frontiers | Frontiers in Earth Science

TYPE Editorial
PUBLISHED 29 August 2022
DOI 10.3389/feart.2022.979106

OPEN ACCESS

EDITED AND REVIEWED BY
Chong Xu,
Ministry of Emergency Management, China

*CORRESPONDENCE
Yih-Chin Tai,
yctai@ncku.edu.tw

SPECIALTY SECTION
This article was submitted to Geohazards and Georisks, a section of the journal Frontiers in Earth Science

RECEIVED 27 June 2022
ACCEPTED 02 August 2022
PUBLISHED 29 August 2022

CITATION
Tai Y-C, Kuo C-Y, Hotta N, Derron M-H and Chen R-F (2022), Editorial: Integration of state-of-art techniques for landslide hazard assessment and for mitigation caused by subsequent multimodal disaster.
Front. Earth Sci. 10:979106.
doi: 10.3389/feart.2022.979106

Editorial: Integration of state-of-art techniques for landslide hazard assessment and for mitigation caused by subsequent multimodal disaster

Yih-Chin Tai[1]*, Chih-Yu Kuo[2], Norifmi Hotta[3], Marc-Henri Derron[4] and Rou-Fei Chen[5]

[1]Department of Hydraulic and Ocean Engineering, National Cheng Kung University, Tainan, Taiwan, [2]Center of Applied Sciences, Academia Sinica, Taipei, Taiwan, [3]Graduate School of Agricultural and Life Sciences, The University of Tokyo, Tokyo, Japan, [4]Institute of Earth Sciences, University of Lausanne, Lausanne, Switzerland, [5]Institute of Mineral Resources Engineering, National Taipei University of Technology, Taipei, Taiwan

KEYWORDS

surface monitoring, landslide-prone area, multimodal disaster, risk assessment, disaster mitigation

Editorial on the Research Topic
Integration of state-of-art techniques for landslide hazard assessment and the mitigation caused by the subsequent multimodal disaster

Landslides and their subsequent multimodal disasters are extremely destructive. A tragedic example is the large-scale Hsiaolin landslide, triggered by heavy rainfall during typhoon Morakot in 2009 in Taiwan. A huge volume of mass was released, forming a landslide dam in the downstream river course, while debris flows developing with the subsequent dam breach buried the Hsiaolin village. More than 470 people were killed in this multimodal disaster. The post-event investigation indicates that the size of the Hsiaolin landslide is of the conventional slow-moving landslide (land creeping). But, the high moving speed is as fast as a shallow landslide. The mysterious complexity and severe destruction received much engineering attention and scientific interest because such a multimodal disaster may take place worldwide. In Japan, the typhoon-triggered catastrophic landslides and debris flow have killed more than 73 people in 2011 (typhoon Talas); the tragedies of the mudslides at Oso (2014, United States) and Atami (2021, Japan), and the landslides triggered by the earthquake in Hokkaido (2018, Japan) were also mournful.

This Research Topic has attracted ten original research articles. All of them focus on hazard assessment and disaster mitigation, and they can be grouped into two themes: the first is related to the assessment of landslide activities, and the second is about the mitigation of sediment-related disasters. Because of the complex strata and the lack of detailed field data, exaggerated assumptions and approaches are applied to assessing the occurrence, the initiation as well as the

scale of a landslide. Kuo et al. focused on the temporal correlation between the motion of deep-seated creeping landslides and the water content in slopes, where the tank model was employed for calculating the water content. With the investigation of five deep-seated landslides, they illustrated that the occurrences of landslides could be estimated by their correlations with the phenomenological water storage index (WSI) of a given catchment, for which some WSI threshold was suggested.

To investigate the correlation between the landslide activity and the dynamic processes of the water saturation in the bedrock or colluvium, Tsai et al. employed the innovative technique of Electrical Resistivity Tomography (ERT) for the time-lapse monitoring. Although no substantial landslide was sensed in the ground, suspected small slide/deformation might have caused detectable variation in the electrical resistivity data, revealing its possible applicability of landslide alert systems. On the other hand, the stream conductivity is utilized to evaluate the activity of potential large-scale landslides in Tsai et al.. This approach is motivated by the suspicion that the conductivity of the spring water near the landslide-prone site increases once the ground surface moves. Sound agreement between the stream electronic conductivity and ground surface displacement was identified, implying the potential for engineering application. Considering fourteen geo-environmental factors, Ou et al. applied the IV-based logistic regression model (LRM) to regional-scale landslide hazard assessment and mapping. It also reveals that the cutting of the slope toe plays a crucial role in the slope stability, and the failure is mainly triggered by rainfall.

Based on the geomorphological concept, Ko et al. proposed the ellipse-referenced idealized curved surface (ER-ICS) to search and mimic the plausible failure surface of a landslide of sliding type for investigating the consequent flow paths when the failure takes place. Their approach does not request detailed field data, and the flexibility of the orientation of the reference ellipse reduces the complexity of constructing the plausible failure surfaces of a landslide-prone area in various scenarios. In Lee et al., the Material Point Method (MPM) was employed to investigate the rainfall-induced landslides, which can provide detailed information concerning the transition from failure initiation to the post-failure stage. In the experimental validation and parameter study, the ratio of rainfall intensity to hydraulic conductivity plays a vital role in distinguishing the cause when the slope failure is triggered by the rising groundwater (up-welling) or the water infiltration (downward). Coupling both the discrete element and finite element simulations, Feng et al. investigated the characteristics of seismic signals induced by rockfalls. These characteristics were validated against field tests, and crucial physical parameters on the seismic signals were identified.

The earthquake on 6 September 2018 in Hokkaido, Japan, has induced thousands of shallow landslides, carrying trees on the slope to the catchment and becoming large woody debris (LWD). Koi et al. examined the link of the hydraulic conditions to the LWD generation, the spatial distribution, and the relocation of the LWD to evaluate the risk of an LWD disaster. Although no significant movement of the deposited LWD was identified 2 years after the earthquake, LWD disasters could be estimated during rainfall events with return periods of more than 10 years. Lee et al. examined and reported the main damage types and deterioration characteristics of check dams in Korea. For condition assessment, ten and nine representative types of damage and deterioration were classified for concrete and stone check dams, respectively. A numerical index was proposed to evaluate the structure conditions and to ease the determination of the mitigation priorities of the check dams. Gong et al. demonstrated an engineering planning method for mitigating the debris flow hazard in scenic areas. Taking into account the requirements of coordinating the landscapes and the ecosystem, they proposed four modes for a systematic strategy against post-earthquake debris flow disasters.

Despite the exciting and valuable articles collected in this issue of Research Topic, the landslide hazard assessment and mitigation countermeasure are still clumsy. The link between detecting the critical conditions of occurrence, complex strata, hydrological conditions, etc., remains to be built for an efficient methodology with precise and accurate prediction/estimation. We see, at this level, the importance of more efforts and investments in this research topic. And we are looking forward to substantial progress with the fast-developing remote sensing techniques in the near future.

Author contributions

Y-CT, C-YK, NH, M-HD, and R-FC edited the Research Topic "*Integration of state-of-art techniques for landslide hazard assessment and the mitigation caused by the subsequent multimodal disaster.*" All the authors listed have made a substantial direct and intellectual contribution to the work and approved it for publication.

Acknowledgments

We thank all the authors for their contributions and the efforts of the reviewers and editorial staff to pull together this collection are sincerely acknowledged.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note