



ESTIA • BIDART, 10 Oct  
2024

# Les solutions de l'European Ground Motion Service (EGMS)

Philippe DURAND  
CNES - Toulouse



**Interférométrie** brève introduction

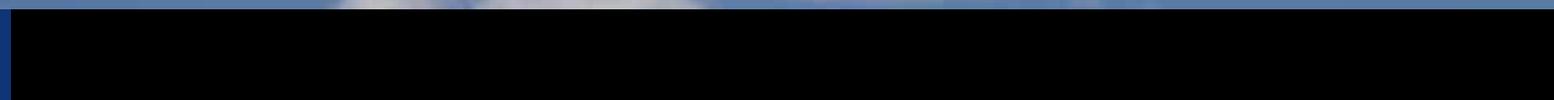
**Sentinel-1** vue du système

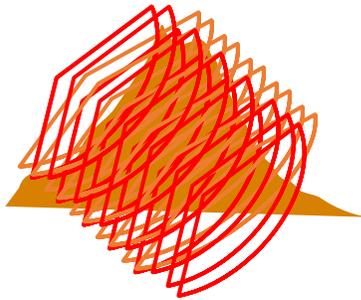
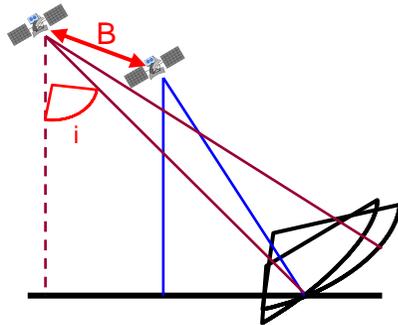
**EGMS** présentation du service

**Pour aller plus loin** Radar imageurs en bande X

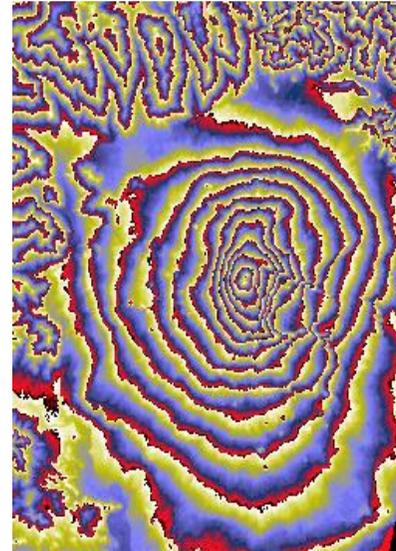
© CNES-CTE/DAF

TTVS





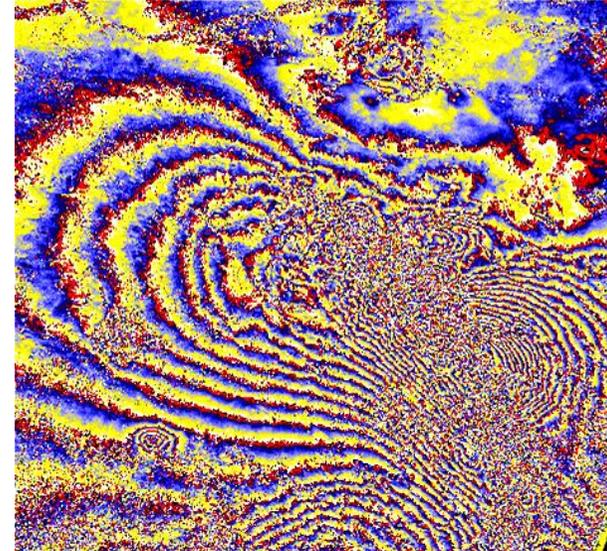
Relief



Etna

Franges Iso-distance

Mouvement du sol



Landers

Franges d'Iso-déplacement

Modèle Numérique de Terrain



ou



Carte de déplacement sur sol



Programme

de l'Union Européenne

## Sentinel-1 ou S1

radar pour imager l'océan, les Terres et répondre aux situations d'urgence

### Mission basée sur 4 satellites identiques

S1A (données depuis Octobre 2014)  
S1B (Septembre 2016 - Décembre 2021)  
S1C and S1D en attente de lanceur, données au-delà de 2030

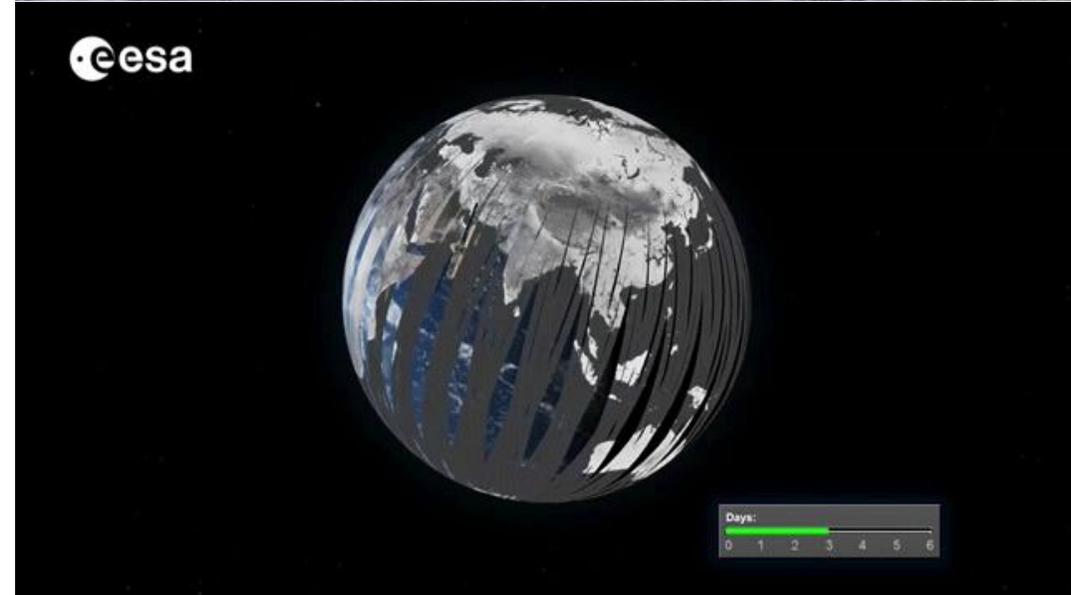
### Principales caractéristiques :

Instrument **de longueur d'onde 5,6cm (bande C)**  
Instrument fonctionnant 25 min/orbite en mode imageur  
Orbite quasi polaire pour une couverture mondiale  
**Durée de vie : 7 ans** pour l'instrument,  
**consommables pour 12 ans**  
**6 jours de répétitivité (avec 2 satellites)**

### Traitement systématique et global

**Données SAR non payantes (pour la première fois !)**

Acquisitions suivant un **scénario pré-établi** révisable à la marge sur demandes spécifiques des états membres.

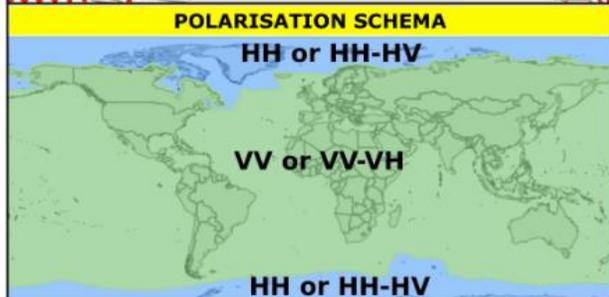
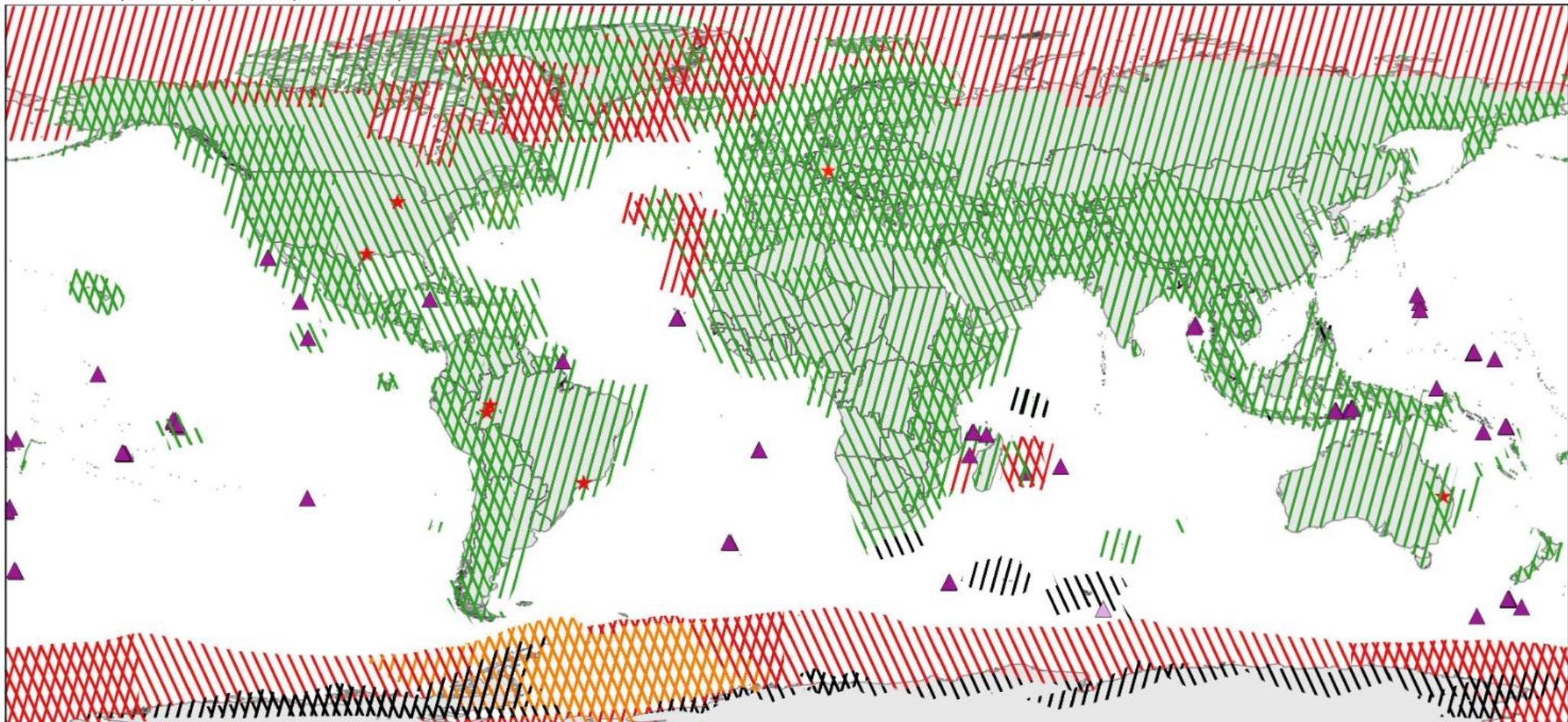


