Use of the European Ground Motion Service (EGMS) at the Geological and Mining Institute of Spain (IGME-CSIC)

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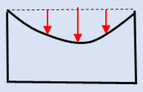
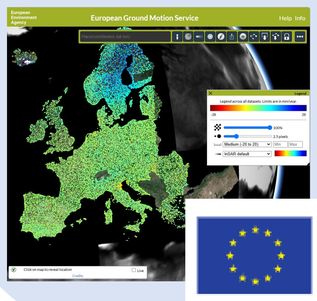
INTRODUCTION

The Geological and Mining Institute of Spain (IGME-CSIC) is a public research organization dedicated to studying the geology and mineral resources of Spain. IGME also advises public administrations and contributes to environmental protection and natural risk management.

InSAR



The Geohazards InSAR Laboratory and Modeling Group (InSARlab) is a multidisciplinary research team specialized in applying Interferometric Synthetic Aperture Radar (InSAR) technology to monitor and analyze ground deformations such as landslides, subsidence, and mining-related instabilities.



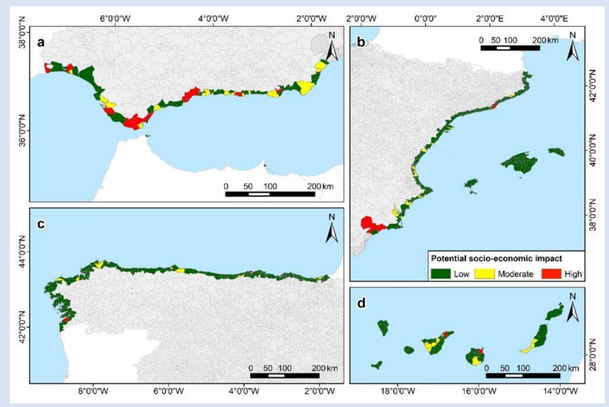
This poster presents different applications that InSARlab (IGME-CSIC) performs and develops, based on the European Ground Motion Service (EGMS), from the Copernicus Land Monitoring Service (CLMS).

Copernicus Europe's eyes on Earth

Land Monitoring Service

SUPPORTS THE DEVELOPMENT OF AUTOMATED ANALYSIS TOOLS

EGMS data enables analysis of ground motion across both European and national scales. Its user-friendly format facilitates the detection, extraction, and interpretation of Active Deformation Areas (ADAs). Within the RASTOOL (ECHO) project, for example, tools are being developed specifically for non-expert end users, promoting broader accessibility to geospatial data. We also explore the development of automatic classification tools, using either machine learning or deterministic approaches, to enhance the identification of deformation patterns. At the regional level, this supports the assessment of geohazards affecting exposed elements such as buildings, roads, and populations. Notably, it allows for the study of land subsidence caused by groundwater overexploitation at a national scale.



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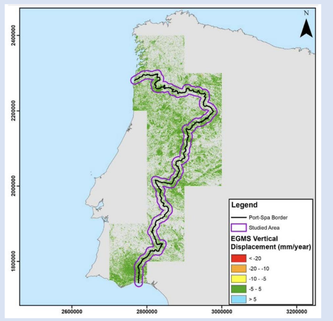
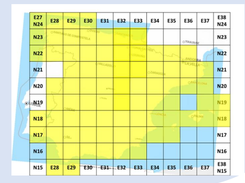


https://sarai.igme.es/index.php/language/en/

Humanitarian Aid and Civil Protection

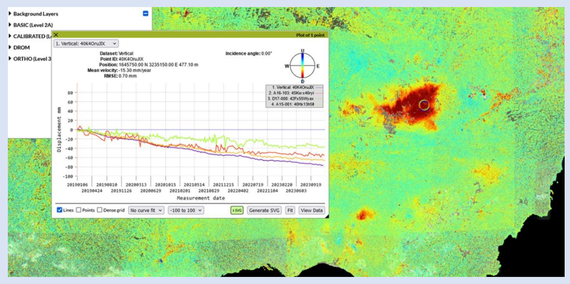
ADAtools for 64-bit Windows & Linux

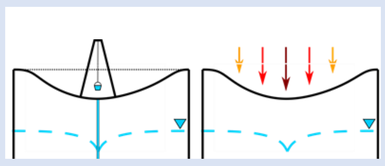
https://adatools.cttc.es/



RAPID DETECTION OF NEW AREAS OF INTEREST

Since the launch of the EGMS, routinely working with this dataset has become a standard activity. It provides immediate access to pre-processed products, enabling quick analysis and decision-making. One of its key advantages is the ability to identify new areas of ground deformation that were previously unknown, opening up opportunities for further study and monitoring. This area presented here is attributed to subsidence triggered by groundwater overexploitation.

