Flood Alert System: From to Models to Measurements to Action in CT

CIRCA Annual Summit 2025

Yaprak Onat & Marc De Vos

Flooding Disasters

More frequent road flooding disrupts business e.g. RT 146

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Tidal flooding in Mystic, CT
December 23rd, 2022

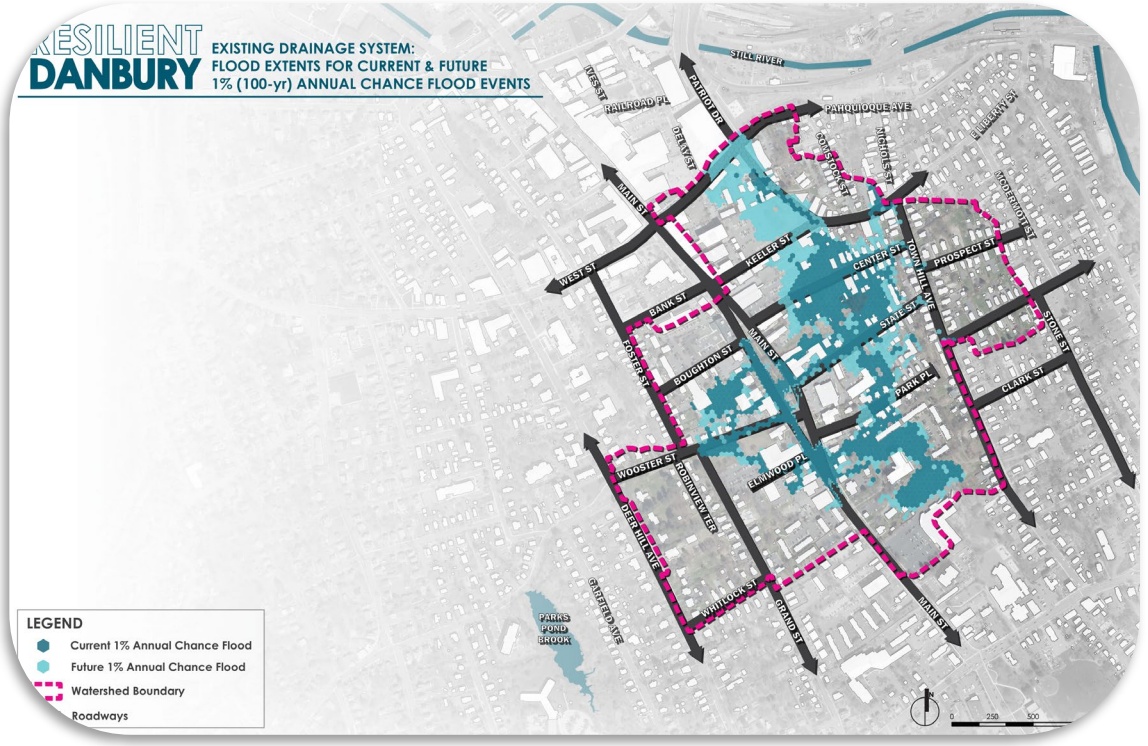
Plan for sea level rise of up to 20 inches (0.5m) by 2050. Continue to update guidance every 5 years as science evolves (next update in 2025)

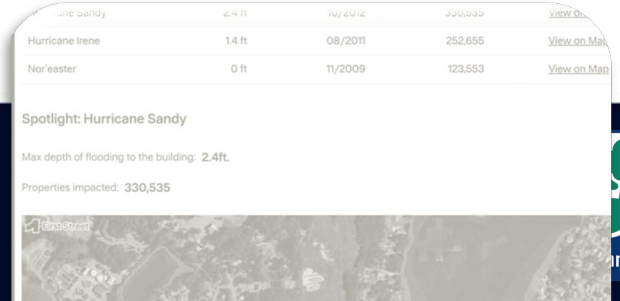
Flooding: Resilience and Adaptation

- Identify Risk Areas and make public and leaders aware
- Provide alerts to avoid losses
- Adaptation projects to reduce the risk

Models and Measurements are required for all these steps

1. Measurements
    a. Topography, structures, drainage networks, and water level





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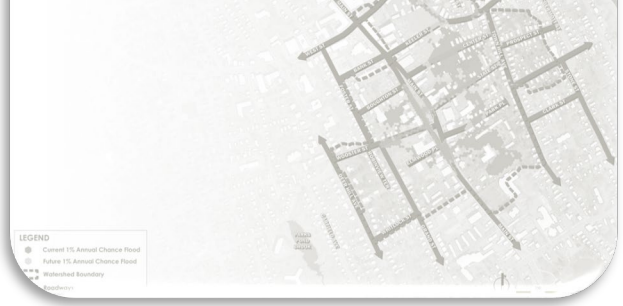
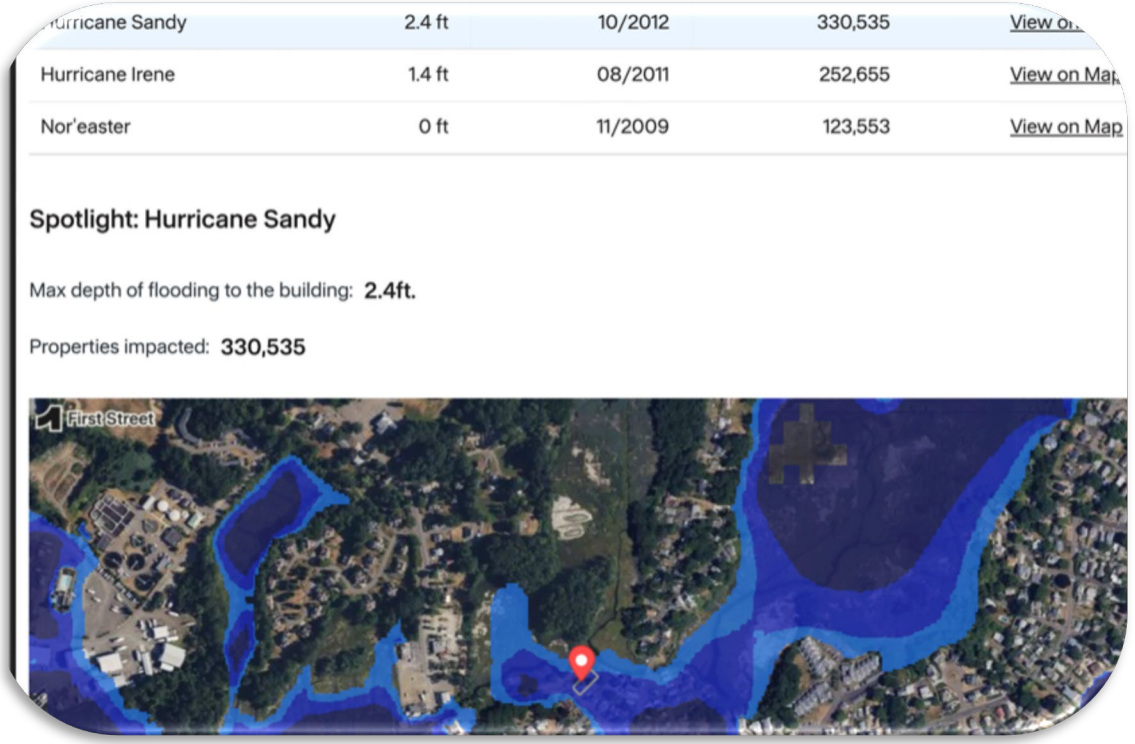
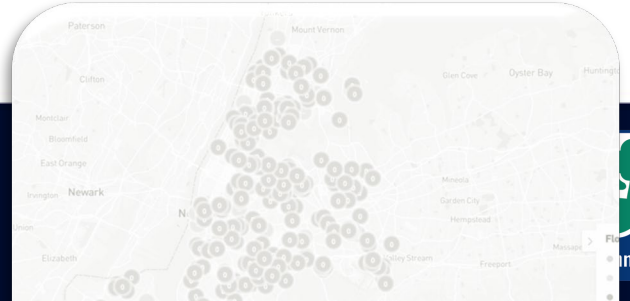
Models and Measurements are required for all these steps

2. Models
   - FEMA do surveys and measurements, and provide risk maps
   - FIRST STREET, FATHOM, FloodMap, USGS, NASA, NOAA, DOE also make risk maps with coarse scale and few applications.
   - CIRCA and many contractors do local risk maps for adaptation planning







