Loss of life caused by the flooding of New Orleans after hurricane Katrina:

A preliminary analysis of the relationship between flood characteristics and mortality

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Addressing Hurricanes and Other Hazards and Their Impacts on the Natural, Built, and Human Environments

HKV LIJN IN WATER

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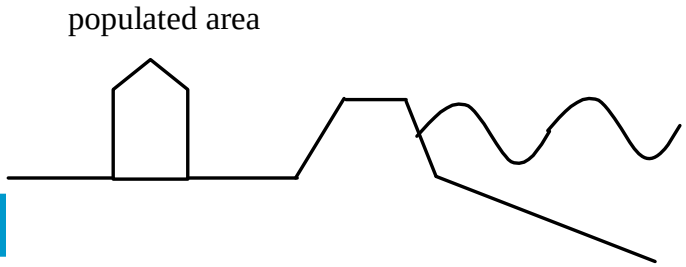
Background

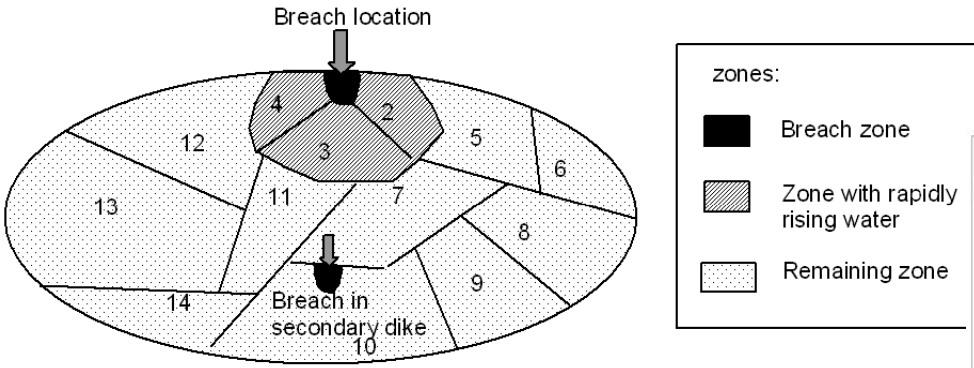
- Methods for estimation of loss of life are used to:
  - Assess consequence and risk levels
  - Analyse mitigation strategies
- A method has been developed for Netherlands, mainly based on Dutch 1953 data
- Objective: analyse relationship between flood characteristics and mortality for New Orleans
- Focus on direct mortality in flooded area

