

## PROGRESS REPORT OF SEA - ICL NETWORKS

**1. PROJECT TITLE OF NETWORK:** South-East Asian Network for Landslide Risk Management (SEA-ICL)

**2. NAME OF COORDINATOR (Affiliation and email)**

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**3. LIST OF MEMBER ORGANIZATIONS**

- (1) Universitas Gadjah Mada (UGM) – Center for Disaster Mitigation and Technological Innovation (GAMA-InaTEK)
- (2) Parahyangan Catholic University
- (3) Agency for Meteorology, Climatology, and Geophysics (BMKG) of the Republic of Indonesia
- (4) Slope Engineering Branch, Public Works Department of Malaysia
- (5) National Taiwan University, Department of Civil Engineering
- (6) Landslide group in National Central University from Graduate Institute of Applied Geology, Department of Civil Engineering, Center for Environmental Studies
- (7) Ministry of Agriculture and Cooperatives, Land Development Department
- (8) Asian Disaster Preparedness Center (ADPC)
- (9) Institute of Transport Science and Technology
- (10) Vietnam Institute of Geosciences and Mineral Resources (VIGMR)

**4. PROGRESS REPORT OF ACTIVITIES UP TO NOVEMBER 2024**

(1) Installation of Landslide Early Warning System (LEWS) in Indonesia

South-East Asian Network for Landslide Risk Management supported the installation of Landslide Early Warning System in 33 provinces, 120 districts in Indonesia and several countries in collaboration with the National Authority for Disaster Management (BNPB), local governments and private sectors. In 2024 the network has installed 4 LEWS in 4 cities in 4 provinces in Indonesia.

(2) INACOLD International Symposium in UGM Yogyakarta, 15-17 November 2024

INACOLD which stands for Indonesian National Committee on Large Dams is a part of the International Commission on Large Dams (ICOLD), which is a non-governmental organization dedicated to the sharing of knowledge and expertise on the planning, design, construction, and operation of large dams. INACOLD holds its Annual and Regular Member Meeting once a year to disseminate information related to dams to the public. This year's meeting held in Yogyakarta, at the Universitas Gajah Mada (UGM) campus, on November 15-17, 2024.

The sub themes for this year are classified into five categories, namely Management and Mitigation Efforts in Dams and River Basins in Anticipating Climate Change Risk; Development of Multifunctional Dams and Reservoirs; Dam Construction Technology in Anticipating/Managing Complex (Extreme) Conditions (e.g., floods, droughts, hurricanes/typhoons, glacial lake outburst floods); Application of Digital Technology in Dams and River Basins (including Static, seismic, and

post-seismic dam monitoring, importance of various earthquake hazard characteristics (e.g., ground shaking, surface fault displacement, mass movements); the Role of Dams in Meeting Carbon Emission Reduction Targets.

The meeting aims to share knowledge and advancements in the field of dam construction, management, and safety, addressing climate change, technological innovations, and the mass movement risk mitigation related to landslide, outburst, fast flood etc.

(3) Development of Formulation of Modeling Parameters for Multi-Source (Non-Seismic) Tsunami (Case Study of the 2018 Palu Earthquake and Tsunami)

The Development of Formulation of Modeling Parameters for Multi-Source (Non-Seismic) Tsunami (Case Study of the 2018 Palu Earthquake and Tsunami) is funded by Indonesia Disaster Resilience Initiatives Project (IDRIP) and conducted from June 2024 to May 2025. The project is a collaboration between various institutions among others BMKG, UGM (ICL SEA-Network), Universitas Syiah Kuala, NCTU Taiwan, Kyoto University, Chuo University, Tohoku University, GNS Science NZ, Geophysical Institute University of Alaska Fairbanks.

The objectives of the activity are:

- a. Providing geological field survey, laboratory experiment ring shear test and LS RAPID, LS Tsunami modeling for analyzing the coastal and submarine landslide and its association to the parameters describing the multisource tsunami triggering.
  - b. Conducting seismological and seismotectonic studies and tsunami modeling in the case of multisource tsunamis to obtain the best parameters (formulation, threshold, coefficients) describing the non-seismic tsunami
  - c. Providing a series of formulation of parameters and its thresholds on multi source (non seismic) tsunami modeling to the processing system of future Indonesia Tsunami Early Warning System (InaTEWS) for the case of a multi-source (non-seismic) tsunami
- (4) A geological survey along the coastal of Palu, Central Sulawesi was conducted in September-October 2024 to obtain rock and sediment samples using geological sampling methods. The result is used for the Ring Shear Test experiment which is conducted at the ICL Office - Landslide Laboratory of Kyoto University for 3 weeks in November-December 2024. The results will provide the strength properties of landslide sedimentary rocks which will be used as input for tsunami modelling through LS RAPID and LS Tsunami.

