



# Building a flood trace database to strengthen early warning and urban resilience in Huế City, Vietnam

## Overview

The project aims to improve community awareness, support impact-based early warning, and provide evidence for urban planning by systematically documenting flood depth at the community level. ISET-International (ISET) and the Huế City Division of Water Resources and Climate Change conducted flood trace surveys to record high-water marks from the October 2022 and November 2023 floods in Huế City. In addition, flood markers were installed at key public locations, serving as visible reminders of flood risk and reference points for community preparedness. The flood depth data and coordinates were integrated into the city's GIS platform and analyzed alongside rainfall and river level information to understand changing flood patterns and their underlying drivers, as well as to estimate location-specific inundation depths to support impact-based forecasting and early warning. A standardized guidebook, developed based on lessons learned during this pilot phase, now supports future replication and institutionalization.

## Our approach

The project applies an evidence-driven and multi-stakeholder engagement approach grounded in the Climate Resilience Measurement for Communities (CRMC) framework and assessment results. Flood trace surveys were conducted at locations frequently affected by deep or recurrent inundation. Flood depth information was collected from multiple sources, including community and commune government reports, on-site surveys, and interviews, and cross-verified to ensure accuracy. At key public locations, permanent flood markers were installed to strengthen community awareness and preparedness. All validated flood depth data and coordinates were digitized and integrated into the publicly available GIS-Hue system to support impact-based early warning and inform urban and land-use planning.



## Facts and figures



**Cost of data collection per flood event (pilot phase):**  
US\$1,500

**Cost of data analysis, reporting, mapping:**  
100 staff days



**Ongoing/maintenance costs (covered by provincial DRM budget):** ~30 staff-days/year



**Time to set up**  
One month for establishing household network for flood data collection



**Easy to replicate?**  
Yes, based on existing DRM system and the guidelines.

## The gap

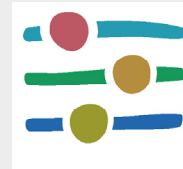
Hue city is frequently affected by severe flooding, which has become increasingly intense and unpredictable due to both climate change and rapid urban development. In 2020, the city experienced five consecutive major flood events within one month, marking one of the most significant flood seasons in recent history. Only five years later, in 2025, Hue was struck by another historic flood event lasting nearly 20 days, during which several records were broken. Most notably, one rainfall monitoring station recorded approximately 2,500 mm of rain over just two days, an unprecedented level for Vietnam.

In addition, rapid changes in land use, urbanization, and infrastructure continue to reshape flood behavior and shift flood risk across areas. However, beyond a small number of automatic gauges, localized and geo-referenced flood trace data are rarely available, creating major data gaps that affect:

- **Risk understanding and risk-informed development:** Limited data on how flood patterns are changing, including the role of urban development, makes it difficult for authorities to assess evolving risks and make informed planning decisions.
- **Preparedness, response, and early warning:** Without flood trace data, it is harder to identify where flooding will occur and how deep it may be. Current early warnings report river or rainfall levels but do not translate them into location-specific impacts such as flooded roads or expected inundation depth.
- **Awareness:** Physical flood evidence fades and community memory diminishes over time, especially among younger generations, leading to reduced awareness and underestimation of flood risk.

## Our solution

The project addresses the above challenges by establishing a database of flood traces from major flood events in the past and developing standardized procedures and guidelines for collecting and managing flood depth data. As of now, flood trace data from more than 500 locations have been collected for the October 2020 and November 2023 flood events with support from the project. The data collection,



### Climate Resilience Measurement for Communities (CRMC)

The Climate Resilience Measurement for Communities (CRMC) is a data-driven process, complemented by a web-based tool and mobile app, which helps communities to evaluate and measure how resilient they are to climate hazards. Using the results, they can identify and implement resilience-building interventions and run additional measurements to track improvements.

Find out more: [ZCRAlliance.org/crmc](https://ZCRAlliance.org/crmc)



A flood trace sign on a local community house, which serves as a reminder to local people about their exposure to floods at this location and marks a reference point for future studies. © Photo: Tho Nguyen, ISET Vietnam

## SOLUTIONS IN ACTION

Following the historic flood in October 2025, the city took the lead in collecting new flood trace data using the developed guidelines before integrating them into the established database.

**The process of data collection and management is now led by city agencies, and the data are integrated into government system with funding allocated from the city budget.**

These actions demonstrate the project's success in scaling up and sustaining its interventions.

management, and analysis process is led by the City Division of Water Resources and Climate Change and follows 4 main steps:

- First, survey points were identified in frequently flooded or high-risk areas based on maps, hydrological data, and community input.
- Second, preliminary information was gathered from commune level authorities, residents, media, and online platforms.
- Third, field surveys were conducted to verify and measure the highest flood marks through direct observation and community interviews, followed by the installation of permanent flood markers at key public sites.
- Finally, all validated data, including GPS coordinates, flood depth, and photos, were digitized, checked for consistency, and integrated into the publicly accessible GIS-Huế platform. This enhances public access to flood exposure information and raises community awareness of local flood risks.

The database also enables analysis of the relationship between rainfall, river water levels, upstream reservoir discharge rates, and flood depth at each mapped location, allowing estimation of inundation levels under different rainfall/discharge scenarios. This information strengthens early warning systems by enabling local government to predict potential water depths at specific locations. Warnings that include such information are far more actionable and effective.

In addition, the flood depth data were used to analyze changes in flood patterns in Huế City and identify their underlying drivers, providing evidence to support more risk-informed land-use and development planning.

