Assessing and Mitigating Public Health Risk in New Orleans: Final GIS Innovations

Binselam, Sait Ahmet
Peele, R. Hampton
Van Heerden, Ivor

Outline

- **Introduction**
- **Assessing and Mitigating Public Health Risk in New Orleans: Final GIS Innovations**
- **Research and GIS Innovations before and after Katrina: Model Insights**
- **Sample Solutions for two encountered modeling problems**
  - Raster Based Solution to Surge Inundation
  - Vector based solution to Zonal Statistics
- **Hurricane Katrina, 2005 Expected outcomes – realized**
- **Hurricane Katrina, 2005 Unexpected outcomes**

Assessing and Mitigating Public Health Risk in New Orleans: Final GIS Innovations

- **Pilot Project, 2002: Build a GIS portal for the New Orleans study area**
  - Incorporate data and models for *health, hurricane research*
  - Multidisciplinary research team state, local agencies contributed
  - Study to determine public health impacts of a major event
- **Hurricane Katrina, 2005**
  - Research and GIS Innovations before and after Katrina: Model insights
  - Unexpected outcomes that were not built into the model

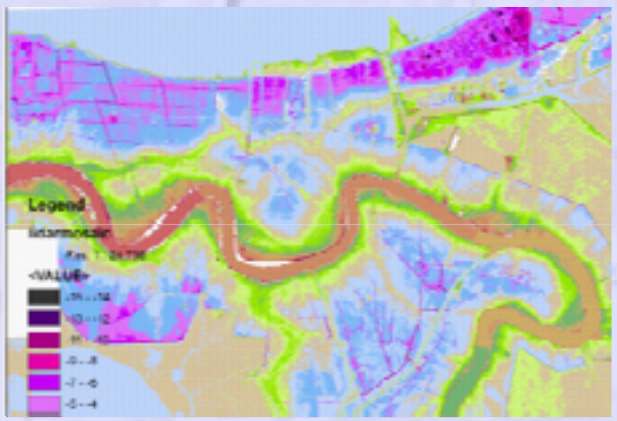
Assessing and Mitigating Public Health Risk in New Orleans – Predicted Outcomes

"Following a major hurricane in New Orleans, flooding would be the principal public health threat - stranding large numbers of the population for significant amounts of time, while subjecting a vast number of evacuees to crowded and possibly unsanitary conditions…"

(I. van Heerden, Lead Project Investigator, Advisory Board meeting minutes, 2002)

Research and GIS Innovations before and after Katrina: Model insights

- **LIDAR Data**
  - The incorporation of LIDAR data into the GIS helped researchers to visualize the areas of the New Orleans “bowl” most at risk from flooding *(Binselam, Peele)*

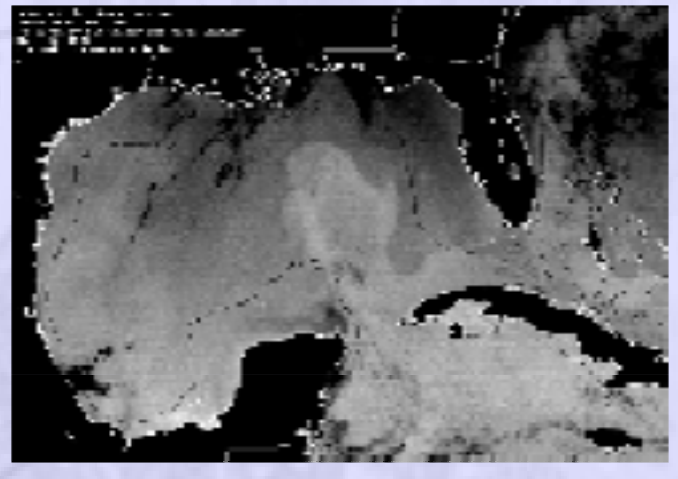


- **Census Data**
  - Vulnerable populations were being identified within the city by mapping census data with other layers (e.g., socio-economic, car ownership, storm surge and elevation)*(Pedro, Pine)*

