2025 DRAGON 6 SYMPOSIUM

14-18 JULY 2025

[PROJECT ID. 95355]

REMOTE SENSING FOR GEOHAZARD MONITORING AND INFRASTRUCTURE IMPACT ASSESSMENT: FIRST RESULTS OF THE RESELMAIN PROJECT







2025 Dragon 6 Symposium

WED. 11/12/2024

ID. 95355

PROJECT TITLE: REMOTE SENSING FOR LANDSLIDE MONITORING AND IMPACT ASSESSMENT ON INFRASTRUCTURE (RESELMAIN)

Universitat d'Alacant
Universidad de Alicante

PRINCIPAL INVESTIGATORS: PROF. ROBERTO TOMÁS AND PROF. ZHENHONG LI

AUTHORS: ROBERTO TOMÁS, ZHENHONG LI, JUAN MANUEL LÓPEZ, CHEN YU, CHUANG SONG, WU ZHU, JOSÉ LUIS PASTOR, CHAOYING ZHAO, MI CHEN, XIAOJIE LIU, ADRIÁN RIQUELME, KEREN DAI, MIGUEL CANO, MARÍA INÉS NAVARRO, HENGYI CHEN, JIANTAO DU, JIAYIN LUO, BO CHEN, YINPENG LIU, GUANCHEN ZHUO, PABLO EZQUERRO, CAROLINA GUARDIOLA, GUADALUPE BRU, JUAN LÓPEZ-VINIELES, ROBERTO SARRO, MARTA BÉJAR, JOSÉ ANTONIO FERNÁNDEZ-MERODO, ESTEBAN DÍAZ

PRESENTED BY: ROBERTO TOMÁS AND PROF. ZHENHONG LI

THE TEAM



EUROPE



CHINA

Universitat d'Alacant
Universidad de Alicante

Instituto Geológico
y Minero de España

Outline

- Objective of the project
- EO data delivery
- Schedule
- First results
- Training of young scientists
- Publications



Objectives

2025 Dragon 6 Symposium

OBJECTIVES



- **O1.** Improvements on image processing and atmospheric corrections.
- **O2.** Integrate various SAR/InSAR/Optical/LiDAR techniques to generate surface deformation map aiming for slow- and fast-moving landslides and subsidence.
- **O3.** Automatic landslide detection based on the above surface deformation maps using machine learning (ML).
- **O4.** Time series prediction based on ML techniques.
- **O5.** Model EO to determine the geological-geotechnical mechanisms responsible for geohazards and provide a quantitative risk assessment across some of the study areas.
- **O6.** To perform a structural health diagnosis of buildings affected by geohazards with the support of remote sensing data.

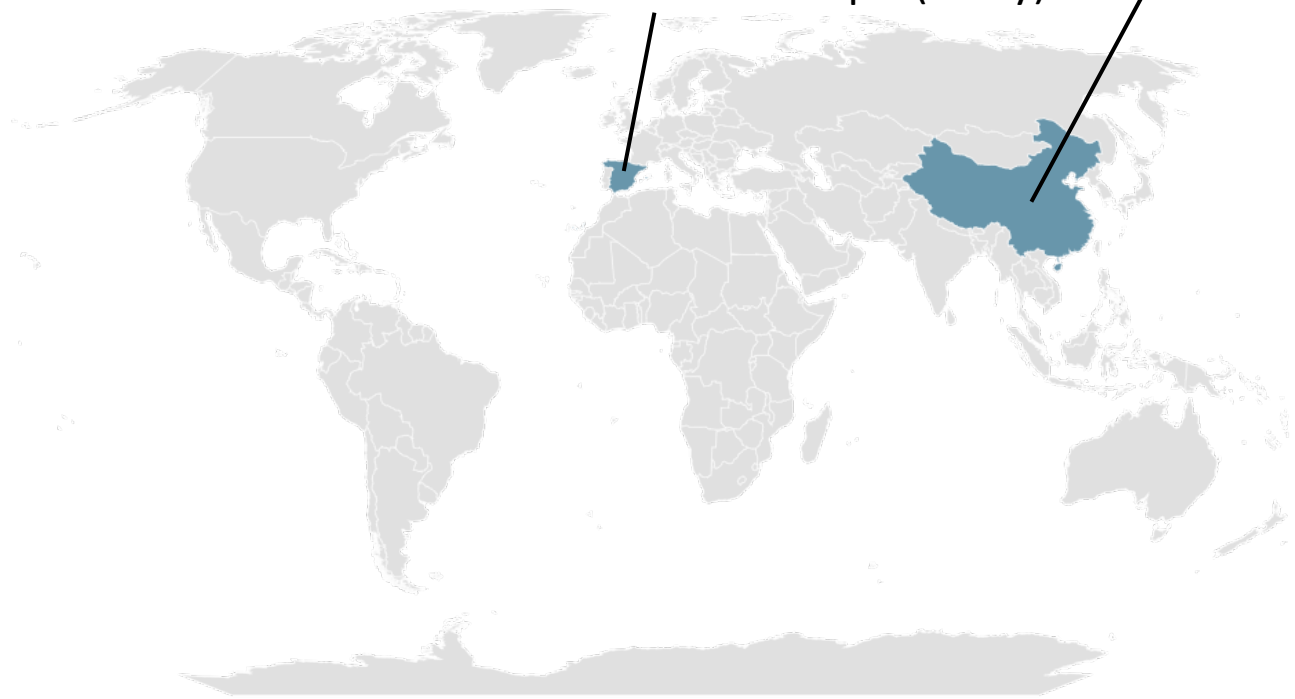


EO data delivery

STUDY AREAS

CHINA
Beijing
Gongjue County (Tibetan Plateau)

SPAIN
Valle del Serpis (Alcoy)



Landslides
Land subsidence

Dragon 6 EO Data Delivery

ESA /Copernicus Missions	No. Scenes
1. ALCOY / EGMS – SENTINEL-1	-
2. GONGJUE COUNTY / SENTINEL-1	906
3.	
4.	
5.	
6.	
Total:	906
Issues:	

ESA Third Party Missions	No. Scenes
1. ALCOY / PAZ (HS)	21
2. BEIIJNG / TSX	86
3. GONGJUE COUNTY / ALOS/PALSAR	8
4. GONGJUE COUNTY / ALOS/PALSAR-2	30
5.	
6.	
Total:	145
Issues:	

Chinese EO data	No. Scenes
1.	
2.	
3.	
4.	
5.	
6.	
Total:	
Issues:	

Schedule

2025 Dragon 6 Symposium

SCHEDULE



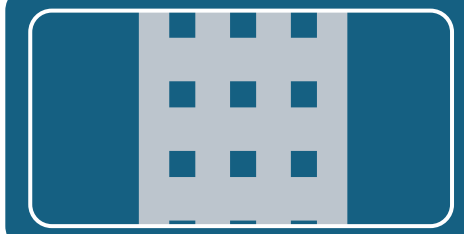
Year 1:

Project kick-off meeting (Dragon-6 Batch-2 Kick-Off/December 2024); Data acquisition and ordering; In situ data acquisition; Presentation of 1st year results in Dragon project symposium by PI, and YSs poster.



Year 2:

Data processing and integration, and landslide/geohazards automatic mapping and analysis; Presentation of Mid-term report in Dragon project symposium by PI, and posters by YSs, and publication.



Year 3:

Infrastructure Monitoring and Health Diagnosis Using InSAR Displacements; Presentation of 3rd year results in Dragon project symposium by PI, and YSs poster.

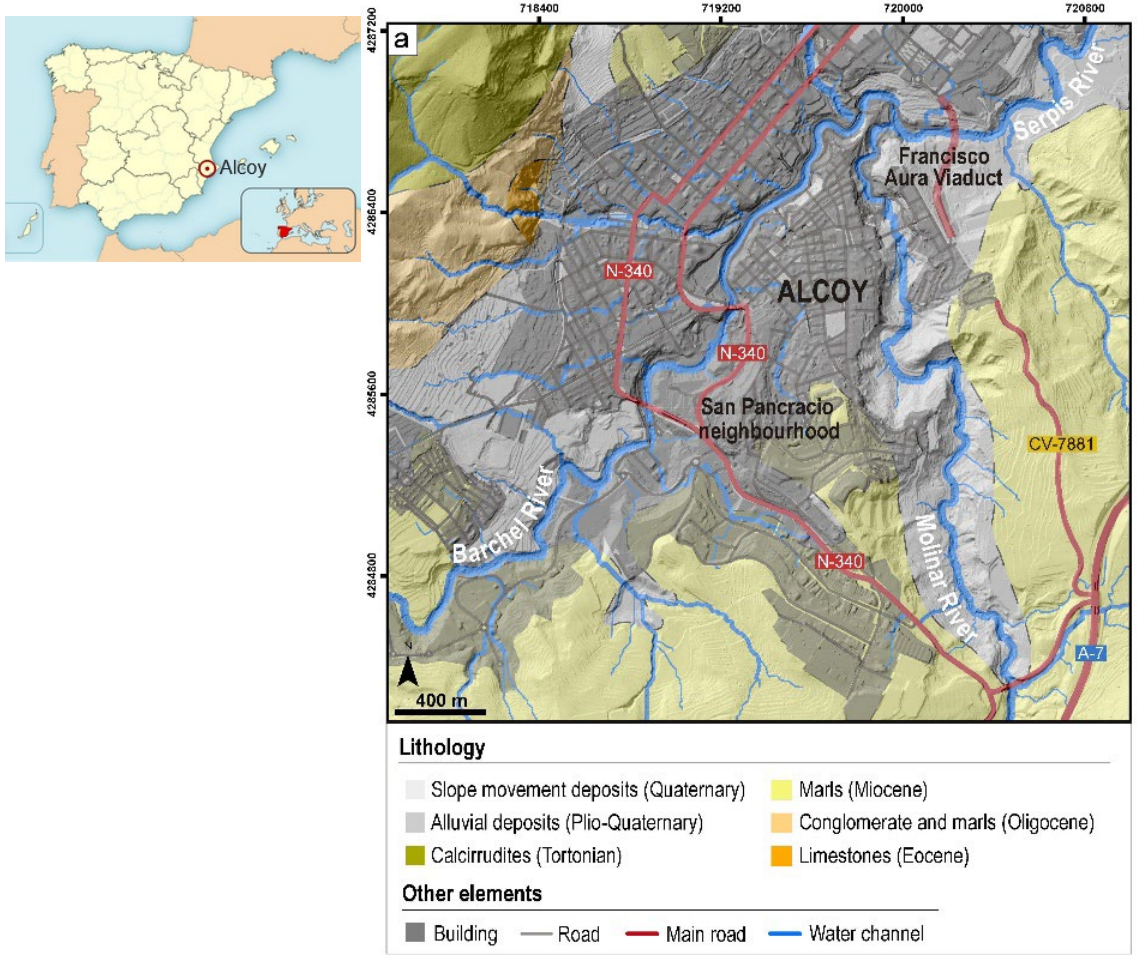


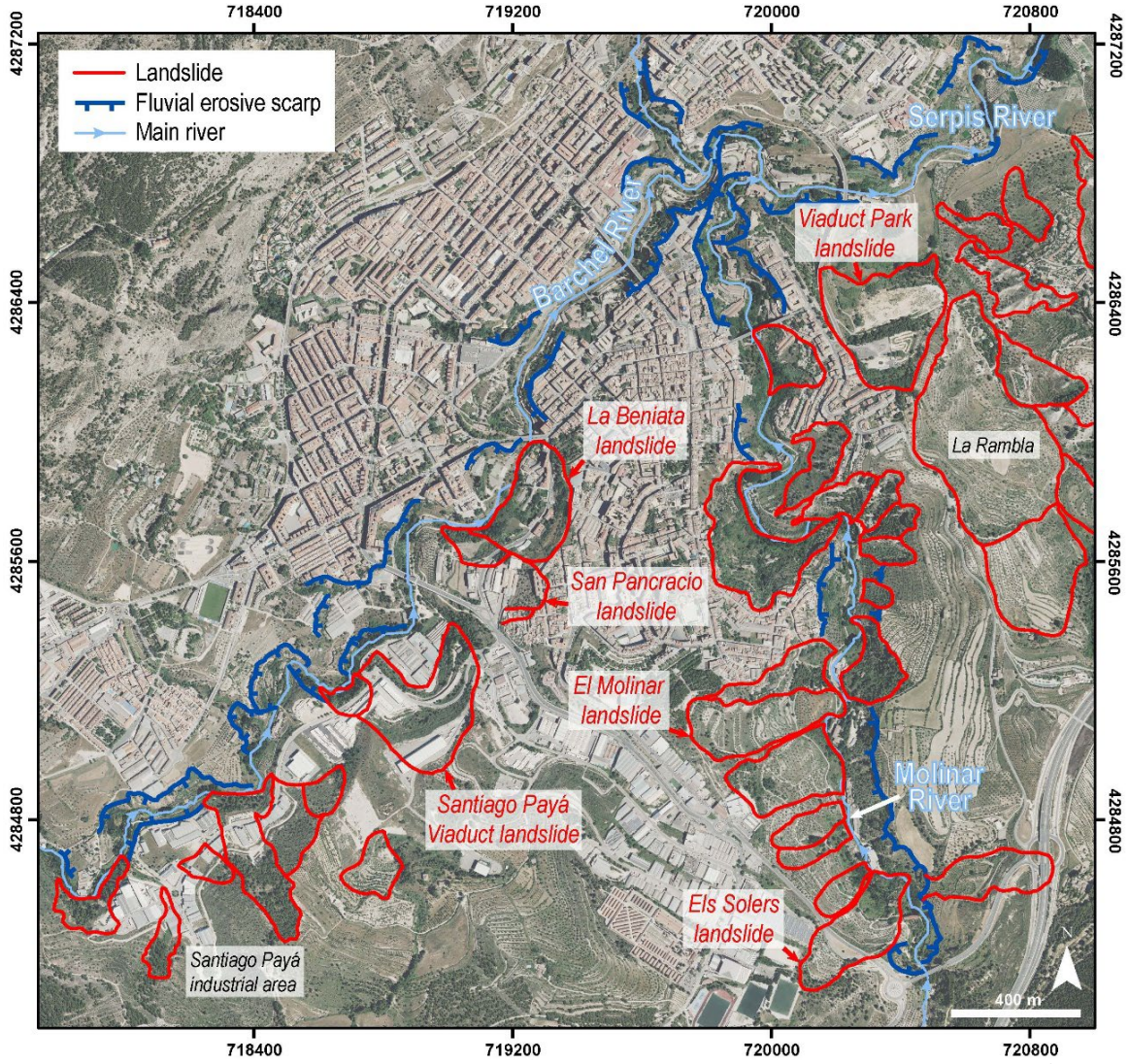
Year 4:

Development of geotechnical models and ground displacement time series prediction by machine learning. Report; Publications. Presentation of final results in Dragon project symposium by PI, and poster by YSs and preparation of final project results.