Models and Measurements are required for all these steps

3. Alerts – NOAA
   - FloodNet – NYC
   - CIRCA

Planning

Coverage, Resolution, Access to flood models

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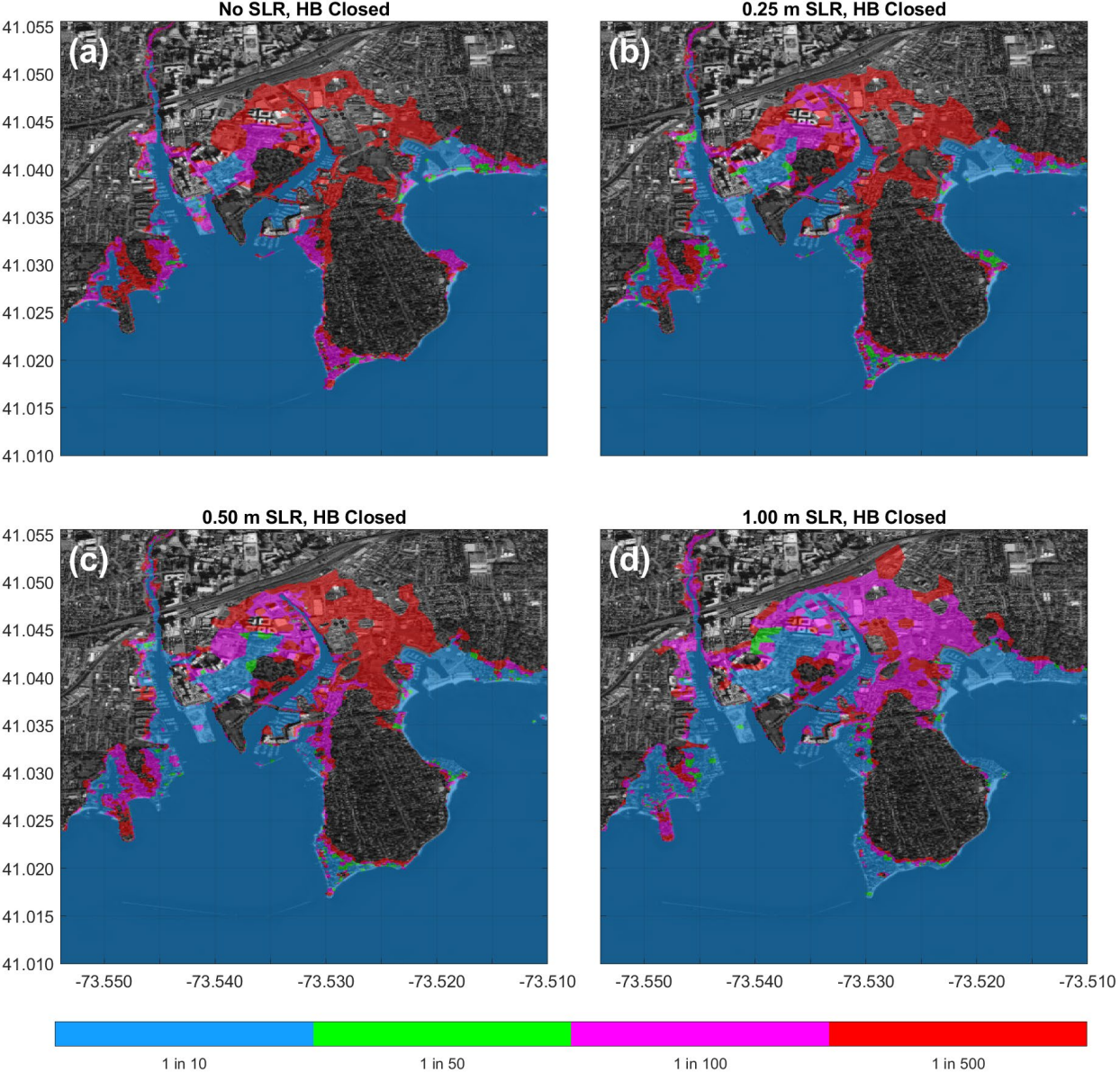
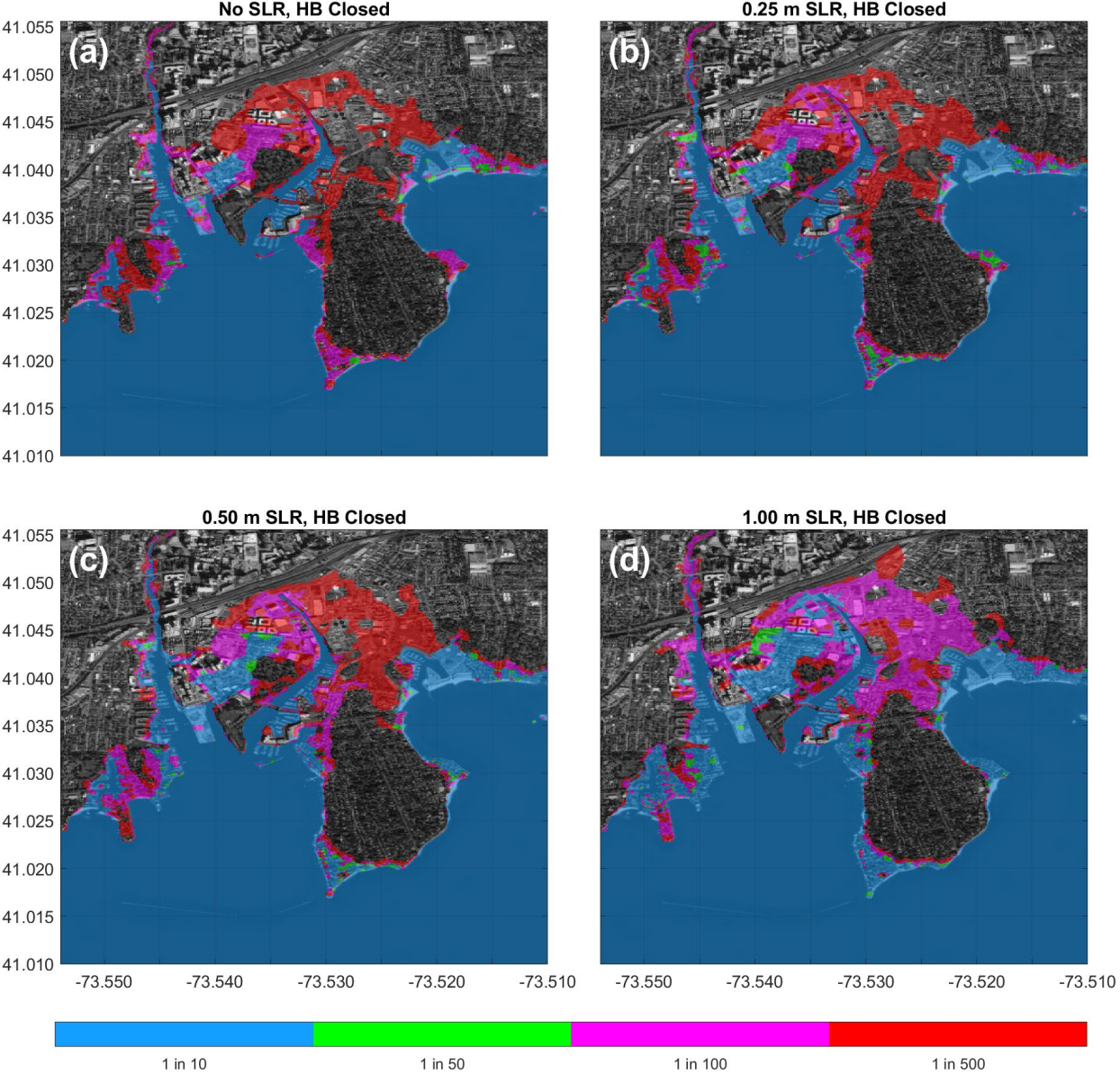
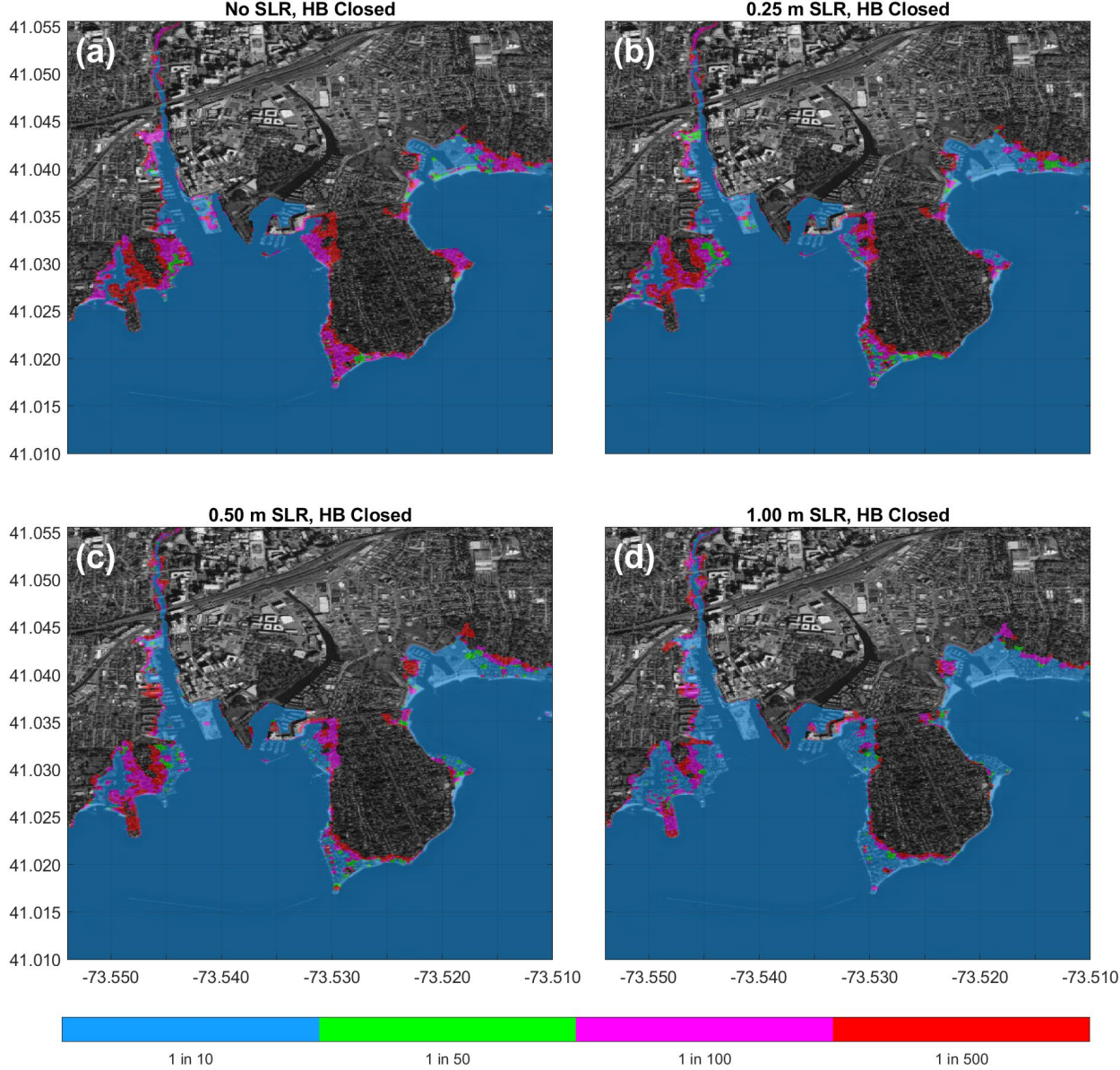


