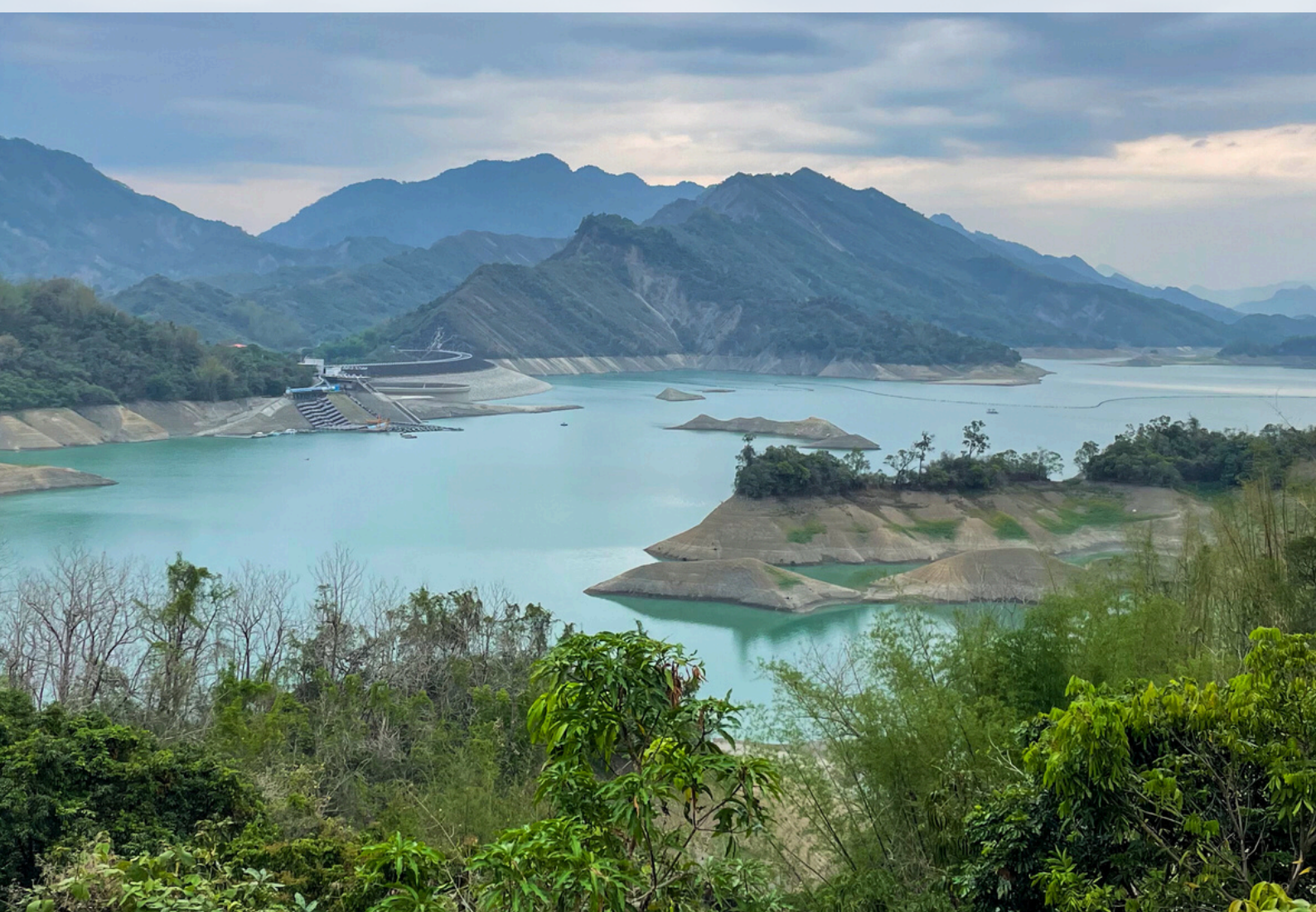


TAIWAN EARTHQUAKE RESPONSE 2024



3 EXPERTS
deployed

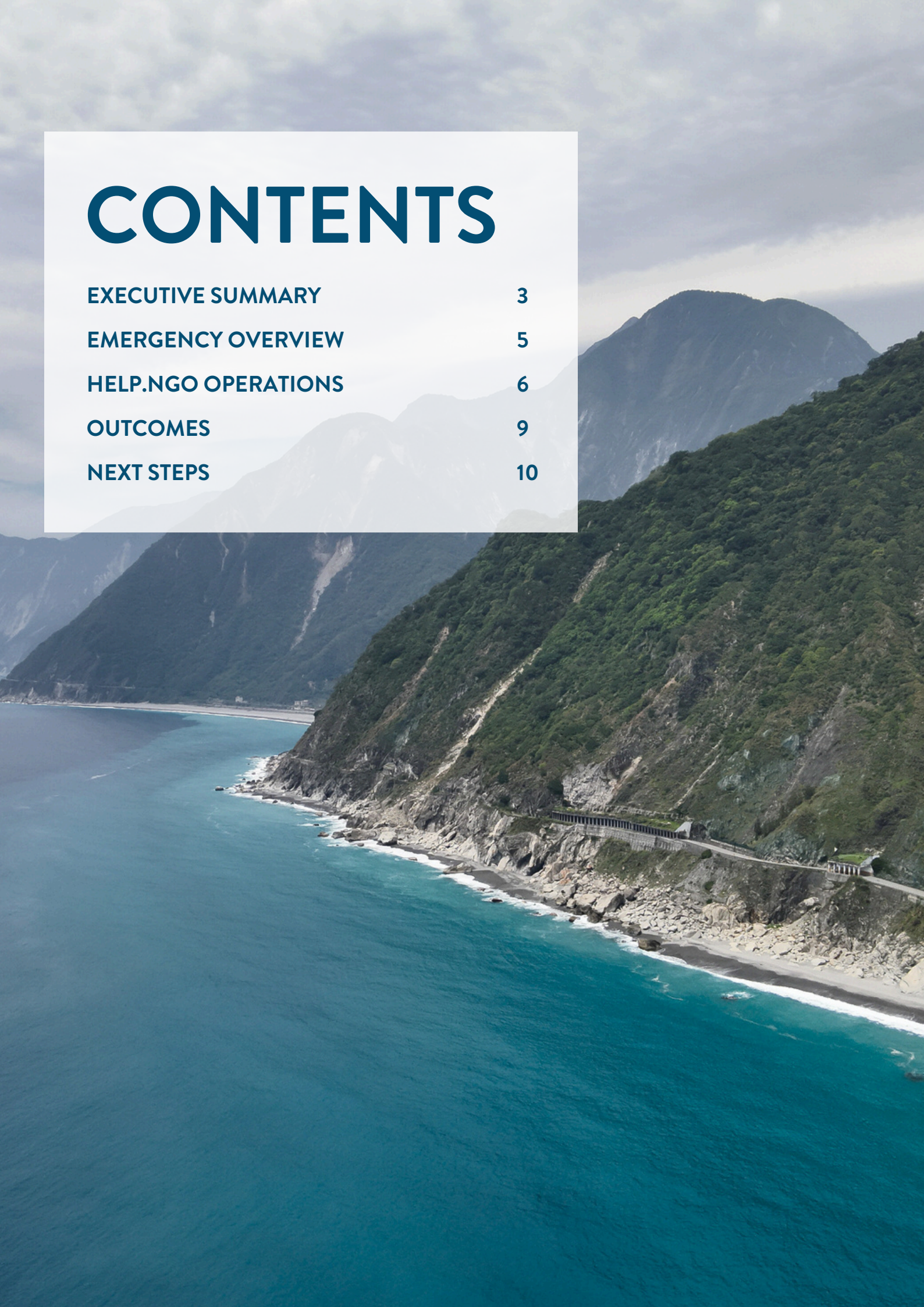
3.5 SQ KM
mapped

≈ 17,000 BUILDINGS
covered

≈ 50 GB DATA
collected

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EXECUTIVE SUMMARY

After the devastating 7.4 magnitude earthquake that struck Taiwan on April 3, 2024, Help.NGO deployed subject matter experts to assist with disaster response and recovery efforts. The earthquake caused significant damage, including casualties and infrastructure destruction. With support from Amazon Web Services (AWS), Help.NGO's intervention aimed to support first responders and local communities, and enhance open-source mapping initiatives through advanced technology and strategic partnerships.