The outcomes of the project are formulation and threshold for the rapid detection and characterization of multisource (non-seismic) tsunami parameters and its tsunami modelling to improve the performances of the InaTEWS. The improvement of Ina TEWS will decrease the disaster risk related to multisource (non-seismic) tsunami such as the 2018 Palu case and minimize the casualties and improve the resilience.

- (5) The International Conference on "Tunnelling and Underground Space for Sustainable Development"
- The International Conference on "Tunnelling and Underground Space for Sustainable Development" was conducted on October 2 - 4, 2024. The conference is organized by Geotechnical Engineering Center Universitas Parahyangan and Centre of Tropical Geoengineering Universiti Teknologi Malaysia. It is supported by Indonesian Geotechnical Society (HATTI), Indonesian Society of Civil and

Structural Engineers (HAKI), Indonesian Road Development Association (HPJI), Indonesian Society of Engineering Geology (MGTI), Indonesian Rock Mechanics Society (IRMS), and Ministry of Public Works and Public Housing.

- (6) The topics discussed in the conference are among others: Forensic Investigation on Tunnel Failures and Legal Aspect; Safety Issues in Tunnel Construction; Fire and Safety, Maintenance, Cost and Risk; Tunneling in Seismic Region; Ground Investigation, Improvement and Instrumentation; Mechanical Excavation; Rock Tunneling and Support Design; Soft Ground Tunneling, Lining Design and Grouting.
- (6) Joint symposium between Japan-Taiwan-Indonesia-Nepal-Bhutan on Multimodal Sediment Disasters, October 30 – November 1, 2024

The symposium aims to disseminate outcomes of research and education activities on sediment-related disasters through partnerships and knowledge sharing among the members. The Network is composed of scientists and engineers from Indonesia, Japan, Nepal, and Taiwan, and Bhutan. The symposium was held from October 30 to November 1, 2024, at the Niigata University Library Hall. It welcomed a total of 61 attendees from Japan-Taiwan-Indonesia-Nepal-Bhutan-French and Brazil.

The symposium featured 22 participants who shared the latest research and practical outcomes on sediment disaster management with the total of 30 presentations. International students from Laos, Brazil, Afghanistan, and Sri Lanka, currently studying in Japan, also participated in the symposium. The next symposium is planned to be held in early November 2025 in Nepal.

- (7) The international standard ISO 22328-2:2024, titled "Security and resilience — Emergency management — Part 2: Guidelines for the implementation of a community-based early warning system for landslides," has been published. This document gives guidelines for the implementation of a community-based disaster early warning system (EWS) for landslides. It complements the generic guidelines in ISO 22328-1. It describes the methods and procedures, implementation methods and activities specifically related to landslides. This document is applicable to communities vulnerable to landslides, without taking secondary/indirect effects into consideration. The SNI 8235:2017 was formulated to standardize early warning systems for landslides in disaster-prone areas. The Indonesian Standardization Agency (BSN), UGM, BMKG and BNPB worked on developing the national and international standards because Indonesia is highly prone to disasters. According to the World Risk Report 2023, Indonesia is ranked second out of 193 countries for disaster risk. From January to July 2024, BNPB recorded 788 disaster events, with landslides and floods being the most frequent. This shows the urgency of improving disaster risk mitigation in Indonesia. Developing standard is critical as it serves as a guide for mitigation efforts. Indonesia's proposal for the ISO standard was positively received, highlighting the global interest in human safety and disaster risk reduction.

The ISO 22328-2:2024 is a revised version of ISO 22327:2018 and aligns with the ISO 22328 series on early warning systems. The announcement was made during the ISO/TC 292 plenary meeting held from September 30 to October 4, 2024, in Liverpool, UK, with Indonesian delegates attending. In addition to the published standard, Indonesia has proposed two new international standards: ISO/NP 22328-4 for floods and ISO/NP 22328-5 for volcanic eruptions. Both have been approved for further development. These standards enhance the series of international standards on early warning systems

previously proposed by Indonesia, showing its significant contribution to global disaster management and helping to mitigate landslide disasters.