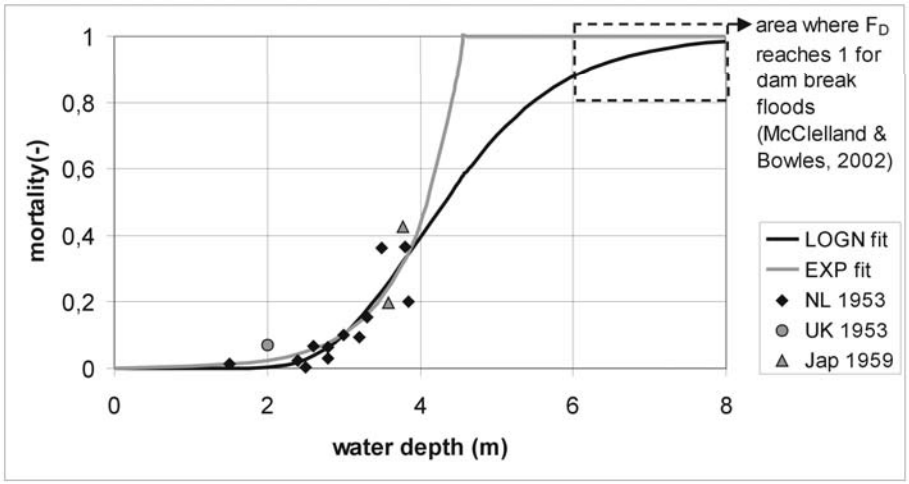


Analysis of mortality

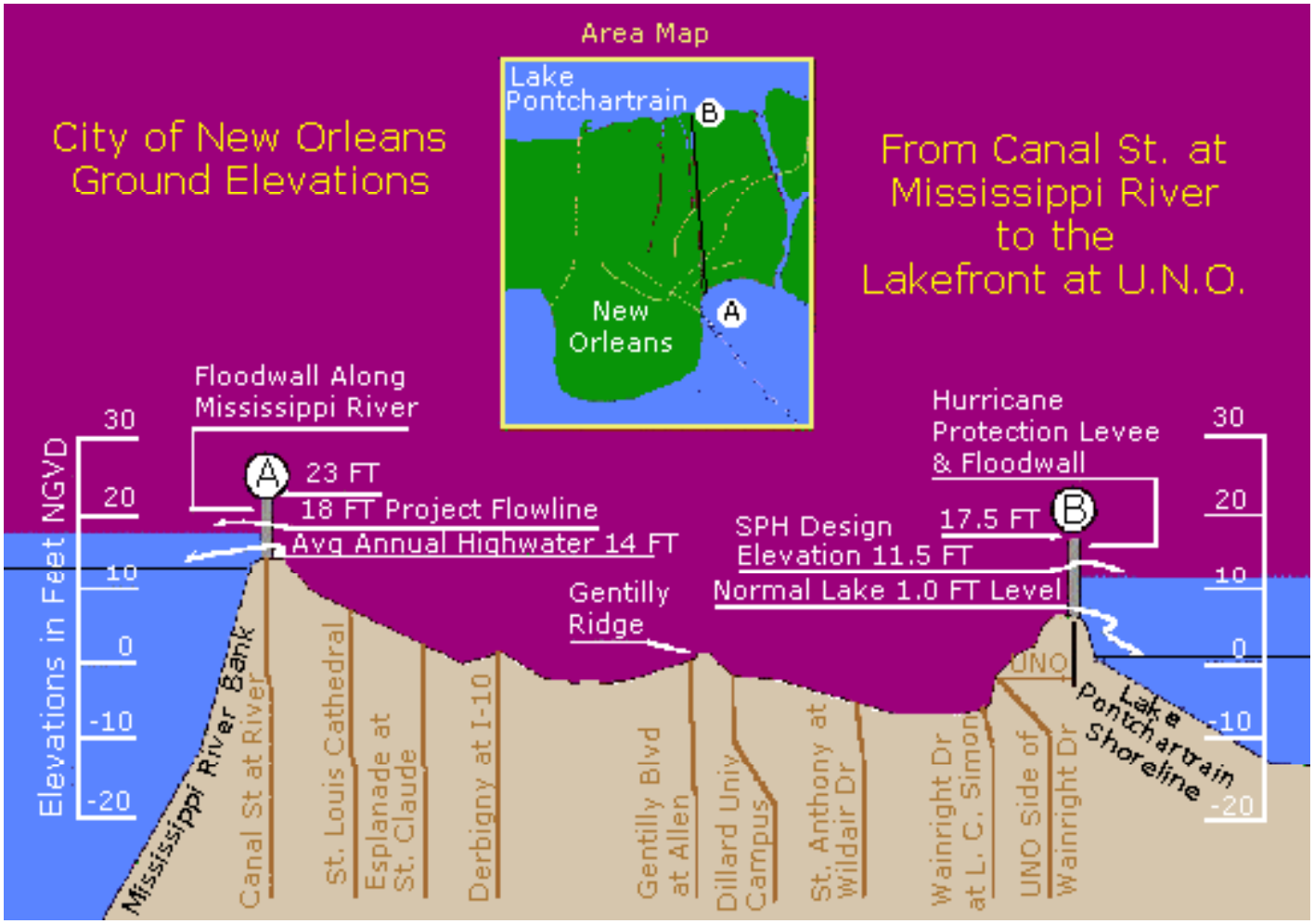
1. Analyse flood characteristics
2. Estimate exposed population (incl. evacuation)
3. Analyse relationship between flood characteristics and mortality