Valle del Serpis, Alcoy – landslide affecting buildings

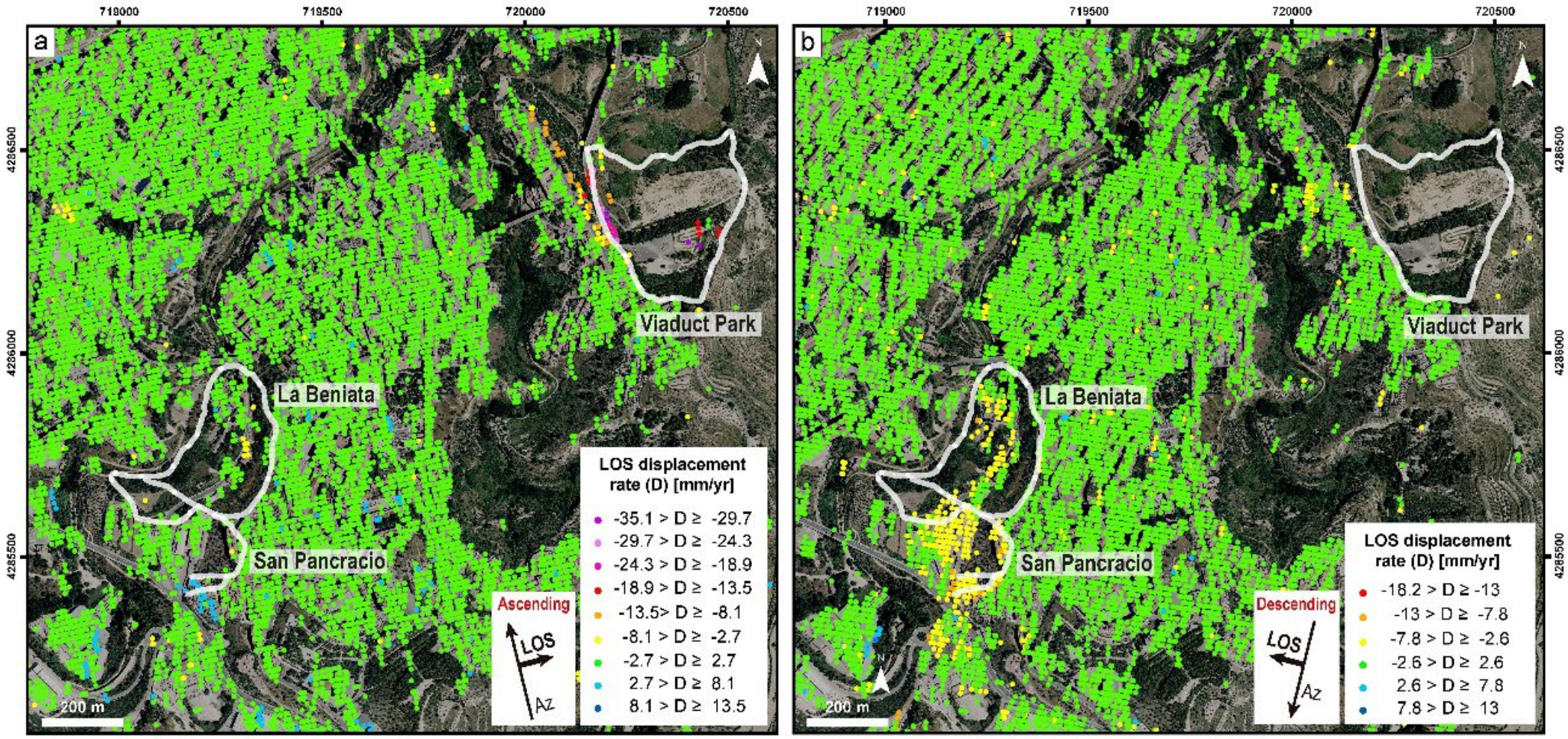
MONITORING BUILDINGS





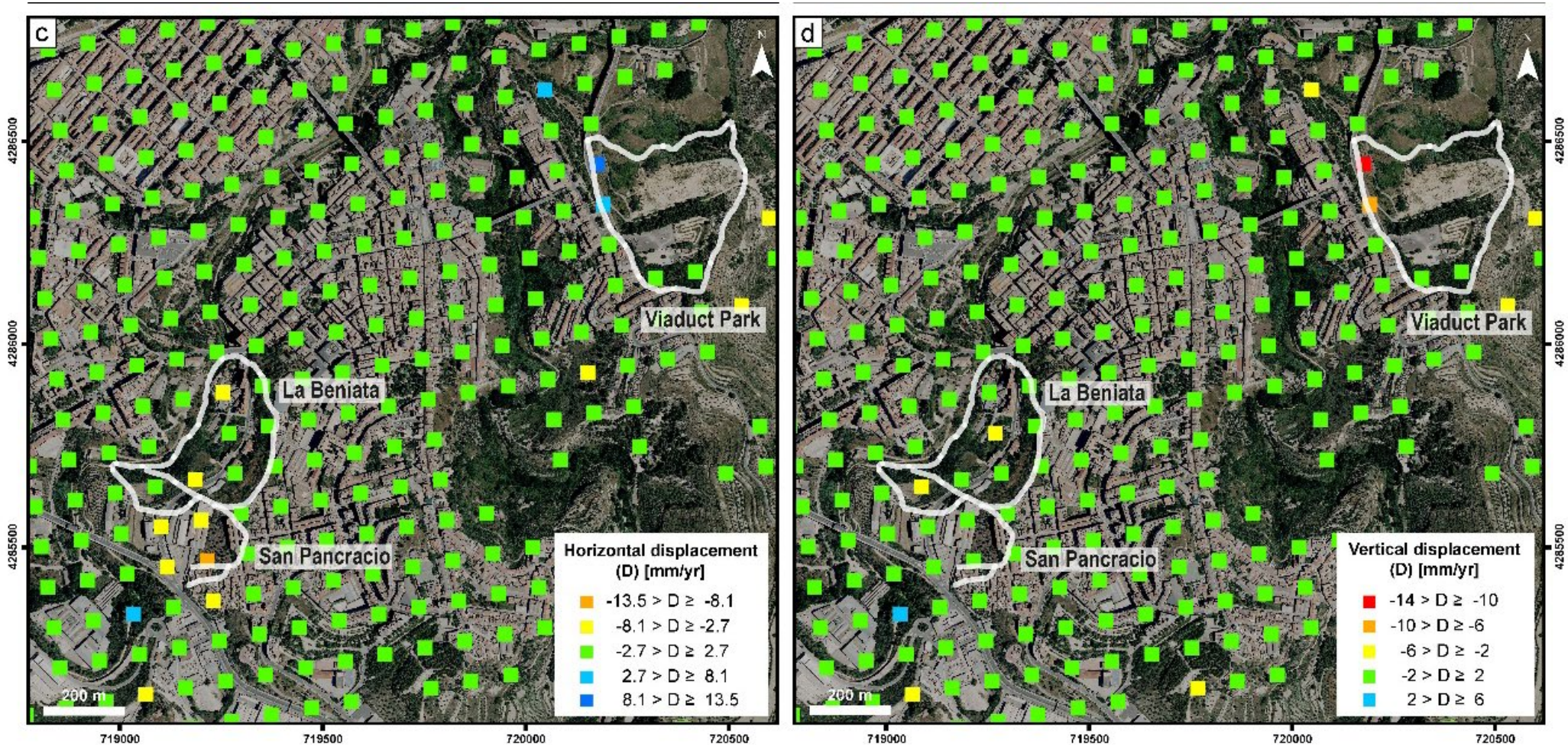
Reyes-Carmona, C., Tomás. R., Navarro-Hernández, M.I. (2025). Facing challenges of urban landslide mapping by complementing geomorphological surveys with satellite interferometry in Alcoy (SE Spain). Landslides. Accepted.

MONITORING BUILDINGS



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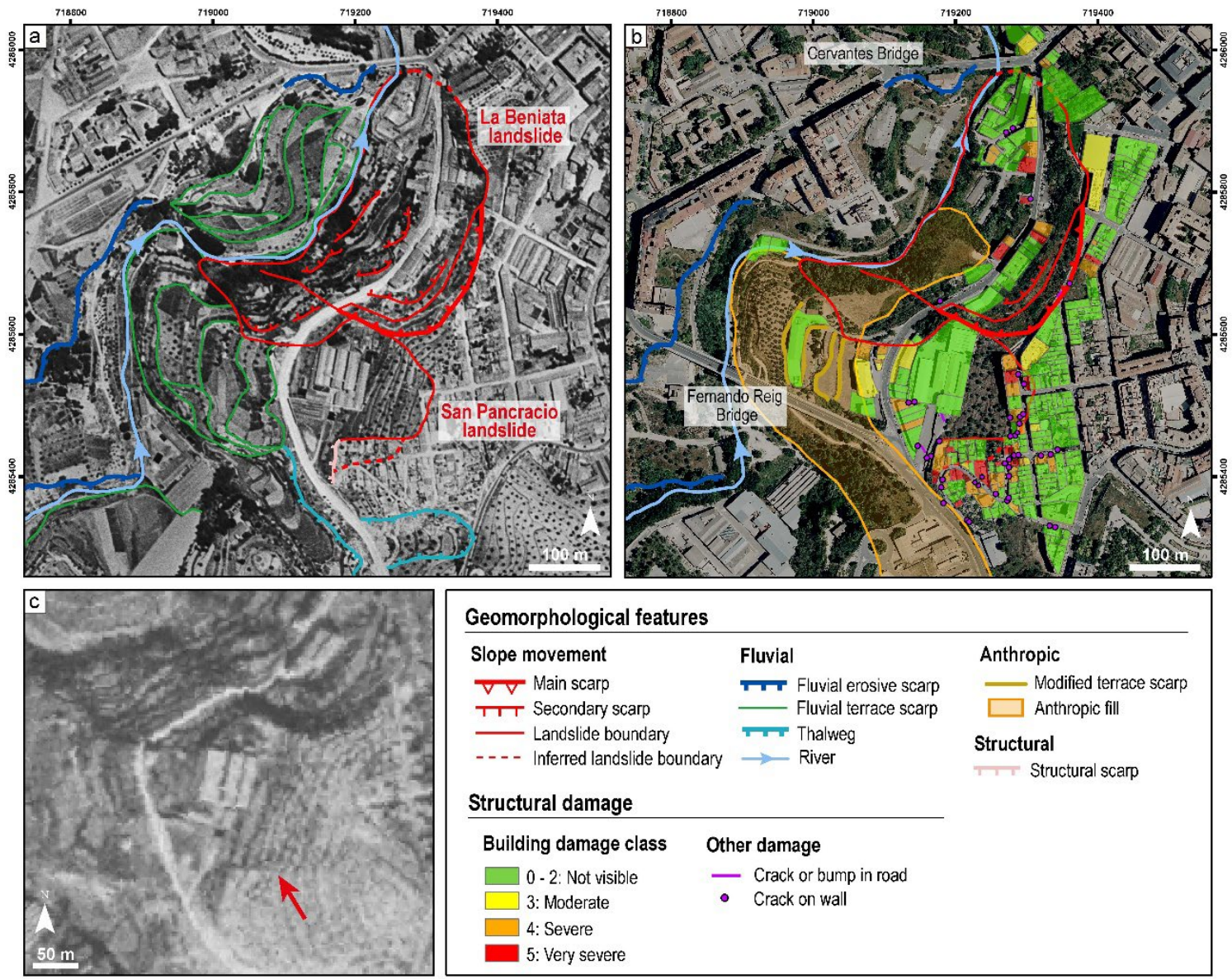
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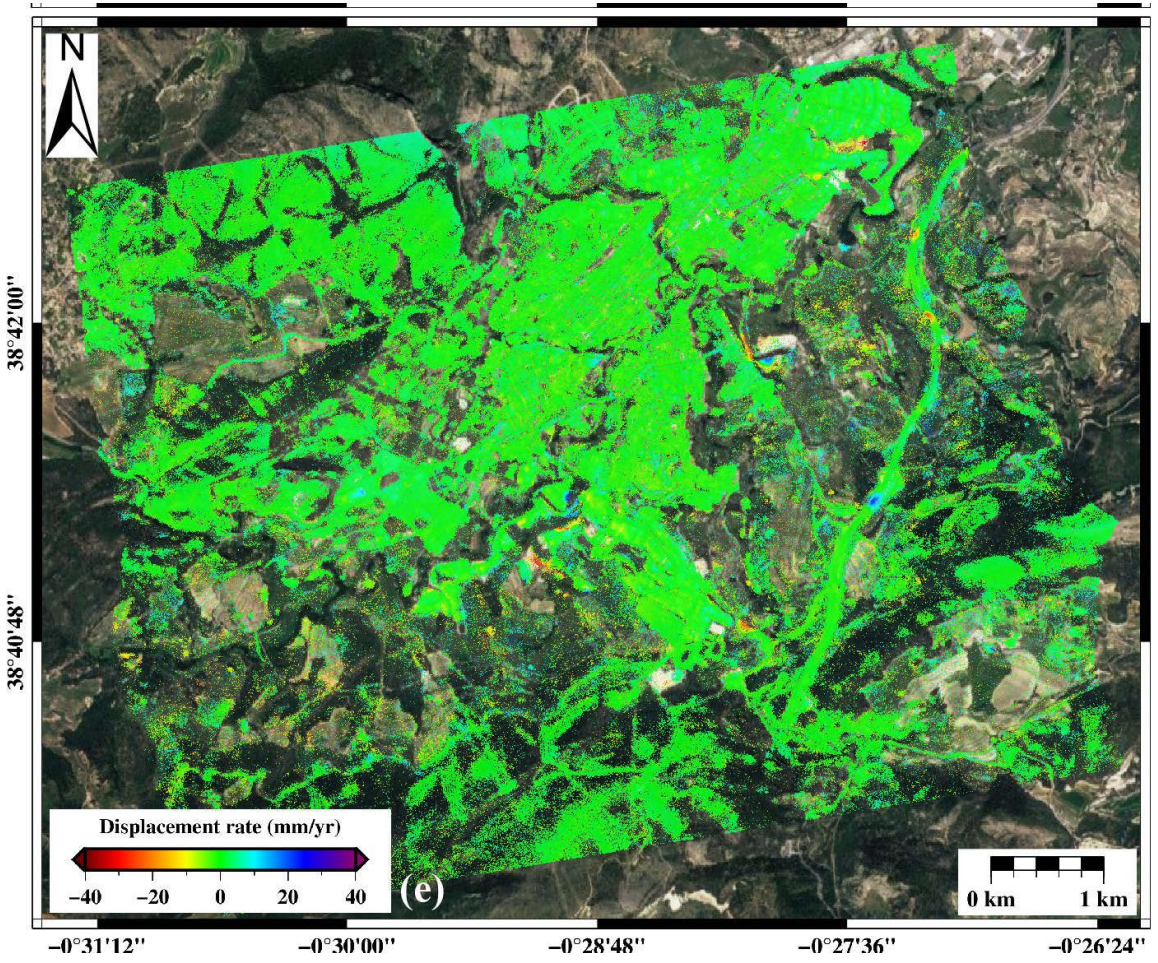
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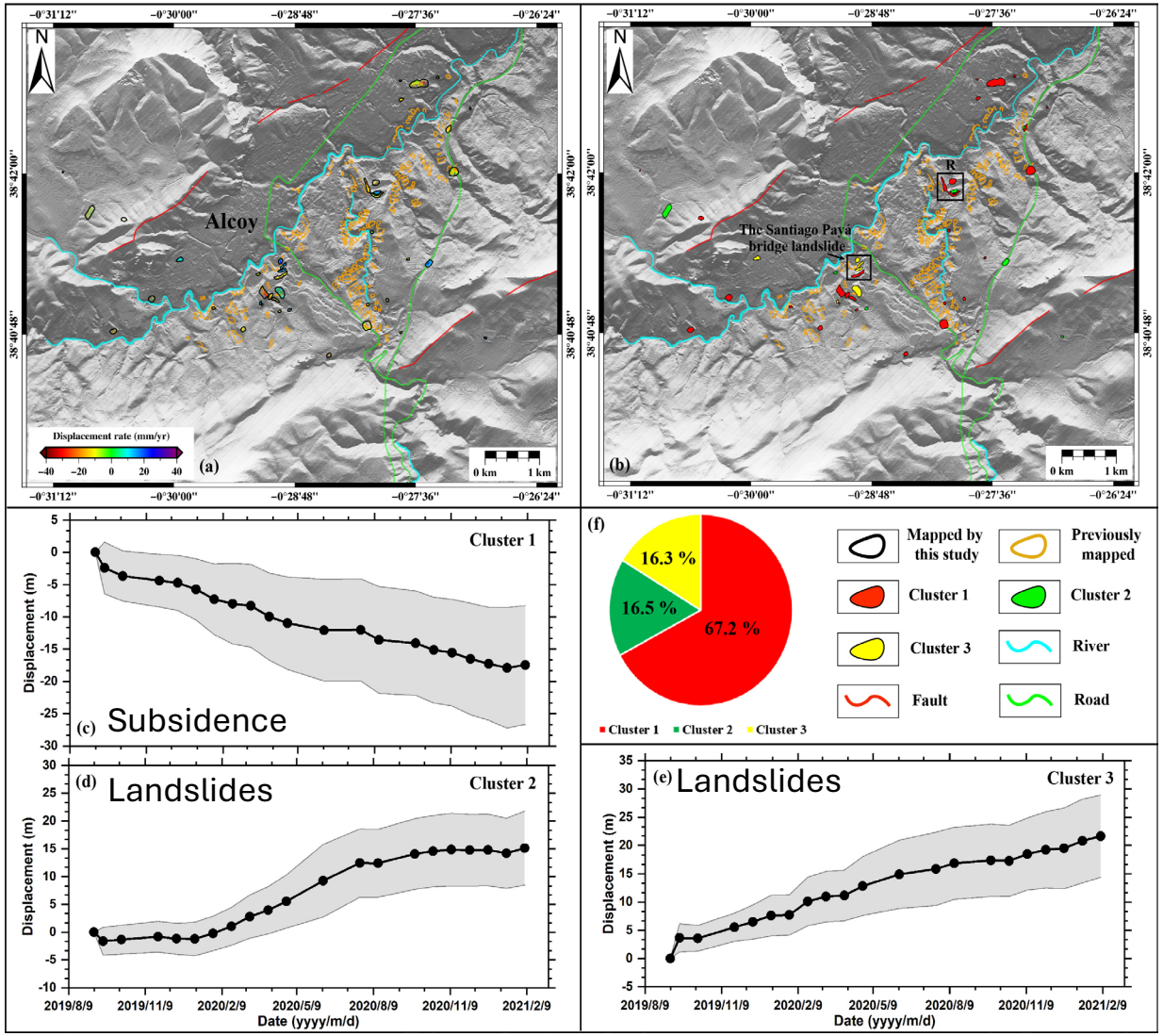


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Valle del Serpis, Alcoy – landslide affecting roads and bridges

MONITORING ROAD

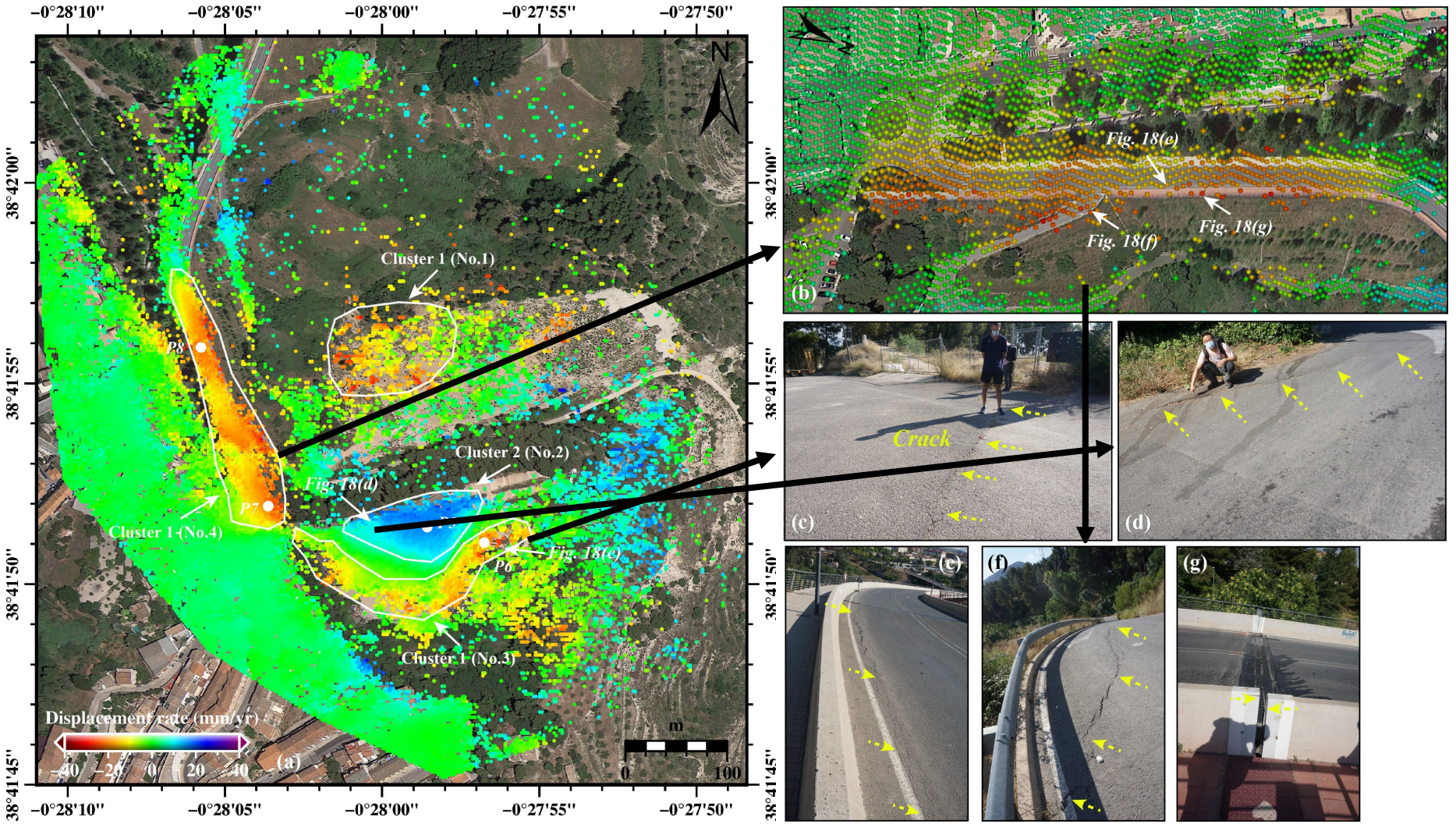




Liu, X., Tomás, R., Zhao, C., Lopez-Sanchez, J. M., Ma, Z. (2025). Millimeter ground deformation retrieving from high-resolution PAZ SAR images with a combined correction of unwrapping and long-wavelength errors: A case study in Alcoy, Spain. Remote Sensing of Environment, 328, 114876.