# Sentinel-1 Constellation Observation Scenario: Mode - Polarisation - Observation Geometry



validity start: 11/2021

Note: Seasonal campaigns not represented  
Note: Wave mode systematically operated over open oceans not represented



**MODE/POLARISATION**

- IW mode / dual polarisation
- IW mode / single polarisation
- EW mode / dual polarisation
- EW mode / single polarisation

- SM mode / dual-polarisation
- SM mode / single-polarisation

**PASS**

- ASCENDING
- DESCENDING

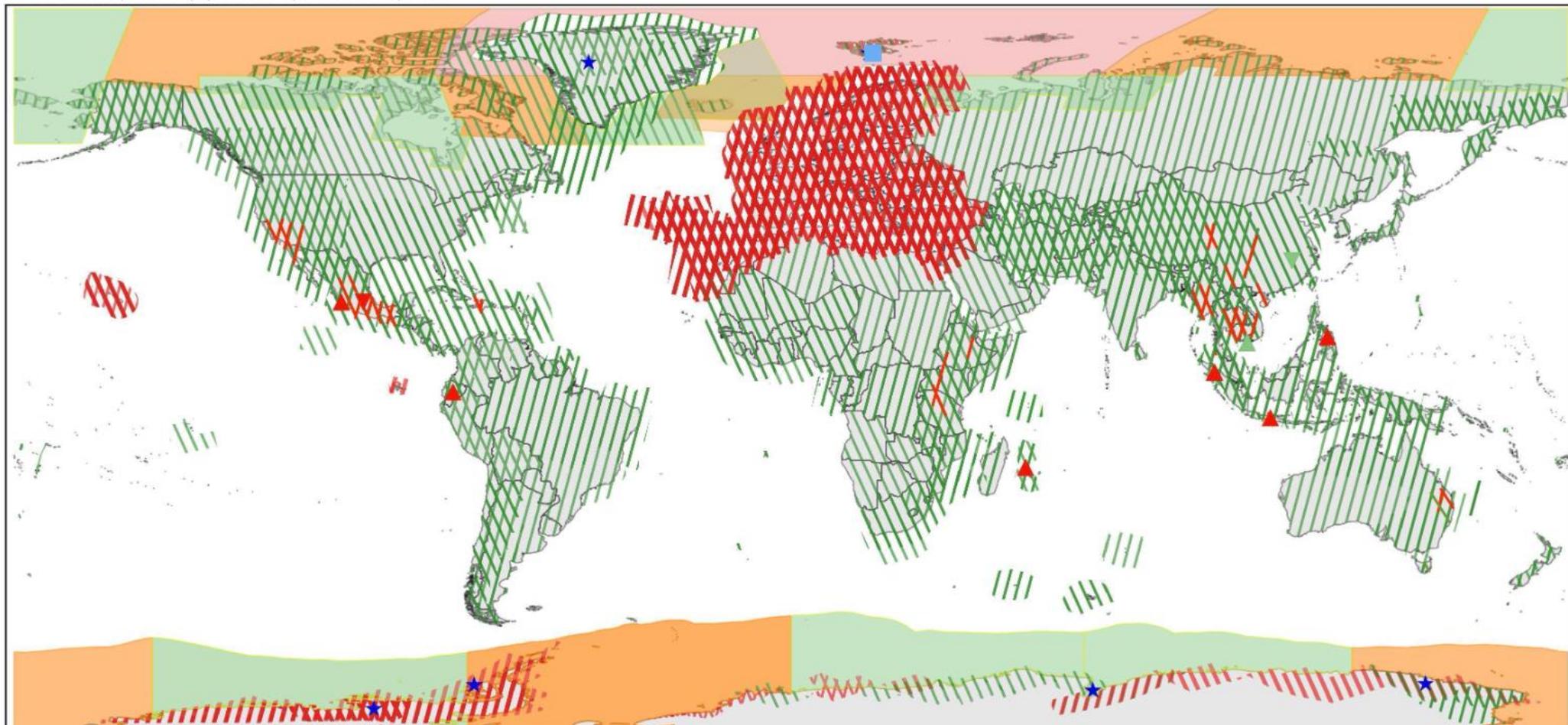
- Calibration Site  
(locally different modes or polarisations possible)

# Sentinel-1 Constellation Observation Scenario: Repeat & Coverage Frequency



validity start: 11/2021

Note: Seasonal campaigns not represented  
Note: Wave mode systematically operated over open oceans not represented



PASS	REPEAT	FREQUENCY **
ASCENDING	6 days	12 days
DESCENDING	6 days	12 days

COVERAGE	FREQUENCY **
1 days	
1-3 days	
2-4 days	

REFERENCE DATA SITES (6d repeat)
Highly active volcanism
Fast subsidence
Short growth cycle, intensive agriculture
Fast changing wetlands
Fast moving outlet glaciers
Permafrost & glaciers

\* coverage ensured from same, repetitive relative orbits  
\*\* coverage considering passes from all (asc & desc) orbits

You are here: [Home](#) / Pan-European

## Pan-European

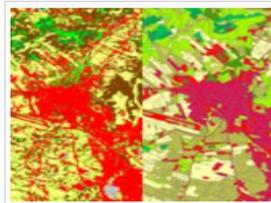
 Print

### User corner

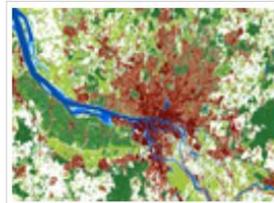
-  How to access our data
-  Technical library
-  Factsheets
-  Use cases
-  Looking for National projection & Expert products?



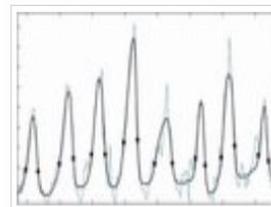
[CORINE Land Cover](#)



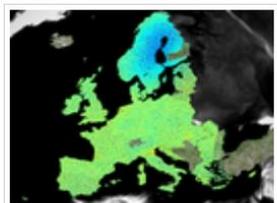
[CLC+](#)



[High Resolution Layers](#)



[Biophysical parameters](#)

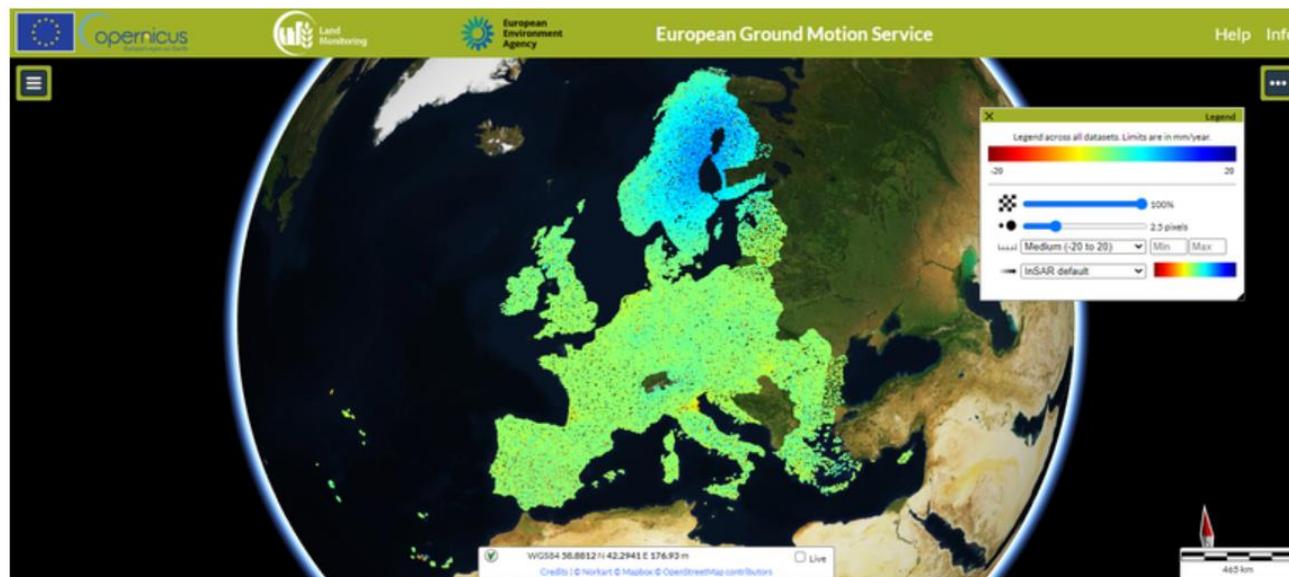


[European Ground Motion Service](#)



[Related Pan-European products](#)

<https://land.copernicus.eu/pan-european>



## Welcome to the EGMS

The European Ground Motion Service (EGMS) provides consistent and reliable information regarding natural and anthropogenic ground motion over the Copernicus Participating States and across national borders, with millimetre accuracy.