Mortality (=nr. of fatalities/nr. exposed)





New Orleans: situation



Hurricane Katrina

Levee systeem

Flood simulations

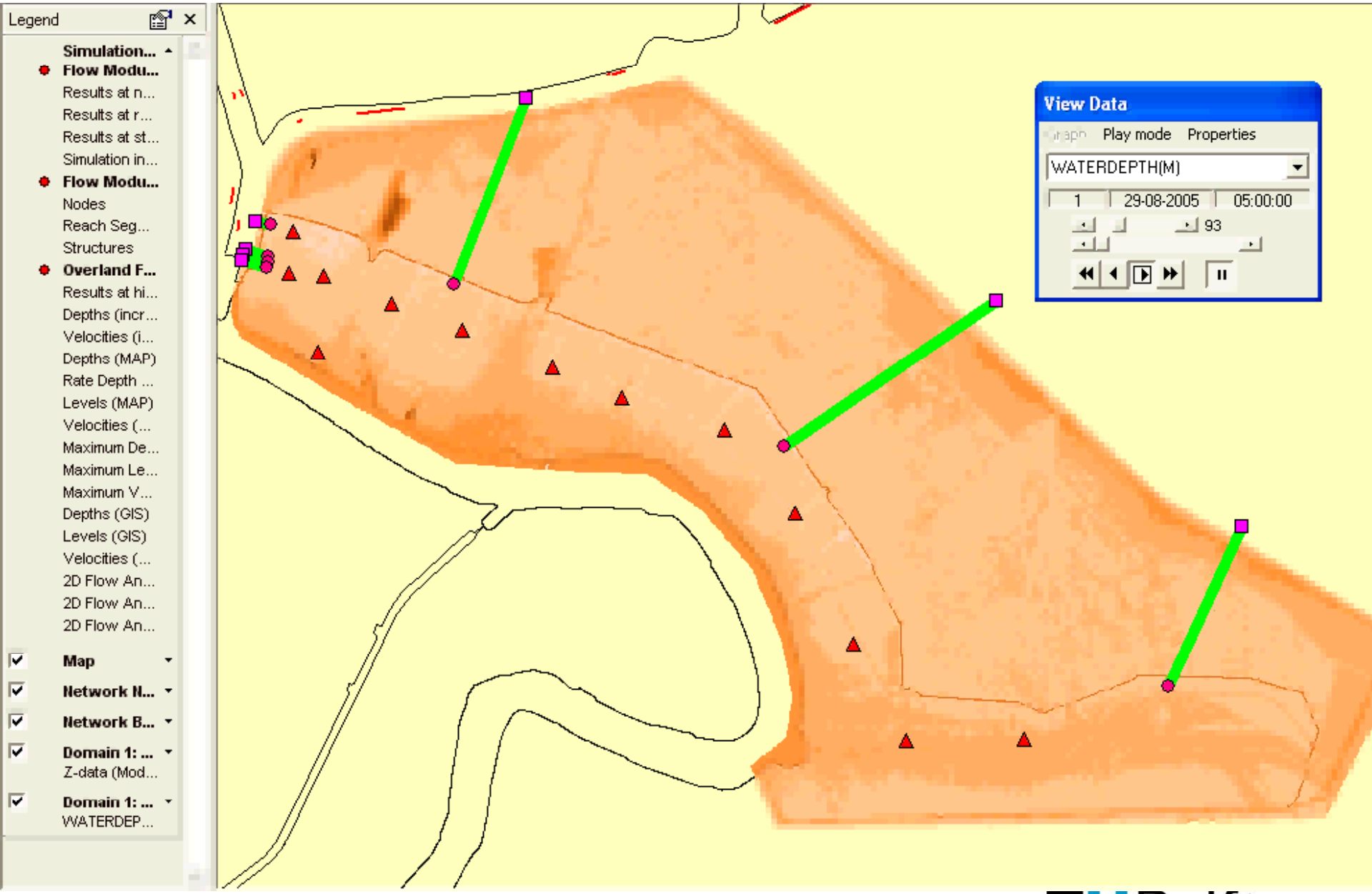
- 2D Hydrodynamic simulations
- To give insight in: depth, velocity, rise rate, arrival time