Unmanned Aerial Systems (UAS) equipped with thermal cameras were deployed to assist in search and rescue operations, alongside the use of satellite imagery to create maps of the affected regions. This effort facilitated the collection of data across 3.5 square kilometers, resulting in detailed maps and records of 17,000 buildings and 170 kilometers of roads and pathways. Help.NGO collaborated with the Humanitarian OpenStreetMap Team, OpenStreetMap Taiwan, National Cheng Kung University, and other organizations to provide open-source information to responding authorities.

Outcomes of the mission included improved datasets for disaster-prone areas in Taiwan, the piloting of new technological applications, such as the AWS Snowball Edge for data management, and strengthened partnerships with local authorities and organizations. Help.NGO's efforts not only supported immediate disaster response, but also laid the groundwork for long-term collaboration, capacity building, and community engagement in disaster preparedness.



EXECUTIVE SUMMARY

KEY INFORMATION



3 EXPERTS DEPLOYED

for coordination, UAS mapping, and communications.



MAPPING WITH DRONES

DJI Mavic 3T was used to map affected areas and areas in potential danger, incl. 16,932 buildings, 168 kilometers of roads.



3.5 SQ. KM MAPPED

to assess the damage and plan future emergency response e.g., access and evacuation routes.



DATA PROCESSING

AWS Snowball Edge and AWS SnowCone were used for data processing.



COLLABORATION

with local authorities, response teams, and HOTSOM to ensure an efficient sharing and distribution of collected information.



EMERGENCY OVERVIEW

On 3 April 2024, a powerful 7.4 magnitude earthquake struck Hualien County in Taiwan, causing significant damage and loss of life. It was the strongest earthquake in Taiwan since 1999, resulting in casualties, with at least 18 people reported dead and over 1,100 injured. The earthquake was followed by nearly 700 aftershocks within 24 hours, adding to the devastation. Significant damage was reported, including damaged buildings, significant amount of landslides on the eastern and central mountain chains, and infrastructure damage to rail, highway and bridges. . Tsunami alerts were immediately issued impacting not only Taiwan but also Japan, the Philippines and Indonesia, prompting evacuations in coastal areas, although the subsequent waves were relatively minor.

Rescue and relief efforts were swiftly initiated, with the Taiwanese government mobilizing military and emergency services to assist affected areas. The response effort included the immediate rescue of hikers, and travelers stuck in tunnels by landslides, road and train track clearing and repairs, rapid building and infrastructure inspections, the establishment of temporary shelters, and the establishment of food and water distribution.

Following the heavy earthquakes of 1999 and 2016, Taiwan has invested heavily in stricter building codes, regulations, and disaster preparedness, reflecting a commitment to enhancing resilience against natural disasters. Now, the country has robust emergency preparedness measures and response protocols in place, which were activated promptly following the earthquake in April 2024. This included the deployment of specialized earthquake technology and educational campaigns to inform the public about safety measures.



HELP.NGO OPERATIONS

OVERVIEW

On April 19, 2024, Help.NGO deployed a team of experts to support the local open-source community in Taiwan, providing crucial satellite and UAS imagery to enhance open-source data, particularly in OpenStreetMap through HOTOSM. The team also conducted a knowledge exchange session at the Geomatics Department of National Cheng Kung University, sharing expertise and fostering collaboration.



HELP.NGO OPERATIONS

UAS MAPPING AND USE OF SATELLITE IMAGERY

Help.NGO recognizes the importance of continuous monitoring and risk assessment in disaster response efforts to develop strategies to mitigate the impact of future disasters. One of the primary focuses of Help.NGO's response was the rapid assessment and mapping of disaster-affected areas.

By leveraging UAS and satellite imagery, Help.NGO provided accurate and up-to-date information on the extent of damage, displacement, and changes in landscape caused by the earthquake. This data enables humanitarian and government organizations to swiftly understand the scope of the crisis and plan their responses accordingly. Analyzing satellite imagery over time can also help responders track changes in the affected areas and evaluate the effectiveness of ongoing interventions.

