



Climate
Resilience
Alliance



SOLUTIONS BRIEF

May 2025

ISET

Flood data mapping and analysis for early warning and urban planning in Vietnam

Summary

ISET-International (ISET) and the provincial DRM agency conducted a flood trace study to identify high-water marks, which indicate maximum flood depths, for the October 2022 flood in Huế City, Vietnam. The high-water marks and their locations were integrated into the GIS database of Huế City and were compared with historical flood depths, rainfall, and river levels during this and previous events to identify both climatic and non-climatic drivers of observed changes in flood patterns. This information is also being used to support urban development planning and flood early warnings.

Our approach

Through application of the Flood Resilience Measurement for Communities, which has evolved into the Climate Resilience Measurement for Communities (CRMC), ISET gathered information about strengths and weaknesses of flood-vulnerable communities in Huế City. Through discussions with communities and the provincial DRM agency, ISET identified that a lack of data on the ways in which non-climatic factors, and particularly urbanization, are exacerbating flood risks was a critical gap in flood risk management.

Facts and figures



Cost of data collection:
US\$1,500

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

Cost of Geographical Information System (GIS) website development (if not already available):
US\$3,000



Ongoing cost/maintenance: covered by provincial disaster risk management (DRM) budget, ~30 staff days/year



Time to set up: one month to establish a household network for flood data collection



Easy to replicate?
Yes, as it is based on the existing DRM system



Vietnam



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What was the problem?

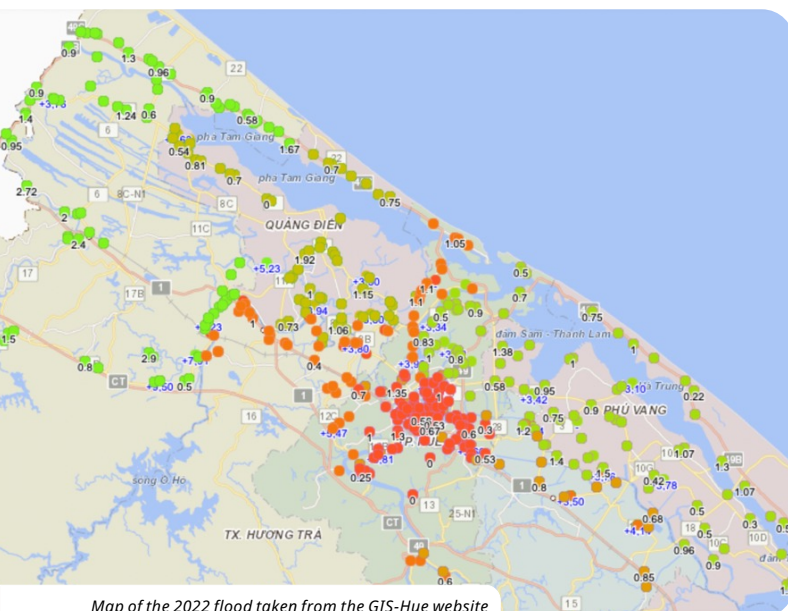
Major flood events occurred in Huế City in 2020, 2022, and 2023. In particular, the 2020 events were historic; the 2022 floods resulted in flood depths equivalent to or higher than in 2020; and, in 2023, flooding damaged over 500 cars parked on supposedly safe roads in areas near new developments.

Flooding in Huế City, as is true in many cities in Vietnam, is increasingly being influenced by a combination of climate and development. Urban development takes place disproportionately on inexpensive, low-lying agricultural lands that are leveled with 1–2 metres of fill to raise them out of the flood-plain and make them buildable. This, however, reduces space for water and changes flood patterns and depths. Despite knowing this, there is not enough evidence available on the specific locations and ways in which development is exacerbating flood risks, partly due to an incomplete database of historical flood events.

What was the solution?

ISET and the provincial DRM agency conducted a flood trace study of the October 2022 flood. A flood trace study is a simple and inexpensive data collection model that works by acquiring data from multiple locations on flood location and flood depth to create a detailed picture of a flood. The data collected were added to the province's flood database and are being used in new, powerful ways.

The data have been made available in the form of the first publicly available flood map integrated into the province's GIS database. This enhances public access to flood exposure information and raises community awareness of local flood risks.