Input information:

- Breach characteristics (location, size, timing)
- Digital elevation model
- Hydraulic roughness

- Results compared with: flood maps, damage patterns, eyewitness accounts

Flood simulation



Simulations by Bob Maaskant (TU Delft) and WL|Delft Hydraulics

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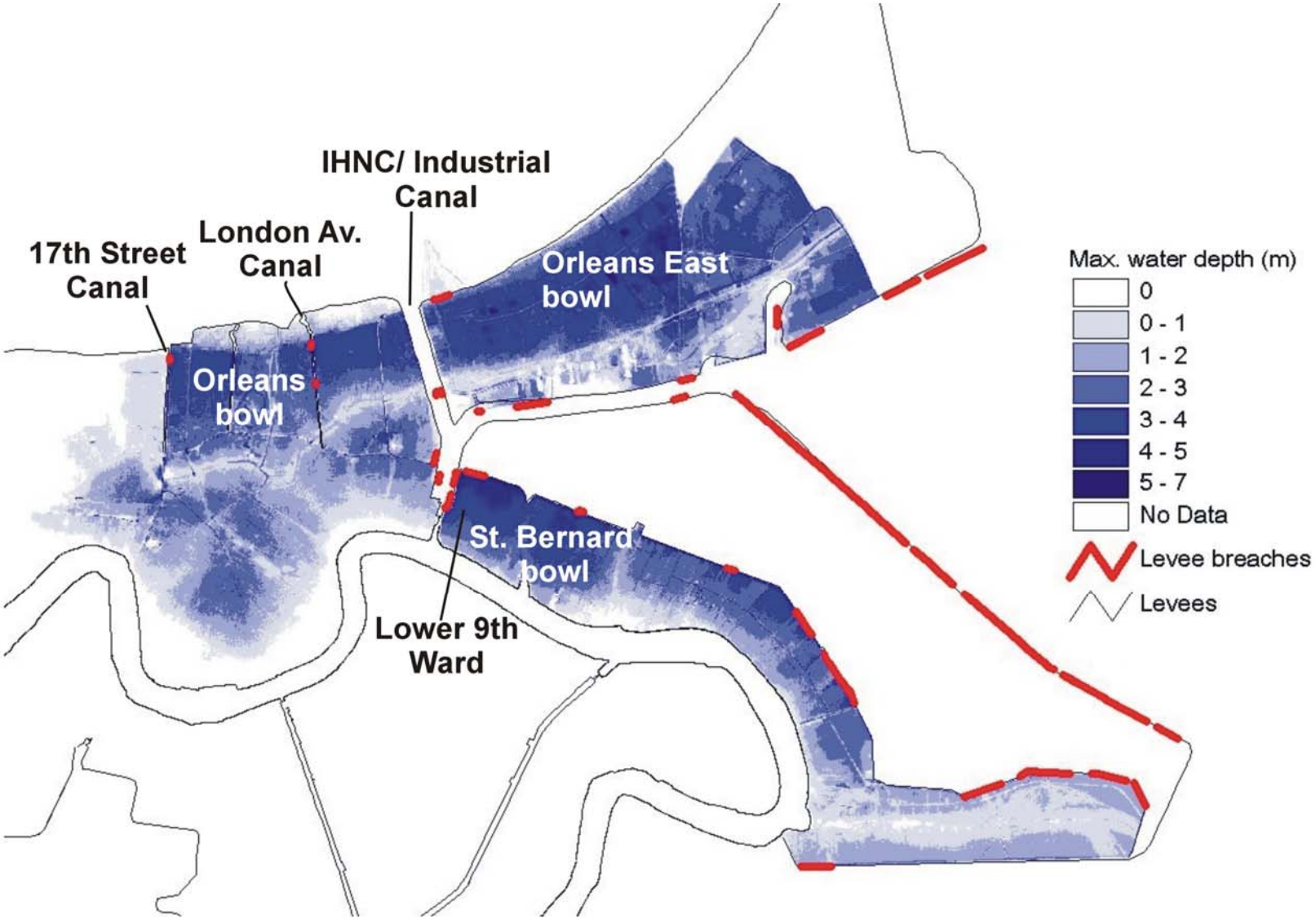
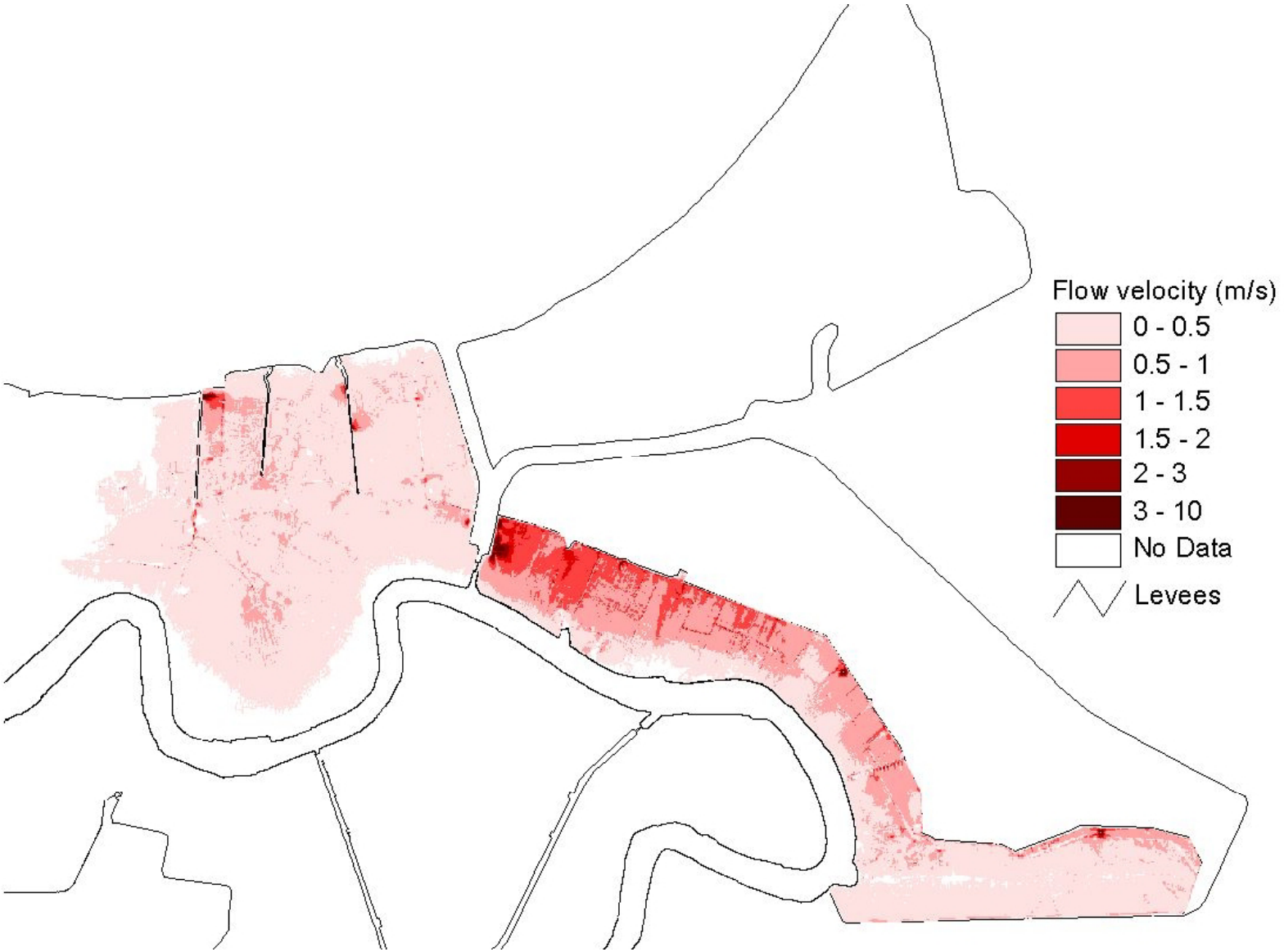
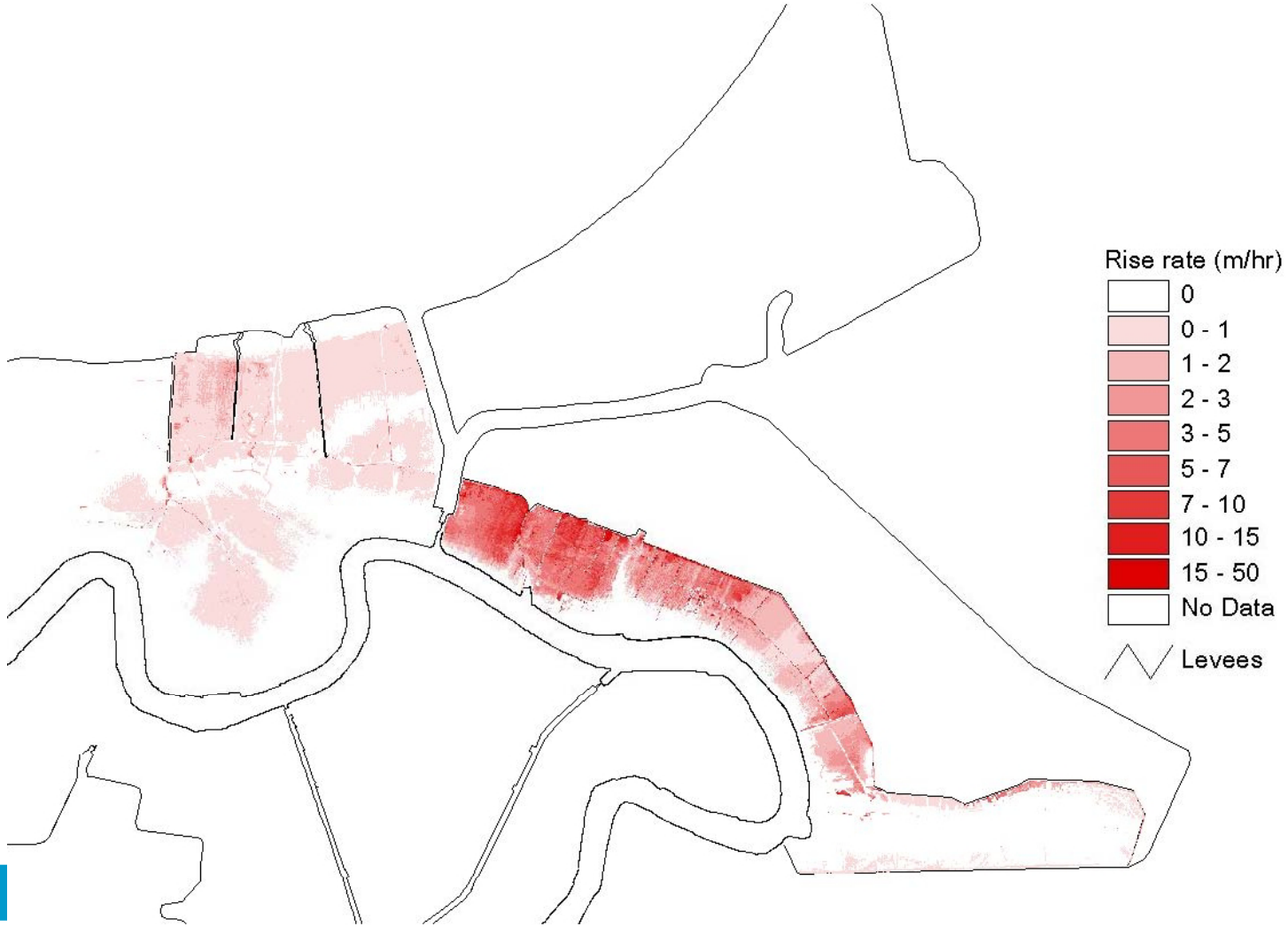
Flood simulations: results