MONITORING ROAD

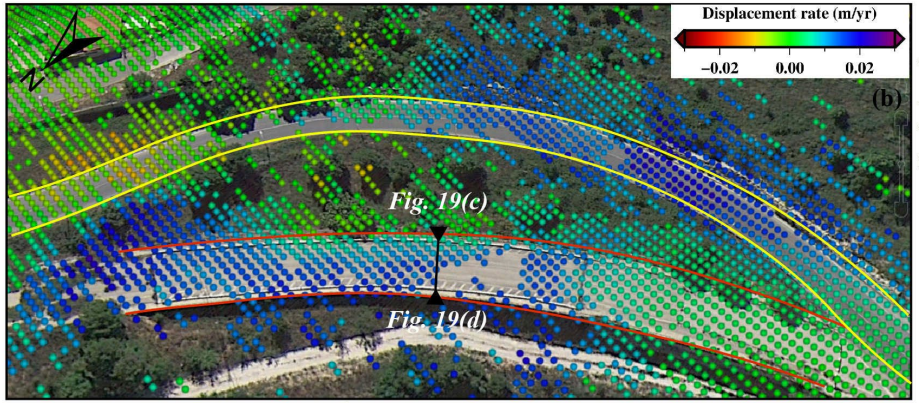


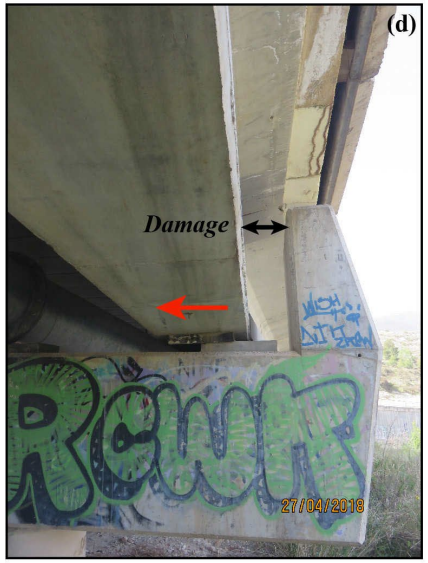


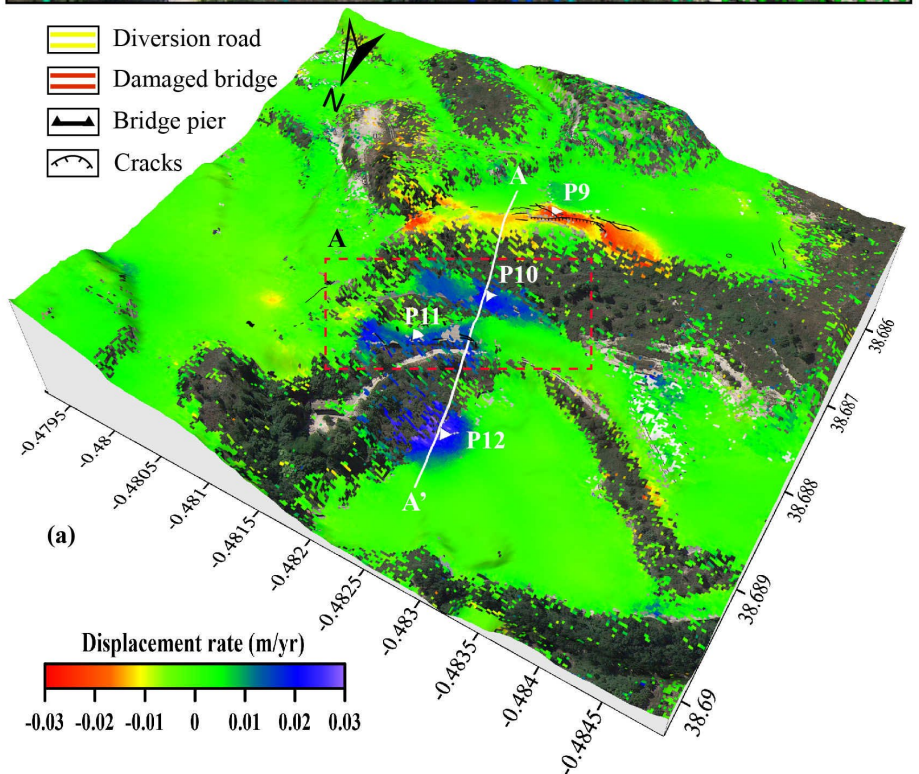
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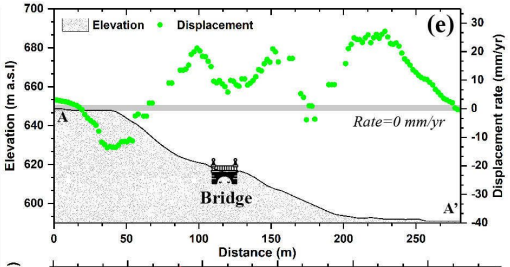
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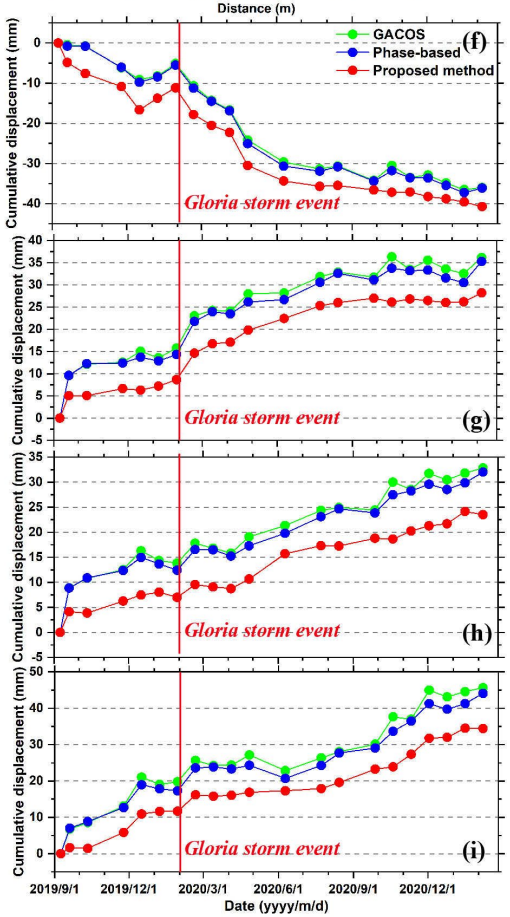






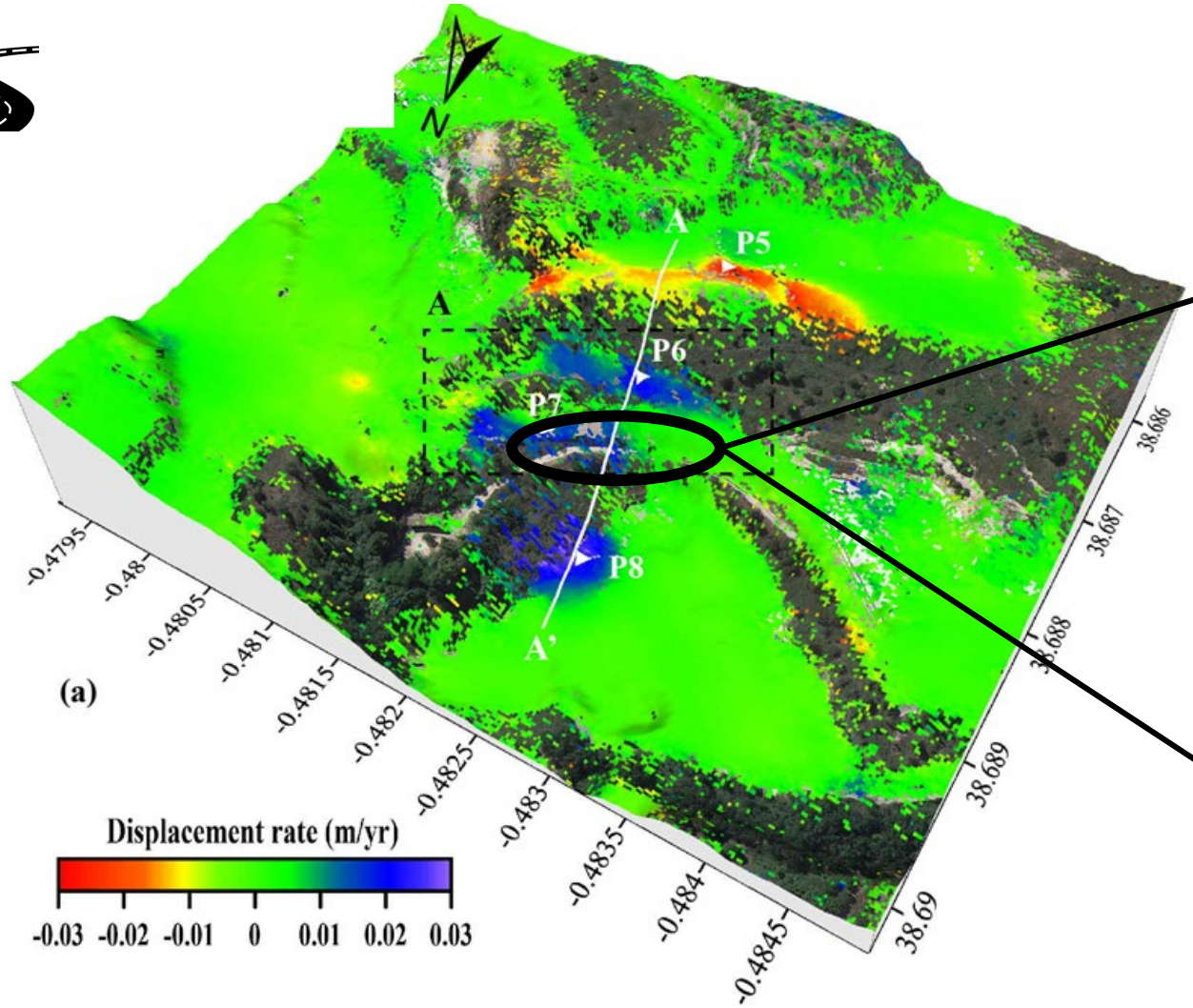


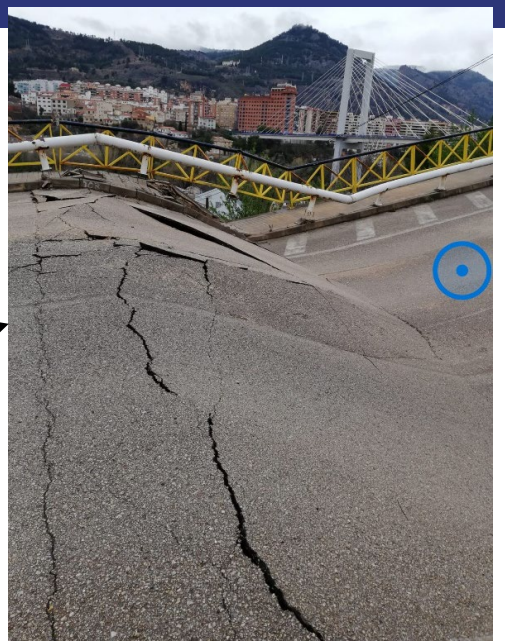




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MONITORING ROAD







MONITORING ROAD

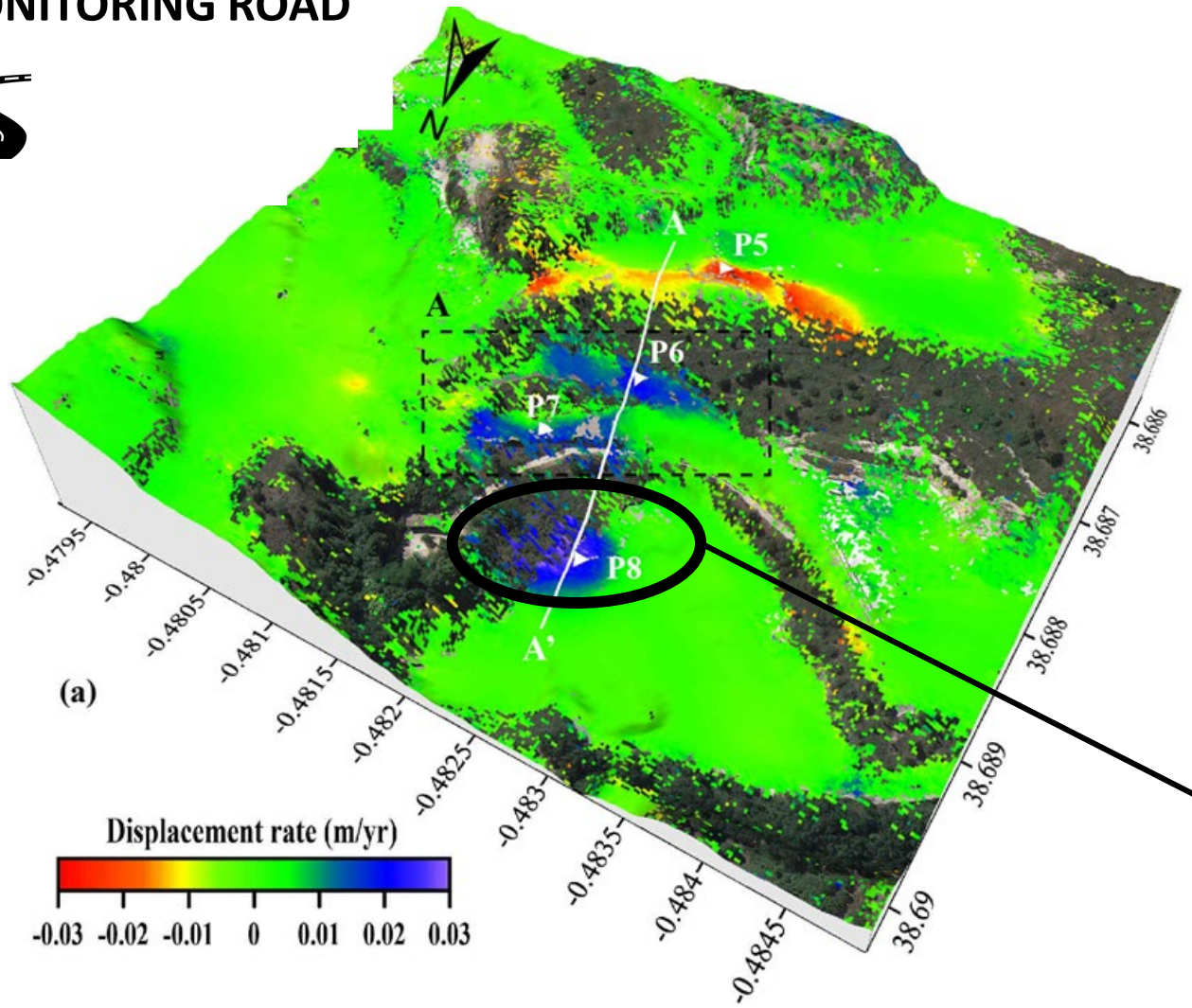
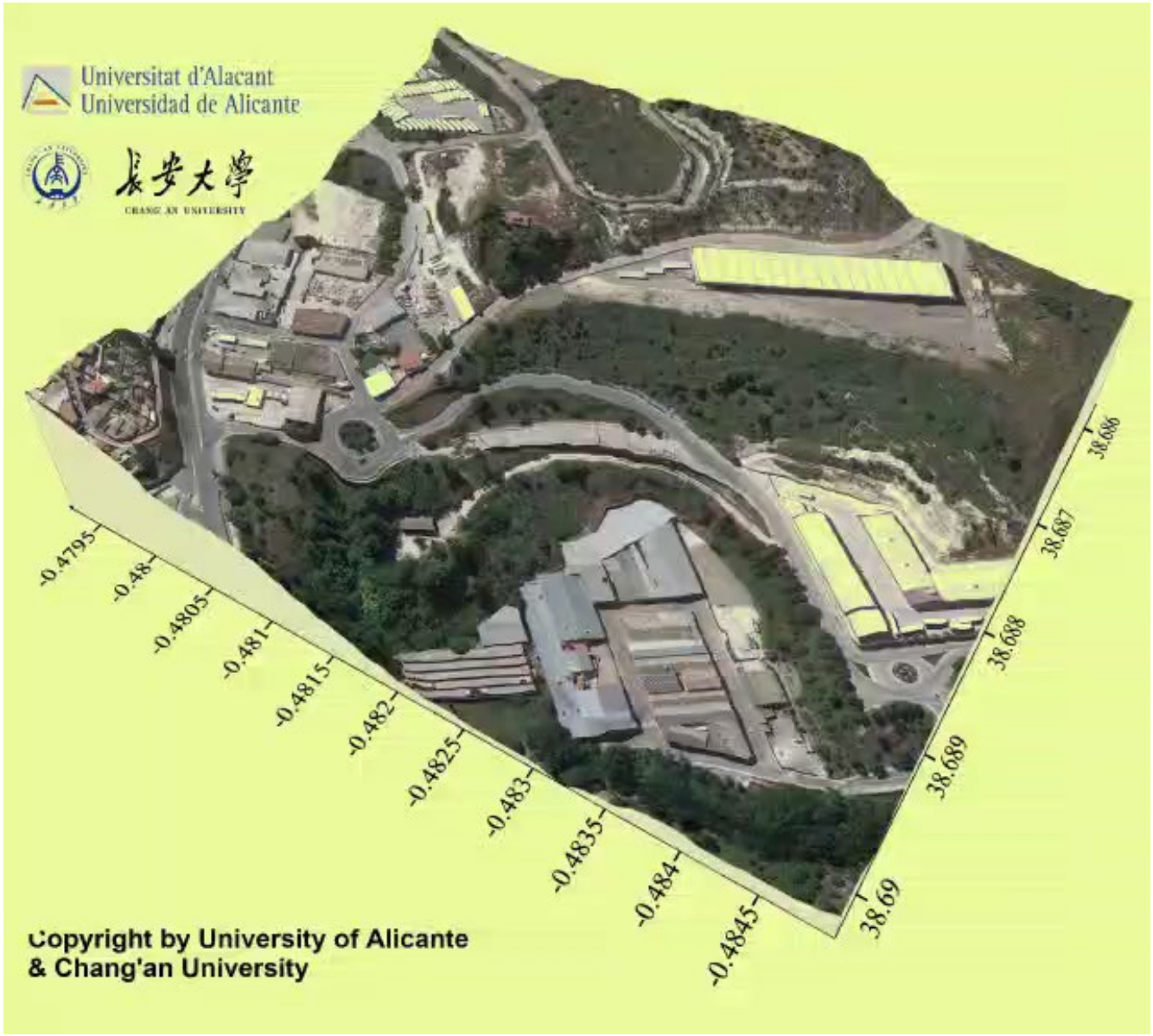


Photo: Diario Información.