Before DEM correction



Before DEM correction



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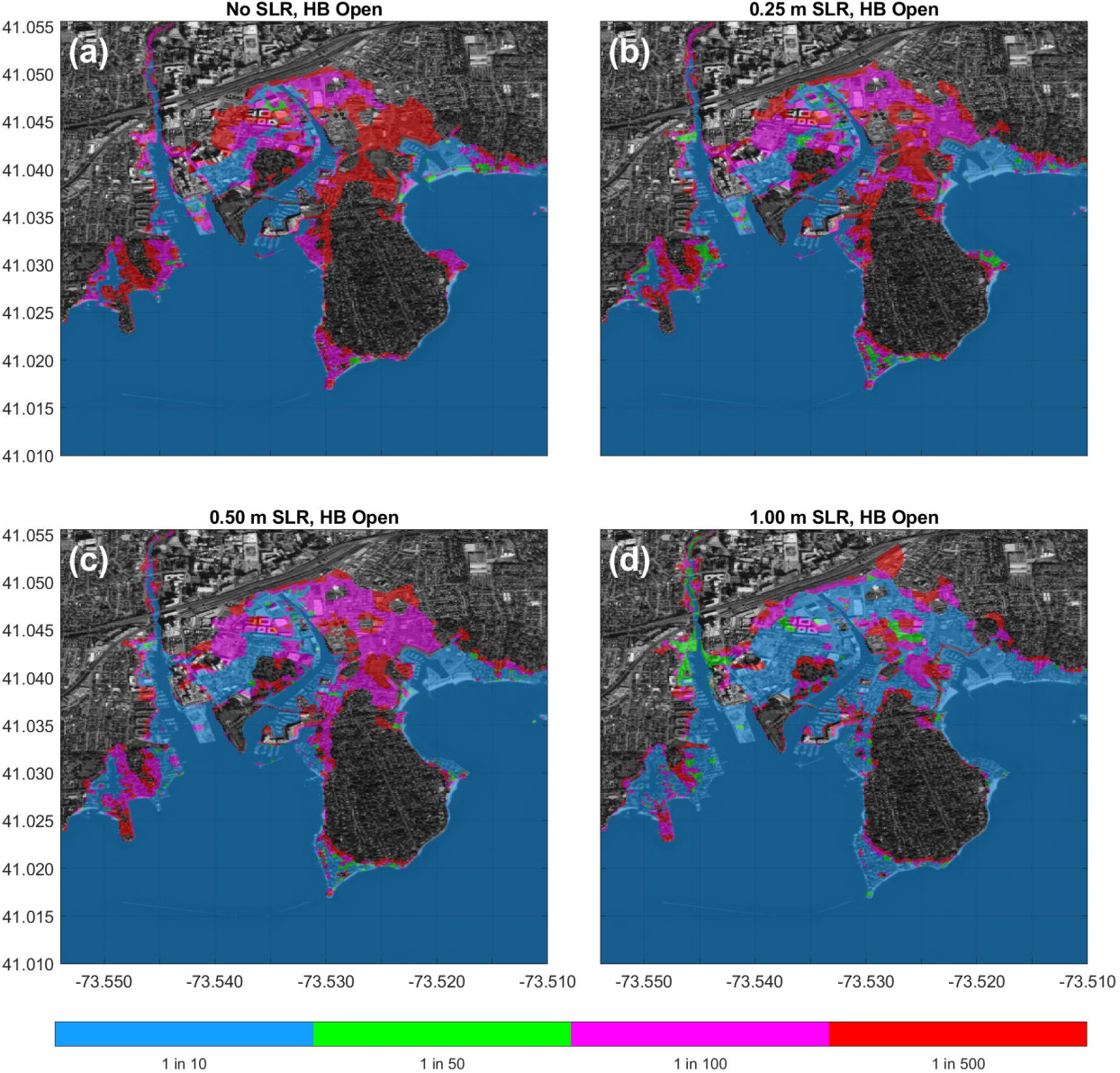

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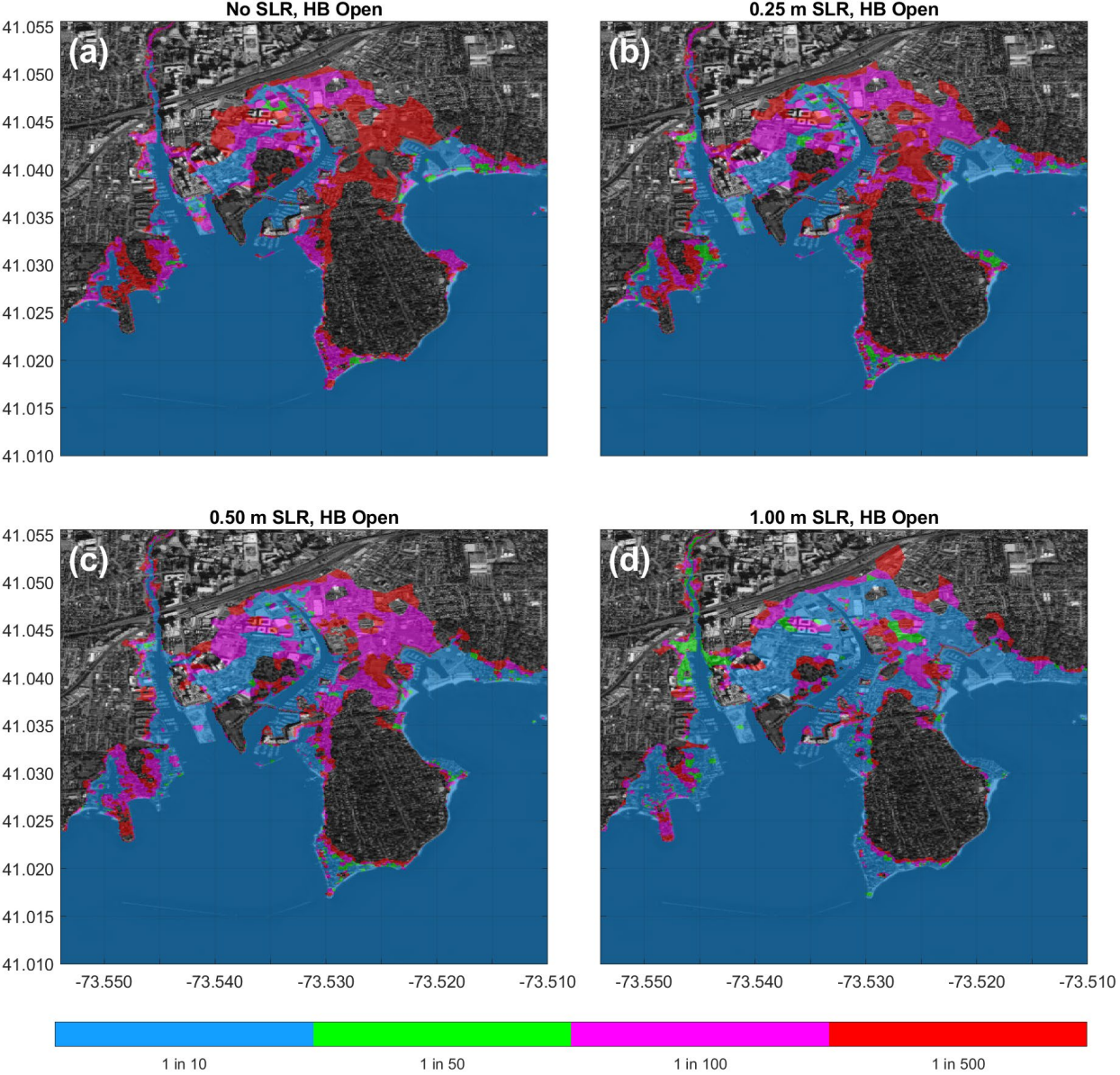

