EGU General Assembly 2025 27 April - 2 May 2025, Vienna, Austria

Cataloging and mapping of landslides rapidly by using an Earth observation-based innovative platform – the Landslide Hunter

Dr. Serkan Girgin^{1,2*} Dr. Ali Özbakır¹ Dr. Hakan Tanyaş¹

<u>s.girgin@utwente.nl</u> <u>https://linkedin.com/in/serkan-girgin/</u>

Faculty of Geo-information Science and Earth Observation (ITC)¹ Centre of Expertise in Big Geodata Science (CRIB)²



https://doi.org/10.5194/egusphere-egu25-16112



Landslide catalogs provide essential data on past events, supporting effective hazard management as well as the training and validation of predictive landslide models.



While landslide catalogs are mainly created by **manual mapping**, methods using **Earth observation** data are emerging that help **automate and improve** their production.

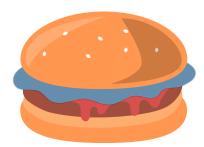


However, these methods are mostly **tested in specific case studies** and are **not yet routinely used** for regular landslide detection.

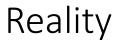




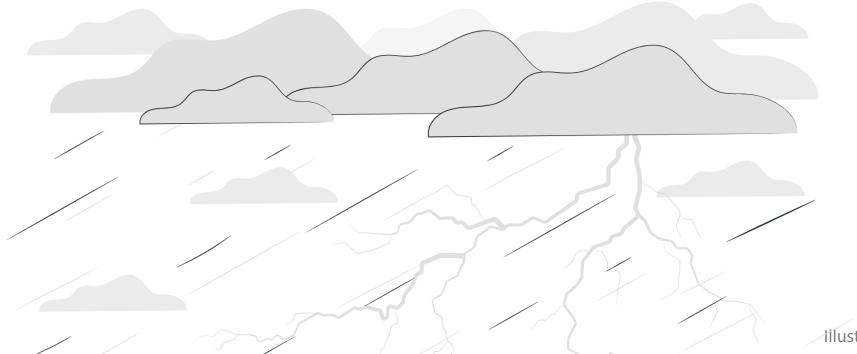
VS



Expectation



Moreover, **optical** methods rely on **obstruction-free* imagery**, often leading to **delays in timely landslide detection**.



The Landslide Hunter platform aims to close the gap by speeding up detection minimizing obstruction-related delays and offering an environment for testing and benchmarking EO-based methods.

The project "Landslide Hunter: the first fully automated AI-based platform to map and monitor landslides remotely" with file number OCENW.XS23.3.145 of the research programme NWO Open Competition Domain Science XS is financed by the **Dutch Research Council (NWO)**