Help.NGO's open data initiatives, such as those conducted through OpenStreetMap, the humanitarian OpenStreetMap Team (HOTOSM), OpenAerialMap, and the Open Imagery Network, play a critical role in these efforts. Open data is made available to individuals and organizations across private, public, and academic sectors, serving as a vital shared component for humanitarian and development ecosystems.

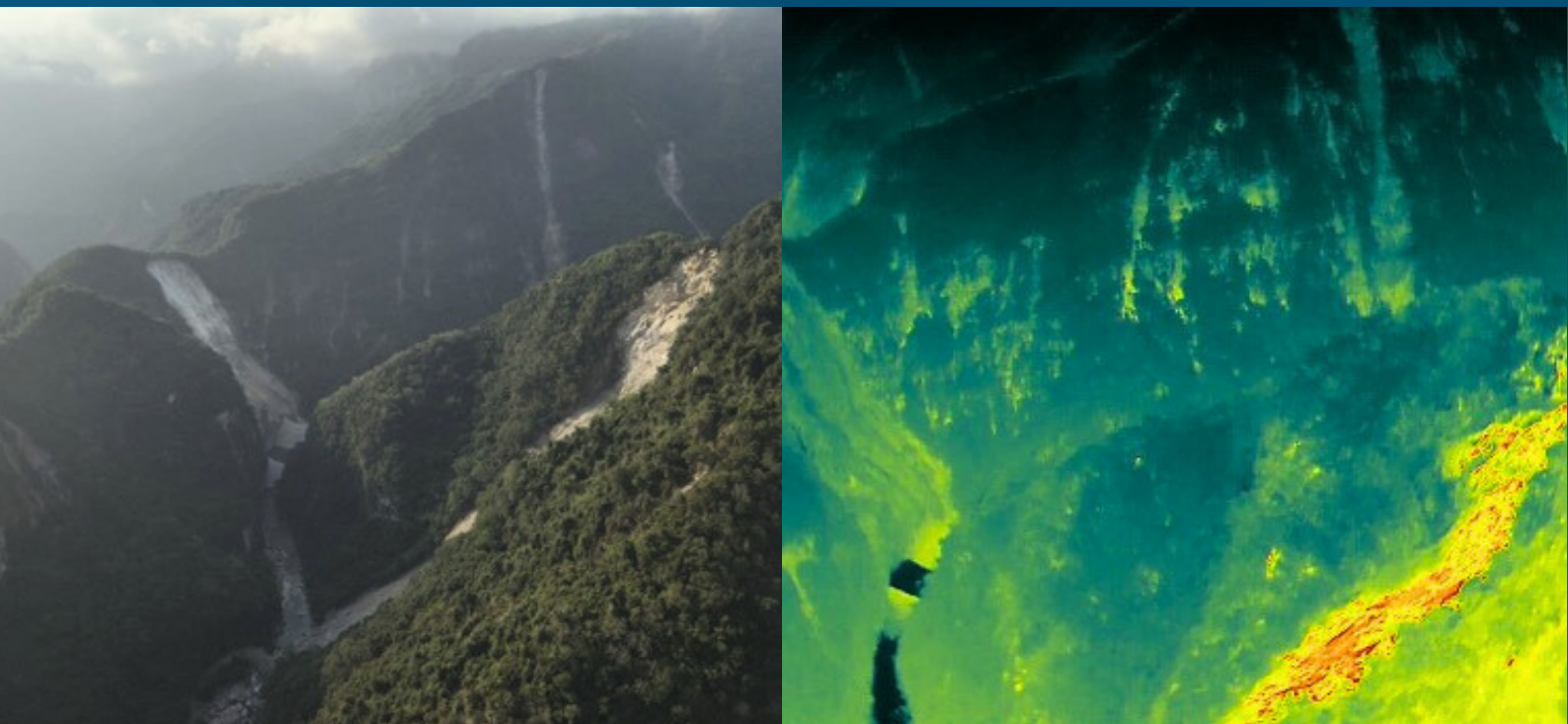
Several UAS mapping missions were conducted in areas of high importance, with the resulting datasets uploaded for future analysis. These missions included mapping dam reservoirs for Tainan City and mangrove forests along the coast—crucial buffer zones that protect inland areas like farmland and residential buildings.



