Time-series analysis reveals long-term trends.
- Copernicus EMS provides actionable intelligence for civil protection.

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Thank you