Flood simulations: results (2)



Flood simulations: results (3)



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Flood simulations: results (4)

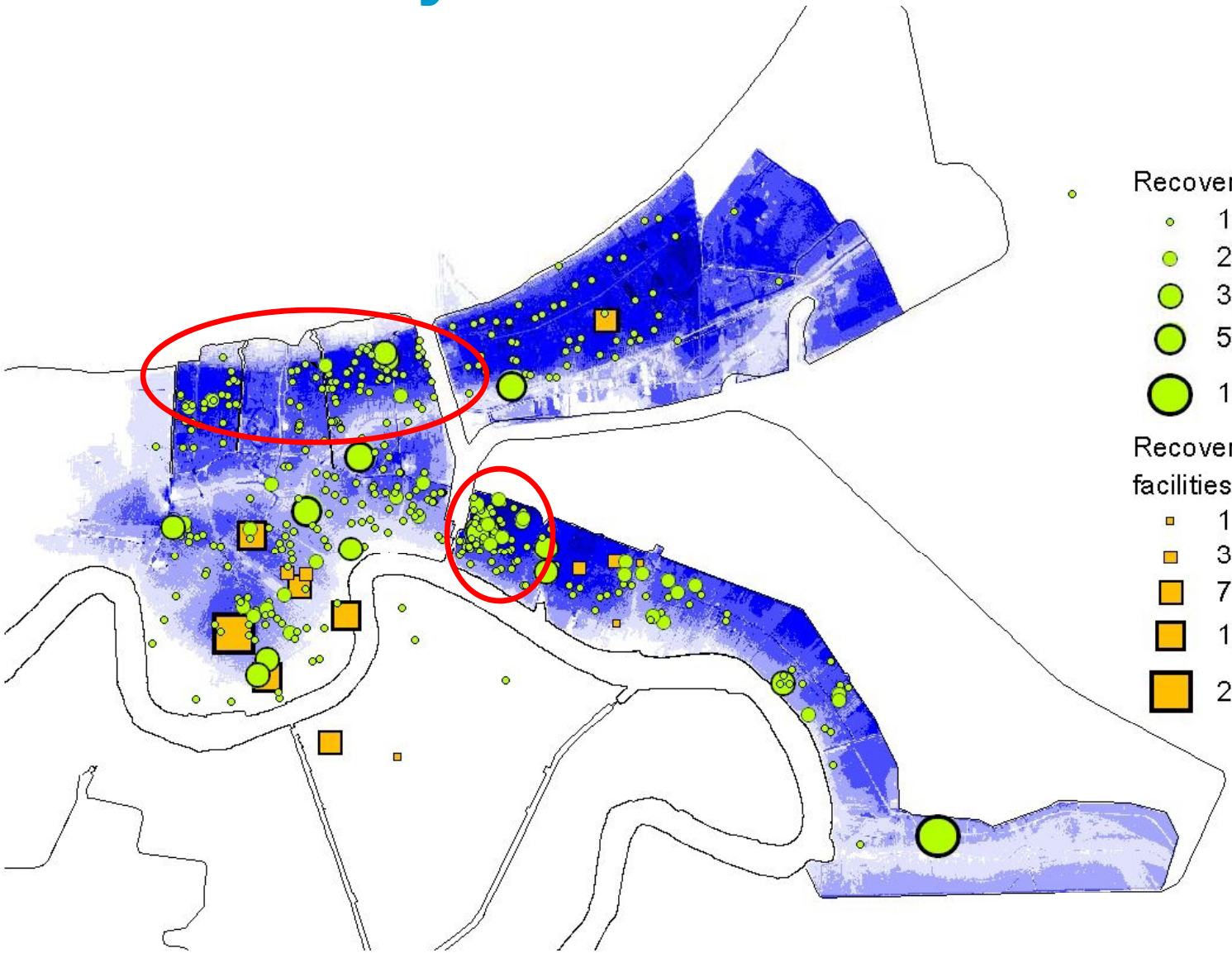
Affected population and evacuation

- Flooded area: ± 450,000 inhabitants
- Evacuation rate: 80% to 90% ((Wolshon, 2006) based on traffic counts)
- Shelter in city (Superdome etc.) ±10%
- Estimate: 10% of population was ‘exposed’ to flooding

Data regarding Katrina related fatalities

- Source: State Louisiana DHH in cooperation with LSU Hurricane Center
- Total: 1118 fatalities in Louisiana
- Recovery locations geocoded for 771 victims (69%)
- Dataset also provides information on:
  - Age (elderly!)
  - Gender (50%-50%)
  - Ethnicity (similar to original population)
  - Type of structure / facility