HELP.NGO OPERATIONS

USE OF THERMAL CAMERAS

Help.NGO also deployed drones equipped with thermal imaging and thermal signatures associated with landslides, such as temperature anomalies and surface displacement patterns can be detected. Thermal Imaging can make easier the search for landslides and other earth disturbances. By using both visual and thermal imaging, a better assessment can be done.



With thermal imagery, the speed and precision of detection of streams and rivers blocked due to landslides which may cause flash floods as the temporary dams and blockage disappear through aftershocks, erosion or other processes.

Help.NGO continues to explore the use of technology to improve operations (faster detection), improve precision and accuracy of data and provide additional scientific information to researchers as the base for research on UAS-based thermal imagery of landslides is still not extensive. However, researchers at the University of Cagliari and Charles University have seen potential in the use of thermal imagery for landslide assessment, monitoring, and prediction.

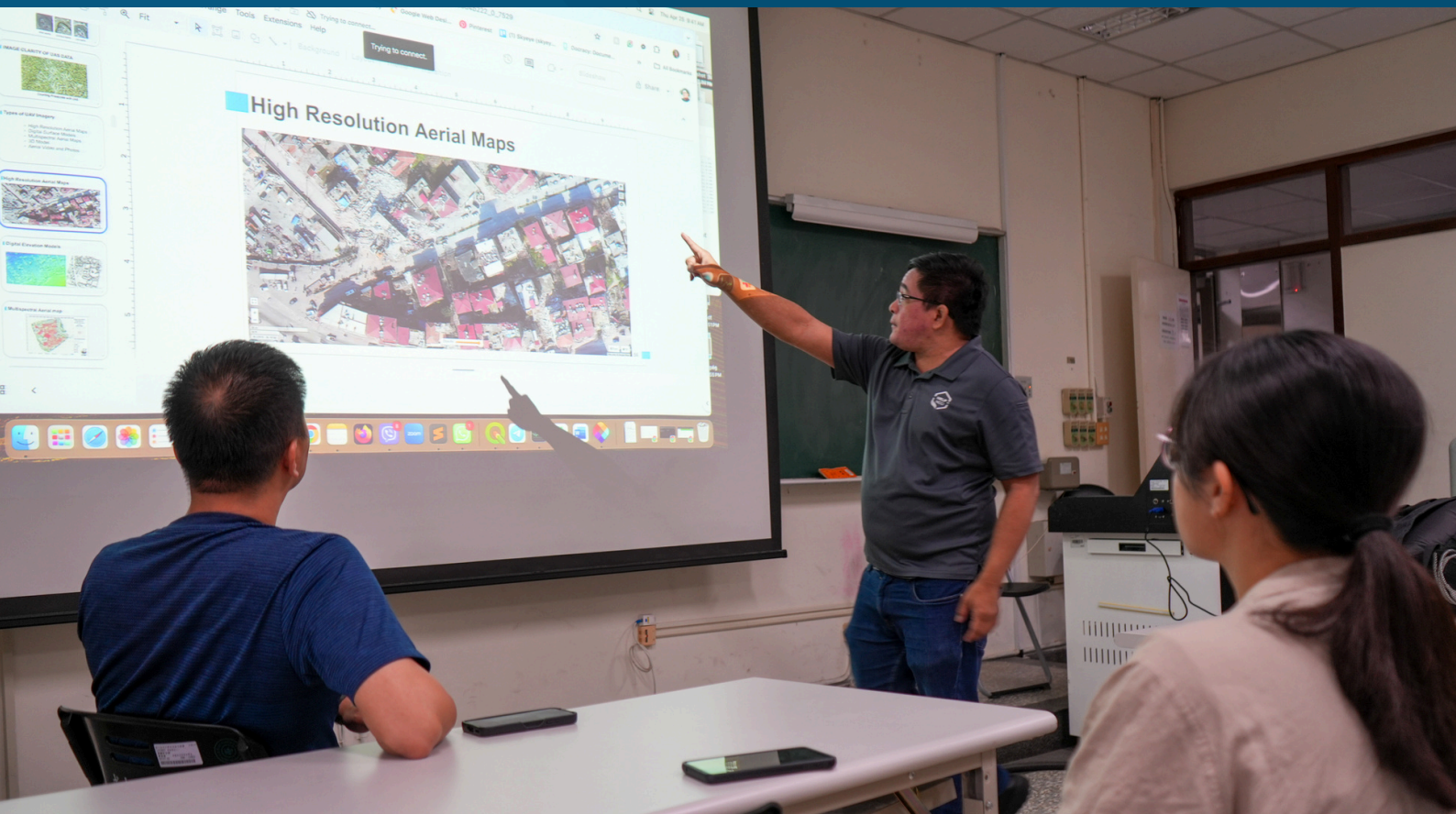
HELP.NGO OPERATIONS

CAPACITY STRENGTHENING & PARTNERSHIP BUILDING