- (8) Course: A course on Natural Hazard of Himalaya -landslide and fault activity is started during the academic year 2024. This course is designed based on overview of the geological background of the Himalaya, exploring factors that contribute to landslide vulnerabilities. Investigation with laboratory test and field monitoring will be included. Moreover, the institute will introduce participants to InSAR
- (9) National Central University, Chinese Taipei
  - (a) Conference: Participants of 2023 Rock Engineering and Engineering Geology Symposium in Taiwan. 19~20 Oct, 2023.
  - (b) Conference: Participants of 2024 Geotech 2024 in Taiwan. 26-28 Aug, 2024.
  - (c) Conference: 2023 WLF6 as the original host of 2026 WLF7.
  - (d) Conference: 2023~2024 AOGS IG session Convener: Identification, Mapping, Monitoring and Forecasting of Landslide and Erosion Processes.
- (10) Project: Measuring the mechanical and hydraulic apertures of smooth, rock joints using porometer/permeameter—Viewpoints from hydromechanical couple behaviors
- (11) Research on the Behavior of Rock Slope Failure and the Critical Angle of Intersection. Date of Certification: 2024
- (12) Project on intelligent debris flow warning system under national Taiwan university and Ministry of agriculture in Taiwan. Aim to establish a fully automated monitoring and warning system, the influence is to replace regional precipitation warning and to effectively send warnings to affected population.
- (13) Landslide group in National Central University from Graduate Institute of Applied Geology, Department of Civil Engineering, Center for Environmental Studies. Chinese Taipei:
  - (a) Supporting the activities of the Global Promotion Committee of the International Program on Landslides and the 2020 Kyoto Landslide Commitment (GPC/IPL-KLC) by chairing this body.
  - (b) Supporting organization of the 6th World Landslide Forum in Florence, Italy in September 2023, Will be participating in the 2022 ICL-IPL Kyoto Conference
- (14) To promote research and training at international level by hosting more workshops, conferences and seminars, as well as by offering scientific facilities to post-graduate students and visiting researchers through scientific networking and professional training and continuous risk reduction.
- (15) The Investigation of the current situation, causes, and prediction of the risk of subsidence and landslides in the central area of Pa My Commune, Muong Nhe District, Dien Bien Province, and proposing preventive measures to minimize damage (2023). Economic Contract No. 01/2023/HĐ-TV dated January 16, 2023, signed between the Department of Natural Resources and Environment of Dien Bien Province and the Institute of Geology and Mineral Resources regarding
- (16) Research, design, and construction of a unified cross-sectoral big data system for early warning of landslides, rockslides, mud-rock flows, flash floods, and debris flows in real-time for the mountainous

and midland regions of Vietnam (2021-2023).

(17) Consulting tender package for geological survey and valuation in the landslide risk area of Thon Thom Ta, Thuong Mang Commune, Ngân Sơn District (2023).

(a) Survey and evaluation of geology and zoning of landslides, rockslides, and erosion in Hoa Binh Commune and Thai Binh Ward, Hoa Binh City, Hoa Binh Province (2023).

(b) Survey, geological evaluation, and zoning of landslides and rockslides in key areas of Cham Mat, Dong Tien, Thai Binh – Hoa Binh City, (2017)

(c) Survey, geological evaluation, and zoning of landslides and rockslides in key areas of Mon Hamlet, Bac Phong Commune, Cao Phong District – Hoa Binh, (2019).

(d) Investigation of the current situation, causes, and prediction of subsidence and landslides in the central area of Tia Dinh Commune, Dien Bien Dong District, Dien Bien Province, and proposing preventive measures to minimize damage (2022).

(e) The detailed investigation results, prediction of landslide risks in the Huoi Dap resettlement area (Group 1), Nam Tin Commune, Nam Po District, Dien Bien Province, and recommendations for a safe resettlement area (2023).

(f) The investigation results, prediction of landslide risks and selection of additional resettlement areas for Pa My 1 Hamlet (Group 2), Pa My Commune, Muong Nhe District, Dien Bien Province (2023).

## **5. PLAN OF FUTURE ACTIVITIES**

a. Development of Multi hazard-EWS

b. Preparing for the next phase of the Ring Shear Test experiment in December 2024 in Kyoto, Japan.

c. Preparing for the contributions to symposium on Multimodal Sediment Disaster in Nepal in 2025

d. Preparing for the development of two new international standards: ISO/NP 22328-4 for floods and ISO/NP 22328-5 for volcanic eruptions

## **6. PUBLICATIONS**

(1) Development of Peak Ground Acceleration Using A Non-Linear Approach to Evaluate Liquefaction Potential in Sei Wampu Bridge, Langkat, North Sumatra, Indonesia, I Aini, W Wilopo ; TF Fathani, Asean Engineering Journal. Vol 14 No 3; pp 41-52, UTM Malaysia, 1 Sept 2024

(2) Post-Earthquake Liquefaction Vulnerability Mapping by Swedish Weight Sounding and Standard Penetration Test; Irdhiani; A Rifa'i, TF Fathani; AD Adi.; Civil Engineering Journal, Vol. 10 No. 7, pp 2216-2232; Salehan Institute of Higher Education, Iran; July 2024.