The EGMS represents a baseline for ground motion applications at continental, national and local level.

**Please consult the [FAQ](#) for general questions and known issues.**

## Get access

View and download EGMS data via the [EGMS Explorer](#).

Get quick video introductions to the [EGMS](#) and the [EGMS Explorer](#).

Read about how to [use the EGMS Explorer](#).

Learn how best to [use EGMS products](#).

<https://egms.land.copernicus.eu/>

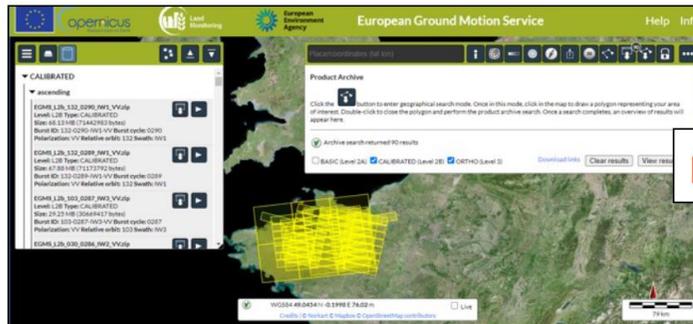


# Product levels

## EGMS provides three levels of products, each with two sub-products

### 1: BASIC (relative)

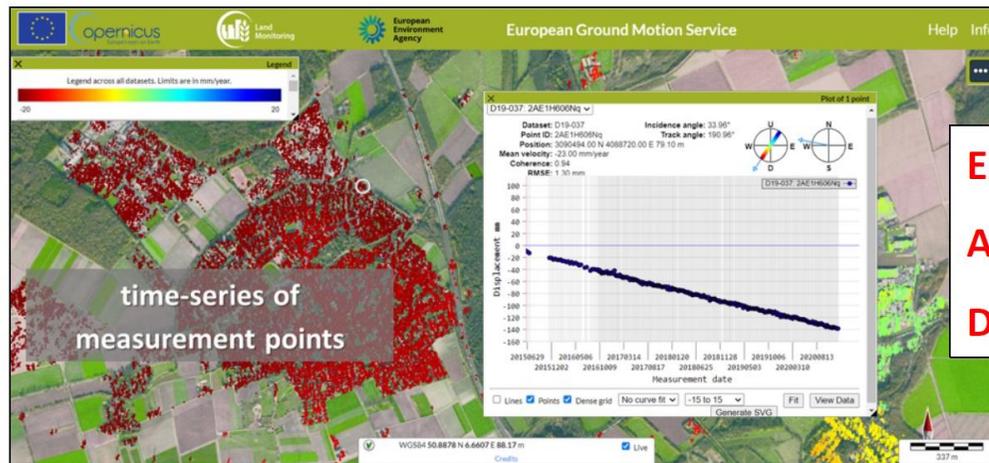
Ascending orbit geometry  
Descending orbit geometry



Download only

### 2: CALIBRATED (absolute)

Ascending orbit geometry  
Descending orbit geometry



Explore  
Analyse  
Download

### 3: ORTHO (absolute)

Vertical  
East-west horizontal





# EGMS Ortho product

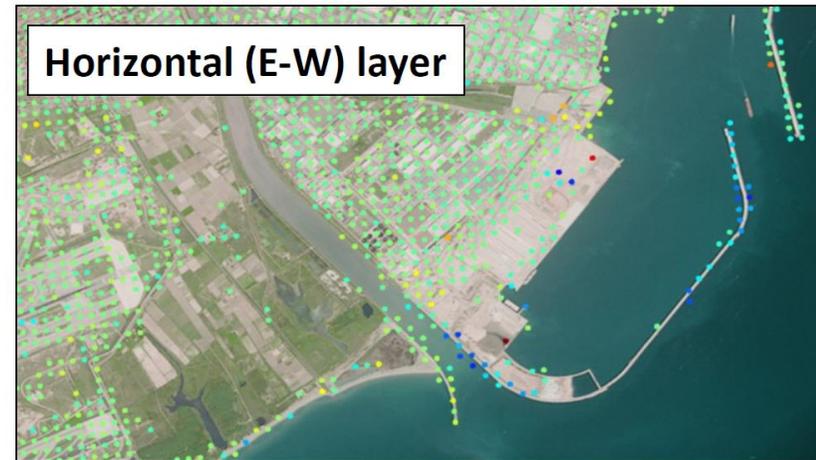
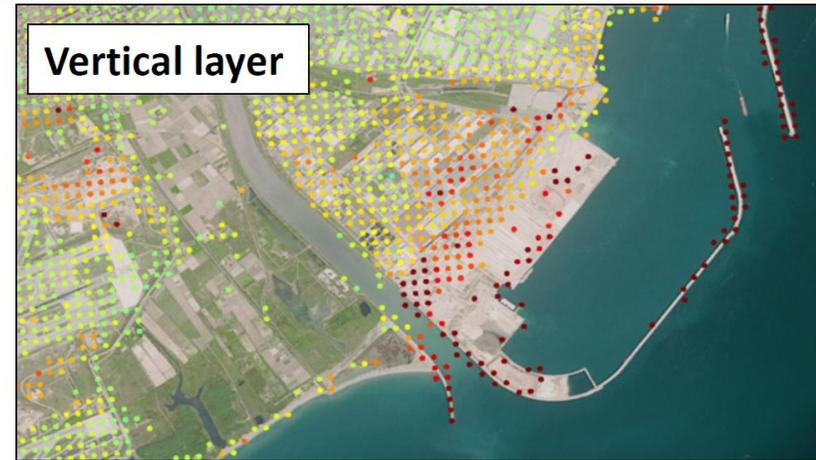
The EGMS **Ortho** product comprises two layers:

- Vertical ground motion
- East-west, horizontal ground motion

The **Ortho** product is made from the two look-angles of the **Calibrated** product.

The **Ortho** product provides unambiguous direction of movement, and so might be easier to interpret.

The **Ortho** product is useful in areas of steeper topography, for landslides, and measurement of lateral displacements.



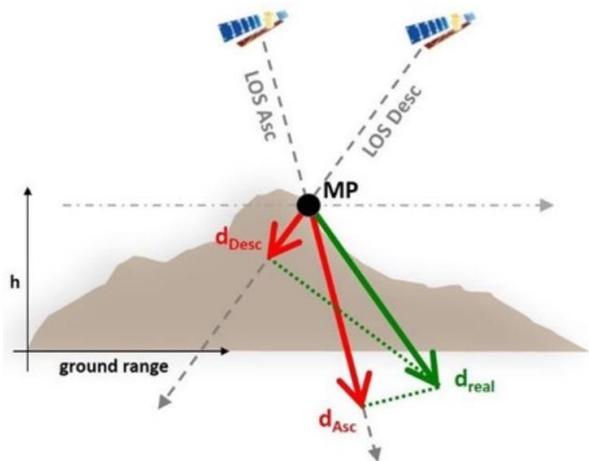
Barcelona, Spain





Land Monitoring

# Ortho product generation



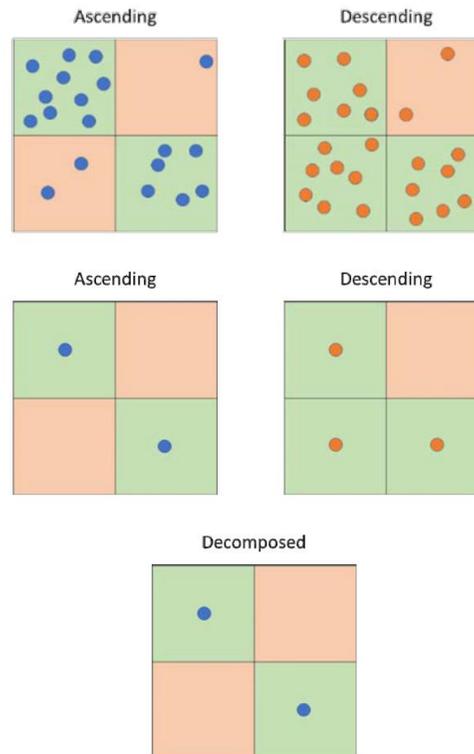
Ascending and descending data collection