Research and GIS Innovations before and after Katrina: Model insights

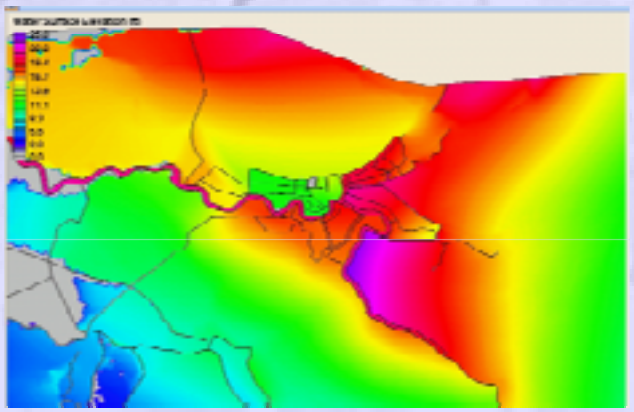
- **Transportation and Evacuation modeling**
  - Studies on Hurricane Ivan Evacuation (2004) made significant improvements to contra-flow plans, resulting in greater evacuation success *(Wolshon)*

- **Remote Sensing and Imagery**
  - Studies on Sea Surface Temperature (SST)/ Sea Surface Height (SSH) and the Loop Current were beginning to indicate when there would be greater potential for the rapid intensification of storms in the Gulf of Mexico *(Walker)*

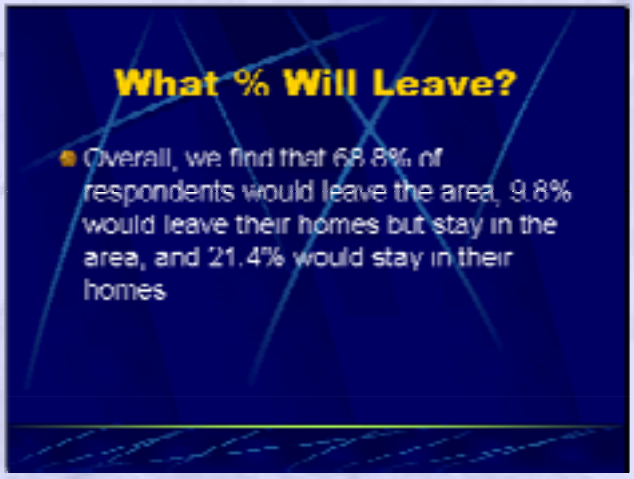


Research and GIS Innovations before and after Katrina: Model insights

- **Storm Surge modeling**
  - Flooding from Lake Pontchartrain and the MRGO “funnel effect” had been modeled for Cat 3 storms; NOFD used ADCIRC surge maps to evacuate residents to higher ground *(Mashriqui, van Heerden)*



- **Population Survey Results**
  - Preliminary survey results were indicating that as many as a third of New Orleans residents would not evacuate for Category 3 hurricane *(Hurlbert & Beggs)*



Research and GIS Innovations before and after Katrina: Model insights

- **ADCIRC Depth of Flooding, Hurricane Pam Catastrophic Hurricane Training Exercise, 2004 *(Binselam)***

- ***Increasing capability of incorporating study area data, high resolution hurricane research and modeling, and aerial photography and imagery in a secure, online GIS***