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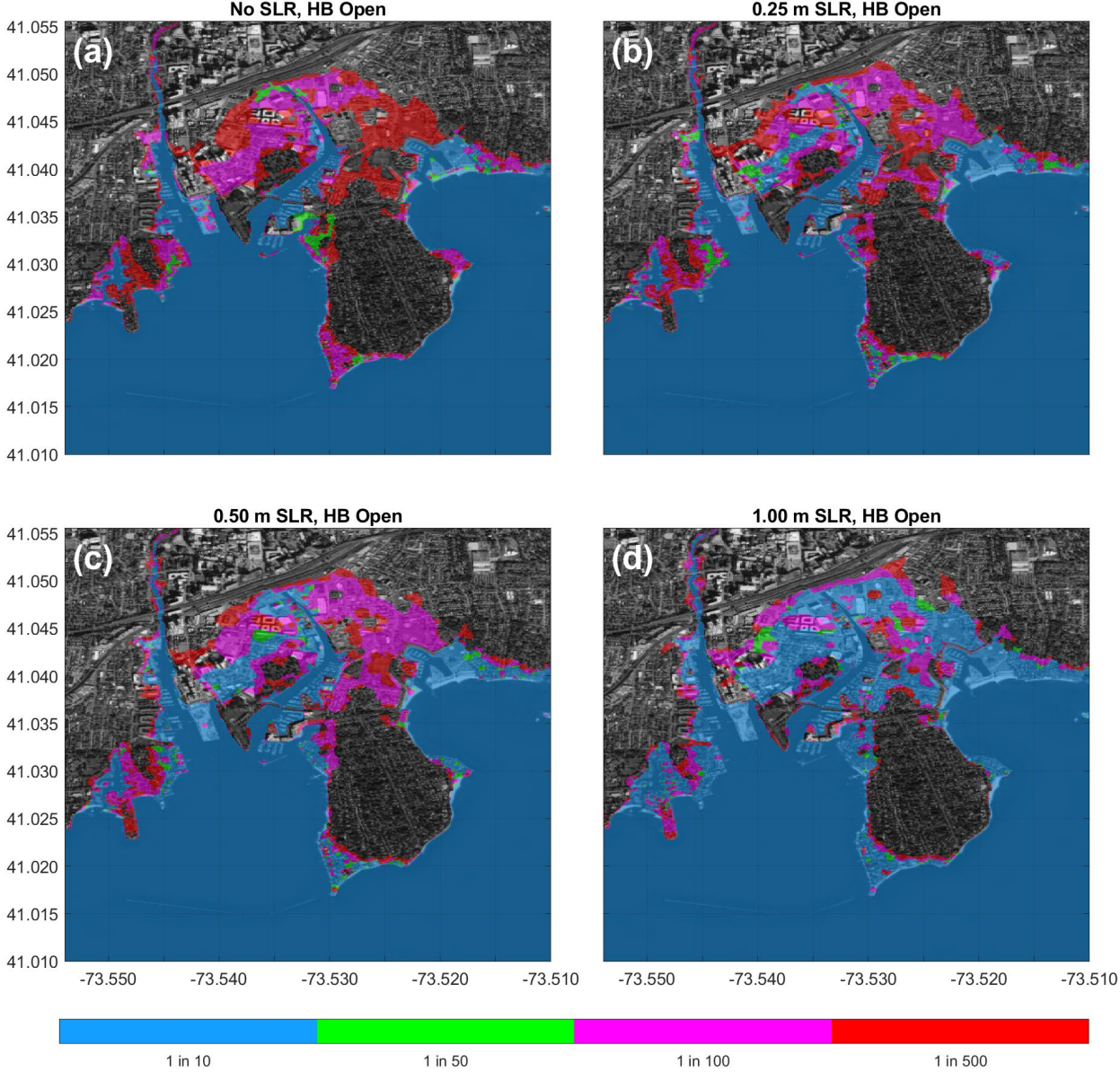

After DEM correction

Operation

Verification, Integration, Reliability of measurements

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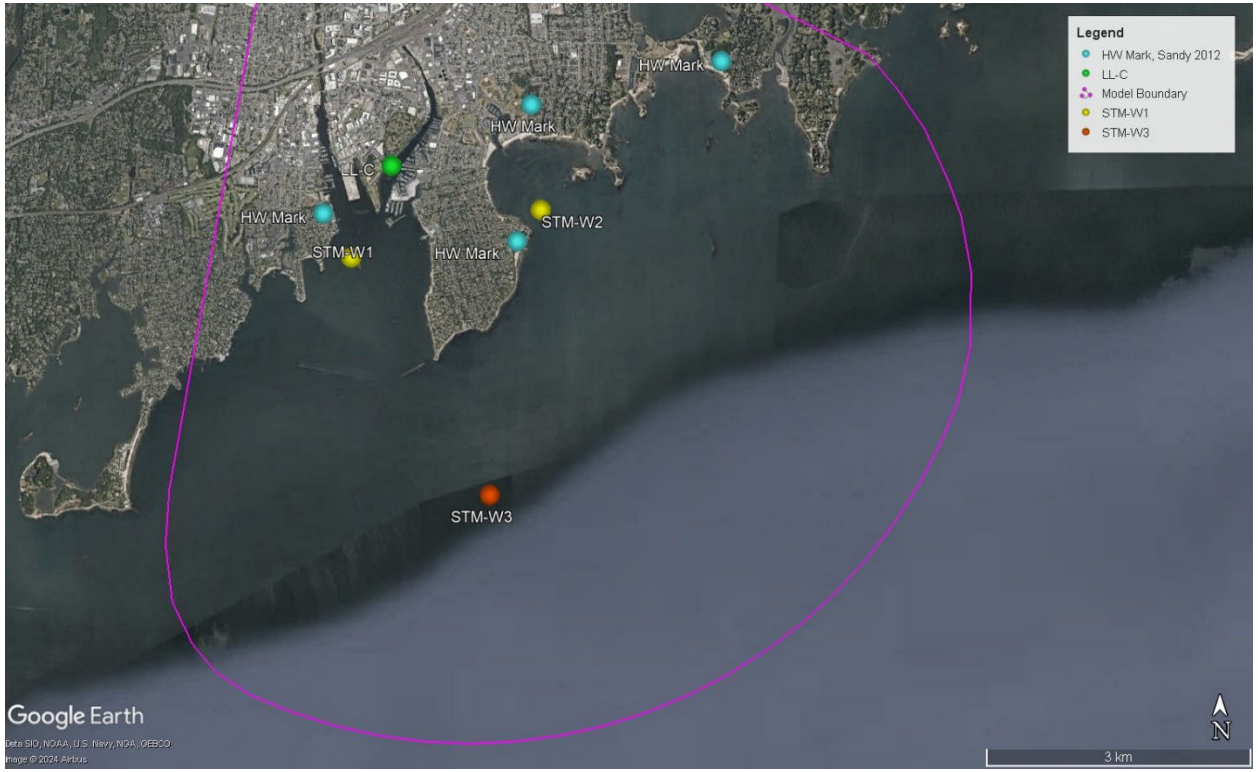
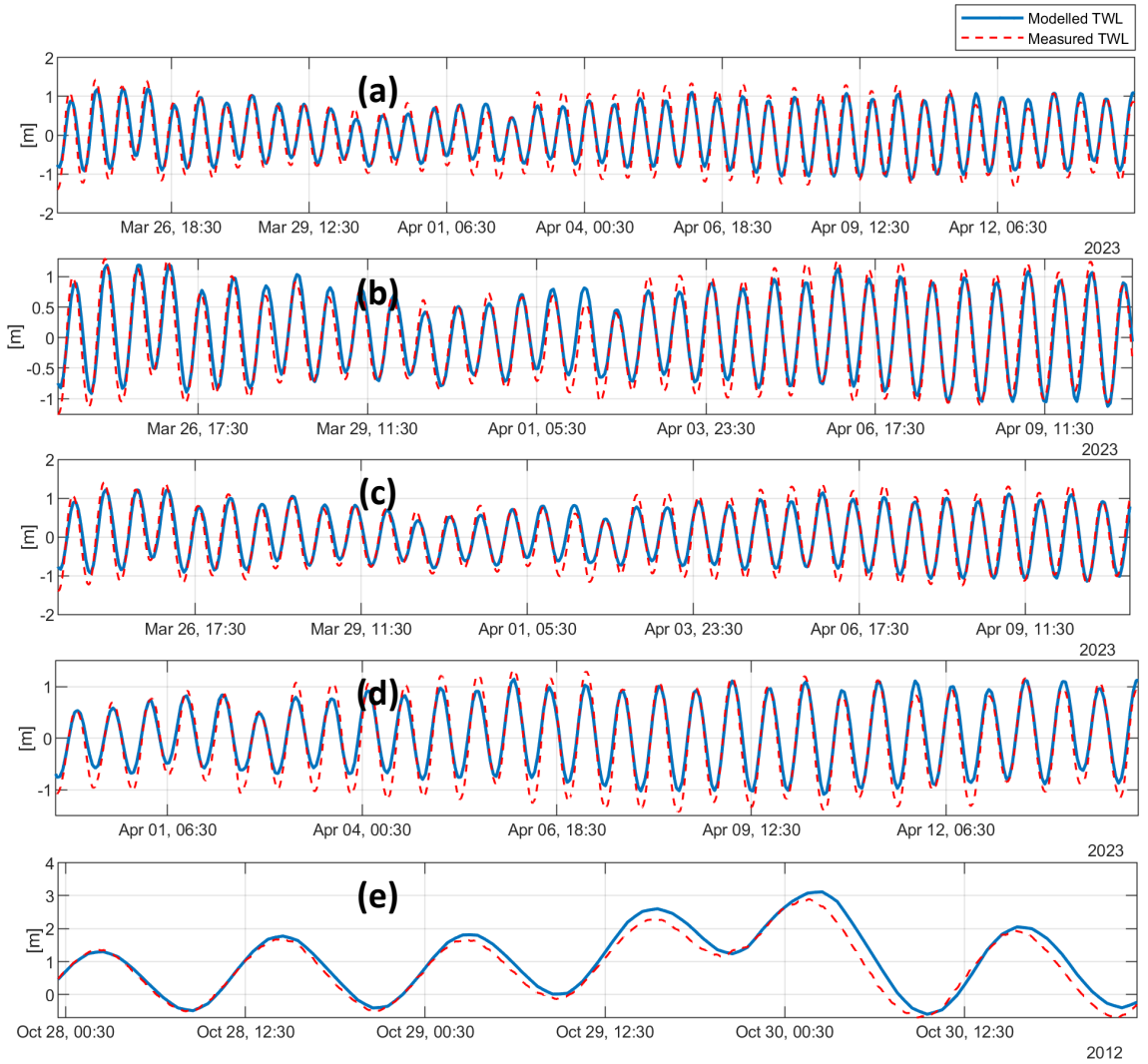