Recovery locations



Source: State of Louisiana DHH & LSU Hurricane Center

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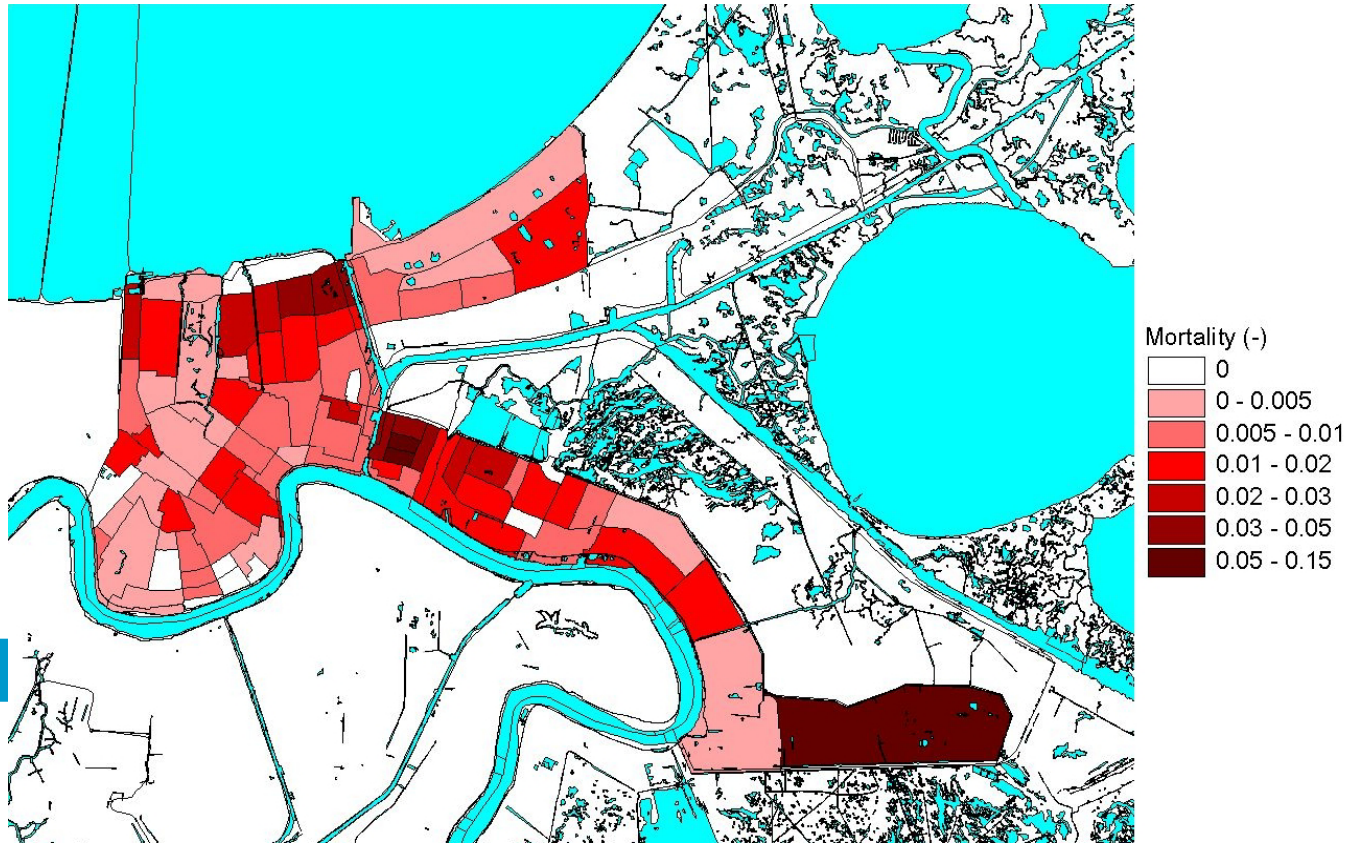
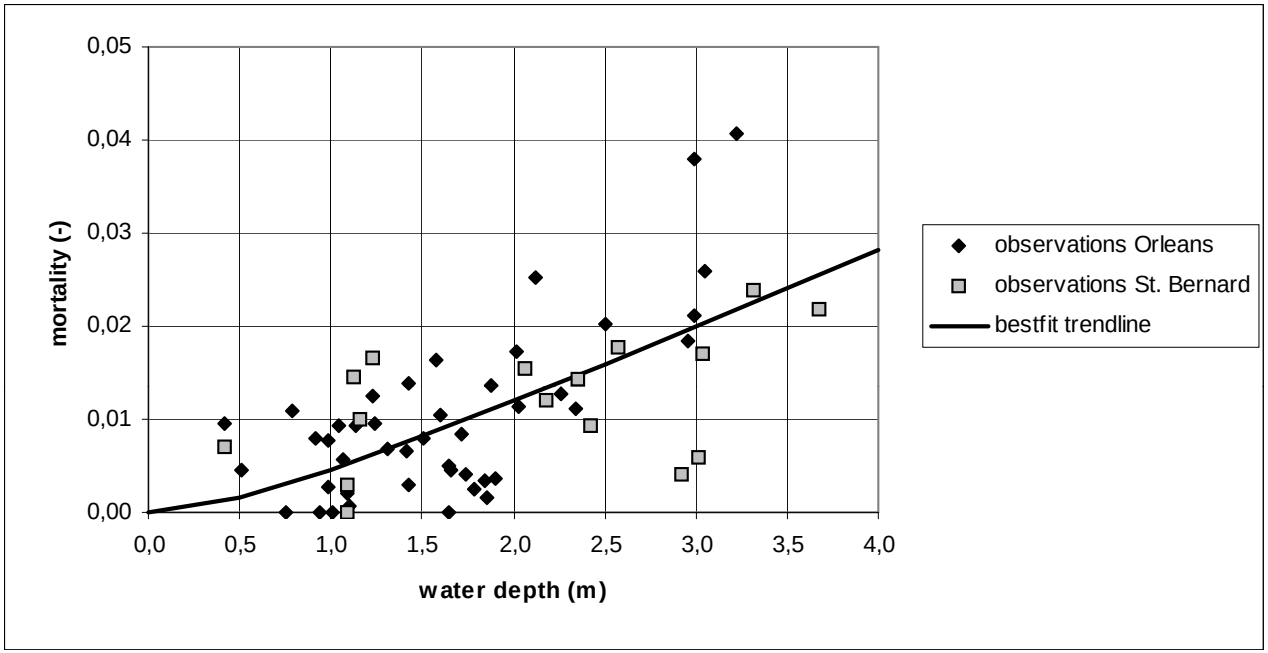
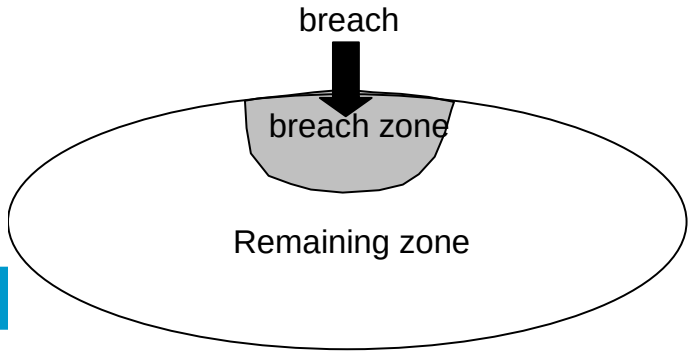
Results by ‘bowl’