Help.NGO has been a long-time contributor to Humanitarian OpenStreetMap (HOTOSM) and when additional support in Taiwan was requested, a team of experts was immediately deployed. Help.NGO also has other partners on the ground such as the TzuChi Foundation who helped in coordinating logistics.

At the end of the mission, Help.NGO team conducted a knowledge exchange session at the Geomatics Department of the National Cheng Kung University which was attended by Professor Kuo-En Ching and students. The session resulted in a fruitful discussion on potential collaboration, especially as Prof. Ching conducts parts of his research in the Philippines, specifically in Leyte, and eastern seaboard understanding plate tectonics, one of the focus geographical areas of Help.NGO.

Help.NGO's operational style is to always look for new partners and engage with partners to increase the impact we have.



OUTCOMES

1 INCREASED COLLABORATION

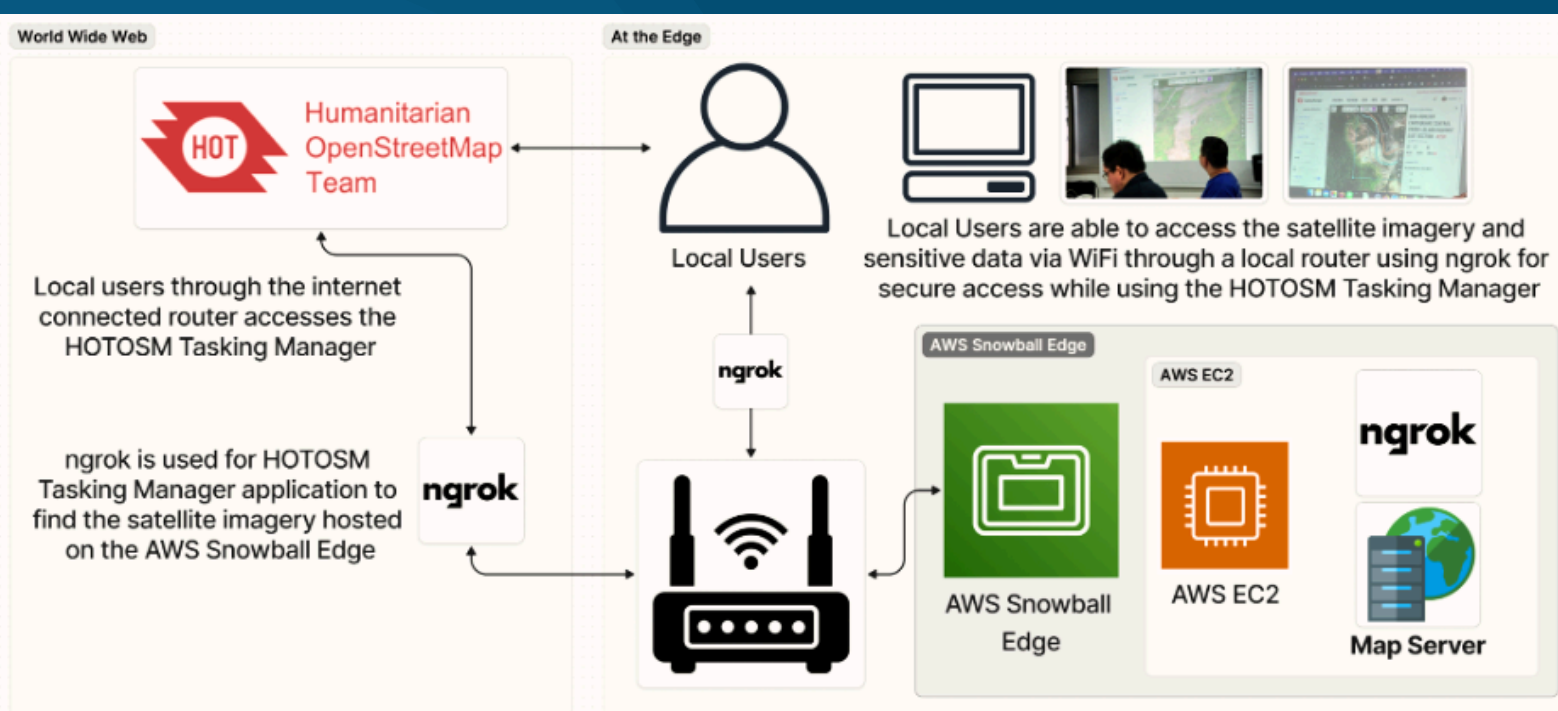
- Help.NGO's engagement in Taiwan deepened the collaboration with HOTOSM and various stakeholders of OpenStreetMap and Open Data Communities.
- Establishment of a new partnership with the National Cheng Kung University and identification of possible collaboration in the region.