Averaging to a common 100\*100m grid



Vertical and east-west components



PROGRAMME OF THE EUROPEAN UNION

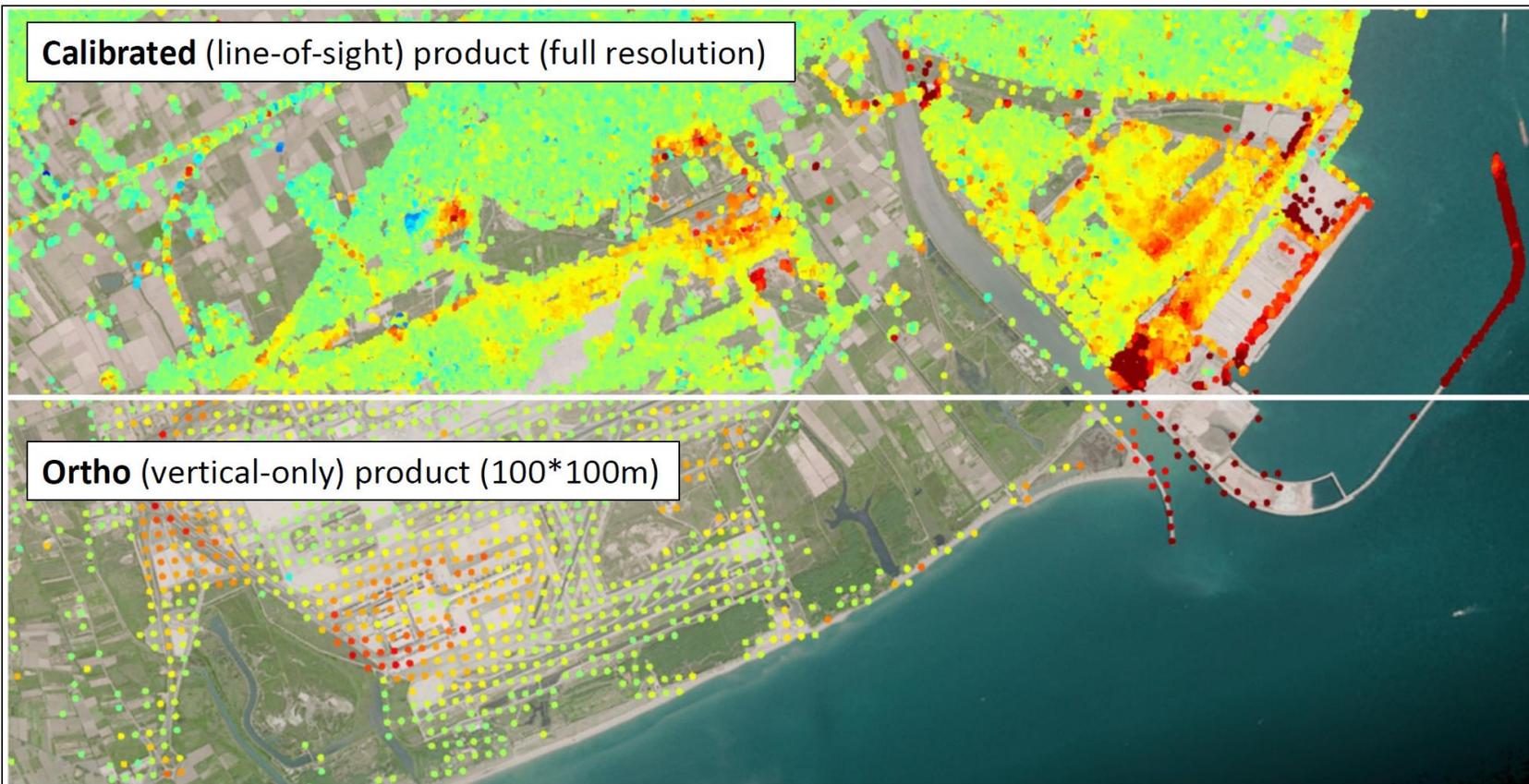


Implemented by  European Environment Agency



Land  
Monitoring

# Calibrated and Ortho product comparison



Barcelona, Spain

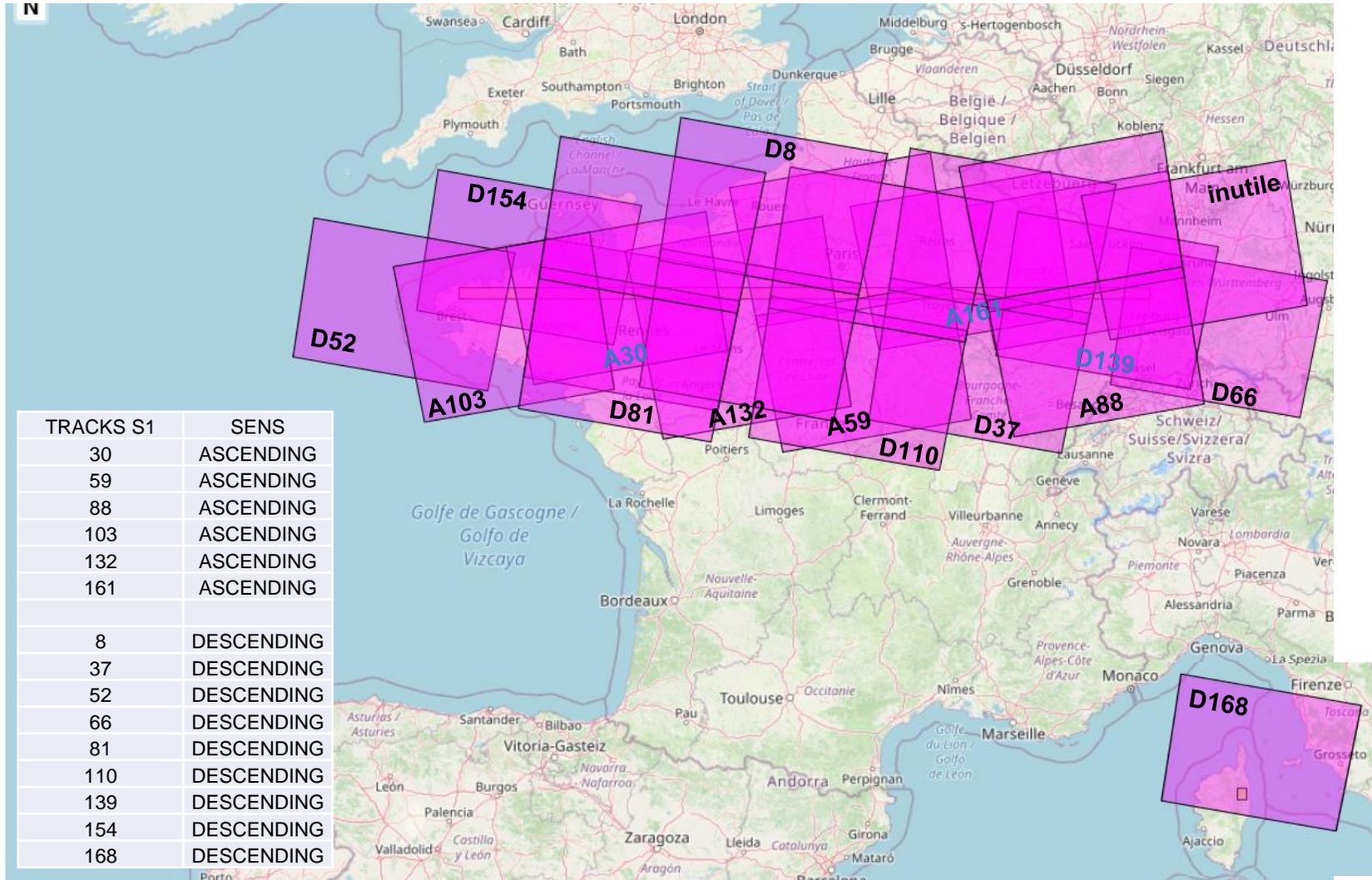