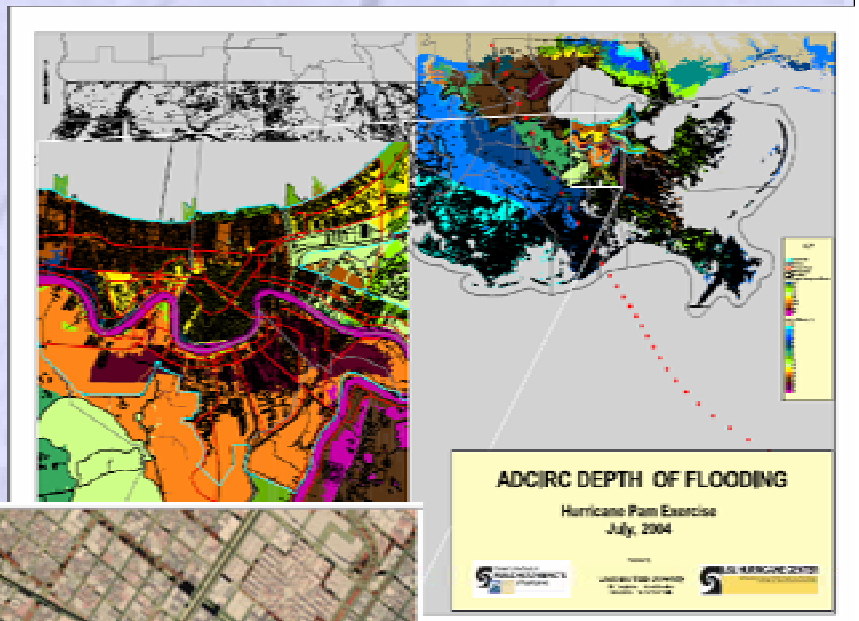
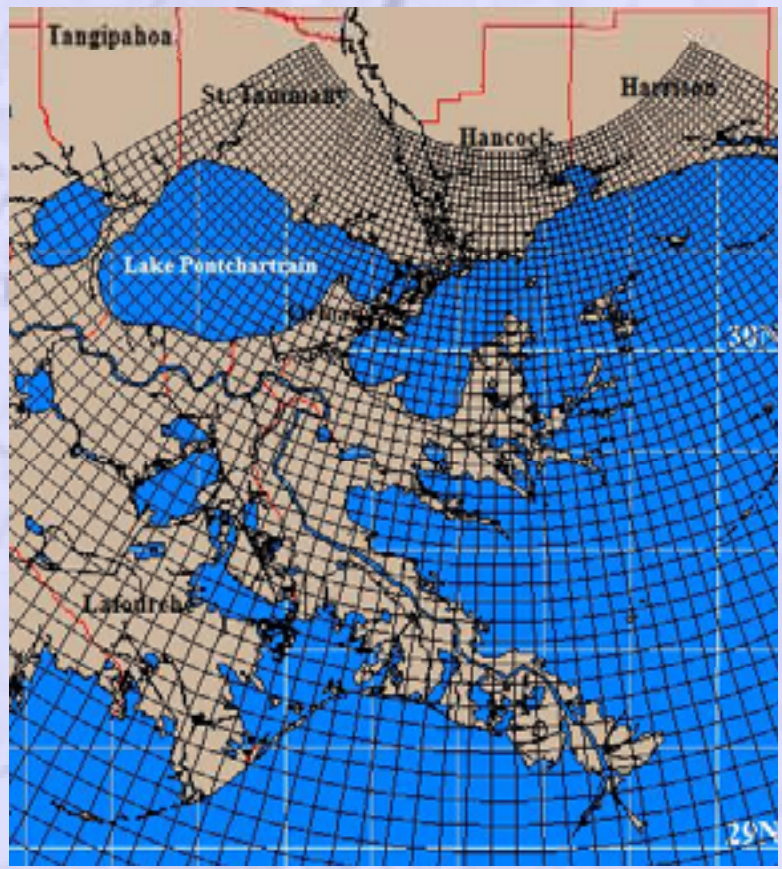


Figure 3. Hospital, parcel and roads data over high resolution panchromatic aerial photography (HPHC 05)

An Encountered Problem

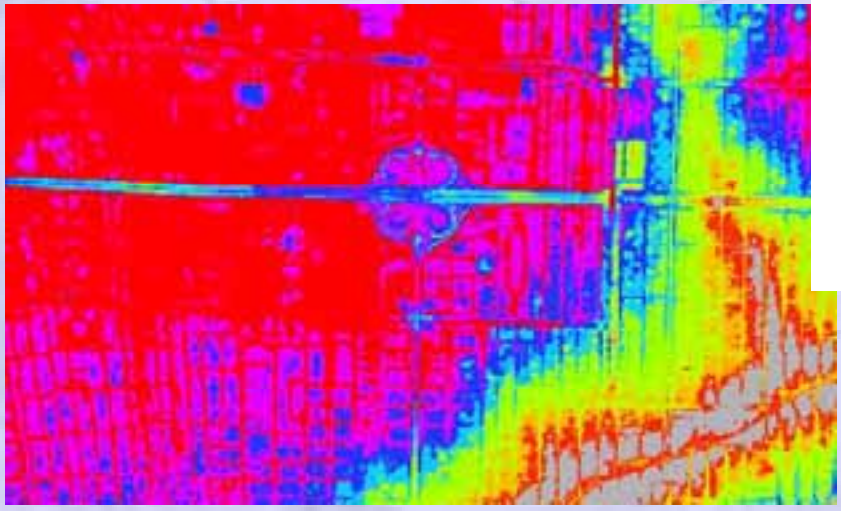
- How can we interpolate SLOSH model surge over land?
  - Problems
    - very large grid cells
    - does not show over topography
    - SLOSH data have to be converted to a suitable GIS format
    - No inundation