2 BETTER DATASETS

- Disaster-prone areas, critical infrastructure (dam near Tainan) and sensitive environments (mangroves in the coastal areas of Tainan) mapped as contributions for Open Data that can be easily accessible to by researchers and analysts.

3 PILOTED NEW USES OF EXISTING TECHNOLOGY

- Help.NGO used the Snowball Edge as a tool to share sensitive data and act as digital rights management (DRM) tool.



NEXT STEPS

1 CONTINUE SUPPORT FOR OPEN DATA

- Drone maps produced and data derived from satellite imagery will be published on Open Data sets e.g. OpenStreetMaps (OSM) and OpenAerialMap part of the Open Imagery Network - supported by AWS and the Amazon Sustainability Data Initiative.
- Help.NGO will continue to support additional derivative data generation from the data collected.

2 CONTINUED COLLABORATION AND CAPACITY BUILDING

- Help.NGO will continue collaboration with Taiwanese organizations, extending the efforts in the region, for example with the National Cheng Kung University.
- Help.NGO continues to support HOTOSM and uses it as a pathway to support the humanitarian network by providing data open to all.

3 KNOWLEDGE SHARING AND BEST PRACTICES DISSEMINATION

- Help.NGO will be publishing blog posts including technical documentation on technologies and processes used.
- Lessons learnt from this emergency will be used during a regional hackathon for Asia Pacific to design best practices for similar emergencies. This response pilot will set the stage for future deployment of imagery assets already captured and hosted on AWS. In future phases, artificial intelligence (AI) / machine learning (ML) solutions via Bedrock and existing Imagery providers who store satellite imagery on S3 can be integrated into the solution pipeline.

4 COMMUNITY ENGAGEMENT AND PREPAREDNESS

- Finally, efforts should be made to engage local communities in disaster preparedness and resilience-building activities. This could involve awareness raising about earthquake response protocols and empowering communities to develop their own resilience strategies.

CONCLUSION

Help.NGO's response to the 2024 earthquake in Taiwan underscores the importance of leveraging technology and local partner networks to enhance disaster assessment, response, and recovery efforts. By using UAS and satellite imagery and collaborating with local organizations, Help.NGO provided timely and accurate information to support the needs of affected communities and facilitate a coordinated and effective response to the disaster. In addition, solid grounds were laid for future emergency response efforts by documenting lessons learned and developing new mitigation strategies.





#TechnologySavesLives

July, 2024