PROGRAMME OF THE  
EUROPEAN UNION

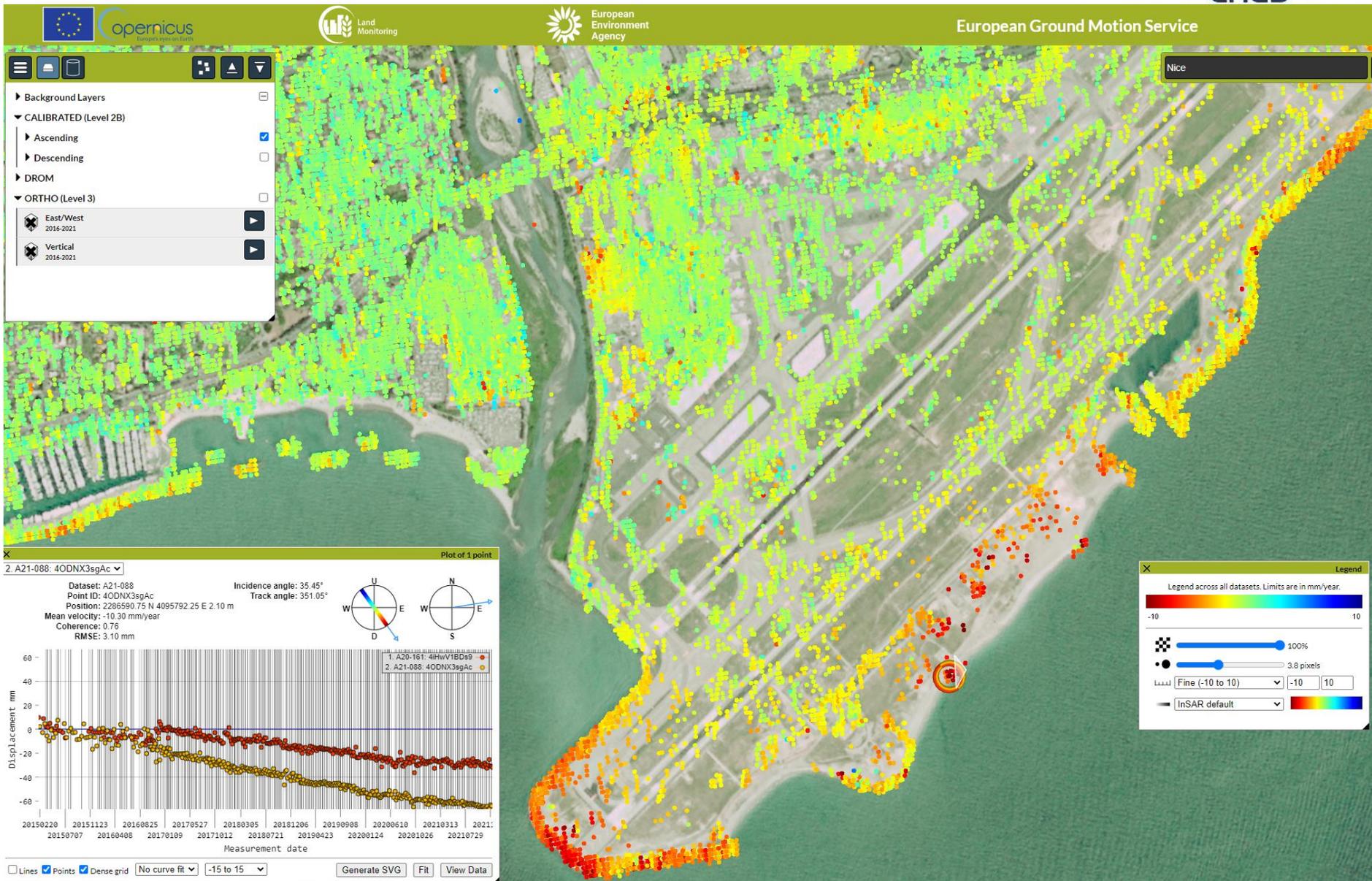


Implemented by  European  
Environment  
Agency

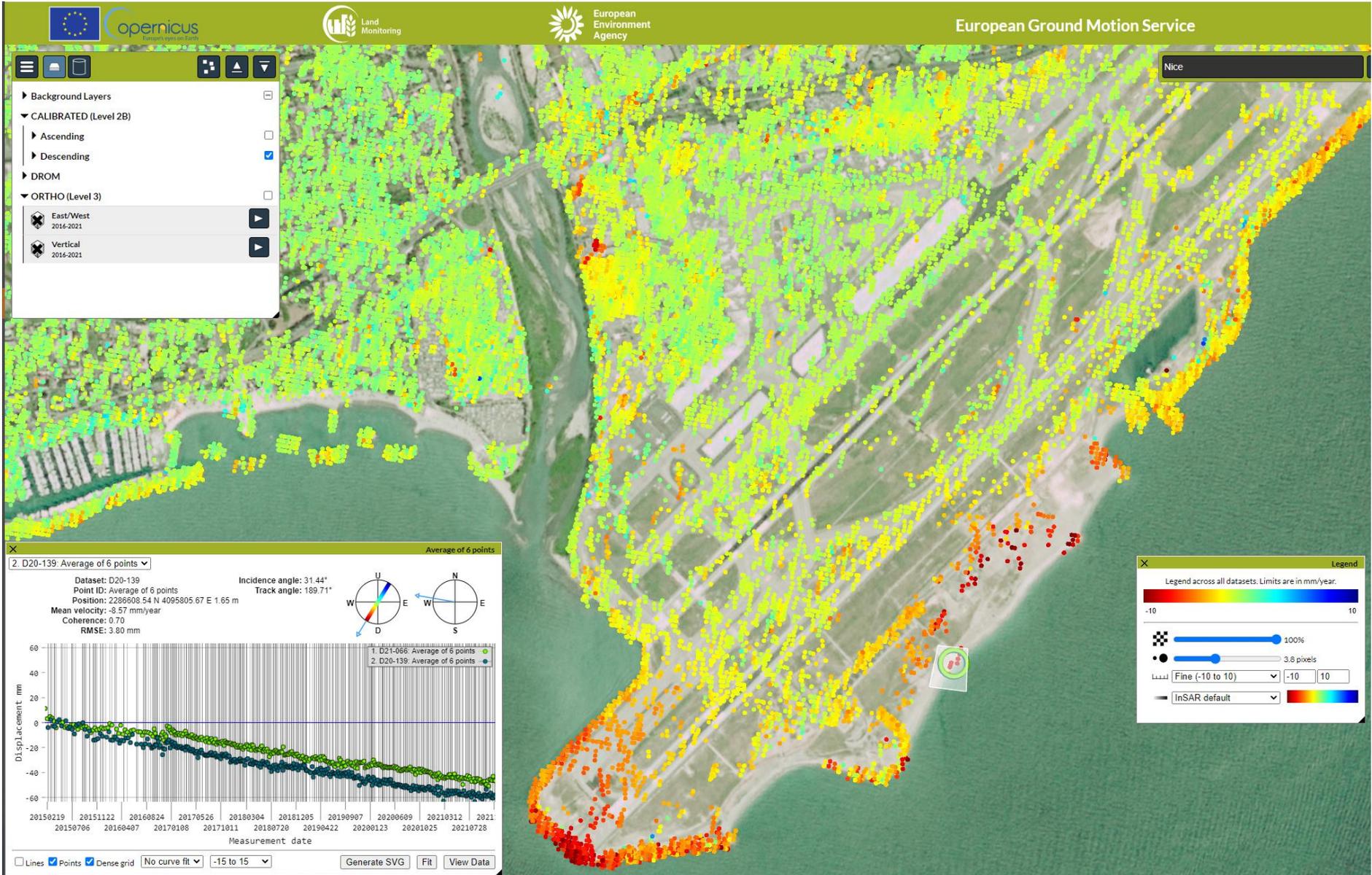
# TRACES S1 SUR LA FRANCE



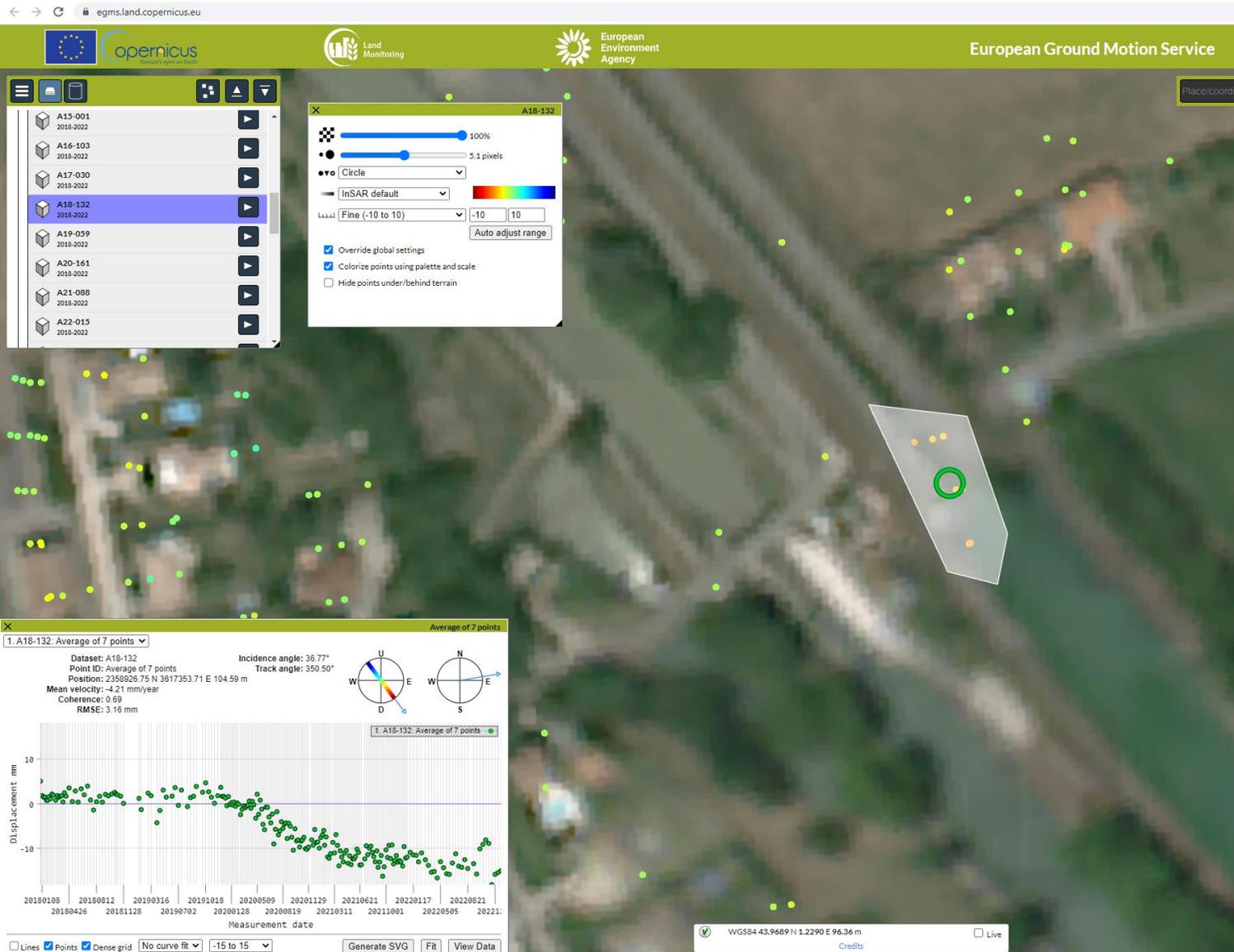
# Aéroport de Nice : traces S1 ascendantes