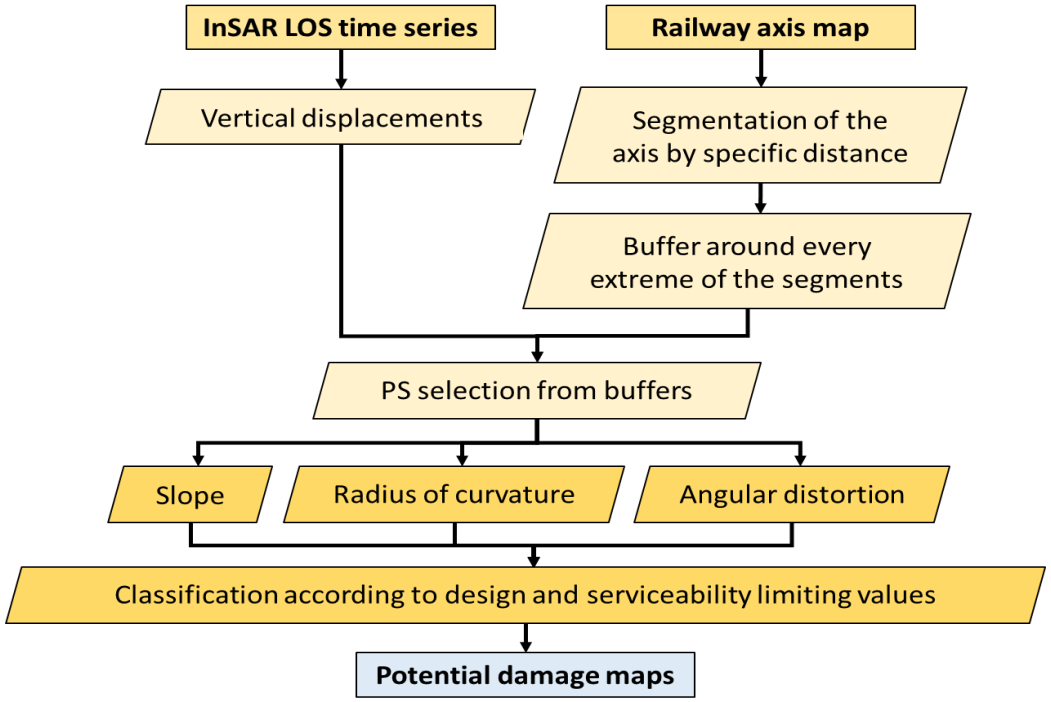
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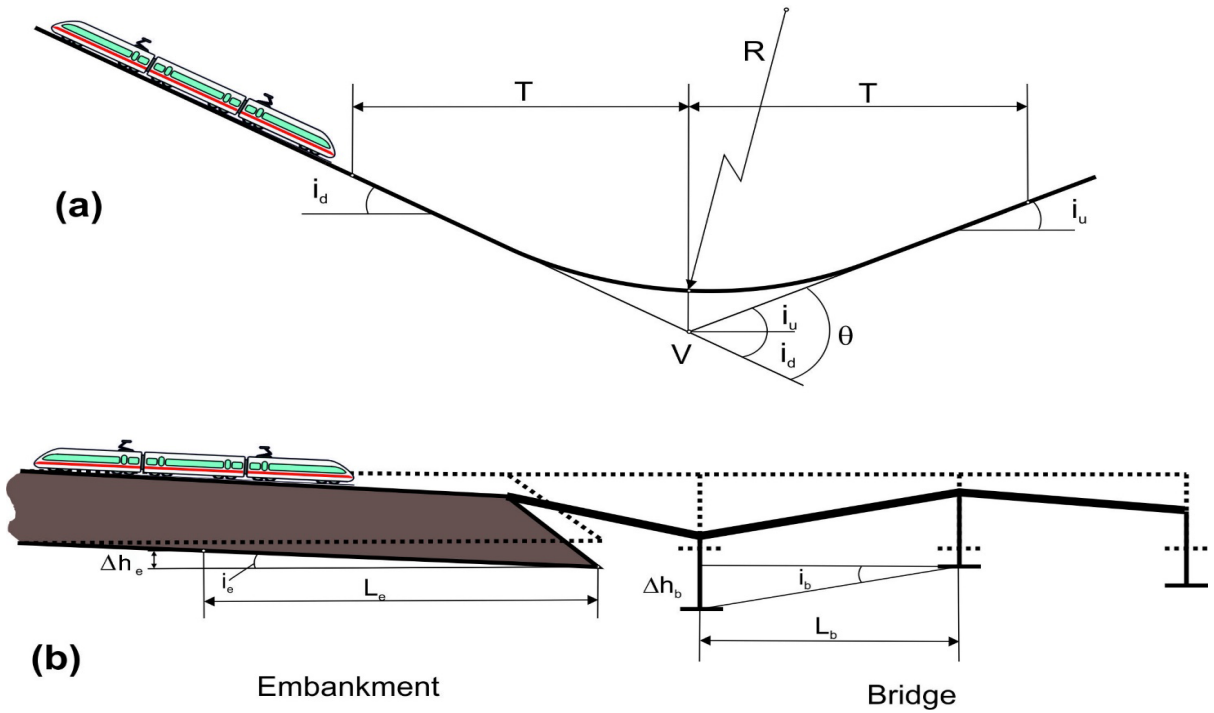




Beijing high speed railway– subsidence affecting railway

STRUCTURAL HEALTH DIAGNOSIS RAILWAY

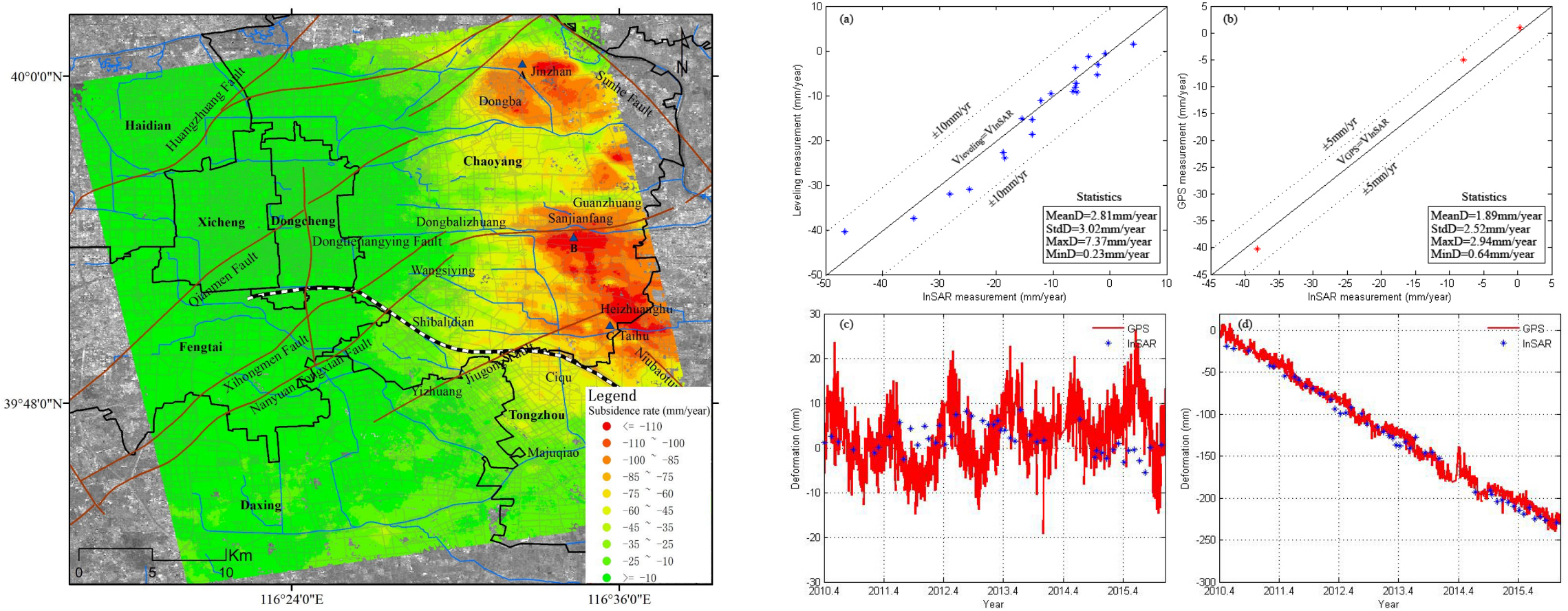




Parameter		Design limiting value
Design parameters	Slope	<2/100 = 0.0200 ~ 2.00%
	Radius of curvature	>49000 m
Serviceability Limit States (SLS)	Angular distortion(embankment, supporting ballasted tracks)	<2/1000 = 0.0020 ~ 0.20%
	Angular distortion(embankment, supporting slab tracks)	<1/2000 = 0.0005 ~ 0.05%
	Angular distortion (bridges)	<1/1000 = 0.0010 ~ 0.10%

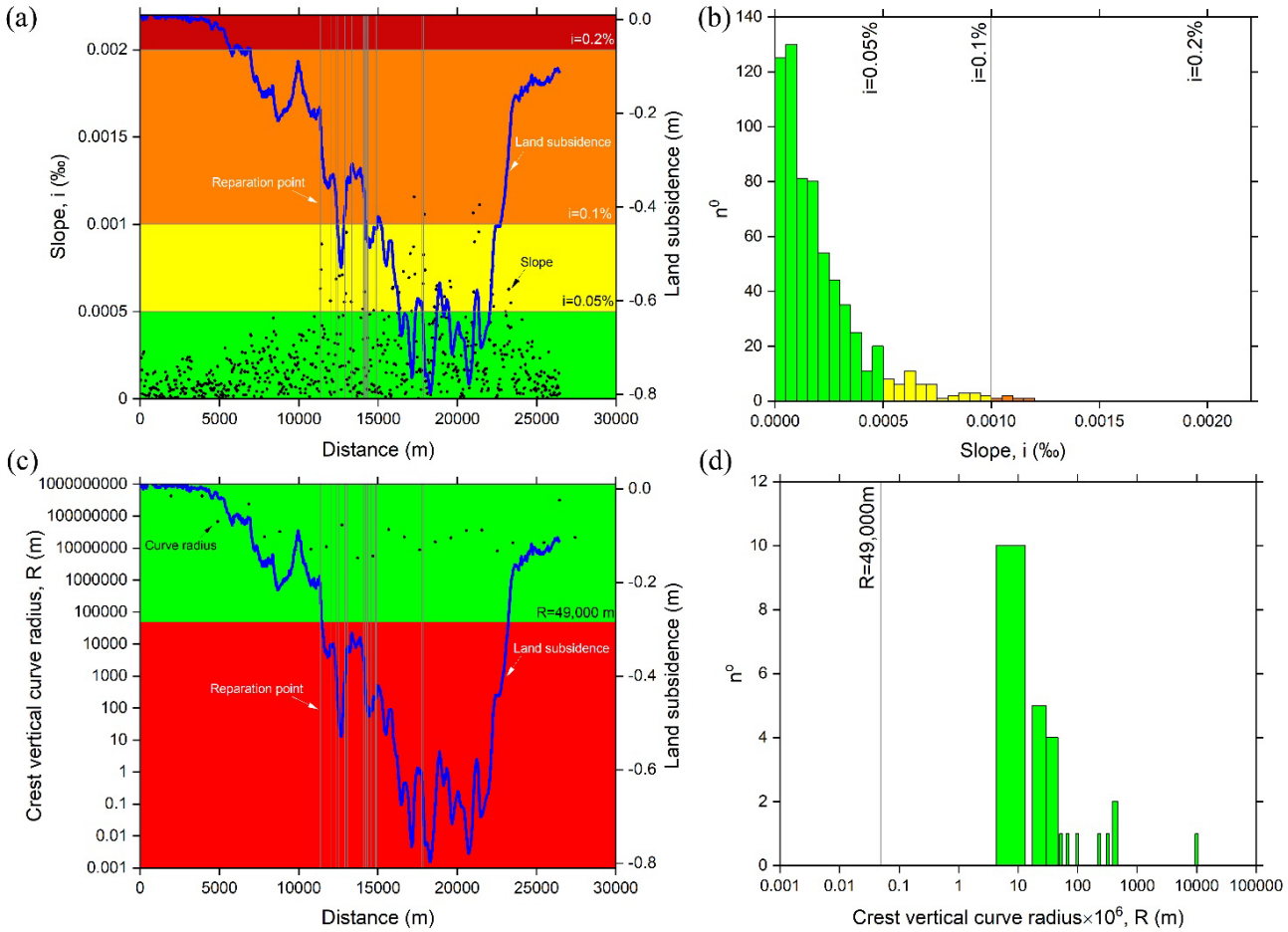
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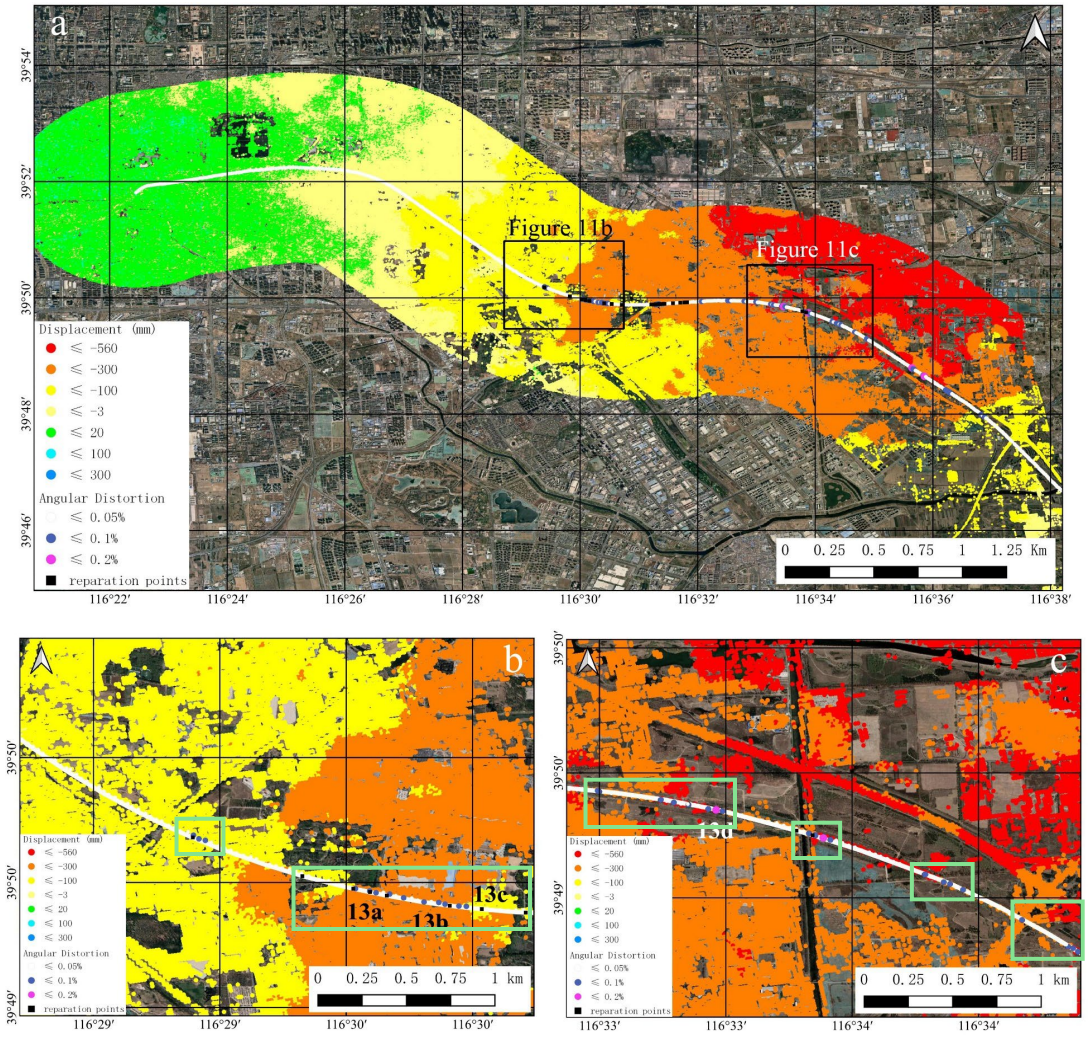
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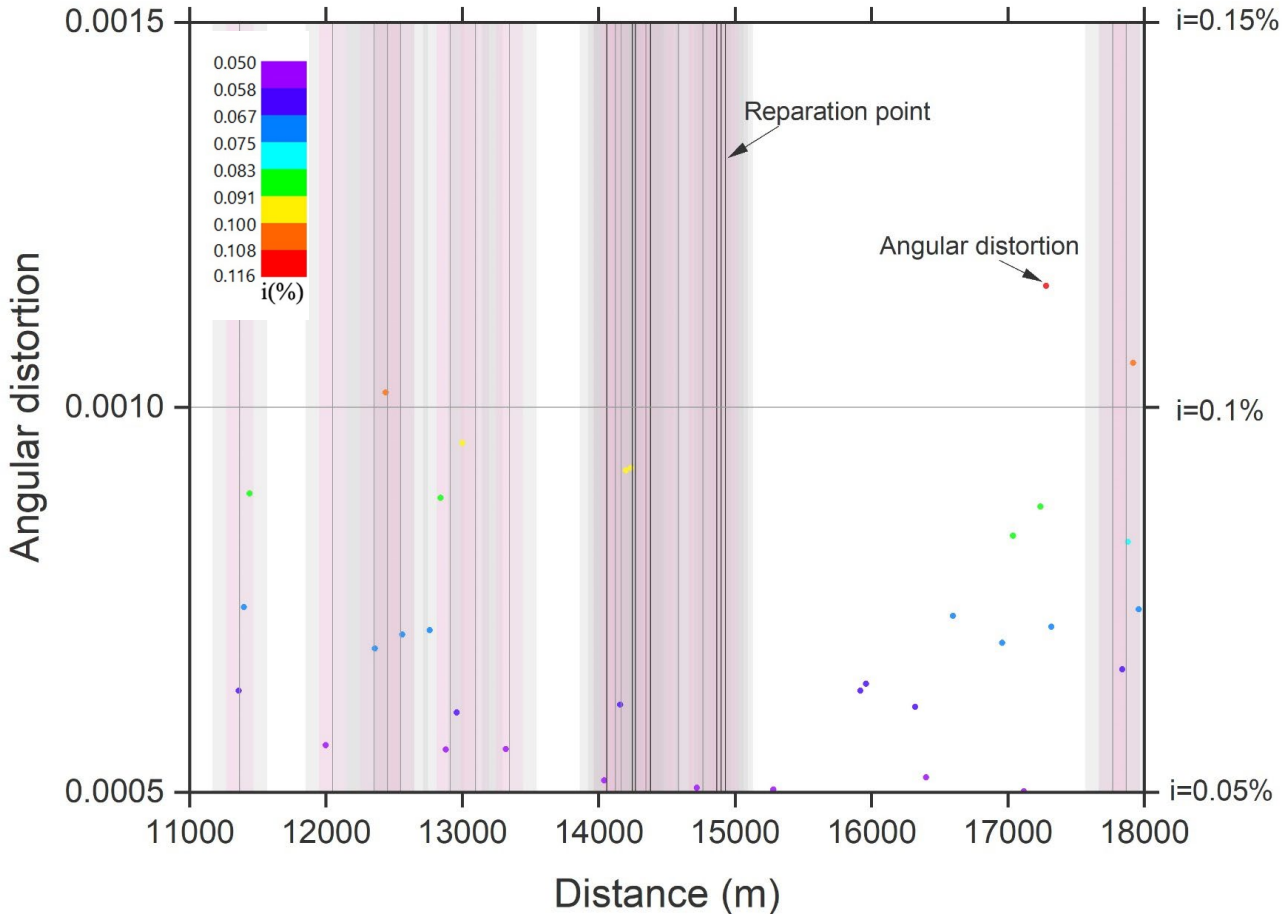
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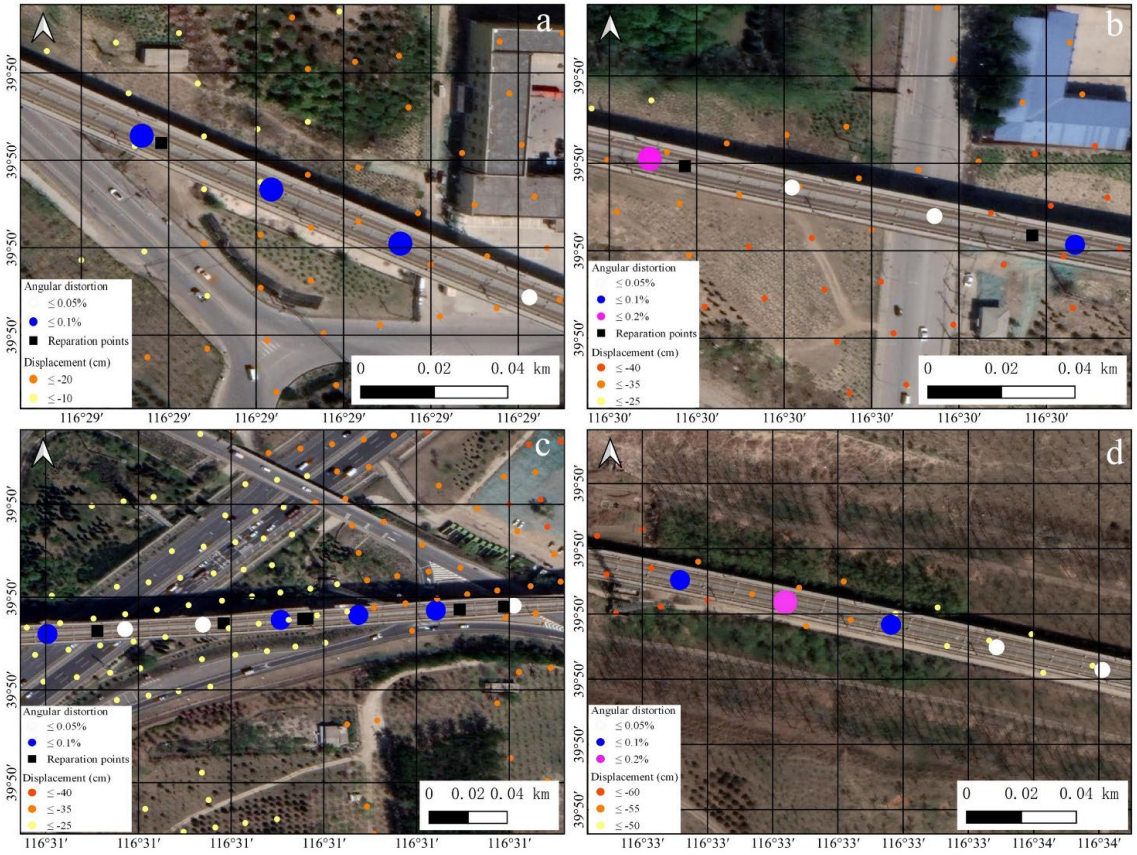