Locations of instruments used for model calibration and evaluation.

1. Shippan Point/ Freedom boat club
2. Cummings Park
3. Harbor Point Marina
4. Greenwich Ave.



Validation curves for the Stamford model. Comparisons between modeled (solid blue) and measured (dashed red) total water levels are shown for (a) STM-3 (offshore of Shippan Point), (b) STM-W1 (entrance to Stamford Harbor), (c) STM-W2 (Wescott Cove), (d) LL-C (East Branch hurricane Barrier) and (e) NOAA's tide gauge at Bridgeport.

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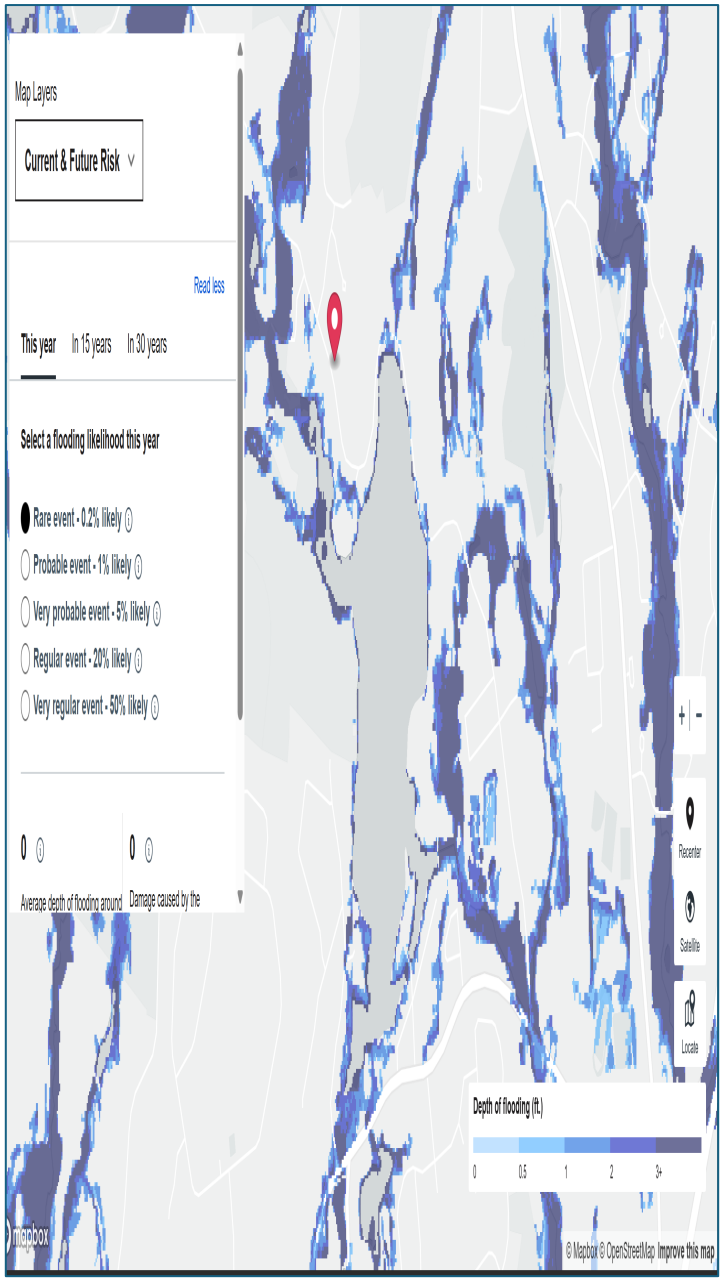
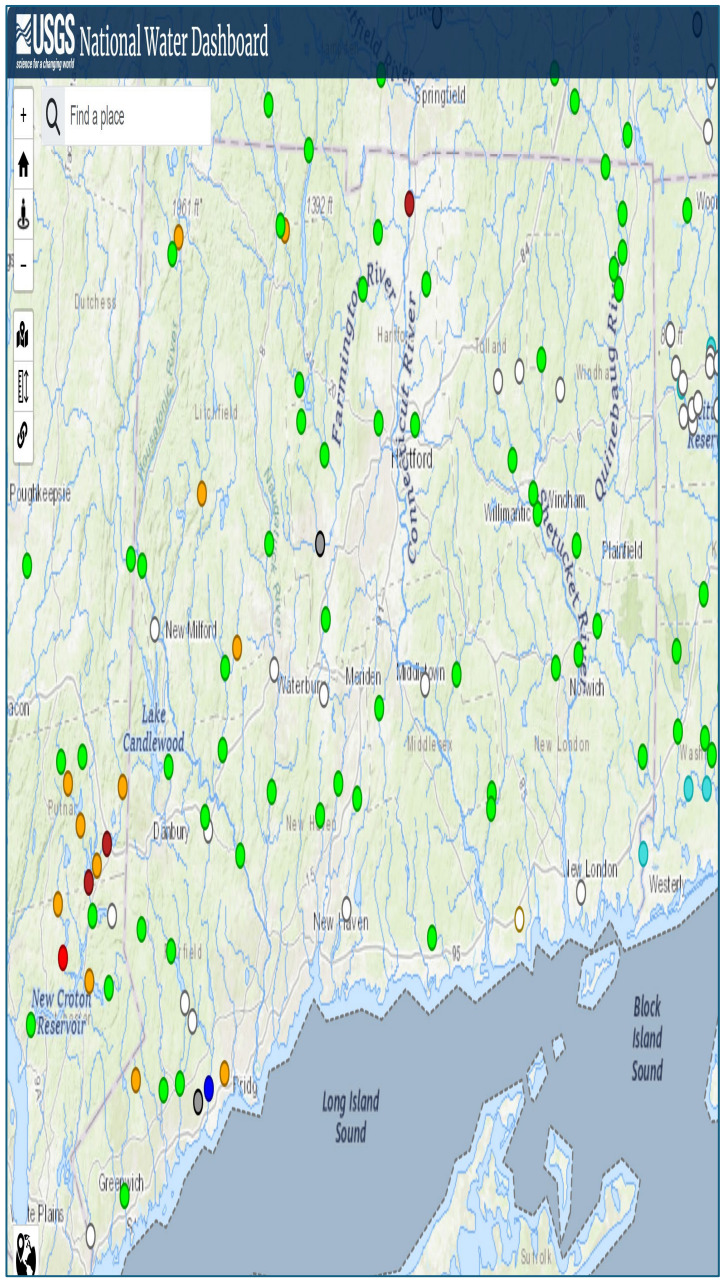
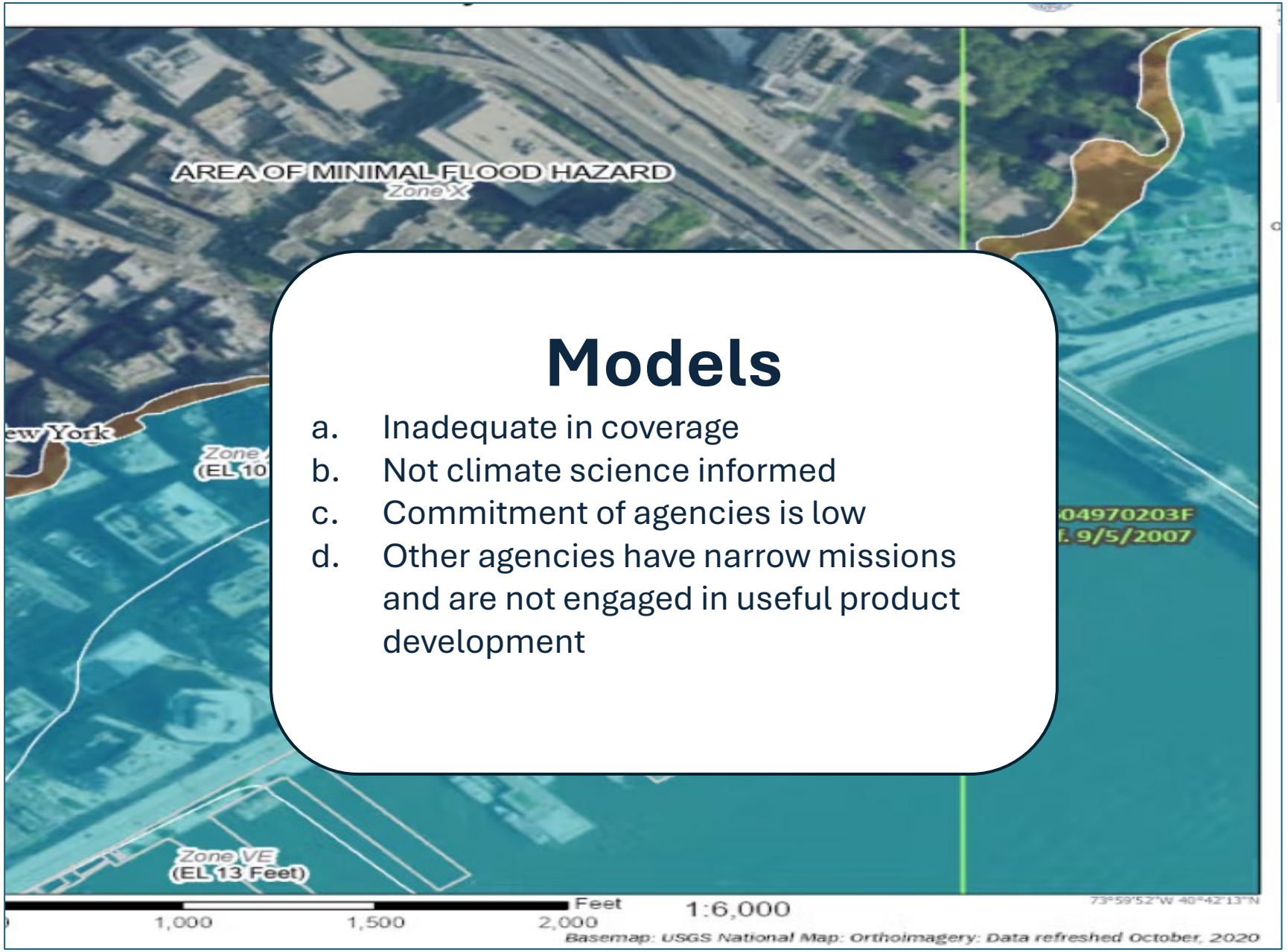
AREA OF MINIMAL FLOOD HAZARD
Zone X
ew York
Zone AE
(EL 10 Feet)
3604970184F
eff. 9/5/2007
3604970203F
eff. 9/5/2007
Zone AE
(EL 11 Feet)
Zone VE
(EL 13 Feet)
Feet
1,000
1,500
2,000
1:6,000
73°59'52"W 40°42'13"N
Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