Bowl	Inhabitants (flooded area)	Exposed	Recovered nr. of fatalities*	Mortality
Orleans	255860	25590	260	1,02%
St. Bernard	85420	8540	190	2,22%
New Orleans East	96290	9620	68	0,71%
Total	437570	43750	518	1,18%



Results





Breach zone: hv>5m^2/s

⇨ F_D=0,053

Remaining zone (hv<5m^2/s):

⇨ $F_D(h)=\Phi_N((\ln(h)-5{,}20)/2{,}00)$

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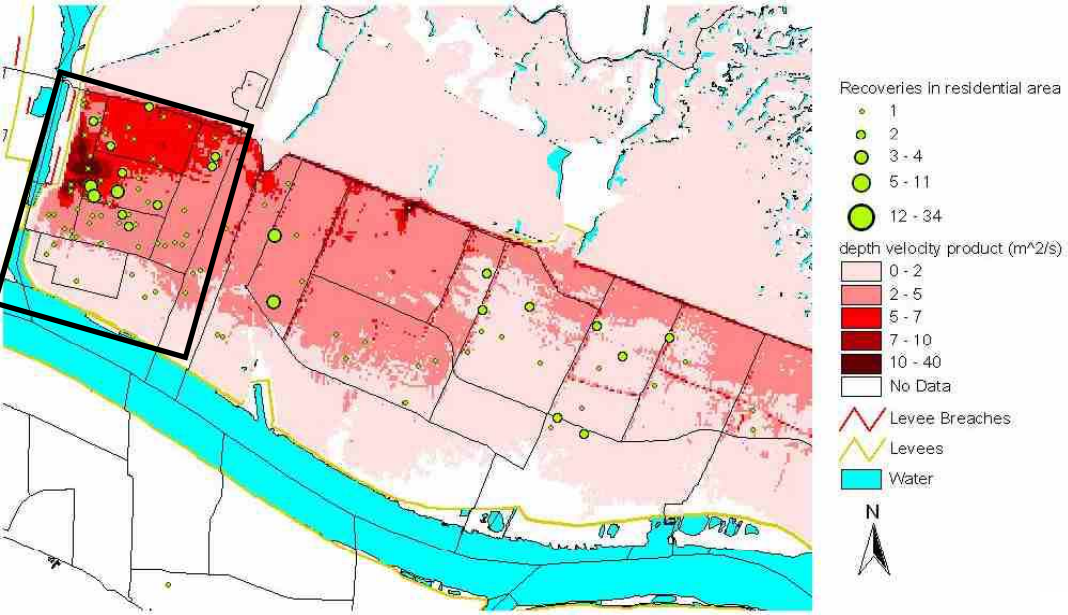
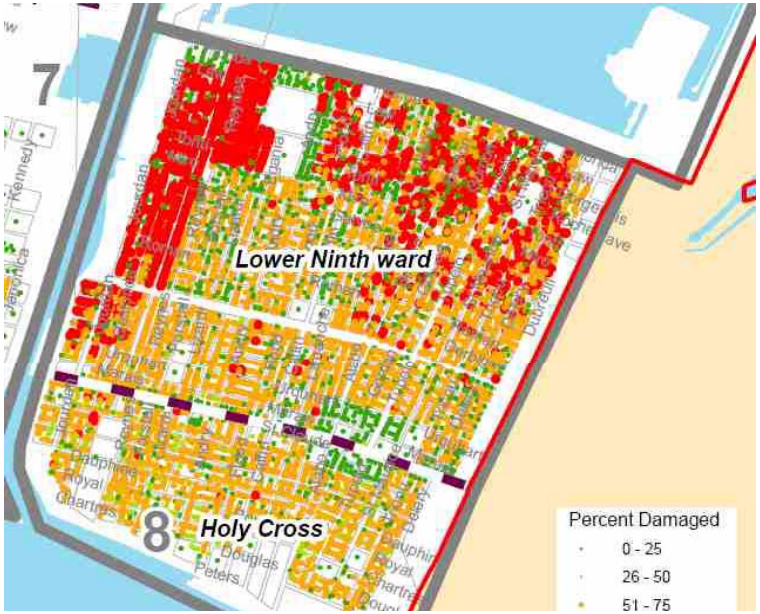
Breach zone: Lower 9th Ward

Flood characteristics



Building damage



- Many fatalities (75) near the Lower 9th Ward breaches
- Characterised by building collapse and $hv > 5 m^2/s$

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Concluding remarks

- Overall event mortality (1%) comparable to historical events
- 2/3 of the fatalities associated with physical impacts of the flood
- Mortality rates were highest in areas with large water depths and near breaches
- Relationship between flood characteristics and mortality was found (but no influence of rise rate)

Recommendations

- Further analysis of mortality and population data is recommended
- Comparison with other methods (e.g. IPET)
- Application in consequence and risk assessments