(3) Landslide susceptibility mapping of Nglipar, Gunungkidul using analytical hierarchy process and geographic information system; P Saenkang, MN Haq, H Setiawan, W Wilopo; AIP Conference Proceedings; Vol. 3145 Issue 1; AIP Publishing; 23 July 2024.

(4) Slope stability of tunnel outlet portal at Budong-Budong Dam, Central Mamuju, West Sulawesi, using limit equilibrium method; S Hardwiyanto, W Wilopo, H Setiawan; AIP Conference Proceedings; Vol. 3110 Issue 1, AIP Publishing; 26 March 2024.

(5) The Correlation of Liquefaction with Excess Pore Water Pressure in Langkat, North Sumatra, I

- Aini, W Wilopo ; TF Fathani; International Journal of GEOMATE; Vol. 125 No.114, pp 117-125; GEOMATE International Society, February 2024.
- (6) Seismic Vulnerability Assessment Using the Hvsr Method at Yogyakarta International Airport Underpass, Indonesia; AR Prasetya, F Faris, AP Rahardjo; GEOMATE Journal; Vol. 26 Issue 26; pp 25-33; GEOMATE International Society; February 2024.
- (7) Scenario Seismic Hazard Analysis of the Mataram “Fault”: An Initial Study of Geophysical Approach; Lian Y Andikasari<sup>1</sup>, AJ Syahbana, C Damayanti, HT Atmojo, LZ Mase, F Faris; BIO Web Conf.; Vol. 131 Article Number 04004; EDP Sciences; 15 October 2024.
- (8) Liquefaction potential and severity analysis on road embankment in Serang-Panimbang Toll Road Section 3; N Priyanto, F Faris, H Setiawan; E3S Web Conf.; Vol. 576 Article Number 03005; EDP Sciences; 03 October 2024.
- (9) Evaluation of release wells for liquefaction mitigation using numerical simulation; O Purbawati, F Faris, Istiarto; IOP Conference Series: Earth and Environmental Science; Vol. 1373 Issue 1; pp. 012056; IOP Publishing; 30 July 2024.
- (10) Rock mass identification using MASW method at Rukoh supplementation tunnel, Pidie district, Aceh Regency; M Marhaendra, H Setiawan, D Karnawati; AIP Conference Proceedings; Vol. 3110 Issue 1, AIP Publishing; 26 March 2024.
- (11) Liquefaction potential hazard assessment and its effect on toll road construction in Seyegan Subdistrict, Yogyakarta; WP Setiadi, F Faris, H Setiawan; IOP Conference Series: Earth and Environmental Science; Vol. 1314 Issue 1; pp. 012120; IOP Publishing; 1 March 2024.
- (12) Empirical design for the excavation method and support system at Budong-Budong Dam Diversion Tunnel, Central Mamuju, West Sulawesi Province; S Hardwiyanto, H Setiawan; IOP Conference Series: Earth and Environmental Science; Vol. 1311 Issue 1; pp. 012074; IOP Publishing; 1 March 2024.
- (13) Groundwater level influence on liquefaction potential at Pombewe housing site, Sigi regency, Central Sulawesi; H Anar, A Rifa’I, F Faris; E3S Web Conf.; Vol. 476 Article number 01048; EDP Sciences; 17 January 2024. Chang, C.M., Ni, C.F., Lin, C.P., Lee, I.H. (2024, Oct). Stochastic analysis of the interaction between excess fluid flow and soil deformation in heterogeneous deformable porous media. *Physics of Fluids*, 36, 106606.
- (14) Chao, N.C., Borja, R.I., Lo, W., Ni, C.F., Lee, J.W. (2024, Oct). Modeling pore fluid pressure and deformation in unsaturated soils under gravitational compaction and cyclic loading. *Journal of Hydrology*, 644, 132108.
- (15) Nguyen, T.V.T., Ni, C.F., Hsu, Y.J., Chen, P.E.R., Hiep, N.H., Lee, I.H., Lin, C.P., Gosselin, G. (2024, Oct). Quantitative evaluations of pumping-induced land subsidence and mitigation strategies by integrated remote sensing and sitespecific hydrogeological observations. *Remote Sensing*, 16, 3789.
- (16) Lin, D.-J., Chang, P.-Y., Chen, Y.-L., Puntu, J.M., Ni, C.-F., Giletycz, S.J., Sobota, I., Czarnecki, K., Chang, Y.-H. (2024, Sep). Investigating Arctic permafrost dynamics using electrical resistivity imaging and borehole measurement in Svalbard. *Water*, 16, 2707.
- (17) Ni, C.F., Chang, C.M.\*, Lin, C.P., Lee, I.H. (2024, Apr). Stochastic quantification of spatial variability of flow fields in heterogeneous, non-uniform, confined aquifers. *Transport in Porous Media*, 151, 1475–1492.