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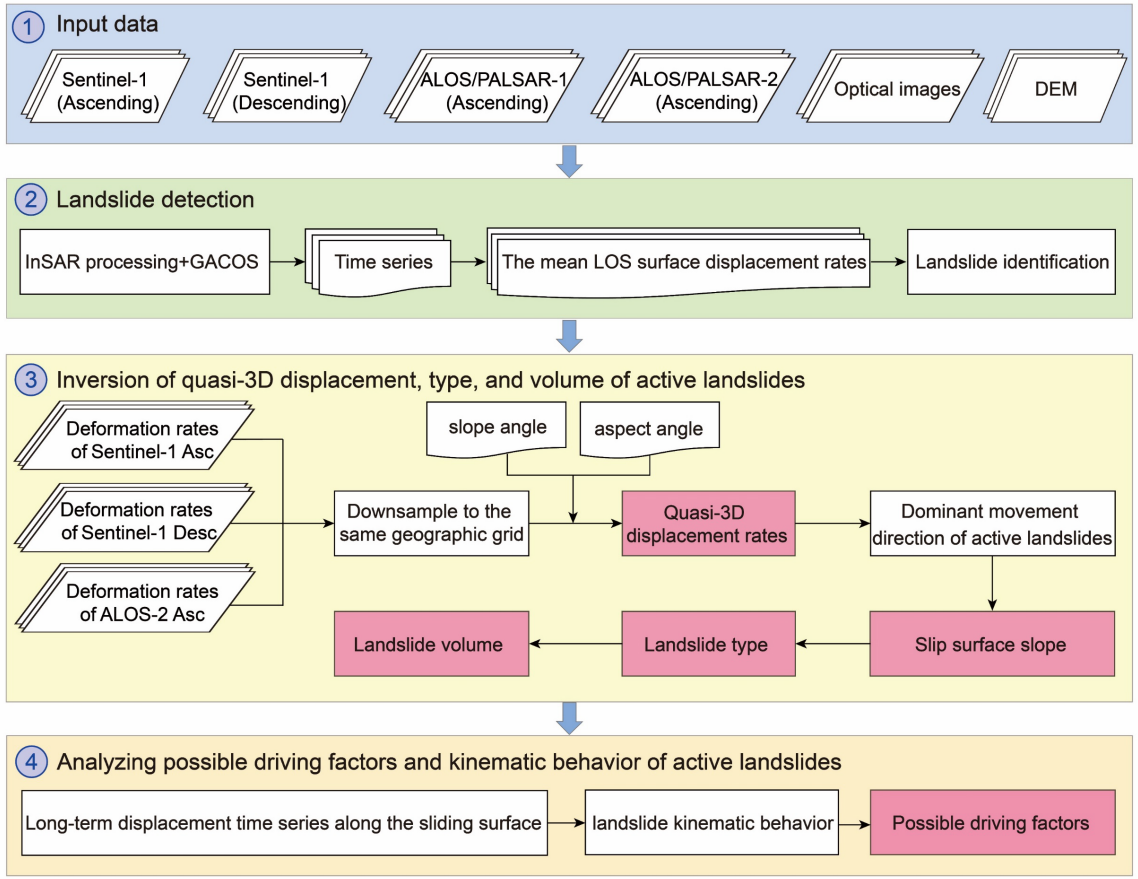


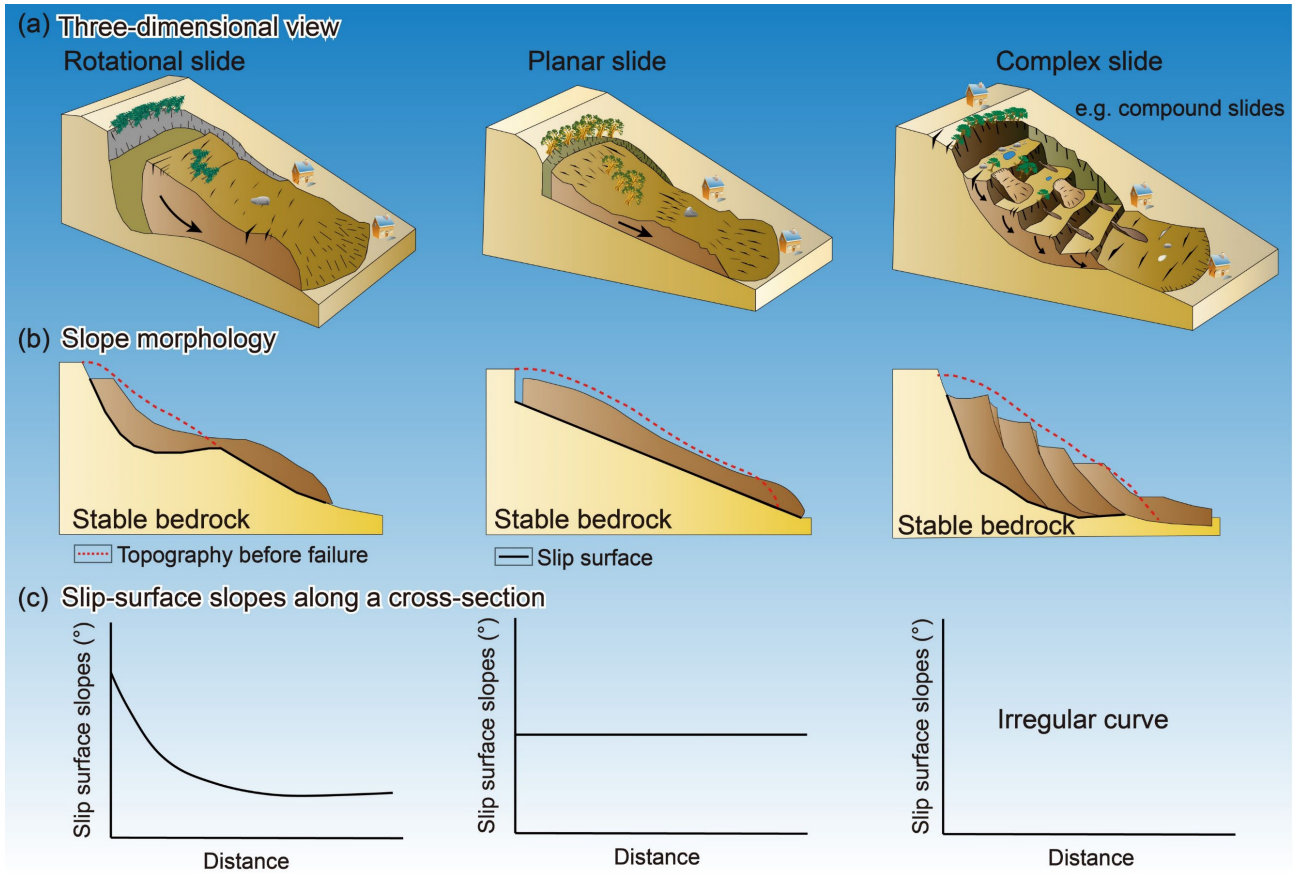


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Landslides in Gongjue County, China – how to determine slip surface from remote sensing

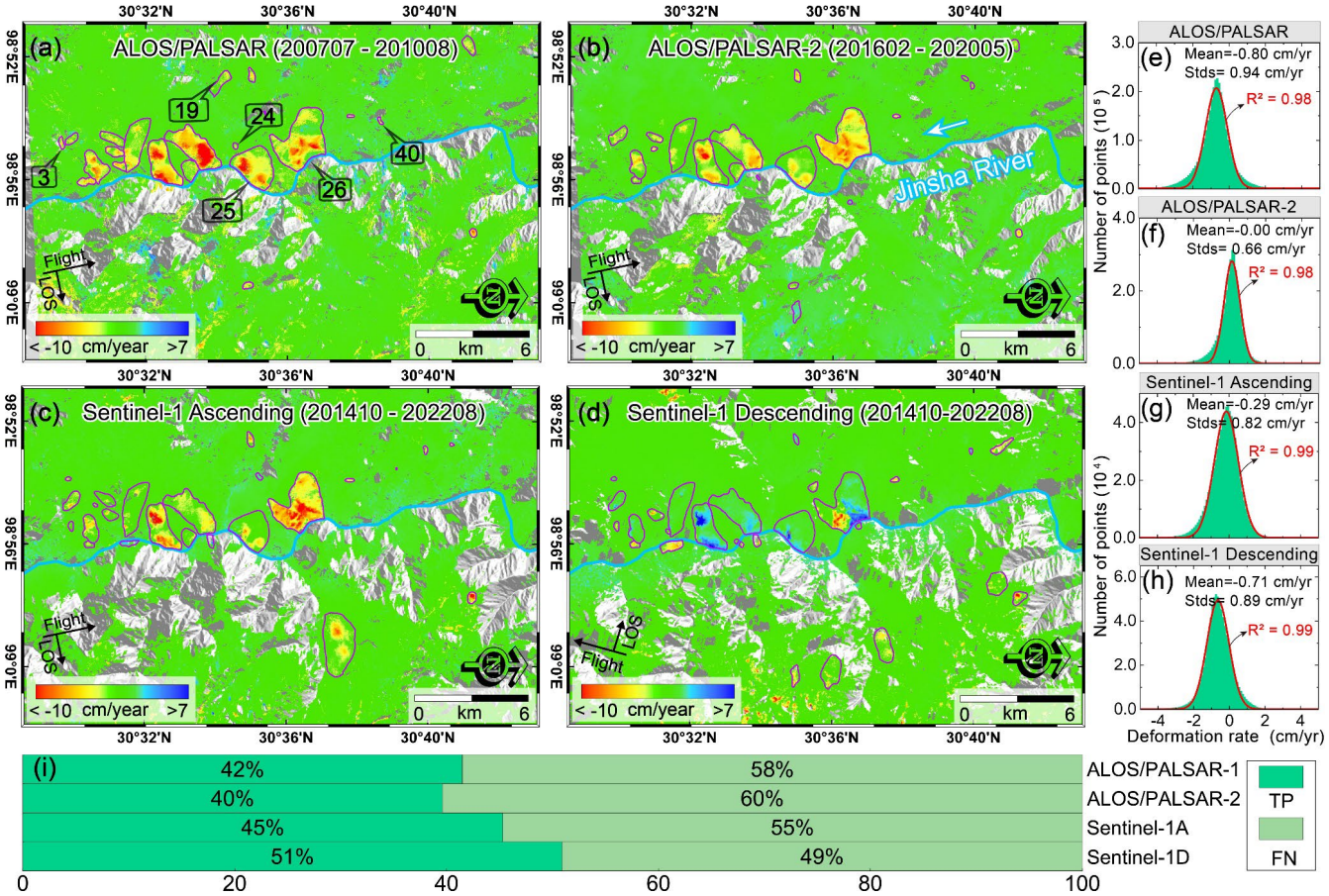
Slip surface inversion of landslide

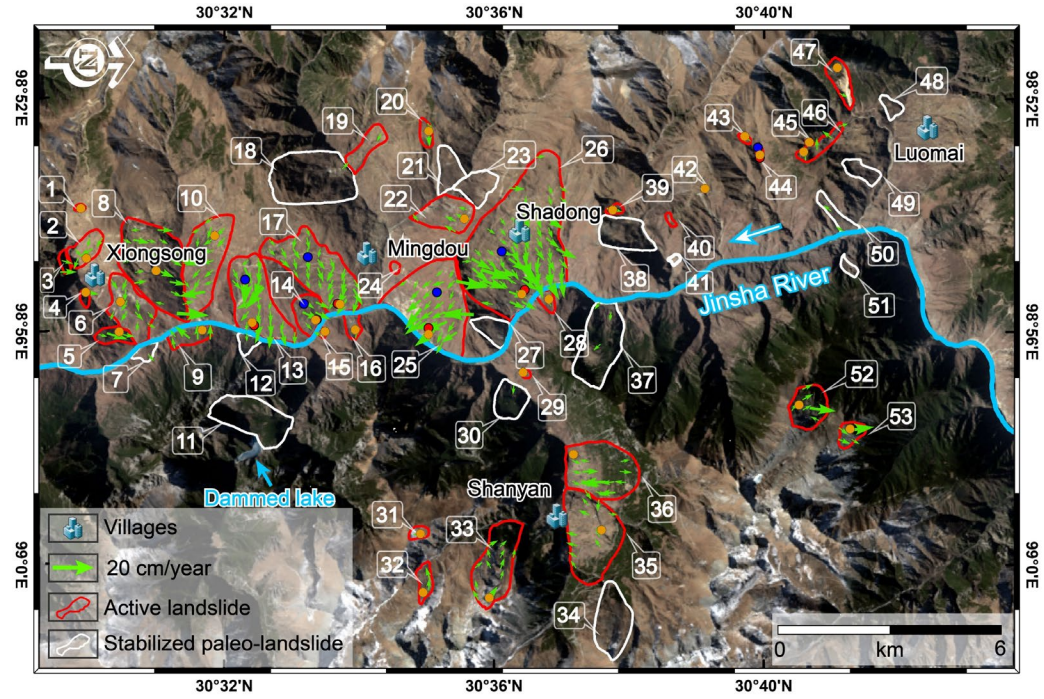




Chen B, Li Z, Song C, et al. Slip surface, volume and evolution of active landslide groups in Gongjue County, eastern Tibetan Plateau from 15-year InSAR observations. Remote Sensing of Environment, 2025, 324: 114763.