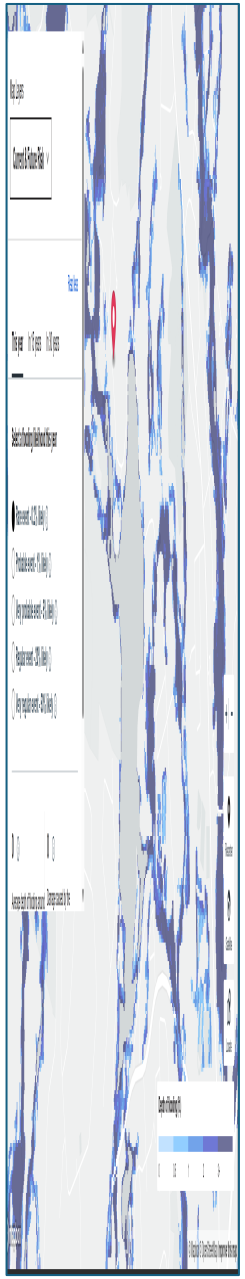

Map Layers
Current & Future Risk
Read less
This year
In 15 years
In 30 years
Select a flooding likelihood this year
Rare event - 0.2% likely
Probable event - 1% likely
Very probable event - 5% likely
Regular event - 20% likely
Very regular event - 50% likely
Average depth of flooding around
Damage caused by the
Recenter
Satellite
Locate
Depth of flooding (ft.)
0
0.5
1
2
3+
mapbox
© Mapbox © OpenStreetMap Improve this map

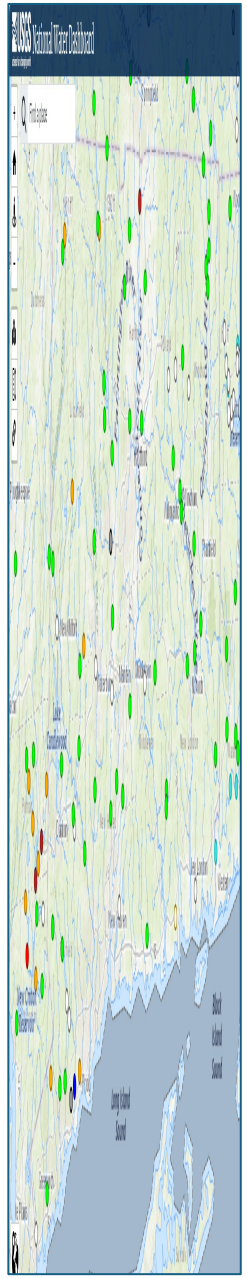

USGS National Water Dashboard
Find a place
Springfield
Dutchess
Litchfield
Farmington River
Connecticut River
Hartford
Tolland
Windham
Quinebaug River
Poughkeepsie
Willimantic
Windham
Plainfield
Retucket River
New Milford
Waterbury
Meriden
Middletown
Norwich
Lake Candlewood
Middlesex
New London
Danbury
New Haven
New London
Westerly
New Haven
New Croton Reservoir
Bridg
Long Island Sound
Block Island Sound
Greenwich
Ile Plains

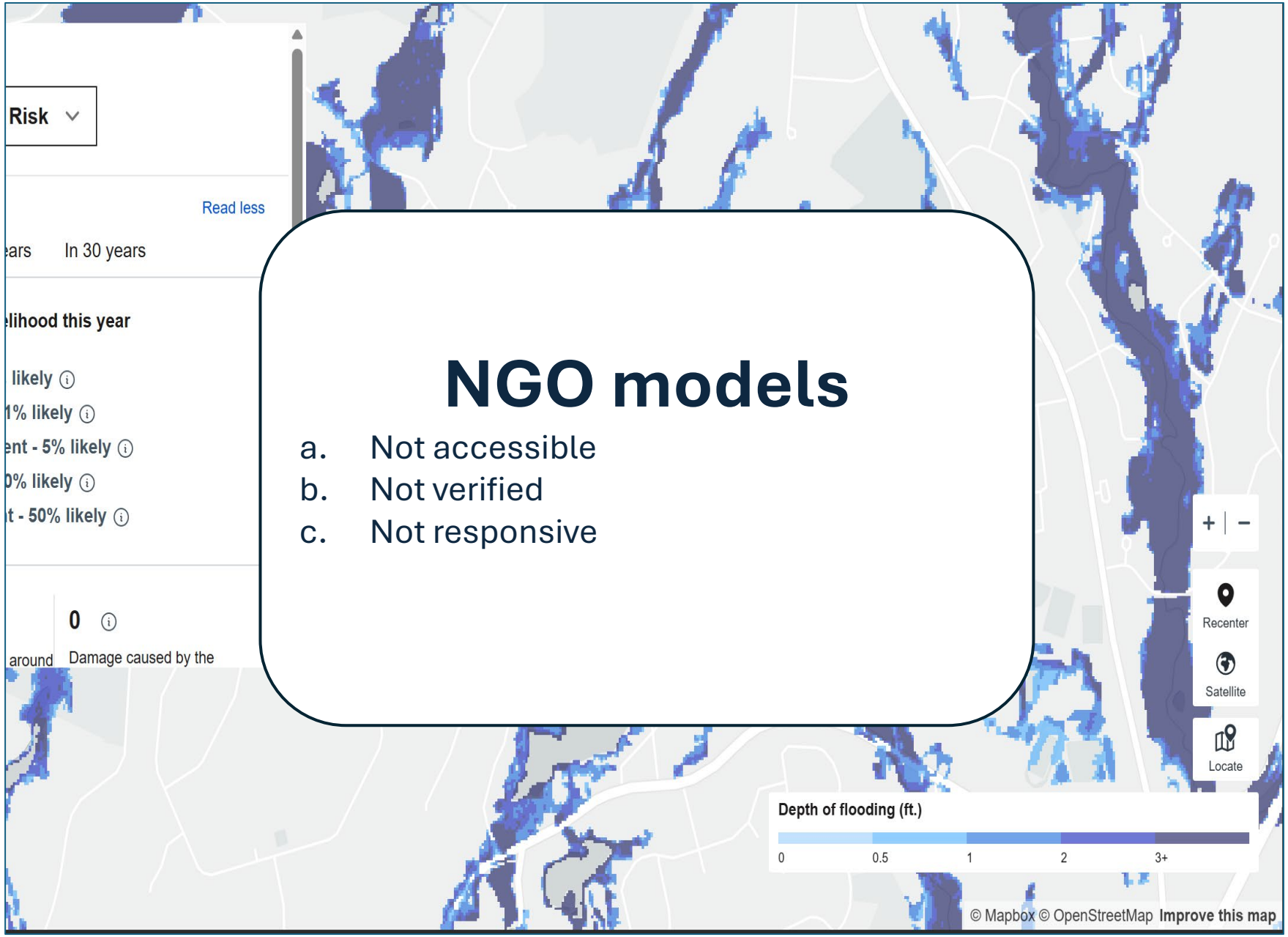


Models

a. Inadequate in coverage
b. Not climate science informed
c. Commitment of agencies is low
d. Other agencies have narrow missions and are not engaged in useful product development