# Aéroport de Nice : traces S1 descendantes



# Ecluse des Peyrets 1/2



Vers Montauban, au Nord de Montech, écluse des Peyrets

coordonnées WGS84 précises en planche 4

Mise en évidence d'un mouvement à partir de Janvier 2020 en phase d'atténuation après mi 2021

# Ecluse des Peyrets 2/2

egms.land.copernicus.eu



European Ground M

- A15-001  
2018-2022
- A16-103  
2018-2022
- A17-030  
2018-2022
- A18-132  
2018-2022
- A19-059  
2018-2022
- A20-161  
2018-2022
- A21-088  
2018-2022
- A22-015  
2018-2022

**A18-132**

100%

5.1 pixels

Circle

InSAR default

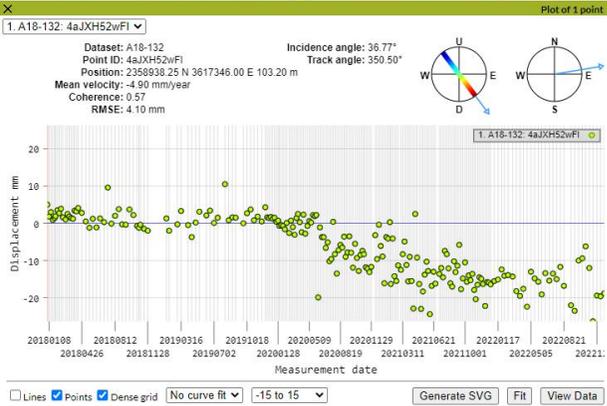
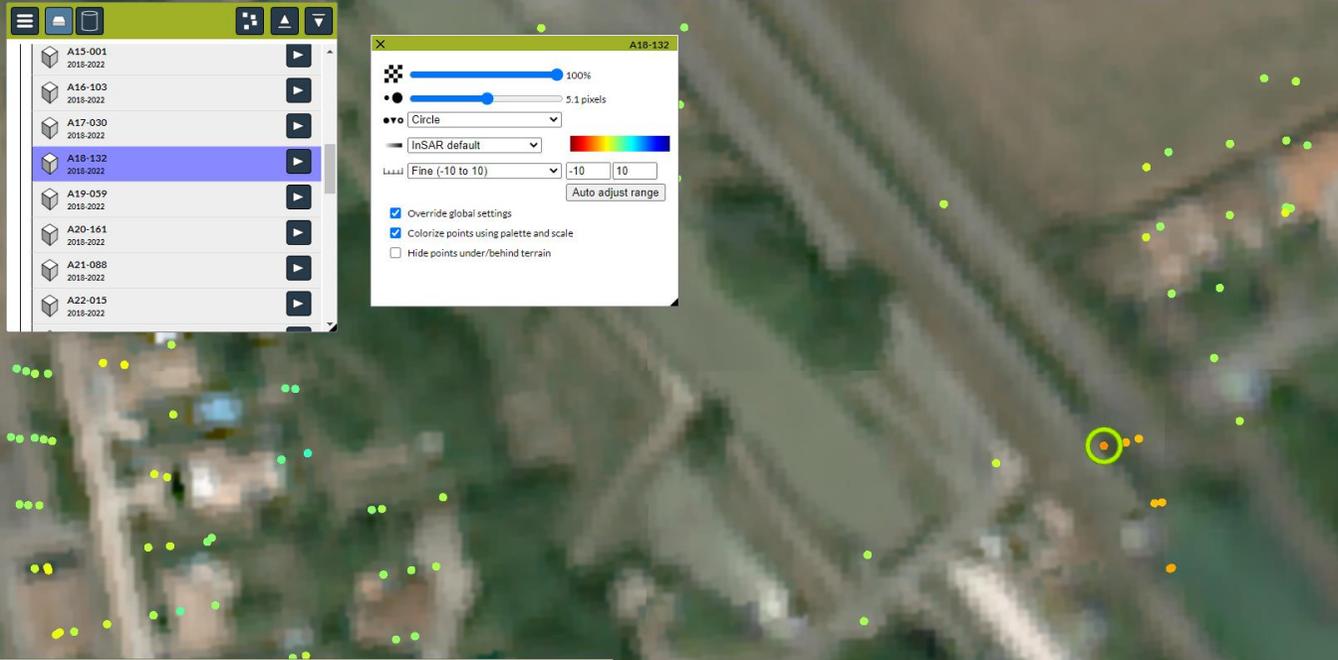
Level: Fine (-10 to 10) | -10 | 10

Auto adjust range

Override global settings

Colorize points using palette and scale

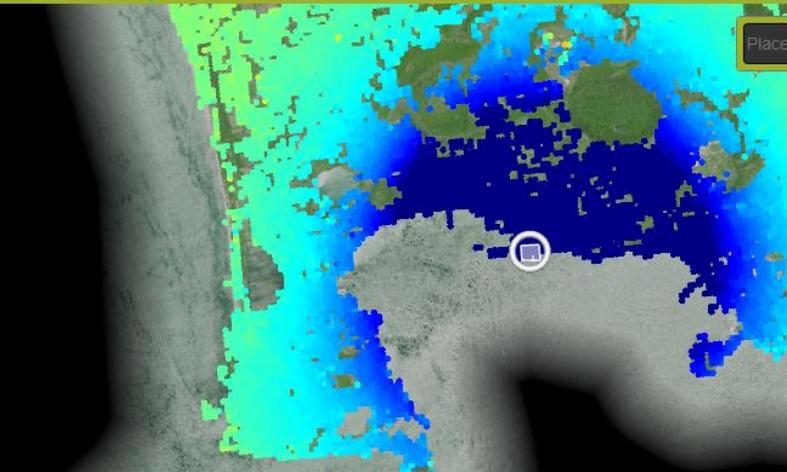
Hide points under/behind terrain



# Champs Phlégréens 1/2

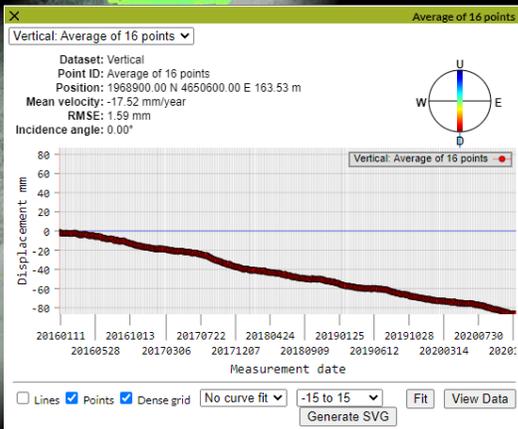
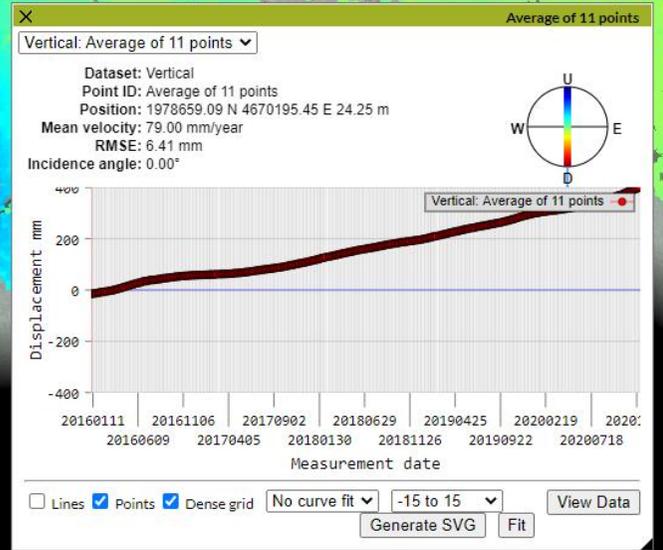
Background Layers

- CALIBRATED (Level 2B)
- DROM
- ORTHO (Level 3)
  - East/West 2015-2020
  - Vertical 2015-2020



Place/coordinates (lat lon) [i] [globe] [back] [refresh] [compass] [print] [3D] [share]