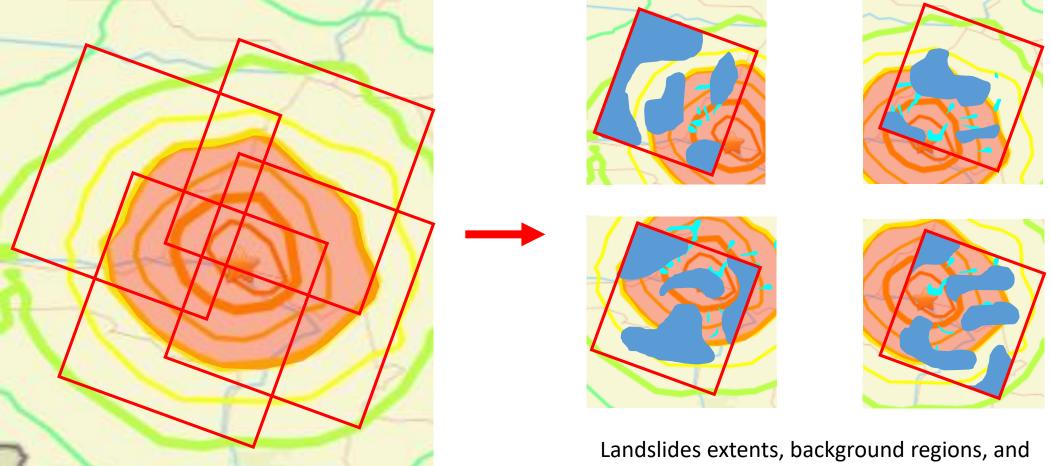


The platform tracks online sources for events that may trigger landslides



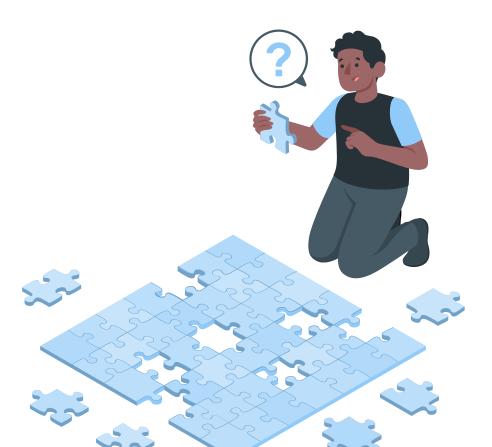
Areas where landslides are likely to have occurred are identified.

Pre- and post-event EO images are **collected and analyzed** to detect **visible landslide extents** using various landslide detection methods



Landslides extents, background regions, and occlusions are identified for each image.

Determining the **actual landslide extents** by combining partial (and unreliable) information is **challenging**.



Analysis results are categorized into cell-based **semantic classes** and associated **certainty indicators**

Classes	Unknown		wn	Anomaly			Not Landslide						Landslide			
Classes	U			A		B!				В	B?		L?		L	L!
Model Inference	Landslide							Not Landslide								
Model Probability	High				Low				Low				High			
Occlusion	No		Yes		No		Yes		No		В					
Occlusion Probability	High	Low	Low	High	High	Low	Low	High	High			blocke	ed clear	lov	v high	
Classification	L!	L	L	А	L	L?	L?	А	В							

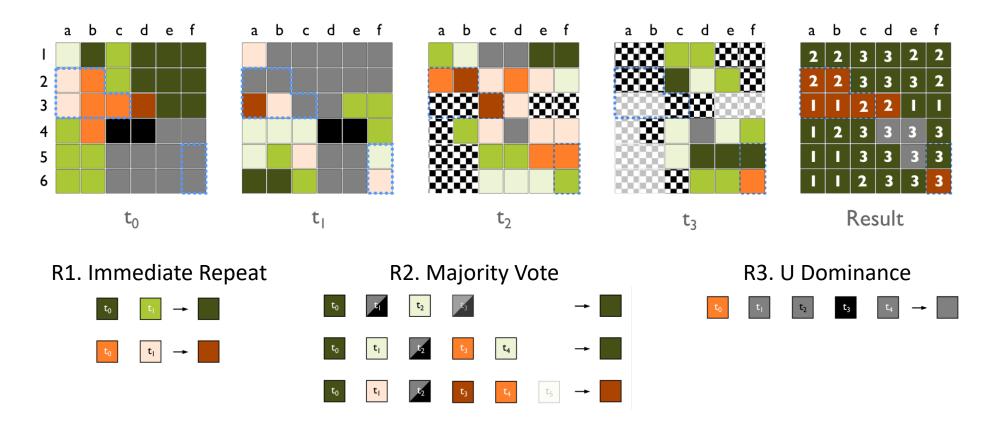
For more information

Mapping of landslides by using partially cloudy optical EO imagery: a case study of 2023 Türkiye Earthquakes A. D. Ozbakir, S. Girgin, H. Tanyas

https://doi.org/10.5194/egusphere-egu25-17549



A rule-based process assigns a single representative class to the time series of each data cell