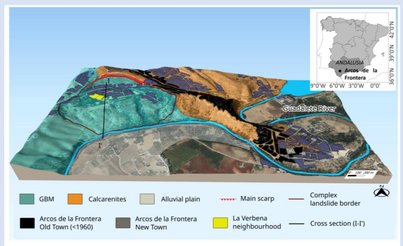


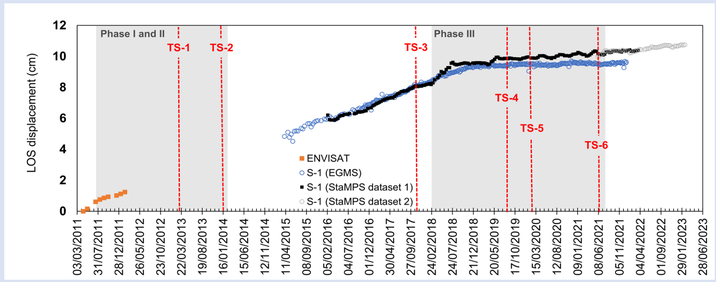


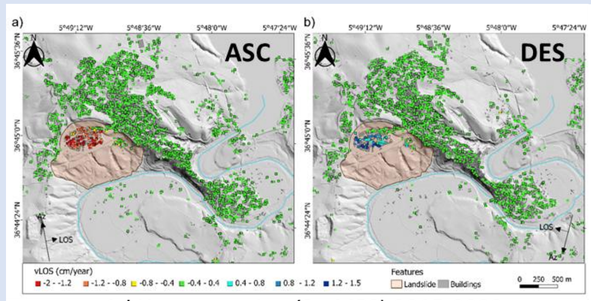
VALIDATION OF DEFORMATION MEASUREMNETS BY COMPARING SPATIAL AND TEMPORAL TRENDS

Comparing our studies with EGMS data has proven valuable for validating the spatial and temporal trends of ground motion. This is particularly useful in areas lacking in situ measurements, such as GNSS, which are typically used to verify InSAR-derived results. One relevant case study is the landslide in Arcos de la Frontera, where we compared the displacement time series from EGMS with those obtained through ad hoc processing using StaMPS. The findings, detailed in Bru et al. (2024), demonstrate how InSAR data successfully captured a deceleration in movement following local stabilization works.

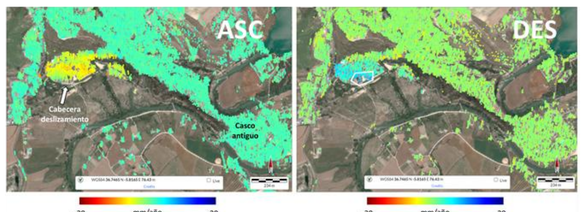
https://link.springer.com/article/10.1007/s10346-024-02292-y







Ad Hoc processing (StaMPS) 2015-2022



EGMS Calibrated 2015-2021

EGMS IS VALUABLE IN EMERGENCY SITUATIONS

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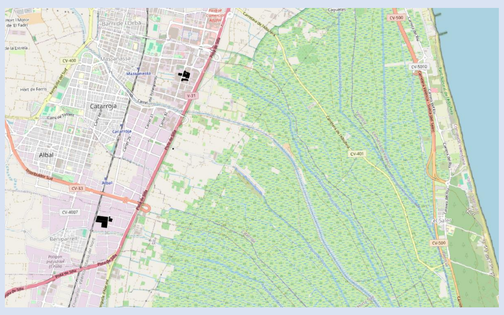
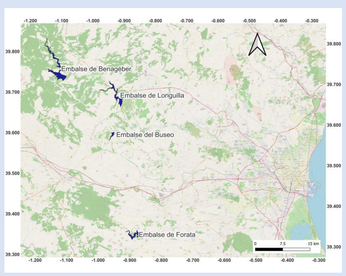
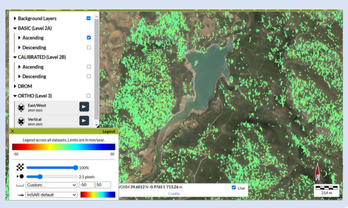
At IGME-CSIC, the EGMS is also used in emergency contexts, such as during the DANA (severe weather event) that occurred in Valencia in October 2024. It supports the identification of buildings that had shown prior movement, helping assess their vulnerability. Additionally, EGMS data is used to detect pre-existing ground motion on slopes surrounding reservoirs, which is essential for anticipating potential hazards and planning mitigation efforts.



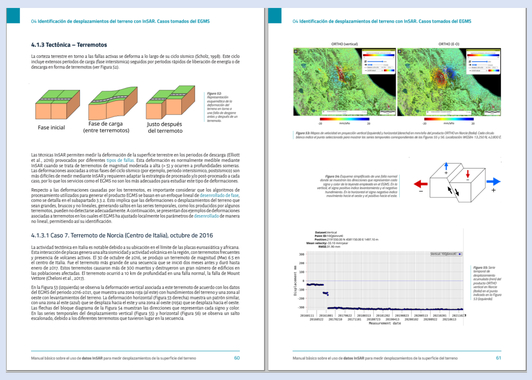




EGMS PLAYS A ROLE IN EDUCATION AND DISSEMINATION

At IGME, EGMS data is also used for educational purposes. It has been incorporated into training courses at both national and international levels (e.g., civil protection), serving as a practical example to illustrate ground deformation monitoring. Moreover, it made an important contribution in the development of a basic manual on the use of InSAR data for measuring surface displacements, helping to build capacity among users with varying levels of expertise.

The manual includes a structured overview of InSAR technology and its practical applications. It begins with an introduction to the InSAR technique and provides an overview of public InSAR services. A dedicated section presents EGMS case studies across various fields, including geological hazards, civil engineering and infrastructure, and mineral and energy resources. The manual also covers key technical considerations when working with InSAR data, using EGMS examples to illustrate concepts. Annexes include a glossary, learning resources, and relevant software tools to support users in applying the methodology.



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