

Extreme Heat and Human Health:

*Interdisciplinary science, stakeholder engagement
and risk communication tools*

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*Workshop on the Development of Climate Information Systems for Heat Health Early Warning
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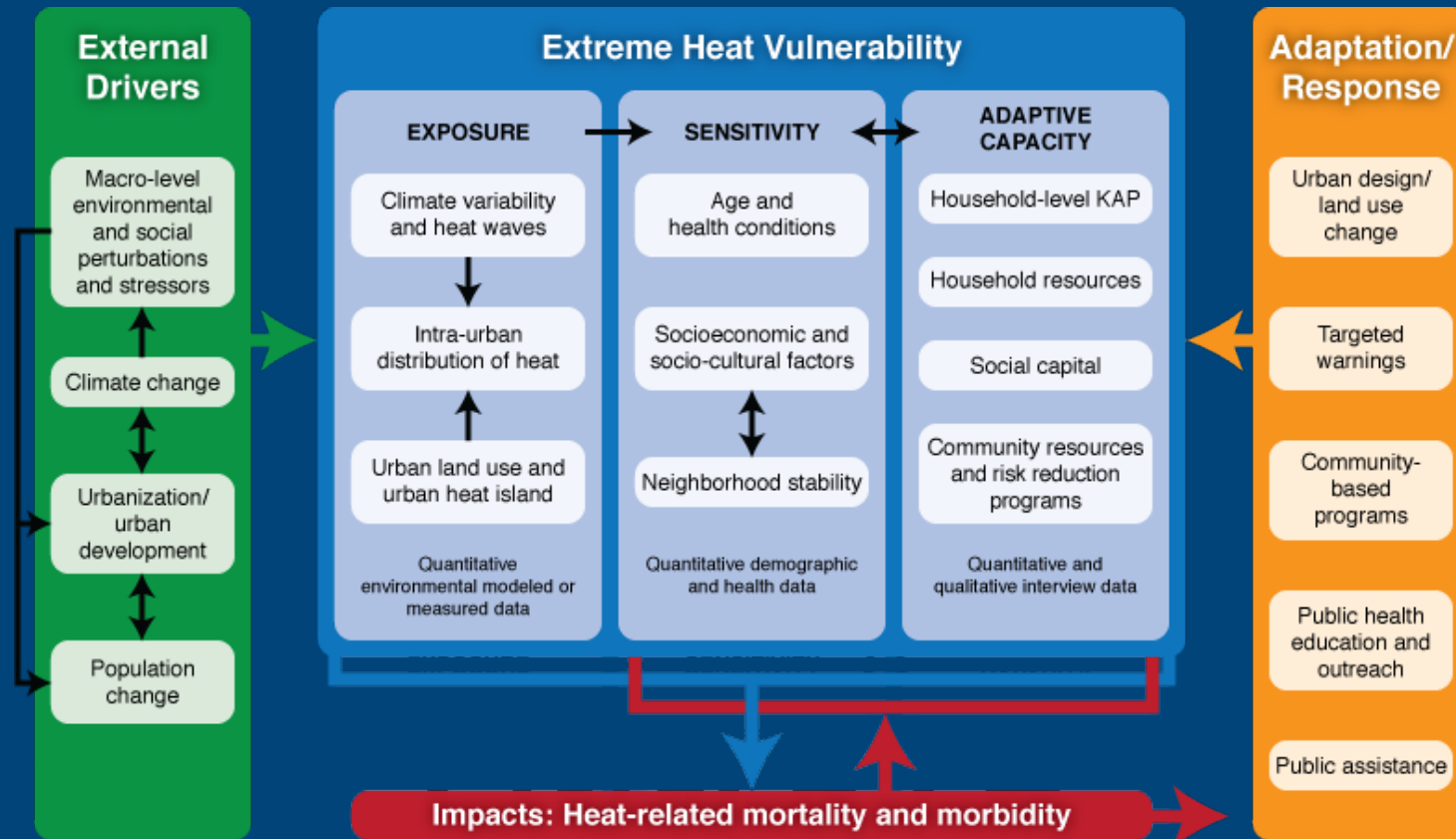
System for Integrated Modeling of Metropolitan Extreme Heat Risk (SIMMER)

Funding: \$1.4M NASA (09-IDS09-34) 2010-2014

- ❖ Advance methodology for assessing current and future urban vulnerability from heat waves
- ❖ Develop a system (SIMMER) for building local capacity for heat hazard mitigation and climate change adaptation in the public health sector
- ❖ Geographic focus:
 - USA and southern Canada
 - Houston and Toronto
- ❖ Multidisciplinary, multi-institutional team



