

LandAware workshop 2025

Science and Practice in Landslide Early Warning

17–19 September 2025

Geological Survey of Slovenia (GeoZS) | Dimičeva uica 14, Ljubljana, Slovenia

Three years after the first in-person LandAware workshop, held in Zürich/Birmensdorf, Switzerland, on 3-5 October 2022, the Geological Survey of Slovenia hosted the second in-person workshop of LandAware, the international network on Landslide Early Warning Systems. The workshop took place in Ljubljana from 17 to 19 September 2025. The main objective of the workshop was to highlight and share recent developments and discuss ongoing challenges in the field of landslide early warning. Moreover, it was an opportunity to evaluate and further extend and strengthen the LandAware network.

The first day of the workshop was dedicated to presentations from Slovenian administrations and colleagues, and other presentations from members of the LandAware network.

The second day was dedicated to a field trip to Jesenice municipality, in NW Slovenia, to visit the Potoška Planina area with two active landslides (Urbas and Čikla) and its operational early warning system.

The third day was dedicated to discussing the past and future activities within the LandAware network.

First day - 17 September 2025

The first day of the workshop was dedicated to some presentations from Slovenian administrations and colleagues, and some other presentations from members of the LandAware network.



The president of LandAware, Michele Calvello (University of Salerno, Italy), summarised the activities of the LandAware network in the last few years and introduced the workshop, together with Mateja Jemec-Auflič (Geological Survey of Slovenia).

The director of the Geological Survey of Slovenia, Miloš Bavec, welcomed all attendees and presented the institute's role, tasks, and activities, both during normal times and emergencies. His talk provided an overview of the extreme rainfall event that occurred in Slovenia in August 2023, which led to widespread flooding and triggered an estimated around 10,000 landslides. He also discussed the role of the Geological Survey of

Slovenia during the immediate intervention phase following the event, focusing on evaluating the number of landslides that had occurred and assisting local communities in managing the aftermath.

Nejc Bezak, from the University of Ljubljana, Slovenia, presented his studies on torrential hazards in the Alpine region of Slovenia, with a particular focus on the case study of Krvavec.

The presentations from Slovenian colleagues were closed by the talk from Neja Pavlica, from the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief. She described the structure of the Slovenian civil protection and reported the Slovenian experience on crisis communication during natural disasters.

Manfred Stähli (WSL, Switzerland) and Andrea Manconi (WSL/SLF, Switzerland) prepared a joint presentation on the Blatten event: a glacier collapse in the Canton of Valais, Switzerland, that caused a landslide which buried and destroyed large parts of the village on 28 May 2025. The failure was preceded by progressive precursors, which were monitored, allowing the evacuation of the village since 19 May. Stähli and Manconi described the process that led from data collection to the evacuation, highlighting the main issues faced.

Sally Potter (Canary Innovation Ltd, New Zealand) presented the methods used in New Zealand to evaluate trial landslide forecasts that were issued for ex-tropical Cyclone Gabrielle in 2023.

This was followed by Sara Harrison (New Zealand Earth Sciences Institute), who spoke about gaps and challenges for impact-based forecasts and warnings, applied to the same case.

Marc Berenguer (Politechnic University of Catalonia, Spain) presented the tools developed within the GOBEYOND project to transform forecasts and early hazard detections into actionable, impact-focused warnings for landslides and other hazards.

Andrea Carri (ASE, Italy) and Alessandro Valletta (University of Parma, Italy) spoke about the challenges they faced in landslide monitoring at the slope scale for early warning purposes, and the solutions they proposed from a company perspective.

Martin Krkač (University of Zagreb, Croatia) presented the work done by his research group in the monitoring of a large landslide located near Zagreb, whose magnitude and several reactivations made it necessary to design early warning measures.

Jason Ngui (British Geological Survey, UK) presented a new geophysical method that can provide an early warning in landslide-prone areas by looking for signs of underlying slope failures in the subsurface.

In order to share the challenges faced when working with LEWS, all the participants were asked to prepare a short presentation describing one or two experiences in which they faced (technical, technological, instrumental) challenges in developing LEWS-related activities.