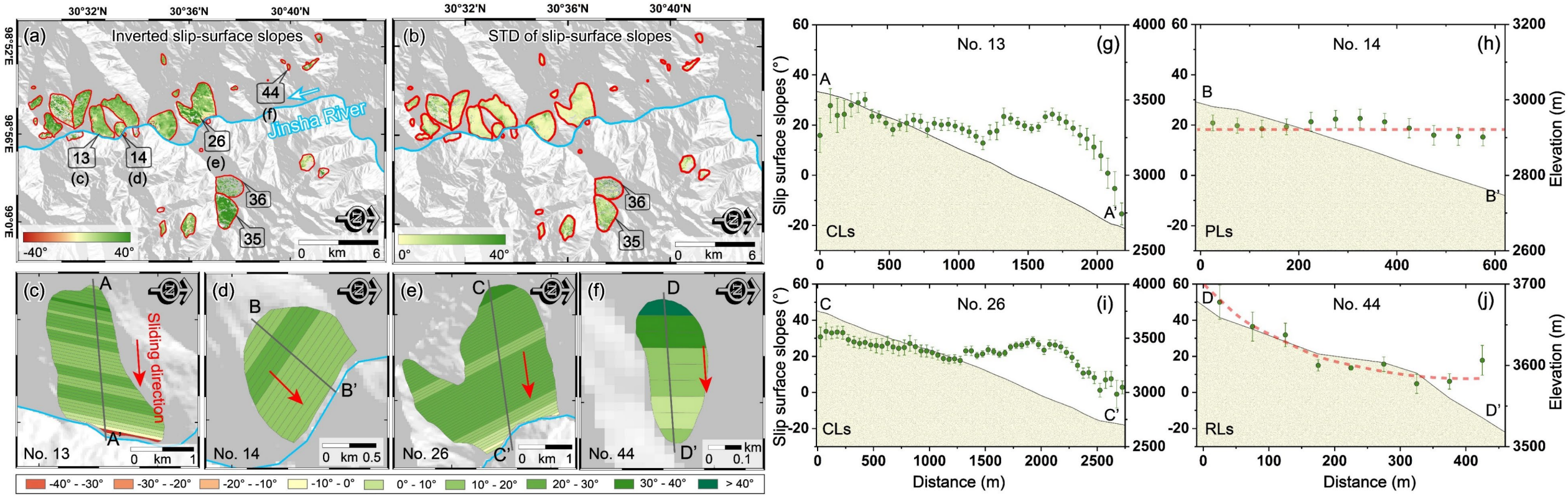
Slip surface inversion of landslide





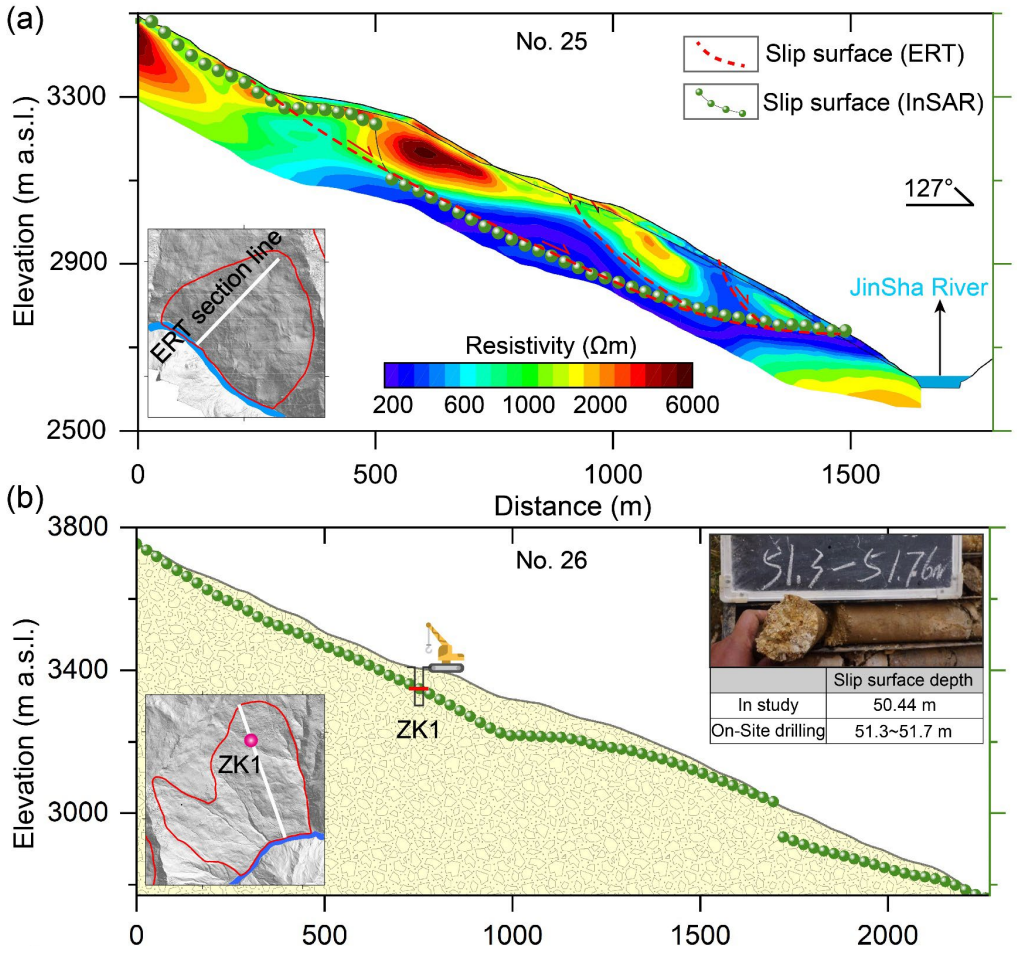
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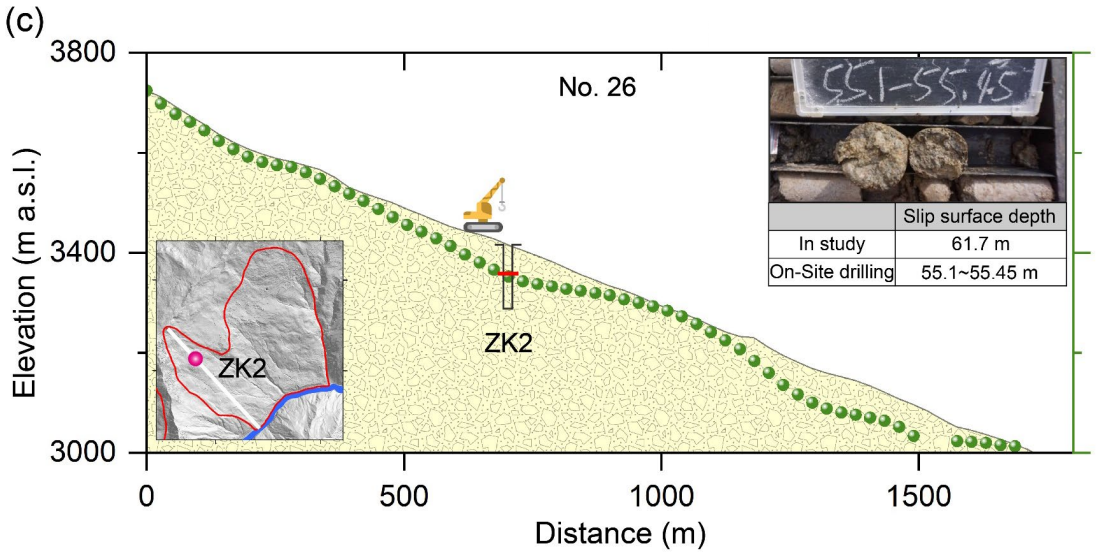
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Slip surface inversion of landslide



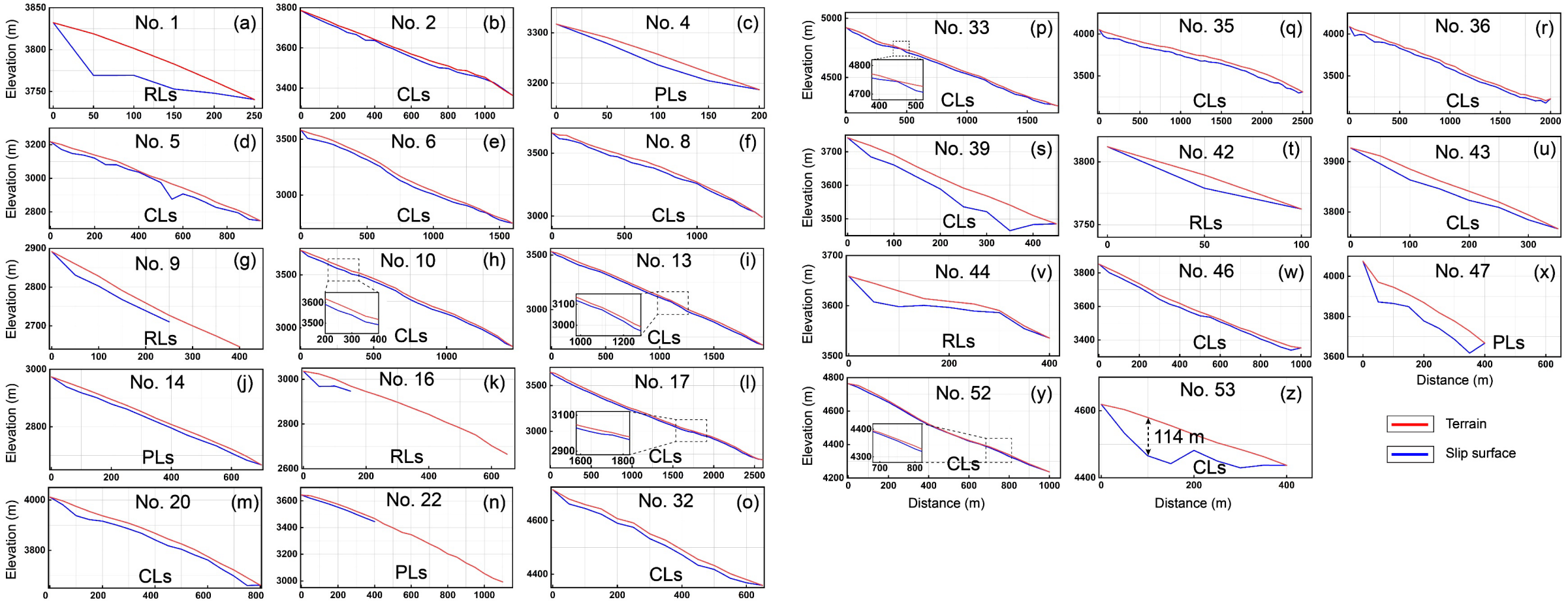


This study VS Previous research

Number	Landslide Name	Volume	
		In this study	Geological survey
No. 25	Sela	5.0×10^7 m³	6.52×10^7 m³ (Zhu et al., 2021) 1.8×10^8 m³ (Yan et al., 2024)
No. 26	Shadong	1.22×10^8 m³	2.6×10^8~6.0×10^8 m³ (Li et al., 2021) 0.5×10^8 m³ (Yao et al., 2022)

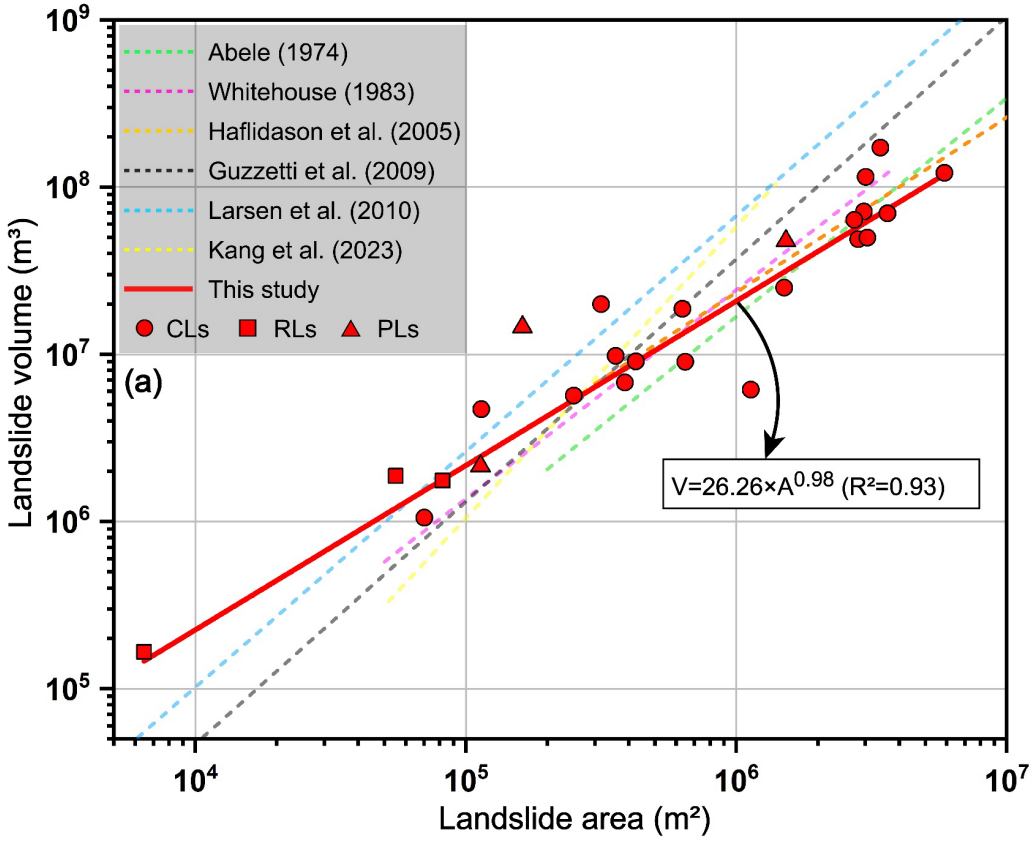
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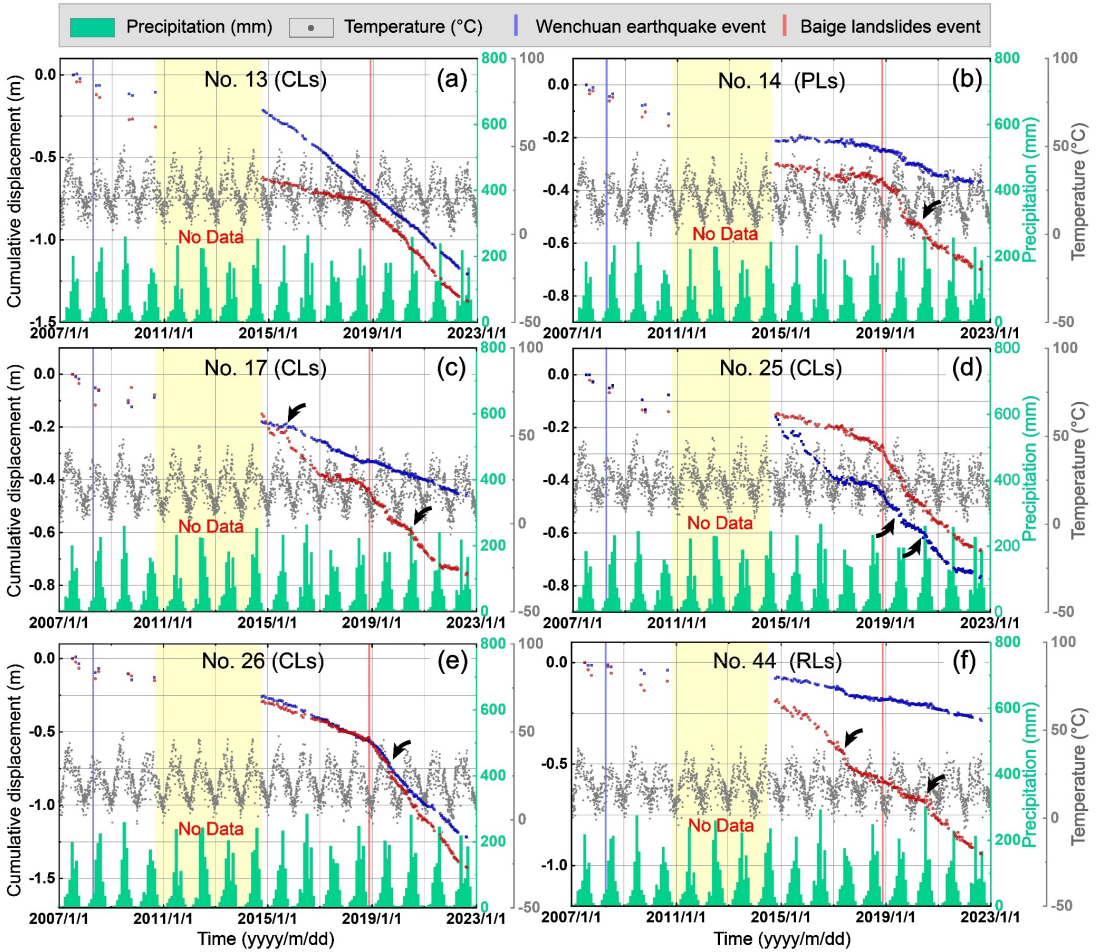
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Slip surface inversion of landslide