### Naples (Pouzoles) : Champs Phlégréens



### Legend

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

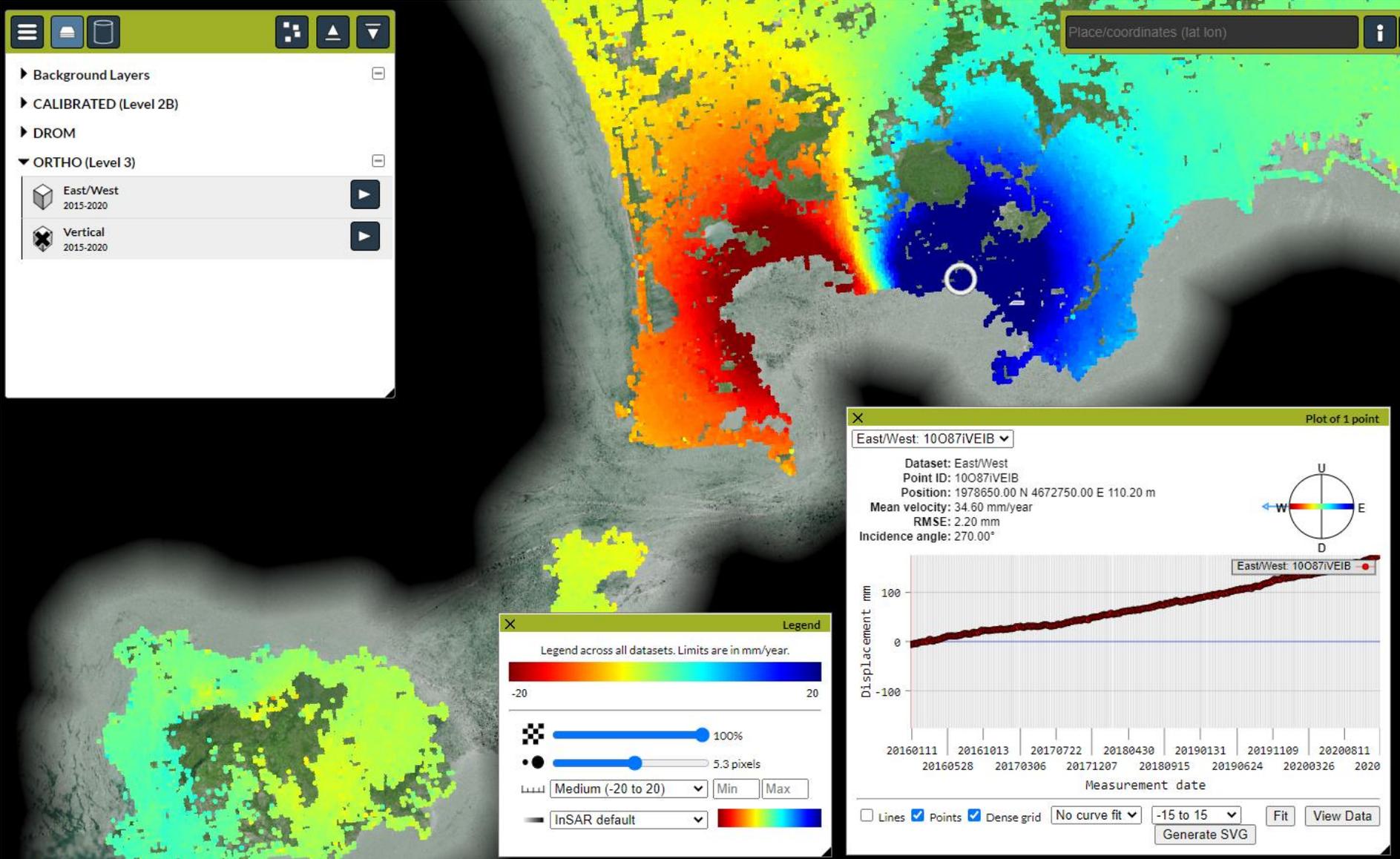
-20 20

100%

5.3 pixels

Medium (-20 to 20) Min Max

InSAR default





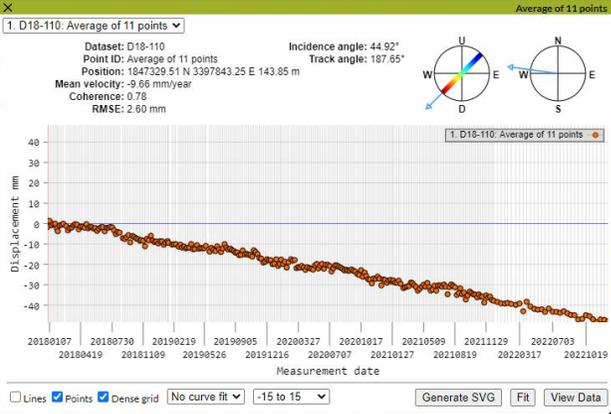
- U14-U24  
2018-2022
- D15-154  
2018-2022
- D16-081  
2018-2022
- D17-008  
2018-2022
- D18-110  
2018-2022
- D19-037  
2018-2022
- D20-139  
2018-2022
- D21-066  
2018-2022
- D22-168  
2018-2022

Alberic

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

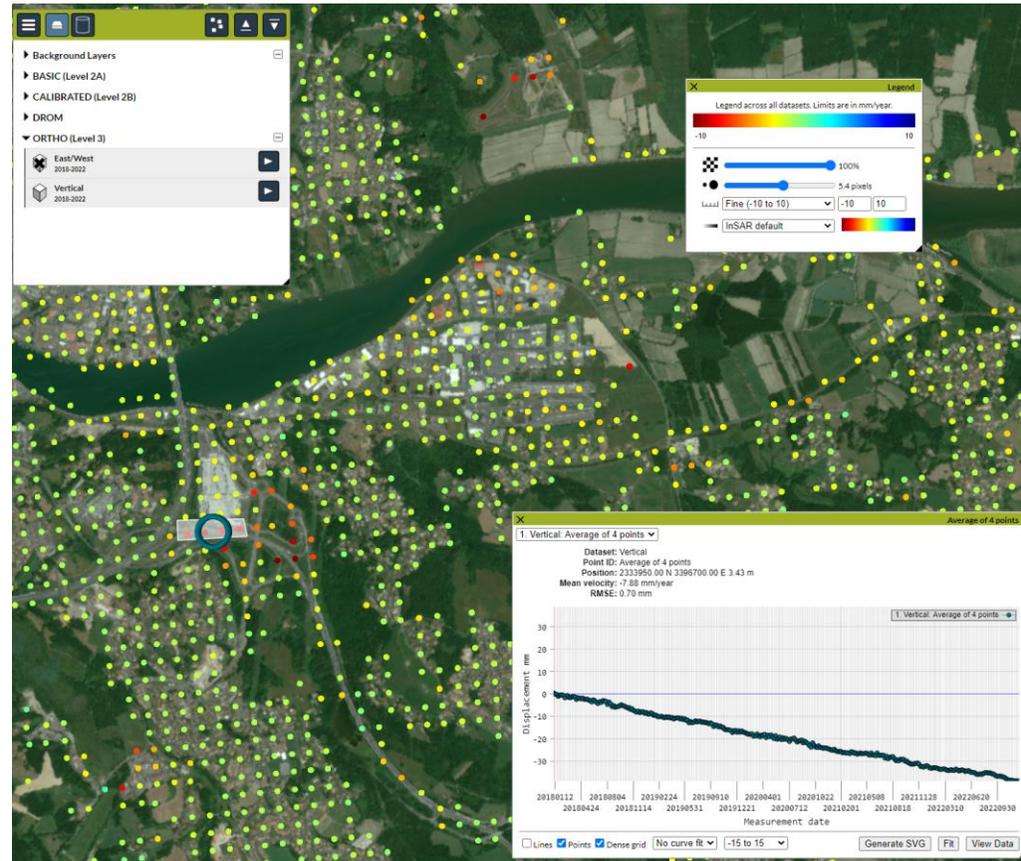
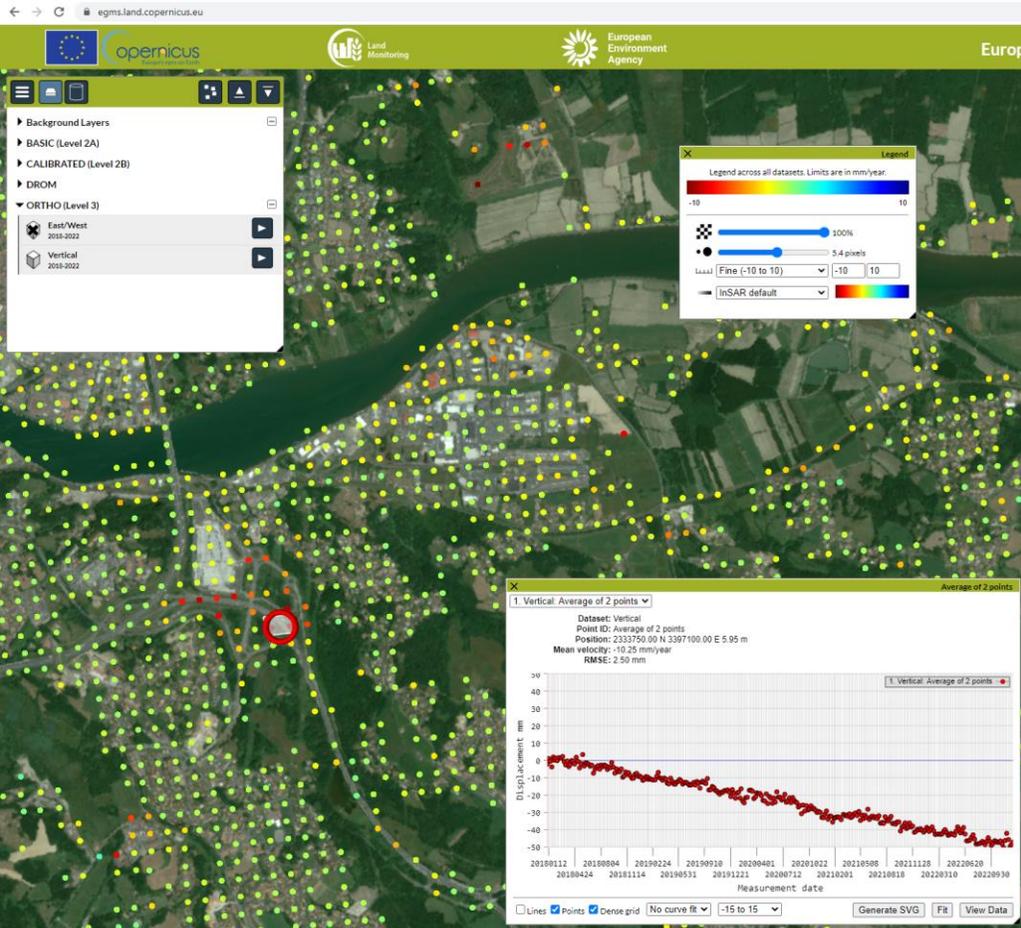
100%  
3.6 pixels

Fine (-10 to 10) -10 10  
InSAR default



WGS84 39.1322 N -0.6541 E 126.83 m  Live





**EGMS est un nouveau service COPERNICUS/Land (depuis juin 2022), accessible à tout citoyen.**

**Il demande une petite expertise** pour en comprendre les informations et les limites.

Les périodes d'analyse recouvrent **plusieurs années glissantes (5 à 6 ans) avec une seule mise à jour annuelle fin d'année N couvrant jusqu'à l'année N-1.**

**Avantages :**

**Couverture globale Europe** avec une **densité de l'ordre de 20 points/km<sup>2</sup>** mais très variable suivant les zones (**mieux en urbain ou sur infrastructures**) et une **fréquence < 6 jours** (avec 2 satellites).