- (18) Chang, C.M., Ni, C.F.\*, Lin, C.P., Lee, I.H. (2024, Feb). Variability in the displacement of solute particles in heterogeneous confined aquifers. *Advances in Water Resources*, 186, 104660.
- (19) Huang, C.W., Yau, S.Y., Kuo, C.L., Kuan, T.Y., Lin, S.Y., Tsou, C.S., Ni, C.F., Lin, Y.C., Chang, L.C. (2024, Feb). Identifying private pumping wells in a land subsidence area in Taiwan using deep learning technology and street view images. *Journal of Hydrology: Regional Studies*, 51, 101636.
- (20) Nainggolan, L., Ni, C.F.\*, Darmawan, Y., Lo, W.C., Lee, I.H., Lin, C.P., Hiep, N.H. (2024, Jan). Cost-effective Groundwater Potential Mapping by Integrating Multiple Remote Sensing Data and the Index-overlay Method. *Remote Sensing*, 16, 502.
- (21) Chang, C.M., Ni, C.F.\*, Lin, C.P., Lee, I.H. (2023, Nov). Variability of travel time of solute particles in single fractures with spatially variable aperture. *Engineering Geology*, 325, 107307.
- (22) Yu, Y.C., Chen, C.J., Chung, C.C., Ni, C.F.\*, Lee, I.H., Wu, Y.C., Lin, T.Y. (2023, Jun). A Multimodel Framework for Quantifying Flow and Advective Transport Controlled by Earthquake-Induced Canister Failures in a Reference Case for Radioactive Waste Geological Disposal. *Energies*, 16(13).
- (23) Ni, C. F., Chung, C. C., Zhang, L., Wang, Y., Dong, J. J. (2023, Feb). Preface of the special issue on “Geological uncertainty and its impact on geohazards and water resources assessments and infrastructure design”. *Engineering Geology*, 313, 106981.
- (24) Hiep, N.H., Luong, N.D.\*, Ni, C.F., Hieu, B.T., Huong, N.L., Duong, B.D. (2023, Jan). Factors influencing the spatial and temporal variations of surface runoff coefficient in the Red River basin of Vietnam. *Environmental Earth Sciences*, 82, 56.
- (25) Ni, C.F., Vu, T.D., Li, W.C., Tran, M.T., Bui, V.C., Troung, M.H. (2023, Jan). Stochastic-based approach to quantify the uncertainty of groundwater vulnerability. *Stochastic Environmental Research and Risk Assessment*, (online) <https://link.springer.com/article/10.1007/s00477-022-02372-2>.
- (26) Nguyen, T. T., L. W. Kuo\*, Q. E. Kong, C. W. Kuo, J. J. Dong, D. Brown, H. Wang, S. T. Kuo, H. Li, J. Si, 2024/09. Fluid drainage leads to thermal decomposition of wet gouge during experimental seismic slip. *Geophysical Research Letters*, 51(18), e2023GL106879.
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- (28) Baron, I., J. Jelenek, J. Klimes, J. J. Dong, R. Melichar, M. Sutjak, Y. C. Chen, C. M. Yang, E. L. Zhang, J. Mendez, C. H. Tseng, F. Hartvich, J. Blahut, T. T. Nguyen, L. Kocianova, F. Barta, V. Dusek, P. Kysel, 2024/01. Source area morphometry and high depletion rate of landslides may indicate their coseismic origin. *Engineering Geology*, 107424.
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- (30) Nguyen, X. X., J. J. Dong\*, C. W. Yu, 2022/11, Is the widely used relation between mechanical and hydraulic apertures reliable? Viewpoints from laboratory experiments. *International Journal of Rock Mechanics and Mining Sciences*. 159, 105226.
- (31) Bahti, F.N., Chung, C.-C.\*, Lin, C.-C. (2023) Parametric test of the Sentinel 1A persistent scatterer- and small baseline subset-interferogram synthetic aperture radar processing using the Stanford method

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