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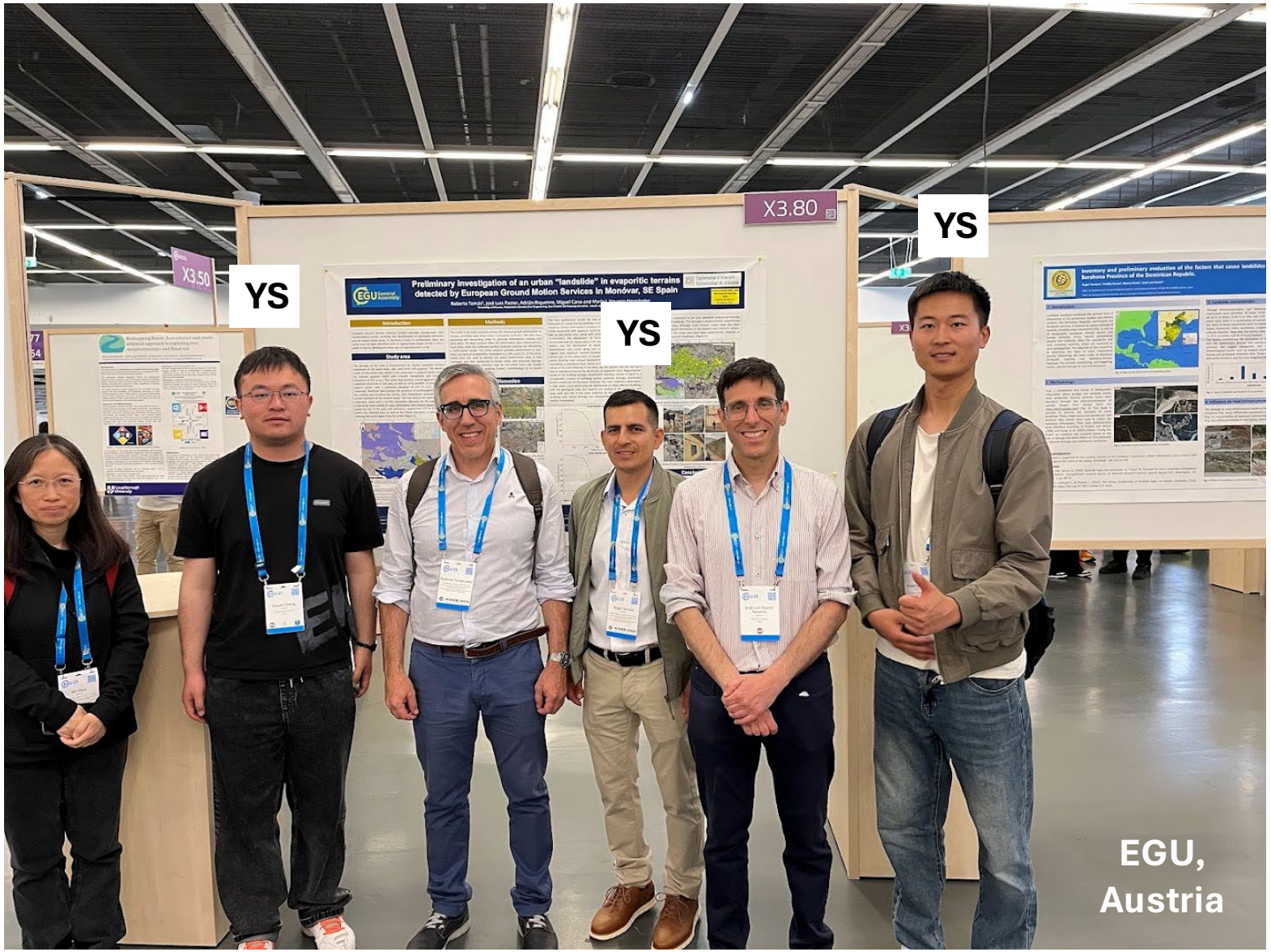
Level of training of YS

TRAINING OF YOUNG SCIENTISTS

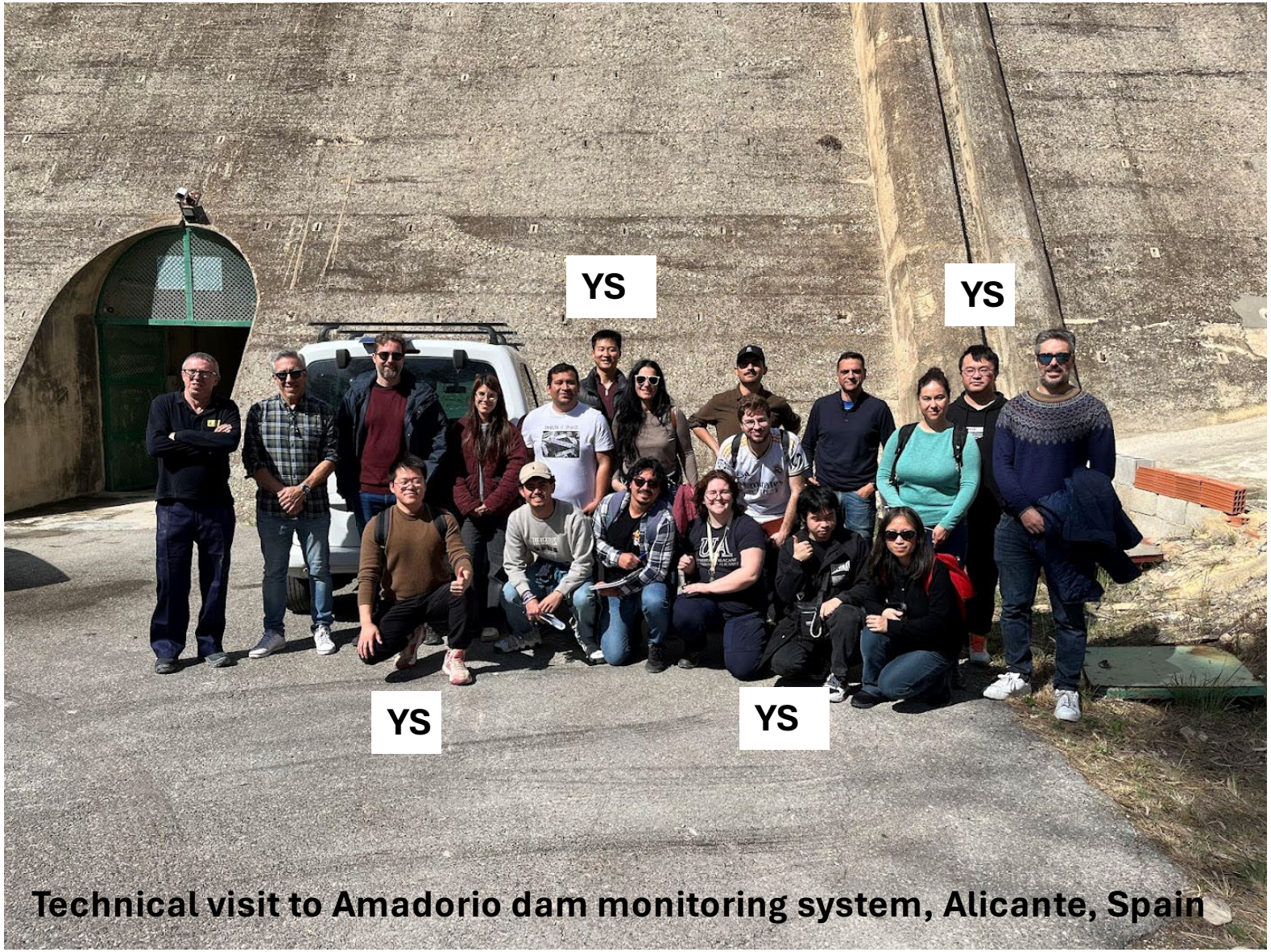
- Exchange in the framework of **Joint International PhD agreements** between Chang'an University and University of Alicante, and Capital normal University and University of Alicante.
- **International secondment** in an associated partner of the UPGRADE project (EU funded project)
- Development of **joint PhD thesis**
- Participation in **seminars** (on line and in person)
- Participation in **field trips, technical visits and field campaigns**
- Participation in **International conferences**
- Preparation of **a poster in YS session (Dragon 6 conference)**

2025 Dragon 6 Symposium

TRAINING OF YOUNG SCIENTISTS



TRAINING OF YOUNG SCIENTISTS



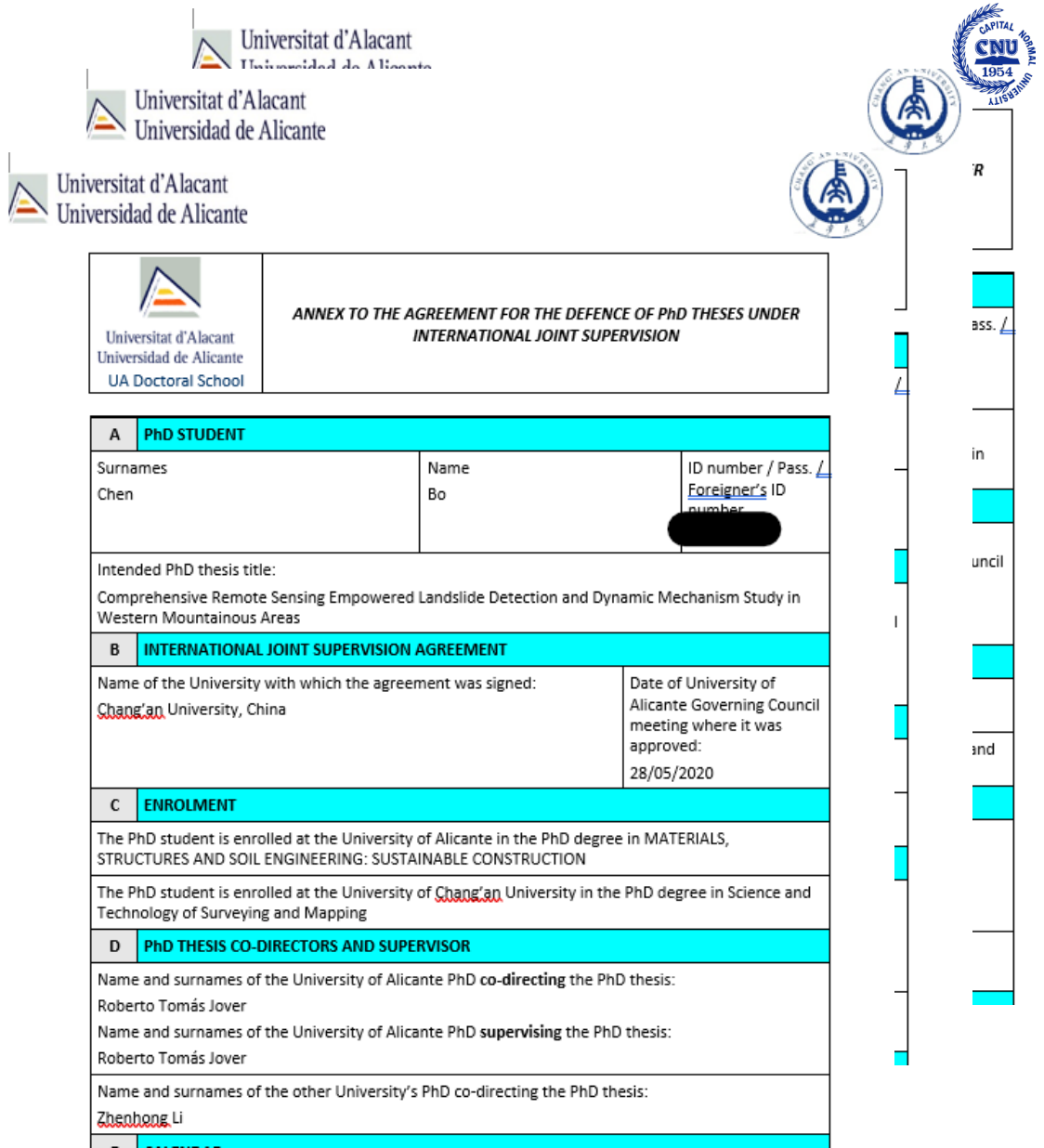
Technical visit to Amadorio dam monitoring system, Alicante, Spain

TRAINING OF YOUNG SCIENTISTS



Seminar about InSAR monitoring, University of Alicante

EXCHANGE IN THE FRAMEWORK OF AN JOINT INTERNATIONAL PHD AGREEMENT BETWEEN CHANG'AN UNIVERSITY AND UNIVERSITY OF ALICANTE



Universitat d'Alacant
Universidad de Alicante

Universitat d'Alacant
Universidad de Alicante

Universitat d'Alacant
Universidad de Alicante
UA Doctoral School

ANNEX TO THE AGREEMENT FOR THE DEFENCE OF PhD THESES UNDER INTERNATIONAL JOINT SUPERVISION

A	**PhD STUDENT**		
Surnames Chen		Name Bo	ID number / Pass. / Foreigner's ID [redacted]
Intended PhD thesis title: Comprehensive Remote Sensing Empowered Landslide Detection and Dynamic Mechanism Study in Western Mountainous Areas			
B	**INTERNATIONAL JOINT SUPERVISION AGREEMENT**		
Name of the University with which the agreement was signed: Chang'an University, China			Date of University of Alicante Governing Council meeting where it was approved: 28/05/2020
C	**ENROLMENT**		
The PhD student is enrolled at the University of Alicante in the PhD degree in MATERIALS, STRUCTURES AND SOIL ENGINEERING: SUSTAINABLE CONSTRUCTION			
The PhD student is enrolled at the University of Chang'an University in the PhD degree in Science and Technology of Surveying and Mapping			
D	**PhD THESIS CO-DIRECTORS AND SUPERVISOR**		
Name and surnames of the University of Alicante PhD **co-directing** the PhD thesis: Roberto Tomás Jover Name and surnames of the University of Alicante PhD **supervising** the PhD thesis: Roberto Tomás Jover			
Name and surnames of the other University's PhD co-directing the PhD thesis: Zhenhong Li			

INTERNATIONAL SECONDMENT IN AN ASSOCIATED PARTNER OF THE UPGRADE PROJECT (EU FUNDED PROJECT)



2025 Dragon 6 Symposium

POSTER PRESENTION IN DRAGON 6 SYMPOSIUM YS SESSION

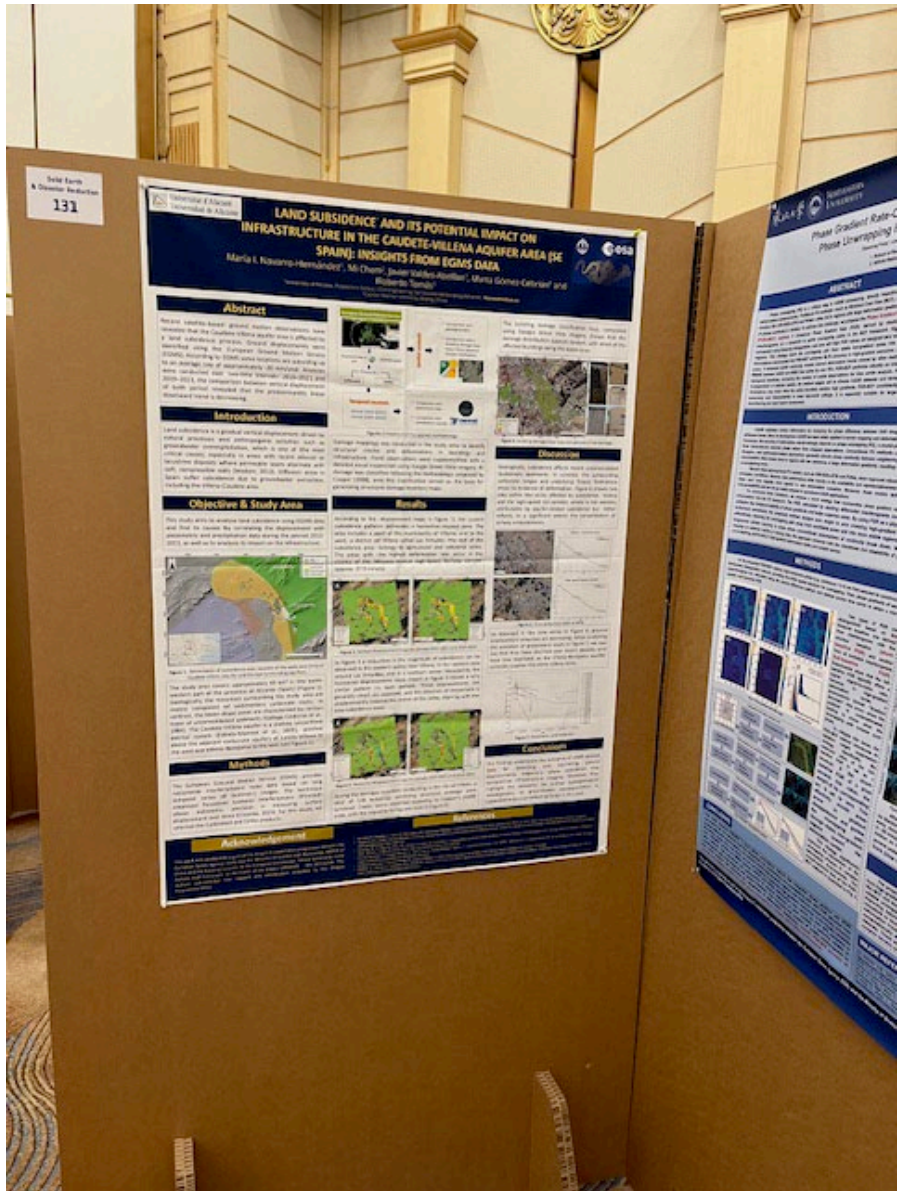
Land Subsidence and Its Potential Impact on Infrastructure in the Caudete-Villena Aquifer Area (SE Spain): Insights from EGMS Data

María I. Navarro-Hernández[1*], Mi Chen[1,2], Javier Valdes-Abellan[1], Marta Gómez-Cebrián[1] and Roberto Tomás[1].