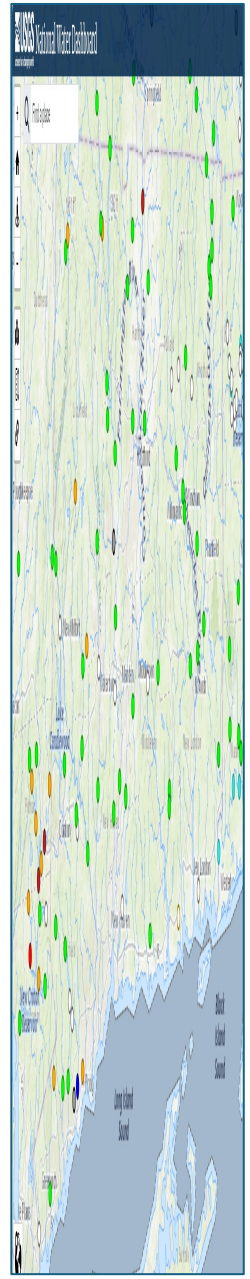


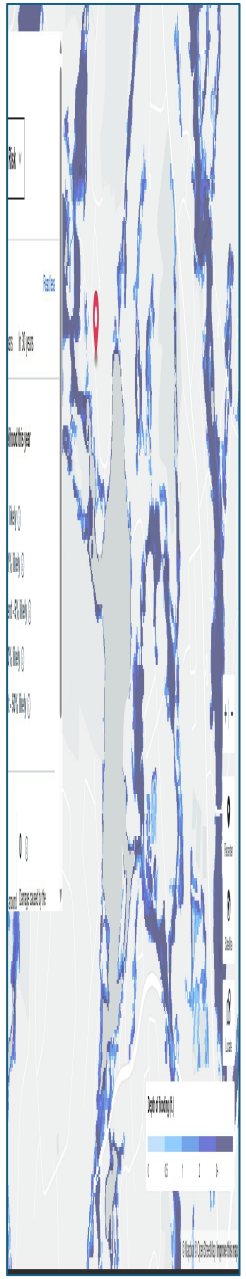


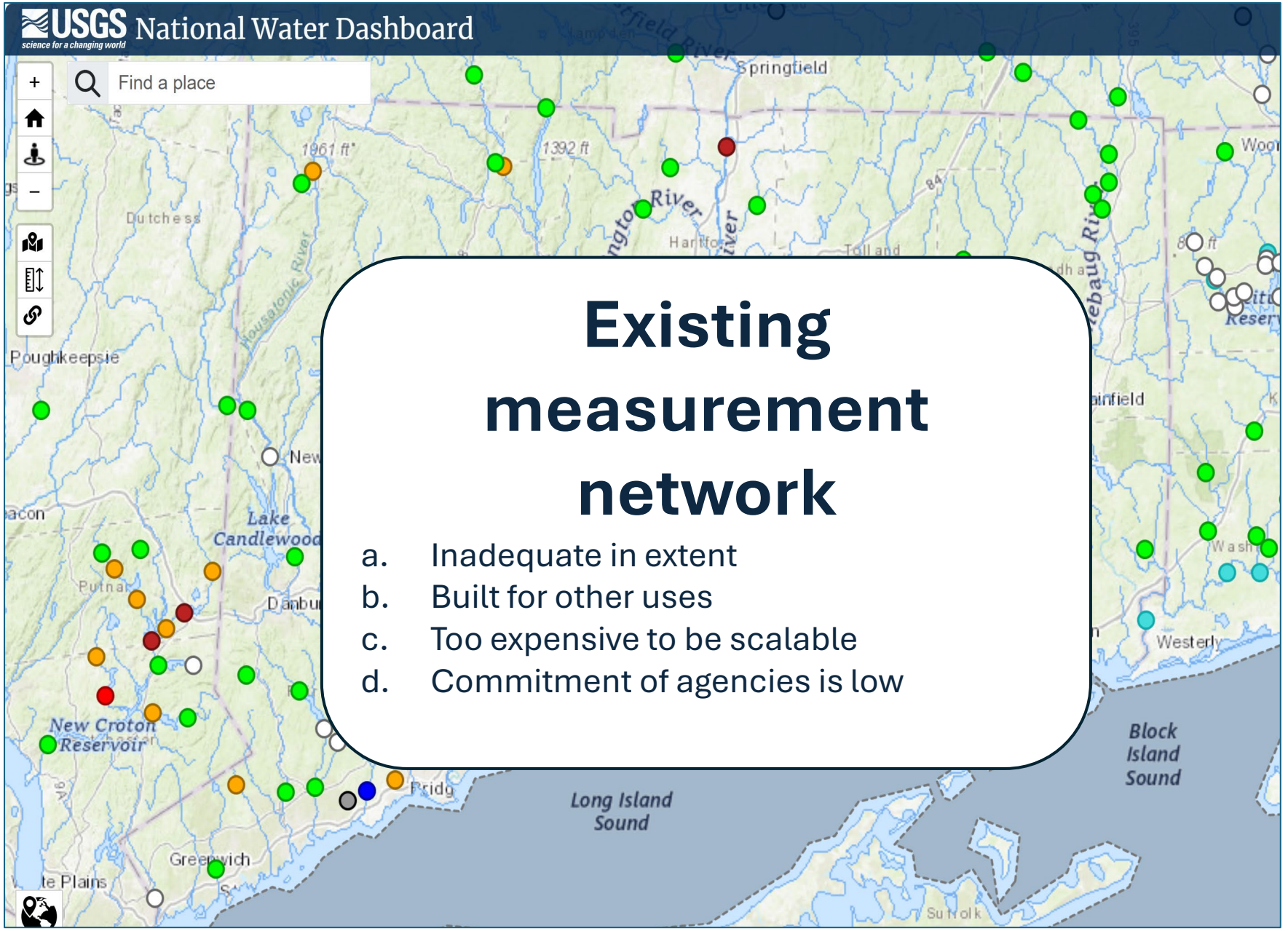


NGO models

a. Not accessible
b. Not verified
c. Not responsive







Existing measurement network

a. Inadequate in extent
b. Built for other uses
c. Too expensive to be scalable
d. Commitment of agencies is low

What we need to develop a capacity in CT

a. Coverage for entire state
b. Capable of revision to assess adaptation options (risk reduction)
c. Open source
d. Sufficiently high resolution to simulate flooding at property scale
e. Verified by measurements & local observations

The Recipe

Scalable
Local Demand
Reliable
Flood Alert System
Target Needs
Durable
Low-Cost
Maintainable

The Process

Demand
Where it is needed, which problems to address

Permit
Access, power, comms

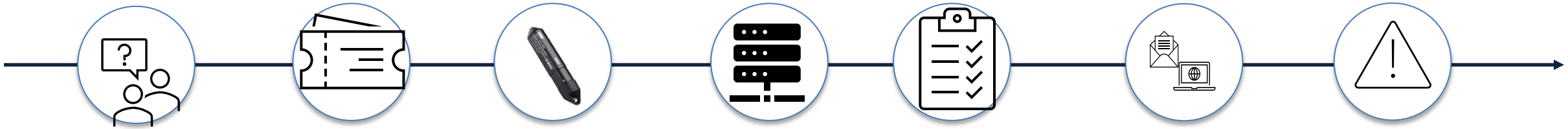
Deployment
Logistics, weather

Gateway
Data, Cloud, Servers

QA/QC
Thresholds, audits

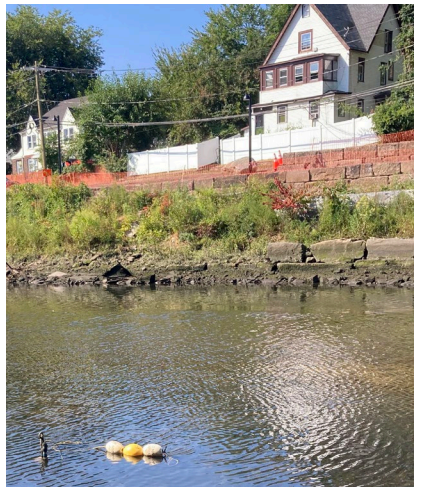
Dashboard
Alert engine, emails, web interface

Governance
on-call, after-action reviews



Real-Time Flood Monitoring for Coastal Resilience

- Dual-sensor system measures water levels and flood elevations
- Live dashboard and alert system helps responders act quickly` during storm events
- Piloted in Stamford and Branford based on historical flood risk
- Supports flood risk mapping, emergency alerts, and evacuation planning
- Data feeds into resilience and infrastructure efforts



Flood Sensor Locations

2 sensors deployed

- Elm St under the railroad bridge
- East Main St at Myrtle Ave

Flood monitoring page (per area)

Back to Site Selection

Use metric units ☐

Units default to knots, ft but can be toggled to metric.