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

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

- The data support an analysis of the relationship between rainfall, river water levels, upstream reservoir discharge rates, and flood depth at each mapped location to estimate flood depths corresponding to various rainfall/discharge scenarios. This is useful information for early warnings as it allows authorities to forecast rainfall and river water levels and to indicate what those levels might mean in terms of water depths at locations across the city. Warnings that are coupled with potential impact information, like expected water depth, are far more actionable than warnings alone.
- The flood depth data were compared with historic flood events (i.e., 1999, 2017, and 2020) to understand changes in the flood pattern in Huế City and surrounding areas. This understanding is important to establish a link between infrastructure development and changing flood patterns.

How does it increase resilience?

The collected flood depth data can be used as a reference for rough estimates of the potential level of flooding in future events based on the maximum flood water depth in past events. Importantly, the assessment and analysis of factors affecting flood risk contributes to flood risk management, better land use planning, and planning of **grey, green, and blue** flood infrastructure, improving the timeliness, accuracy, and effectiveness of flood early warnings and minimizing damage (e.g. being able to move motorbikes and cars, often critical household assets, to safe parking areas).

The comparison of flood depth, duration, and direction of flow across events also helps identify subjective factors, such as how new development is contributing to changing flood patterns. Understanding how current development practices – such as leaving inadequate space for drainage or failing to connect drainage systems across the city – are leading to increased flood

risk can be used to inform urban development and land use planning in ways that ultimately strengthen the resilience of communities.

Other benefits

ISSET and the provincial DRM office added to the existing dataset by conducting another flood trace study for the November 2023 flood event. This combined, enhanced flood database was used as an input for developing a flood warning map for the transport system in Huế City and a map of safe vehicle parking locations where people can move their vehicles during floods. The maps are now available on the GIS-Hue website and the Hue-S app.

Common conditions for success

Q: Is this intervention appropriate for other communities?

A: Yes, the flood trace study is a simple and inexpensive methodology that supports the collection of data.

Q: What conditions are needed for the interventions?

A: People trained on collecting data, and a flood database to integrate the data into.

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

A: Local people were highly engaged and volunteered a significant amount of data through the mobile app.

Early Warning Systems (EWS)

EWS are one of the best-proven and effective measures for saving lives and minimizing losses and harm caused by disasters. They help those at risk of floods, heatwaves, wildfires and other climate hazards to take risk-informed, timely, meaningful and impactful early action to keep themselves and their assets safe. The Alliance works across all eight components of an EWS so that they deliver essential services for the most vulnerable women, men, and children, supporting communities to be resilient to climate hazards, enabling them to thrive.



Success story

For the flood trace study, data requests were sent to ward/commune governments and individuals. The images show the location and flood depth where one household submitted flood depth information, which the study team visited for validation.

We documented flood marks at survey sites, revisiting locations assessed in 2017 and 2020, and adding several new ones. We recorded coordinates for mapping, measured and marked flood depths using nails and spray paint, or attached flood trace signs at key locations, and captured photographs to supplement our documentation."



Mr. Lê Mai Minh Tân
Huế DRM office



Location of the flood trace sign. © Photo: Huế DRM Office



A flood trace sign in front of a shop at Dong Ba market, 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: Huế DRM Office

Expert view

The flood trace study helped to collect valuable flood data, using a data collection method that is low cost, easy to maintain, up to date, and can be applied to future flood events. We have worked with the Smart Urban Centre to integrate the data from the 2022 flood into the provincial database (GIS-Hue). The database will be officially managed and updated regularly by the DRM office for flood risk management in Thừa Thiên Huế province, with support from the provincial government budget."



Mr. Lê Diên Minh
Huế DRM office



Flood level in November 2023 in Phan Chu Trinh Street, Huế City © Photo: Thanh Ngo, ISET-International

Lessons learnt

- The flood trace study is a simple and inexpensive solution for collecting detailed flood depth data and developing event-specific flood maps.
- The provincial DRM office has come up with innovative ideas about how to make the data even more useful, such as using the data for mapping of safe vehicle parking locations in Huế city.

Get in touch

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For more resilience solutions visit:

ZCRAlliance.org/solutions

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Further reading

Thừa Thiên Huế DRM Agency (2023) Flood trace study result for the October 2022 flood (14–18 Oct) in Thừa Thiên Huế province. Report (in Vietnamese).

Tuyen, T.H. (2023) Assessing flood risks in downstream areas of the Huong River based on the flood data of the October 2022 flood event. Report (in Vietnamese).



The Zurich Climate Resilience Alliance is a multi-sectoral partnership, powered by the Z Zurich Foundation, focused on enhancing resilience to climate hazards in both rural and urban communities. By implementing solutions, promoting good practice, influencing policy and facilitating systemic change, we aim to ensure that all communities facing climate hazards are able to thrive. [Find out more at ZCRAlliance.org](https://ZCRAlliance.org)

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