An interdisciplinary perspective



Methods

- ❖ **GIS and remote sensing methods**
- ❖ **Numerical weather and climate modeling**
- ❖ **Bayesian statistical hierarchical modeling**
- ❖ **Quantitative and qualitative social science methods**
- ❖ **GIS web-based technology**

Research highlights

- ❖ Mid-century global **climate model projections**: more than half of summer nights qualify as high heat stress (Oleson et al. 2013)
- ❖ Urban morphology, vegetation, and building materials play a big role in determining **urban heat island (UHI)** characteristics. (Monaghan et al. 2014)
- ❖ **Relative risk of heat-related mortality** in Houston has associations with high daily minimum temperature, high percent of + 65, low income, and socially isolated. (Heaton et al. 2014)
- ❖ Multiple social and behavioral factors interact to compound **vulnerability**. Presence of A/C does not always protect from heat. Most vulnerable populations have little or no knowledge of the **symptoms of heat stress**, nor do they know where the closest **cooling center** is. (Wilhelmi and Hayden, 2015, Hayden et al. 2015)

Stakeholder engagement: interactive & iterative process



❖ Models of stakeholder engagement

1. Study *of* stakeholders: knowledge, perceptions, practices regarding heat and health;
2. Study that includes active input *from* stakeholders: collaboration & co-production of knowledge
3. Study *for* stakeholders: disseminating research results in a usable and useful format

Houston stakeholder survey: effectiveness of programs, risk perception and risk reduction

❖ Online survey was conducted in 2012. n=33 (response rate 37.5%)

Effectiveness

Weather and
health
surveillance

UHI reduction

Future risk

Increase in
vulnerable
population

Urbanization

Risk reduction

Improvement in
EH preparedness
& response

UHI reduction

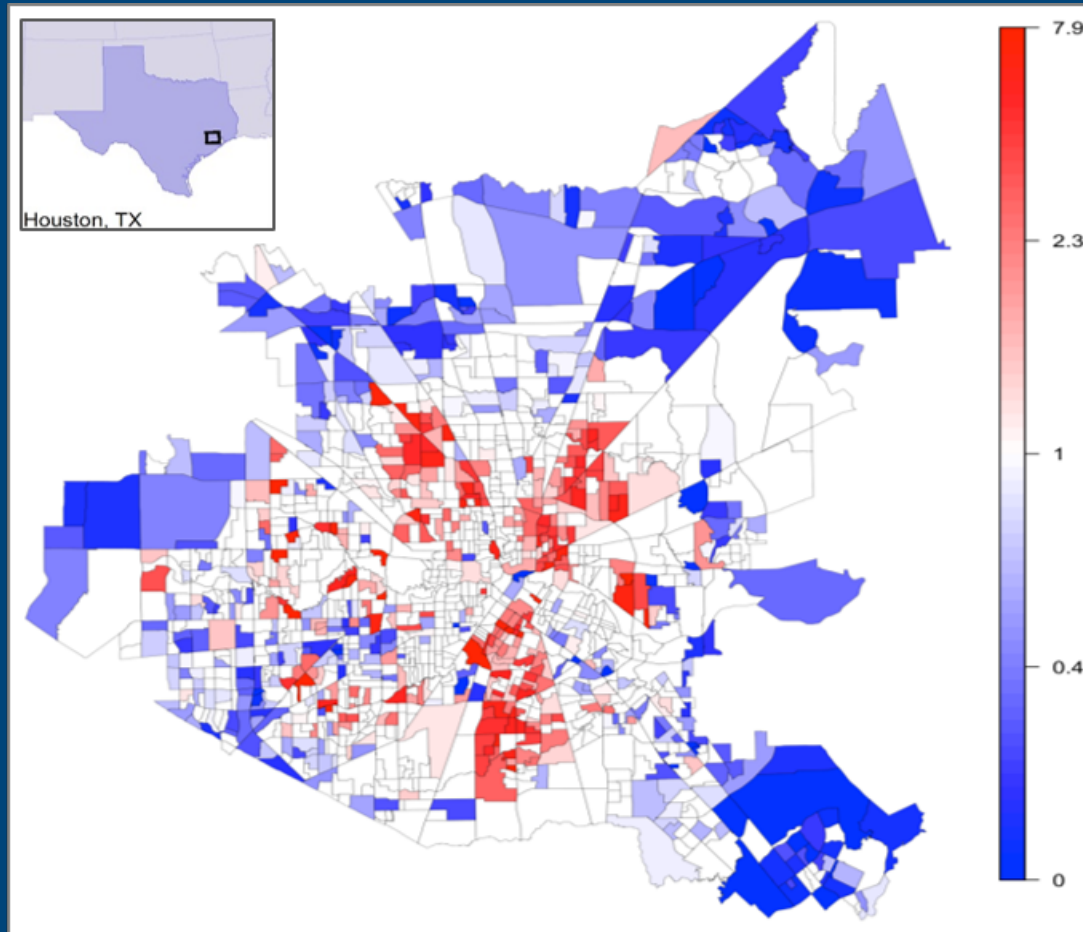
Stakeholder workshop: reducing future risks