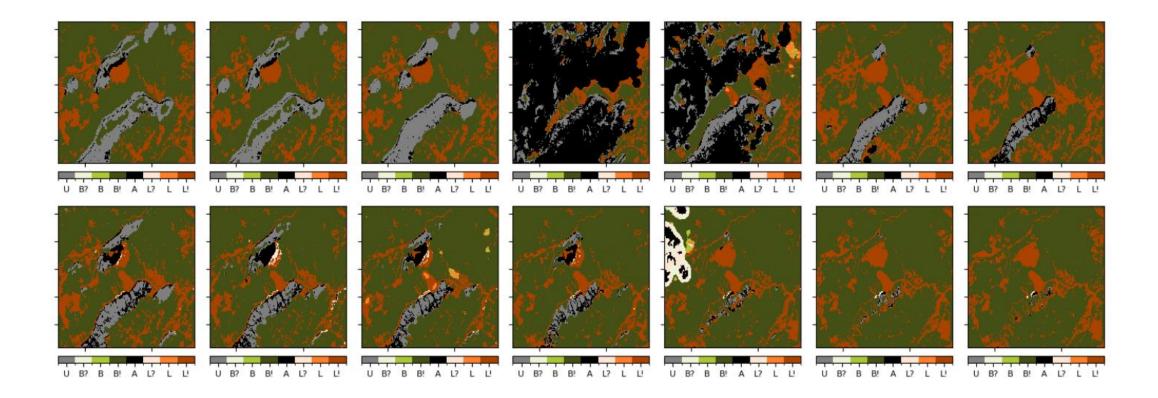
For more information

Mapping of landslides by using partially cloudy optical EO imagery: a case study of 2023 Türkiye Earthquakes A. D. Ozbakir, S. Girgin, H. Tanyas

https://doi.org/10.5194/egusphere-egu25-17549



Partial extents are marked for further tracking until complete landslide coverage is obtained through successive analyses



This enables the timely first detection and effective monitoring of landslides, even under obstructed conditions (e.g., cloudy).

The results are made available in an **open-access landslide catalog** through a **user-friendly web portal**

Model			Data Item			Model Run					
Name	Rapic	Triggering Event	+	1	Monitoring Campaign	+	1.0	Event View			
Description	redic volur grop globi techr statis and r by re	Antiper Barrier Marrier		Ż	Annual Basic Connell		X				
Data Sources	Senti	otapar			danba	A PART OF THE REAL		Y VINE	A Contraction		
References	Tanya	Visakhagatnam	Data Source	Sentii	Visakhapatnam	Date Created	22/04	Marthan V	A Carton and an		
	Land	8971	Date	20/04	8.927	Triggering Event	2025	Date Identified	28/03/2025 06:20		
Status	Enab	Туре	Earthqu		Triggering Event 20	Model		Country	China		
		Name	2025 Sa	S2B_:	Model	bid	Rapic	Triggering Event	2025 Southern Tibetan Plateau Earthquake, M 7.1, 07/01/2	23	
Usage Statistics		Date	STAC Item URL 28/03/2	https	Date Created 22	Data Item 04	S2B_:	Model	U-Net + ResNet34		
Number of Campaigns	2,345		Metadata Myanma	(Last Updated 22	Date Started	22/04	Enclosing Area Known Area	24.5 km ² 24.0 km ²		
Number of Runs	23,45					Date Finished	22/04	Unknown Area	0.5 km²		
Total Processing Time	1,234		8,623 kn	-	Study Area 8,6	Duration	278 s		0.5 km²		
		Source	USGS		Pending Area 0 k	m ² Status	Com	Patch Area	2.0 km²		
Processing Time Per Run	3.15	Date Created	22/04/2		Processed Area 10,	83-		Patches	12		
Total Area Processed	56,78	Last Updated	22/04/2		Processed Items 15	Assets		Last Updated	22/04/2025 09:15 (Version 3) Complete		
Processing Time Per Km ²	1.30	Status	Active		Processing Time 0.2	h		Status	Complete		
Number of Items Processed	3,456			1	Identified Events 59	# Description		Assets			
Number of Assets Processed	6,785	Related Monitoring Campaigns			Status Co	1. Event Map		# Description		Role Size	
Data Processed	6.78				54465	 Event Probability Map 		1. Event Map		Deta 128 MB	
		# Model		Dowr	Related Model Runs	3. Metadata		2. Event Probability Map		Dists 128 MB	
		1. U-Net + ResNet34	Area	8,623	Related Model Runs	4. Thumbnail		3. Metadata		Metrodata 32 KB	
			Number of Assets	8	# Date Created Data Item			4. Thumbnail		Thurstevel 78 KB	
		U-Net + ResNet34	Data Size	2.4 G	1. 22/04/2025 15:15 S2B_38TPQ_20250420_0	L2A		Timeline			
		3. NDVI + Slope			2. 21/04/2025 15:15 S2B_38TPQ_20250421_0_	LZA		2			
		4. Rapid Prediction of Earthquake-Induced La		22/04	3. 20/04/2025 15:15 S2B_38TPQ_20250422_0_			60			
			Requesting Campaign	2025				(july) 15			
			Number of Requests	4				10 10			
			Last Request Date	23/04/	/2025 07:15			5			
			Status	Cache	d			28 Mar 06:00 12:00 11	800 29 Mar 0600 12:00 18:00 30 Mar 06 — Enclosing Area — Known Area — Unknown		
								Date 28/03/25	03/03/25 🕢	01/04/25 Commt	
								Enclosing Area 22.2 km ²	22.2 km²	24.5 km ²	
								Known Area 11.7 km ²	15.8 km²	24.0 km²	
		ш			—			Unknown Area 10.5 km²	6.4 km²	0,5 km ²	
	Λ	- 1						Uncertain Area 8.2 km²	4.2 km²	1.0 km²	
(- <-)		JUE				- 1 ÷ 11		Patch Area 1.5 km² Patches 8	1.8 km² 10	2.0 km² 12	
	ggering Events	Models N	Model Runs Data So	urces	Data Items Monit Camp		og	Patches 0			

