WHERE SHOULD WE PUT FLOOD SENSORS?

SOUTHEAST TEXAS
URBAN INTEGRATED FIELD LAB

Incorporating multiple objectives in designing observation systems.

WHY NOW?

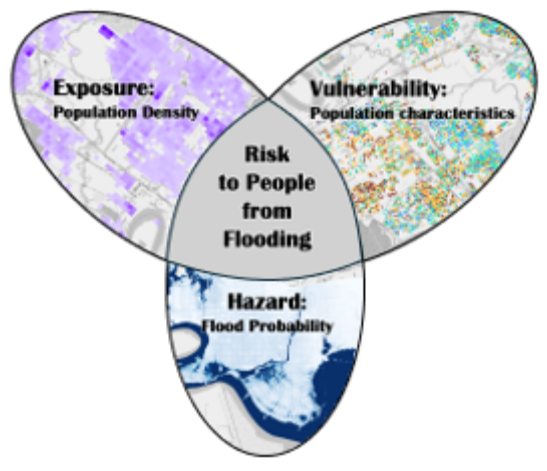
Flooding is a major and growing problem in Southeast Texas, especially after storms like Hurricane Harvey and Tropical Storm Imelda. Communities need good flood sensor networks to know when and where flooding happens. Sensor networks have primarily been used and located to assess the physical aspects of flooding. This approach provides an incomplete picture for decisions intended to reduce risk to people. our budget for flood sensors is limited, so we should make the best possible use of each sensor we can afford. Poorly placed sensors can create misunderstanding of who is at risk, while better placement helps communities protect lives and homes and support recovery efforts. Because local budgets for flood sensors are limited, using a holistic approach for sensor placement can support more effective decision making.

WHAT WE DID

Working together, the Water Team and Equity Team created a decision-support framework to guide where flood sensors should be placed by looking at three parts of flood risk: 1. hazard (how likely flooding is), 2. exposure (how many people are affected), and 3. vulnerability (how hard it is for people to recover). Using flood maps, population data, and social vulnerability data, we measured how well the current sensor network captures these risks. We then tested two strategies for adding new sensors: one that focuses on the highest-risk areas and another that aims to represent all types of conditions across the region.

WHO WAS INVOLVED?

Over the years, the Southeast Texas Flood Control District, local counties, river authorities, and Lamar University designed, installed, and now manage and operate the flood sensor network we studied, which includes over 200 flood sensors.



Risk to people from Flooding can be described as the intersection of Hazard, Exposure, and Vulnerability.

FINDINGS

1. Sensor location matters

It was found that flooding is most likely to happen near the coast and rivers, while the greatest number of people at risk live in Orange County cities like Orange and Bridge City, areas that would benefit from additional flood sensors. Fortunately, the current sensor network already covers many socially vulnerable residents, or those that may have a more difficult time preparing for, responding to, and recovering from a disaster. Adding sensors based only on highest risk would capture more total risk, but could lead to an incomplete understanding of the whole system, because we would understand flooding in low risk areas less well. Adding sensors to proportionally represent all conditions could improve understanding across the whole region. There is a tradeoff between monitoring the worst risks and learning how flooding affects the whole region. This tool allows Southeast Texas decision makers and water managers to explore flood sensor placement suggestions for either objective, and could be expanded statewide or applied to other hazards (like extreme heat). The Team hopes this project can support their work if they expand the sensor network in the future.

2. More information

The interactive maps can be accessed free in: https://ckan.tacc.utexas.edu/dataset/optimized-sensor-locations-flood-risk-southeast-texas/resource/0972fb94-3f3d-46a3-9b8b-246fbf7b8067 Find more information: Brelsford, C., Coon, E. T., Wang, M., Rosenheim, N., Brake, N., Haselbach, L., & Passalacqua, P. (2026). Multi-Objective Urban Observational Strategies: A Risk-Based Framework for Expanding Flood Sensor Networks. Water Resources Research, 62(1), e2025WR041135. https://doi.org/10.1029/2025WR041135

Find more information: Brelsford, C., Coon, E. T., Wang, M., Rosenheim, N., Brake, N., Haselbach, L., & Passalacqua, P. (2026). Multi-Objective Urban Observational Strategies: A Risk-Based Framework for Expanding Flood Sensor Networks. Water Resources Research, 62(1), e2025WR041135. https://doi.org/10.1029/2025WR041135

MORE ABOUT SETX-UIFL

The Southeast Texas Urban Integrated Field Lab (SETx-UIFL) is one of four projects funded in 2022 by the U.S. Department of Energy to study how climate, environment, and urban changes affect cities. A team of over 80 researchers from UT, Lamar University, Texas A&M, Prairie View A&M, Oak Ridge National Lab, and Los Alamos National Lab has collected data and conducted modeling across hazards including flooding, hurricanes, heat stress, and air quality. Our Why: Southeast Texas faces numerous hazards, yet smaller communities like this one have often felt forgotten compared to larger cities. The SETx-UIFL was designed to explore the complex dynamics of disaster vulnerability for this economically and culturally vibrant region. We believe Southeast Texas is a bellwether for the entire Gulf Coast, and an exemplar for strategies that protect people and places. We hope this effort supports your path toward lasting resilience.

CHRISTA BRELSFORD
Los Alamos National Lab
cbrelsford@lanl.gov

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