- ❖ **Improving preparedness and response to extreme heat in Houston**
 - Effectiveness and use of cooling centers
 - Heat advisories, products and services
 - Health-based thresholds, health-specific messages, tailored geographically or demographically
 - Public education / communication and messaging
 - Collaboration and coordination among agencies and organizations
 - Future Research
 - Integration of SIMMER with weather forecasting



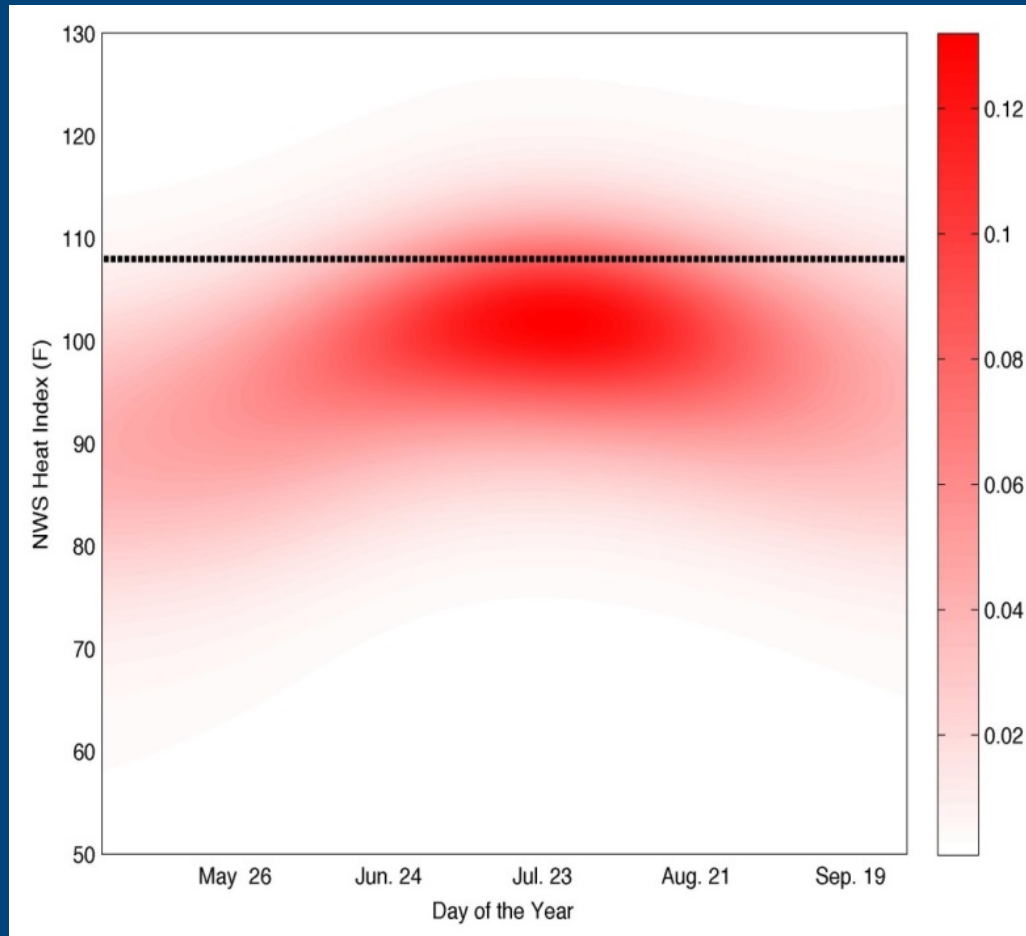
Extreme Heat and Health in Houston: Reducing Future Impacts
August 2013, Rice University, Houston, TX