## How it increases resilience

At the provincial level, the flood trace data support evidence-based, risk-informed planning, including land-use and infrastructure design such as drainage and roads. Comparing flood depth and duration across years reveals how new development or inadequate drainage have changed local flood patterns, enabling adjustments in urban planning and preparedness to reduce losses and strengthen resilience.

Community flood trace data also provide a foundation for impact-based early warnings by linking forecasted rainfall and river levels to expected flood depths at specific localities. This transforms warnings from generic messages to

## Conditions for success

**Q:** Is this intervention appropriate for other communities?

**A:** Yes. While the intervention requires some coordination and technical support, the developed guidelines make replication in other communities much easier.

**Q:** What conditions are needed for the interventions?

**A:** Strong local government buy-in (DRM agency and commune authorities), trained officers, and active participation of local stakeholders under a standardized flood trace update process

An existing WebGIS platform combined with in-house GIS expertise would significantly enhance efficiency and accelerate implementation.

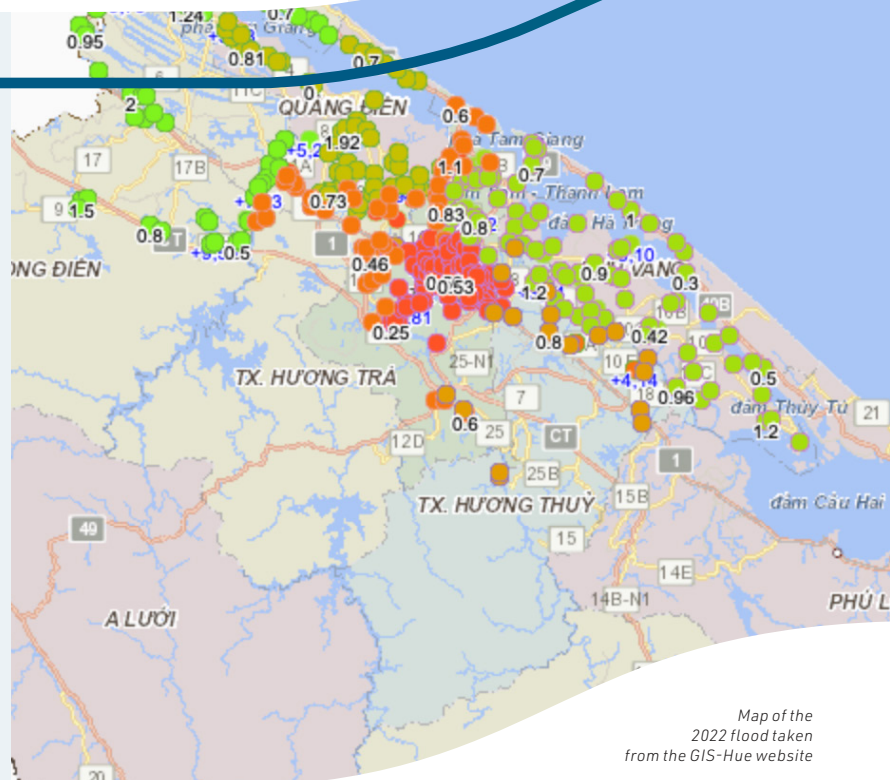
**Q:** Was there anything special about the communities where interventions were effective?

**A:** Local people were highly engaged and voluntarily provided detailed flood information.

## LIVED EXPERIENCE

“The flood trace study helped to collect valuable flood data, using a data collection method that is low cost, easy to maintain, update, and apply to future flood events. We have worked with the Smart Urban Centre to integrate the collected data into the provincial database (GIS-Huế). The database will be officially managed and updated regularly by my division to support flood risk management in Huế city, with the support of provincial government budget.”

– Mr. Lê Diên Minh, Head of Disaster Risk Management, Huế Division of Water Resources and Climate Change



Map of the 2022 Flood taken from the GIS-Hue website



actionable information that indicates which areas are likely to flood, how deep the water may be, and who will be most affected.

In addition, flood markers serve as visible reminders of past flood severity and references for estimating future flood levels. They raise community awareness, help households and authorities make informed decisions on building and asset protection, and improve understanding of early warnings for timely preparedness.

*October 28, 2025  
flood reaching the  
2023 flood trace sign  
© Photo: Hue City Division of Water  
Resources and Climate Change*

## Co-benefits

Other benefits of the project include its wide applicability beyond data collection:

- It enhances inter-agency coordination through the publicly accessible GIS-Huế platform, promoting transparency and shared use of data.
- The collected data have also been used in other interventions, such as conducting flood risk assessments to identify locations for flood-smart towers and developing safe parking maps to guide residents during major flood events.

## Lessons learned

- Harnessing local knowledge, ownership, and commitment made data collection efficient, low-cost, and credible, while building trust and awareness at the city level.
- Embedding project initiatives within official systems and regulations transformed short-term projects into sustained practices, ensuring continuity, consistency, and integration of local insights into broader disaster-risk management and planning processes.

### Get in touch

For questions, contact:  
Toan Vu, Technical Lead, ISET  
Vietnam, [toanvu@i-s-e-t.org](mailto:toanvu@i-s-e-t.org)

For more resilience solutions:  
[i-s-e-t.org/category/solutions](https://i-s-e-t.org/category/solutions)

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*Cover photo: October 2025 Flood in Hue city © Tran Thien via Facebook*



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