Twelve very engaging presentations were received:

- Lisa Luna asked "What controls spatial variability in rainfall thresholds in post-glacial landscapes?" and "How predicting tools can be defined in a data-scarce region?"
- José Becerra Rivera spoke about the challenges in preparing susceptibility maps, within the SPIRAL project.
- Nicola Nocentini presented the Double-Threshold Validation Tool, useful when one has to pass from landslide hazard maps to operational early warning systems.
- Nikolaos Tavoularis described the challenges in the implementation of a LEWS in a geologically unstable provincial road in the Region of Attica (Greece).

- Danny Love Wamba Djukem spoke about the challenges in acquiring post-earthquake data for Landslide Early Warning and Validation.
- Johannes Leinauer presented some challenges faced in continuous real-time monitoring under extreme snow and lightning conditions
- Tobias Halter related how challenging and time-demanding the homogenization of in-situ soil moisture data from different measurement networks is.
- Gaetano Pecoraro talked about the practical challenges in deploying an IoT monitoring network for a municipal LEWS.
- Sandra Melzner discussed regulatory and practical issues in rockfall early warning in Austria.
- Corey Froese presented his work on the development of Regional Activity Baselines to Support Warning and Awareness
- Anika Braun asked her and us if and how early warning for landslide-induced tsunamis is possible.
- Johannes Reinthaler spoke about challenges when passing from warning to action.

The session concluded with a lively and constructive discussion, which provided valuable insights and represented a highly productive moment of the workshop.



Second day - 18 September 2025

The second day was dedicated to a field trip to Jesenice municipality, in NW Slovenia, to visit the Potoška Planina area and landslide Urbas and its operational early warning system. The field excursion was hosted by the Municipality of Jesenice and led by experts from the Geological Survey of Slovenia (GeoZS), who guided the participants through the landslide-affected area and provided detailed explanations of the landslide characteristics, dynamics, and current activity. The visit was organised in collaboration with local civil protection representatives Živa Ozmec and Igor Arh, who accompanied the group to the landslide site and to the Communication Centre located at the Fire Brigades Station in the Municipality of Jesenice. During the visit, they presented the operational framework of the local monitoring and warning system, illustrating the procedures adopted for real-time surveillance, data interpretation, and emergency response.

GeoZS experts described the geological setting of the landslide, its evolution, triggering factors, and observed deformation mechanisms, highlighting the ongoing monitoring activities and the role of scientific support in risk management. The excursion provided participants with a comprehensive overview of the technical, organisational, and institutional aspects involved in landslide early warning and emergency preparedness at the municipal level.





Third day - 19 September 2025

The third day was dedicated to discussing the past and future of the LandAware network. New task forces and activities were proposed and discussed.

Graziella Devoli was elected as the new President of LandAware. Manfred Stähli and Thom Bogaard left the Executive Committee, while Lisa Luna, Andrea Carri, and Corey Froese joined the EC.



Workshop Agenda

Wednesday, 17 September 2025 (9:00 – 17:30)

9:00 – 9:20	Introduction: Michele Calvello (<i>University of Salerno, Italy</i>), Mateja Jemec Auflič (<i>Geological Survey of Slovenia</i>)	Introduction
9:20 – 9:40	Miloš Bavec (<i>Geological Survey of Slovenia</i>)	Navigating extreme landslide events and early warning: insights from Slovenia's August 2023 disaster and the role of the national geological survey
9:40 – 10:00	Nejc Bezak (<i>University of Ljubljana, Slovenia</i>)	Mitigating the effects of torrential hazards in the Alpine region of Slovenia: the case study of Krvavec
10:00 – 10:20	Neja Pavlica (<i>Administration for Civil Protection and Disaster Relief, Slovenia</i>)	Challenges of Crisis Communication During Natural Disasters
10:20 – 10:40	Manfred Stähli (<i>WSL, Switzerland</i>) & Andrea Manconi (<i>WSL/SLF, Switzerland</i>)	From Data collection to evacuation: Insights from Blatten event
10:40 – 11:00	Sally Potter (<i>Canary Innovation Ltd, New Zealand</i>)	Evaluation of landslide forecasts with users
11:00 – 11:20	Coffee break	
11:20 – 11:40	Sara Harrison (<i>New Zealand Earth Sciences Institute</i>)	Challenges relating to impact-based warnings, applied to landslides.
11:40 – 12:00	Andrea Carri (<i>ASE, Italy</i>) & Alessandro Valletta (<i>University of Parma, Italy</i>)	Challenges and solutions in landslide monitoring at slope scale for early warning purposes
12:00 – 12:20	Jason Ngui (<i>British Geological Survey, UK</i>)	Sensing Instability: Harnessing Subsurface Signals for Coal Tip Safety in Landslide-Prone Areas
12:20 – 12:40	Sanja Bernat Gazibara & Martin Krkač (<i>University of Zagreb, Croatia</i>)	Kostanjek landslide monitoring and early warning system (Zagreb, Croatia)
12:40 – 13:00	Discussion	