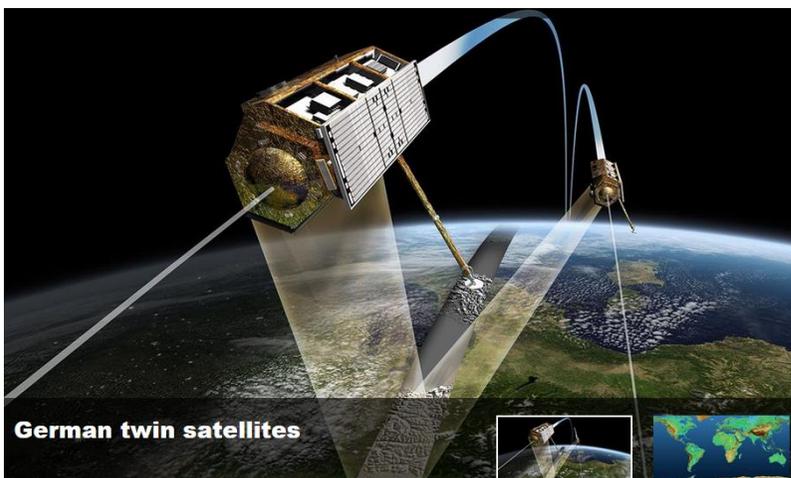
**Très longue série et continuité de ces données RADAR depuis 2014 et au-delà 2035.**

**ATTENTION : un point avec mouvement trop rapide risque de ne pas être sélectionné sur la période d'analyse.**

traitements mieux ciblés sur les données Sentinel1 (données gratuites)

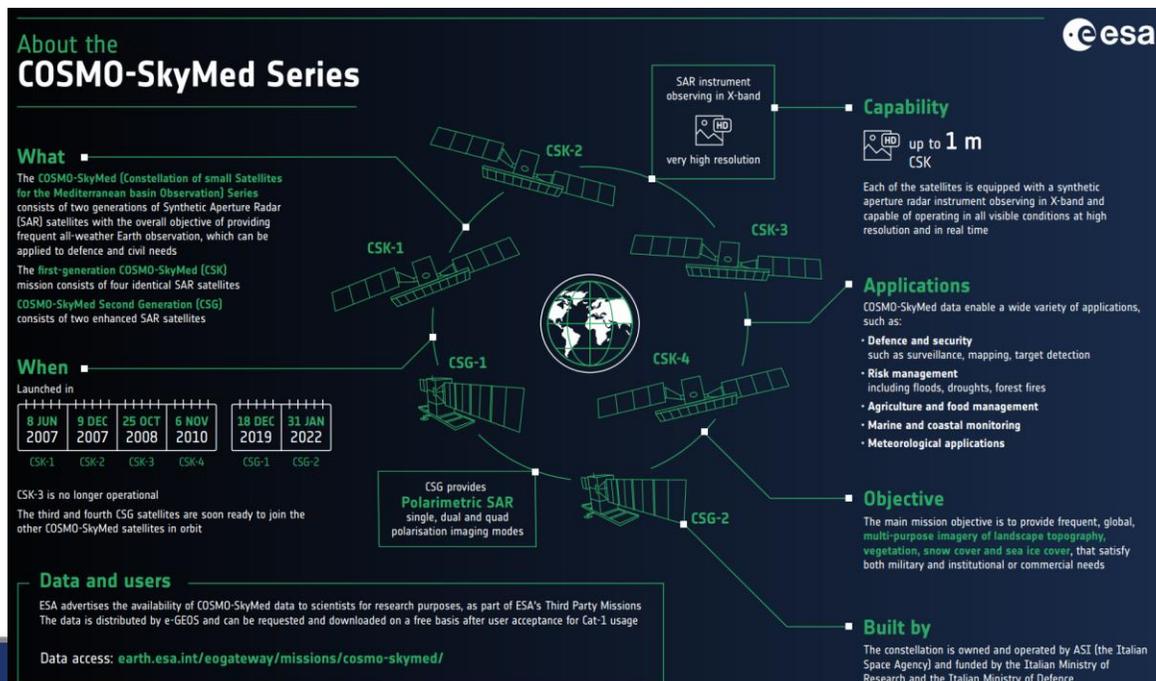
et/ou

appel à des capteurs mieux résolus en bande X (données payantes)



Capteurs TSX / TDX à 11 jours  
 Depuis 2007 et jusqu'à 202?  
 avec satellite identique  
 PAZ (Espagne) depuis 2018

## Constellation Italienne CSK/CSG



**About the COSMO-SkyMed Series**

**What**  
 The COSMO-SkyMed (Constellation of small Satellites for the Mediterranean basin Observation) Series consists of two generations of Synthetic Aperture Radar (SAR) satellites with the overall objective of providing frequent all-weather Earth observation, which can be applied to defence and civil needs.  
 The first-generation COSMO-SkyMed (CSK) mission consists of four identical SAR satellites.  
 COSMO-SkyMed Second Generation (CSG) consists of two enhanced SAR satellites.

**When**  
 Launched in

8 JUN 2007	9 DEC 2007	25 OCT 2008	6 NOV 2010	18 DEC 2019	31 JAN 2022
CSK-1	CSK-2	CSK-3	CSK-4	CSG-1	CSG-2

CSK-3 is no longer operational.  
 The third and fourth CSG satellites are soon ready to join the other COSMO-SkyMed satellites in orbit.

**Capability**  
 SAR instrument observing in X-band  
 very high resolution  
 up to 1 m  
 CSK

**Applications**  
 COSMO-SkyMed data enable a wide variety of applications, such as:

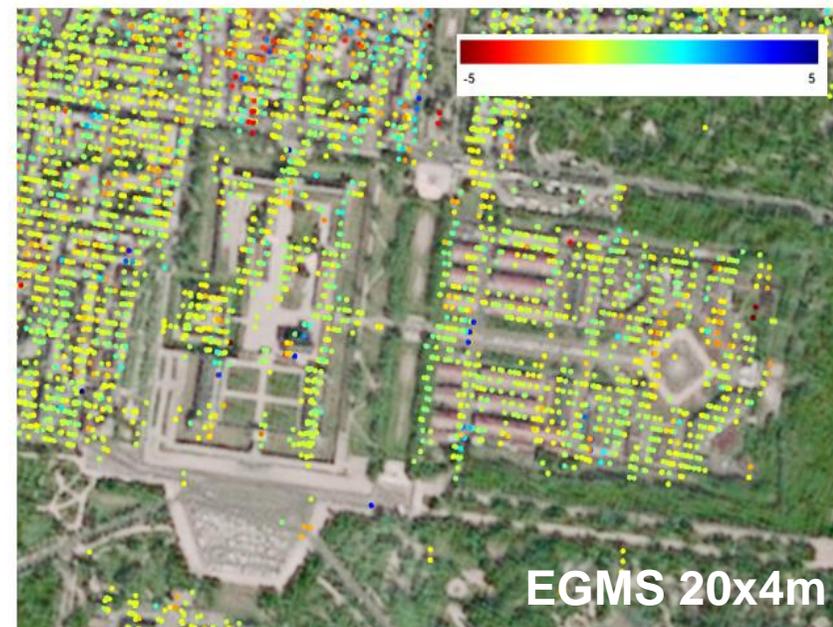
- Defence and security such as surveillance, mapping, target detection
- Risk management including floods, droughts, forest fires
- Agriculture and food management
- Marine and coastal monitoring
- Meteorological applications

**Objective**  
 The main mission objective is to provide frequent, global, multi-purpose imagery of landscape topography, vegetation, snow cover and sea ice cover, that satisfy both military and institutional or commercial needs.

**Built by**  
 The constellation is owned and operated by ASI (the Italian Space Agency) and funded by the Italian Ministry of Research and the Italian Ministry of Defence.

**Data and users**  
 ESA advertises the availability of COSMO-SkyMed data to scientists for research purposes, as part of ESA's Third Party Missions. The data is distributed by e-GEOS and can be requested and downloaded on a free basis after user acceptance for Cat-1 usage.  
 Data access: [earth.esa.int/eogateway/missions/cosmo-skymed/](http://earth.esa.int/eogateway/missions/cosmo-skymed/)

# Comparatif TSX et COSMO vs EGMS



Les données bande X à 3m offre une densité de points 10 fois supérieure à EGMS



# **Merci pour votre attention !**