Raster Based Solution

A possible raster base solution.

- create center points for SLOSH grid
- interpolate the data to raster
- subtract the cell values



1	1	0
0	1	2
4	0	0

Elevation Grid

+

0	-1	-1
-1	-2	0
0	-1	-1

Surge Grid

=

1	0	-1
-1	-1	2
4	-1	-1

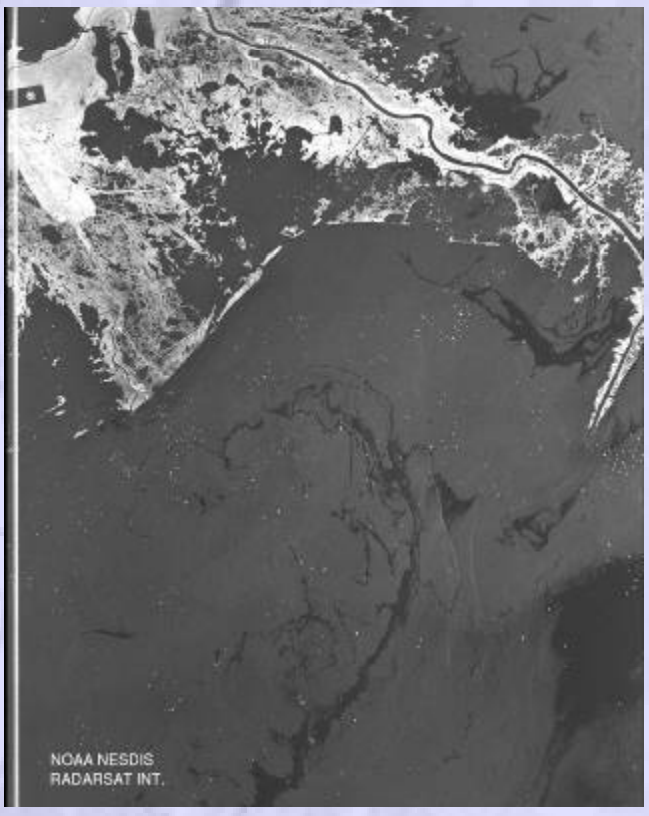
Output Grid

Expression:

Output Grid = Elevation Grid + Surge Grid

Hurricane Katrina, 2005
Expected outcomes -- realized

- Flood deaths and injuries, lack of basic needs (food, water), and exacerbated medical conditions
- Public health impacts identified by Diaz, Hugh-Jones ranged from chronic conditions to gastrointestinal and upper respiratory conditions, etc.
- Major oil spills *(Walker 2005 – image from LSU Earth Scan)*
- Many animals left behind, in need of shelters or rescue



Hurricane Katrina, 2005
Unexpected outcomes -- not in the model

- Levee Breach
  - Storm surge models could not simulate or build in a breach scenario, although overtopping of levees was modeled
- Wind damage was not as severe as expected in much of the city *(Levitan)*
- Water contamination was less than anticipated (Pardue 2005)
- Disease vector control of WNV, Dengue Fever, Malaria was not as bad as anticipated (Diaz, Hugh-Jones)

Hurricane Katrina, 2005
Unexpected outcomes -- not in the model (cont'd)

- Success of Search and Rescue
  - Flood Fatality models and estimates were luckily proven wrong, for various reasons. Mainly due to the significant military, state and local emergency responders and volunteer rescues
- High numbers of hospital, nursing home, and other medical special needs residents sheltering in place in the impact area, including many elderly and disabled.