14:30 – 14:50	Marc Berenguer (<i>Politechnic University of Catalonia, Spain</i>)	Toward multi-risk Early Warning Systems - the GOBEYOND tools for landslides
15:00 – 16:00	2 minutes talk	Technical challenges in your LEWS experience

Lisa Luna	What controls spatial variability in rainfall thresholds in post-glacial landscapes? Examples from Southeast Alaska, USA
José Becerra	Slope units vs Pixels. The susceptibility map of the SPIRAL project.
Nicola Nocentini	Double-Threshold Validation Tool (DTVT): from landslide hazard maps to operational early warning systems
Nikolaos Tavoularis	Towards the implementation of LEWS in a geologically unstable provincial road P. Epidaurus-Galata in the Region of Attica (Greece)
Danny Love Wamba Djukem	Challenges in Acquiring Post-Earthquake Data for Landslide Early Warning and Validation
Johannes Leinauer	Continuous real-time monitoring under extreme snow and lightning conditions
Tobias Halter	Homogenization of in-situ soil moisture data from different measurement networks
Gaetano Pecoraro	Deploying an IoT monitoring network for a municipal LEWS: practical challenges
Sandra Melzner	Rockfall Early Warning
Corey Froese	Building Regional Activity Baselines to Support Warning and Awareness
Anika Braun	Early warning for landslide-induced tsunamis - is it possible?
Johannes Reinthaler	From Warning to Action

16:00 – 17:30	Discussion: What we wish to learn from technical challenges
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Thursday, 18 September 2025 (8:00 – 20:00)

Field trip to Potoška Planina landslide and its operational early warning system

Potoška Planina landslide is in the NW part of Slovenia. It lies at the tectonic contact between Upper Carboniferous and Permian clastic rocks, as well as Upper Triassic to Lower Jurassic carbonate rocks. The sliding mass consists of tectonically deformed and weathered clastic rocks, covered by talus material. The Bela torrent contributes to erosion and downstream mobilization of the sliding mass.

Surface Movement Monitoring: We observe surface movement patterns using GNSS, crackmeters and piezometers. This technology provides high-resolution measurements for analysing surface displacements which are integrated into the local early warning system.

8:00	Departure from GeoZS, Ljubljana
8:00 – 9:00	Transfer to Jesenice municipality
9:00 – 12:00	Potoška Planina study tour
12:30 – 14:00	Lunch
14:00 – 15:00	Lectures
15:00 – 16:00	Visit to the Communication Center
18:00	Dinner nearby Bled
20:00	Arrival to Ljubljana

Friday, 19 September 2025 (9:00 – 13:00)

9:00 – 9:20	Michele Calvello & Jo Robbins	Overview on past network activities
9:20 – 10:00	WG leaders	WG activities
10:00 – 11:00	All	Discussion from the questionnaire on the past and future of LandAware
11:00 – 11:20	Coffee break	
11:20 – 12:30	All	Discussion on the future of LandAware and General Assembly
12:30 – 13:00	Mateja Jemec Auflič, Michele Calvello, New LandAware president	Closing remarks

Scientific Committee Mateja Jemec Auflič (Mateja.Jemec-Auflic@geo-zs.si), Stefano Luigi Gariano (stefanoluigi.gariano@cnr.it), Thom Bogaard (t.a.bogaard@tudelft.nl)

Organizing Committee LandAware Executive Committee

Local Organizer Geological Survey of Slovenia **Contact** Mateja Jemec Auflič (Mateja.Jemec-Auflic@geo-zs.si)