Project outcomes: SIMMER risk model



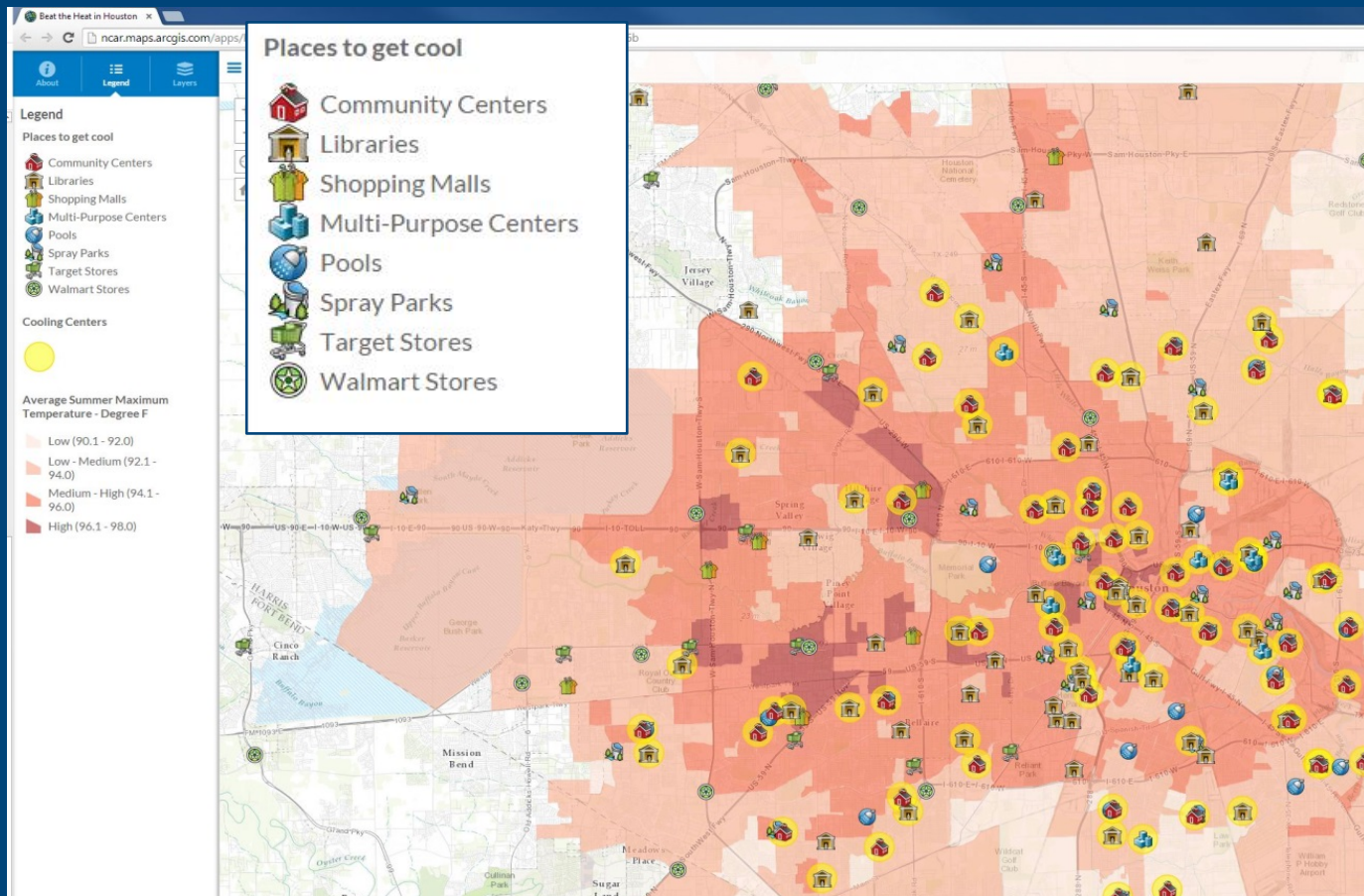
- ❖ A hierarchical model with spatially varying coefficients is used to account for differences in relative risk among census block groups
- ❖ Spatial model input data as GIS layers

Project outcomes: heat health thresholds



- ❖ Probability of 911 heat-related calls (May-September, 2007-2011). Largest volume of 911 calls occurs at ~104F Heat Index (HI).
- ❖ Heat advisories in Houston are issued at 108F HI

Project outcomes: GIS+Web “Beat the Heat in Houston”



(1 of 4)

Independence Hts.

This Community Center is located at 603 E. 35th

M-Th: 8 am -6 pm; F: 8 am-6 pm

Zoom to

(2 of 4)

Average Summer Maximum Temperature - Degree F: 94.28

Beat the Heat in Houston!