[1]Department of Civil Engineering, Escuela Politécnica Superior, University of Alicante, P.O. Box 99, 03080 Alicante, Spain. mainnahe@ua.es, javier.valdes@ua.es, roberto.tomas@ua.es.

[2] College of Resource Environment and Tourism, Capital Normal University, Beijing, China.

The study area encompasses approximately 65 km² in the north-western sector of Alicante province, south-eastern Spain. Centred on the municipality of Villena and extending to its municipal boundary with Caudete, this region lies at an average elevation of 504 m a.s.l. Recent satellite-based ground motion observations have revealed that this area is affected by a progressive land subsidence process, the causes and consequences of which are the subject of the present study. Ground deformation was identified using the European Ground Motion Service (EGMS), a product of the Copernicus Land Monitoring Service that provides nationwide interferometric radar data based on long temporal series of Sentinel-1 images. The technique employed Persistent Scatterer Interferometry (PSInSAR) allows millimetric precision in measuring surface displacement over time. According to EGMS ascending and descending track data, the affected zone is subsiding at an average rate of approximately 9 mm/year. Analyses were conducted over two-time intervals: 2015–2021 and 2019–2023, both revealing a predominantly linear downward trend, suggesting continued subsidence beyond the last available date. From a geological perspective, the subsidence affects recent unconsolidated Quaternary sediments, composed primarily of conglomerates, sands, and clays. In contrast, the surrounding carbonate ranges (limestones and dolomites) and underlying Triassic gypsum and clay formations show no evidence of deformation. In some instances, slight uplift of Triassic units is observed, potentially indicating the rise



Overview of European YSs research

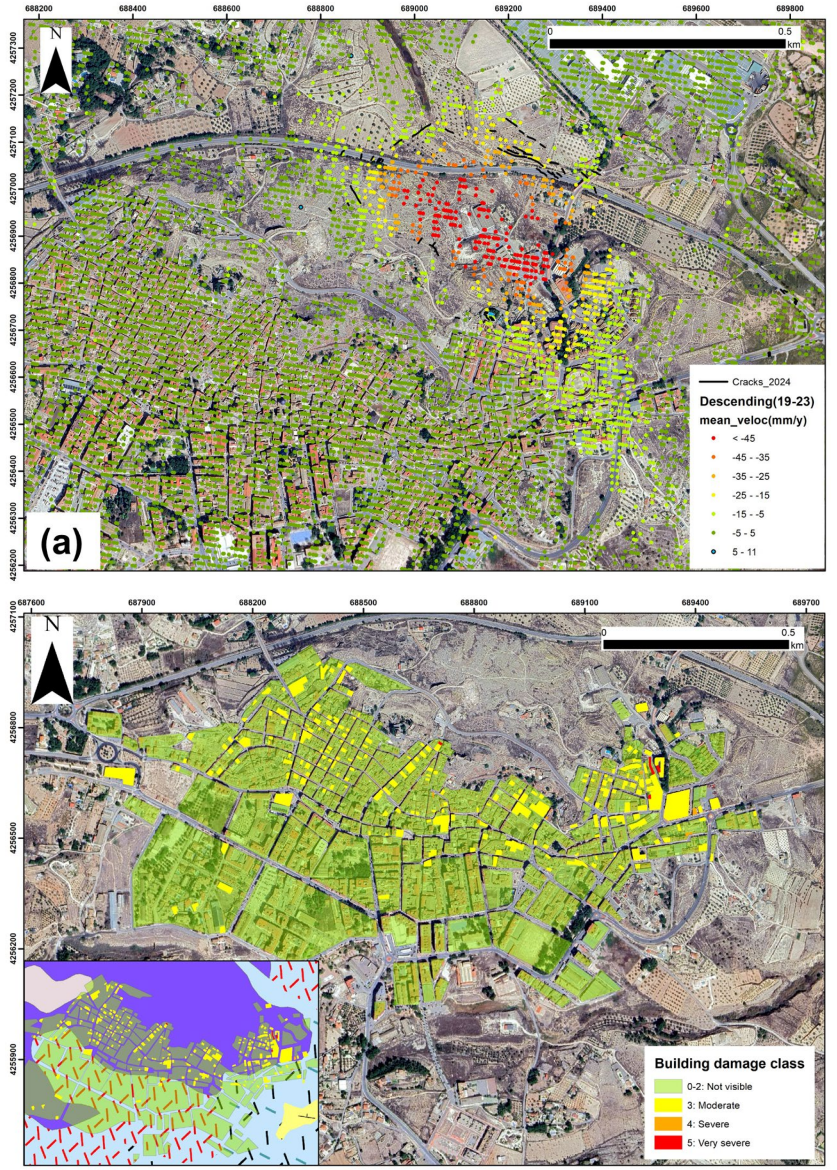
María Inés Navarro Hernández

Universidad de Alicante, Spain
PhD Universidad de Alicante (2024)



- Expertise: InSAR, subsidence, flooding modelling, damage assessment
- Hired by DRAGON 6 project
- Now working on subsidence and landsliding areas affecting buildings using InSAR and complementary techniques.





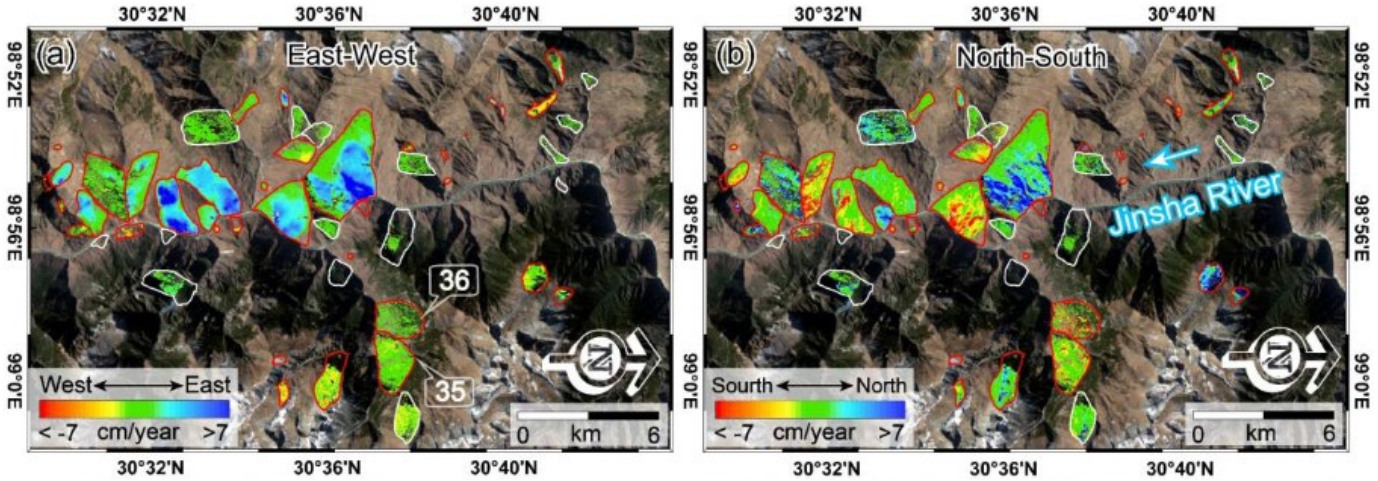
Overview of Chinese YSs research

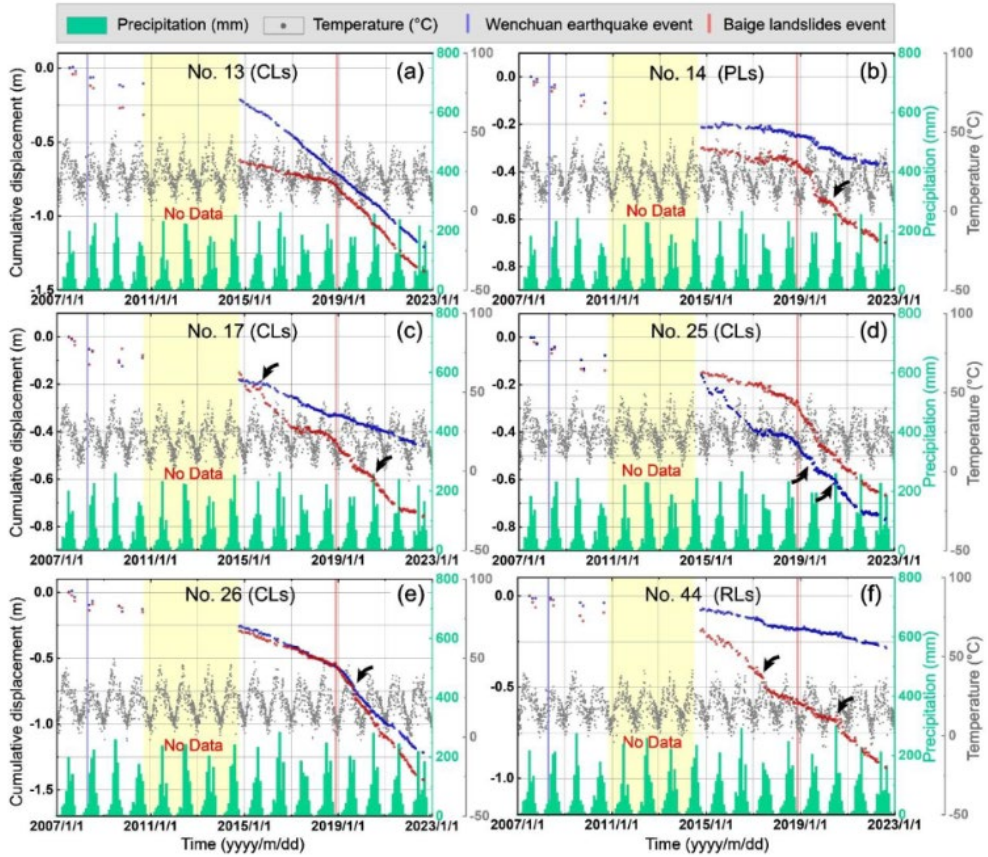
Chen Bo

University of Chang'an, China
Joint international PhD program
Universidad de Alicante-University of Chang'an



- Expertise: InSAR, landslides
- CSC scholarship
- Now working on identification, mapping, monitoring and characterization of landslides using InSAR





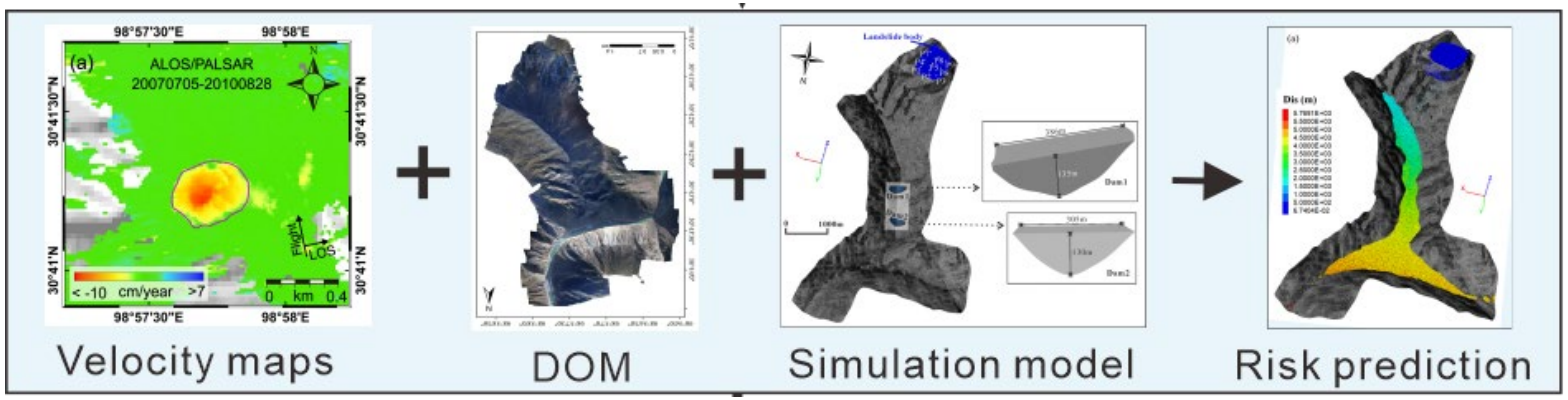
Overview of Chinese YSs research

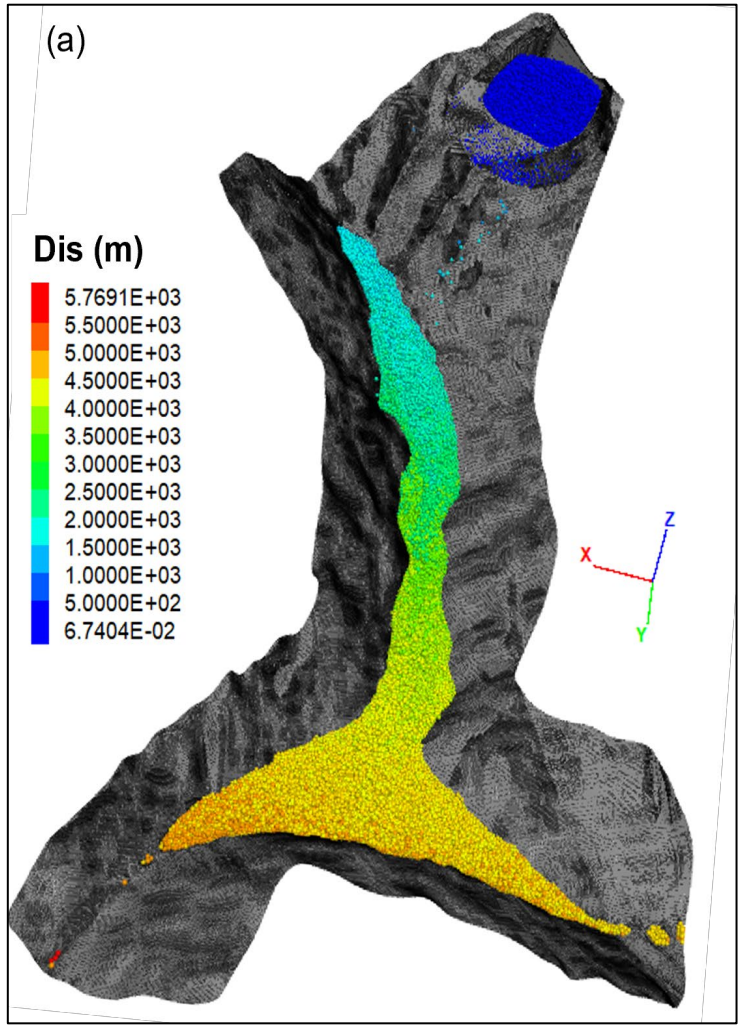
Yinpeng Liu

University of Chang'an, China
Joint international PhD program
Universidad de Alicante-University of Chang'an



- Expertise: InSAR, landslides, modelling
- CSC scholarship
- Now working on monitoring, characterization and modelling of landslides using InSAR





PAST, ONGOING AND FUTURE TRAINING OF YS

Name	Institution	Training period	Contribution including period of research
Jiantao Du	Chang'an University (China) and University of Alicante (Spain)	He has spent 1 year in the UA (October 2023-October 2024)	This research has been performed in the framework of an international PhD cotutelle agreement. He successfully finished a China-EU doctoral program.
Hengyi Chen	Chang'an University (China) and University of Alicante (Spain)	He has spent 2 years in the UA (October 2022-September 2024)	This research has been performed in the framework of an international PhD cotutelle agreement. He successfully finished a China-EU doctoral program.
Guanchen Zhuo	Chengdu University of Technology	He has spent 1 year in the UA (October 2023-October 2024)	He has developed part of his research during a 1-year research stay in Alicante, Spain.

PAST, ONGOING AND FUTURE TRAINING OF YS

Name	Institution	Training period	Contribution including period of research
Jiayin Luo	University of Alicante, Spain	01/12/2021-present	She has fully developed her PhD thesis in the University of Alicante, Spain.
Chen Bo	Chang'an University (China) and University of Alicante (Spain)	September 2024-present	This research is being performed in the framework of an international PhD cotutelle agreement.
Yinpeng Liu	Chang'an University (China) and University of Alicante (Spain)	September 2024-present	This research is being performed in the framework of an international PhD cotutelle agreement.

PAST, ONGOING AND FUTURE TRAINING OF YS

Name	Institution	Training period	Contribution including period of research
Mi Chen	Capital Normal University	August 2024-present	This research is being performed in the framework of an international agreement between UA and CNU.
María Inés Navarro	Universidad de Alicante, Spain	July 2025- present Looking for a potential exchange with China partners	This researcher is hired in the framework of DRAGON-6 project.

2025 Dragon 6 Symposium

Publication Title	Journal	DOI
A machine learning approach for mapping susceptibility to land subsidence caused by ground water extraction	Applied Computing and Geosciences	https://doi.org/10.1016/j.acags.2024.100207
Slip surface, volume and evolution of active landslide groups in Gongjue County, eastern Tibetan Plateau from 15-year InSAR observations.	Remote Sensing of Environment	https://doi.org/10.1016/j.rse.2025.114763
Land subsidence-induced damage assessment along Beijing-Tianjin high speed railway from space using high resolution TerraSAR-X data.	Structural Health Monitoring	https://doi.org/10.1177/14759217251334328
Millimeter ground deformation retrieving from high-resolution PAZ SAR images with a combined correction of unwrapping and long-wavelength errors: A case study in Alcoy, Spain.	Remote Sensing of Environment	https://doi.org/10.1016/j.rse.2025.114876
Facing challenges of urban landslide mapping by complementing geomorphological surveys with satellite interferometry in Alcoy (SE Spain).	Landslides	Accepted. Not available yet
An Improved Spatial Clustering Method for Automatic Detection of Active Geohazards in Lanzhou	IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing	Accepted. Not available yet



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THANKS FOR YOUR ATTENTION

感谢您的关注。