The core features and capabilities of the platform focus on **robust operation**, **sustainability**, **interoperability**, and **open access**

- Open-source software adhering to research software development best practices. Python
- Plug-and-play functionality for integrating models through abstract classes and utility methods for spatiotemporal processing and machine learning. Powered by Model Sherpa
- Automated monitoring of data sources for new EO data and management of model runs.
- **Smart caching** for storage of EO data items and assets.
- Automated aggregation of model outputs to generate versioned landslide clusters.
- Identification of individual landslide patches related to the same landslide cluster.
- Open-access data sharing via **STAC** and OpenAPI-compliant **REST API**.
- Mobile friendly user interface with notification features facilitating relational browsing.
- Scalable backend architecture with **parallel processing** capabilities.

Besides enabling rapid first identification of landslides triggered by hazard events, the platform can also **serve as a testbed** for landslide mapping

- Evaluation of the **reusability** of existing landslide detection methods. Plug-and-play functionality for integrating models through abstract classes and utility methods.
- Further testing and validation of existing methods.

Global analysis capability backed by robust data access, processing, and storage infrastructure.

- Development, validation, and testing of **new methods**. Focus on the methodology without spending time for data access and processing.
- **Benchmarking** of methods for accuracy, robustness, and performance. Easily run multiple monitoring campaigns using different methods and parameters.
- Identification and mapping of **other phenomena**.

The platform or spinoffs using the same architecture can support mapping of other events, such as earthquake damage, flooding, etc.



The platform is scheduled for beta testing in June 2025.

Want early access? Reach out to join our early adopter group!





Contact us if you want to learn more or collaborate!



Dr. Serkan Girgin

Head of Department Center of Expertise in Big Geodata Science Associate Professor Department of Geoinformation Processing

<u>s.girgin@utwente.nl</u> <u>https://linkedin.com/in/serkan-girgin/</u>

https://itc.nl/big-geodata/



Dr. Ali Değer Özbakır Researcher Center of Expertise in Big Geodata Science

a.d.ozbakir@utwente.nl https://linkedin.com/in/aozbakir/



Dr. Hakan Tanyaş Assistant Professor Department of Applied Earth Sciences

<u>h.tanyas@utwente.nl</u> https://linkedin.com/in/hakan-tanyaş-663aab84/



Faculty of Geo-information Science and Earth Observation (ITC)