CIRCA Severe Weather Monitoring - Branford

Near-Real-Time Wind & Flood Data for Branford

Customizable supplementary info (e.g., NWS warnings, via API).

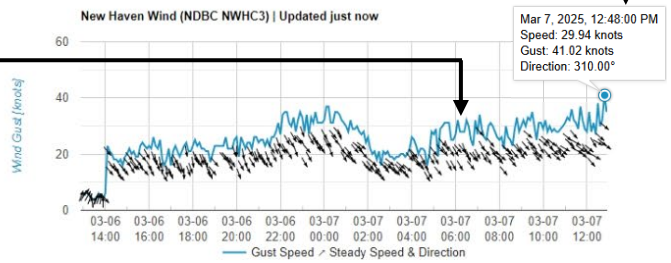
Winter Weather Advisory
1/16/2025 04:05 EST through 1/17/2025 04:00 EST

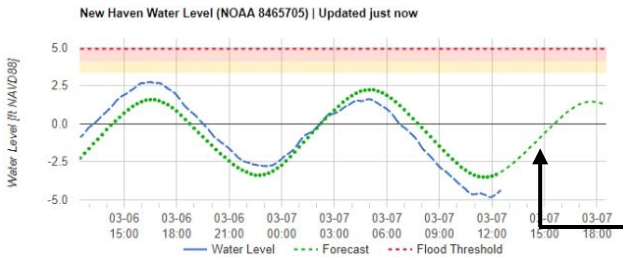
Winter Weather Advisory issued January 16 at 4:05AM EST until January 17 at 4:00AM EST by NWS Upton New York NY

- **WHAT:** Snow expected. Total snow accumulations between 1 and 3 inches. Localized higher amounts possible in banding.
- **WHERE:** Portions of south-eastern New York and western Connecticut.
- **WHEN:** Until 4 AM EST Friday.
- **IMPACTS:** Plan on slippery road conditions. The hazardous conditions could impact the Thursday morning and evening commutes.

Graphs can be queried by hovering over them with cursor

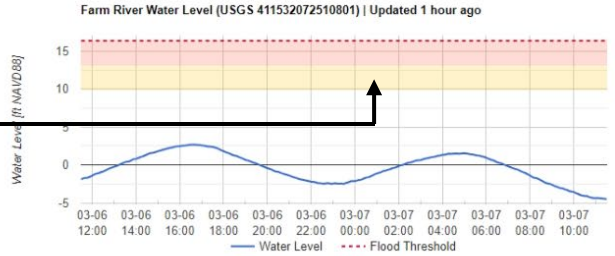
Wind gust speed shown in blue. Steady speed and direction shown with arrows.

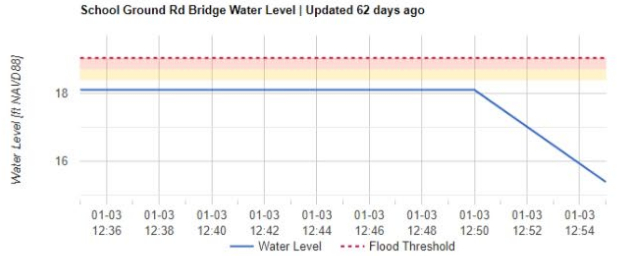


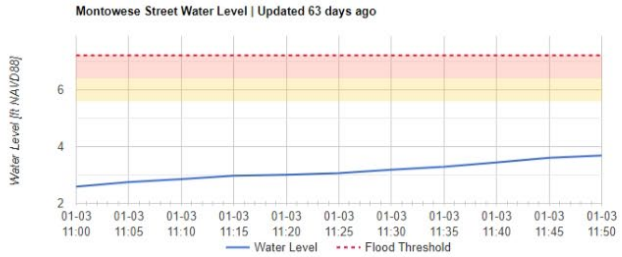


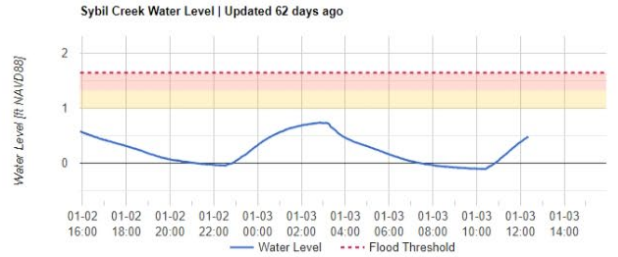
Predicted tide forecast overlaid on measured water level plots where applicable

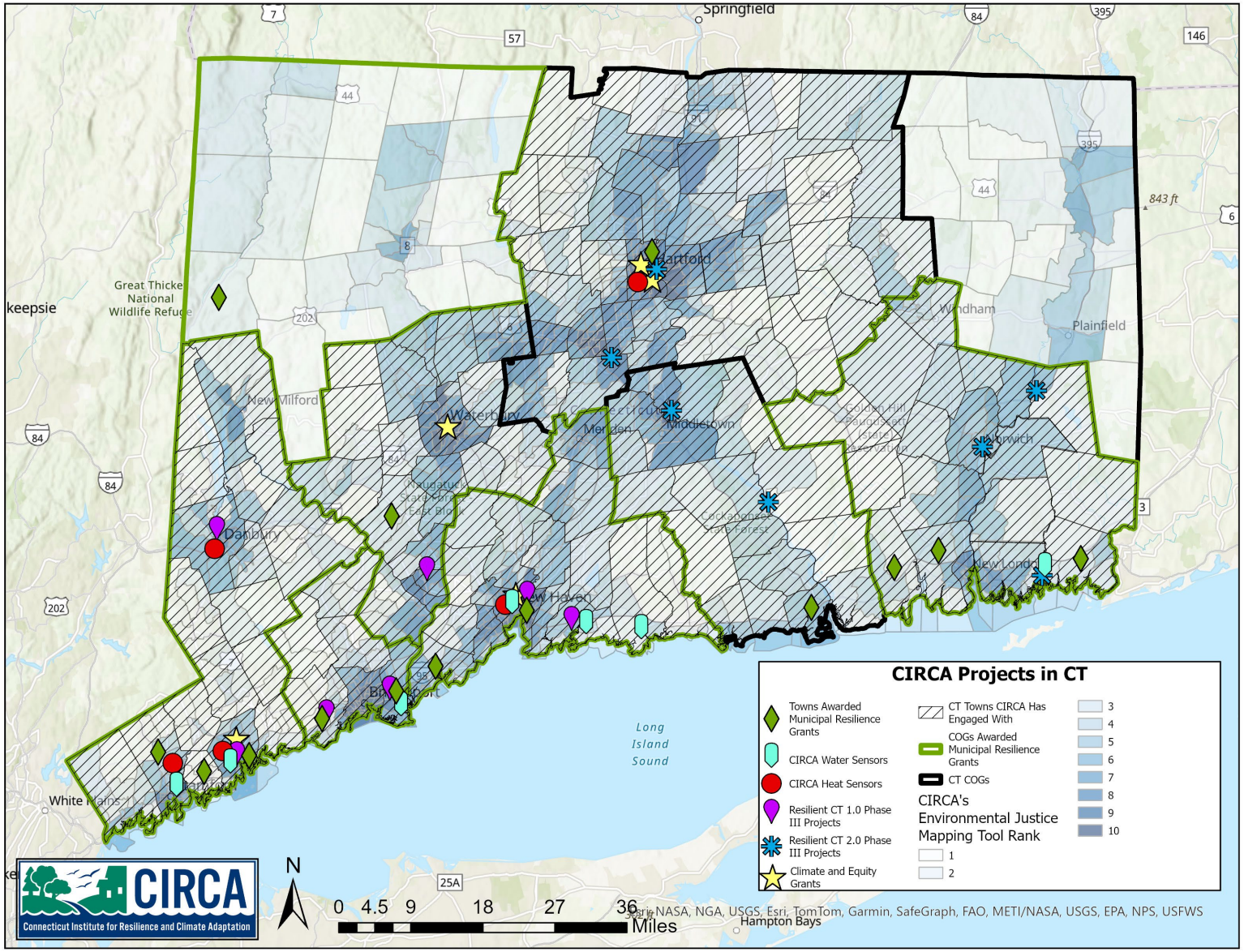
Customizable flooding thresholds per site and user requirement. Three different alerting levels. Customizable response to threshold exceedance (e.g. graphical warnings and/or emails)











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Recommendations

1. Deploy flood Alert Network across the state
   a. For routine/nuisance flooding adaptation
   b. Emergency manager information
   c. Model validation
   d. Development of operational alerts in combination with forecast and AI.
2. Develop State-wide flood modeling capacity to make
   a. Climate-change informed, locally validated, revision-aware, open-source risk maps
   b. Enable access to model infrastructure for adaptation planning by towns/contractors
   c. Augment observation-based alerts
3. Develop Long-term plan for sustaining capacity

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