- Drink plenty of water
- Restrict physical activity
- Cool off in an air-conditioned place

More information on ways to stay safe in hot weather:

- [People aged 65 and older](#)
- [Infants and children](#)
- [People with chronic medical conditions](#)
- [Outdoor workers](#)
- [Athletes](#)

Zoom to

CDC Centers for Disease Control and Prevention

Extreme Heat and Your Health

Heat and the Elderly

People aged 65 years or older are less likely to sense and respond to changes in temperature. People in this category should be given special attention in hot-weather situations.

Closely monitor people who depend on you for their care!

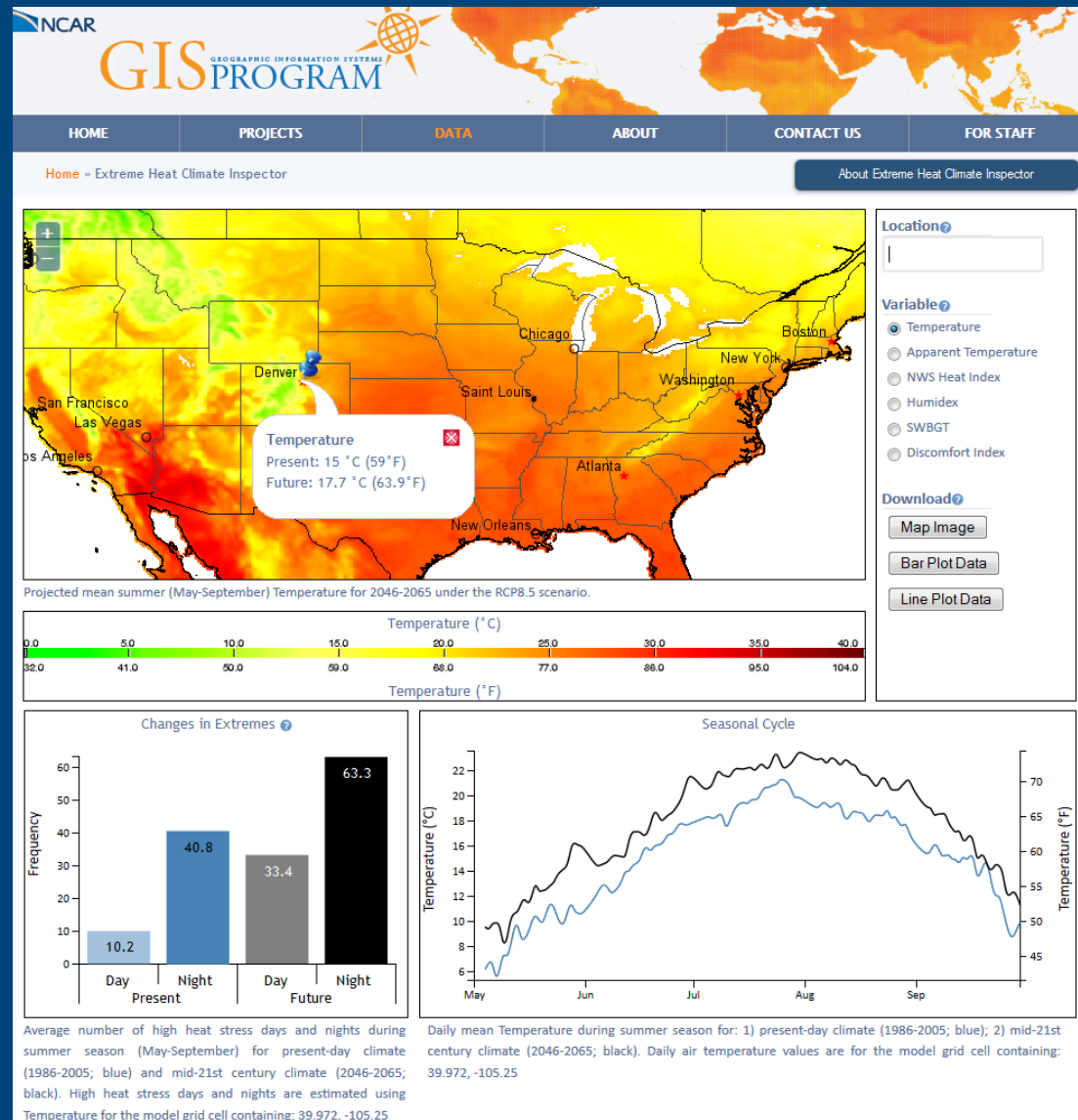
- Do you do anything enough to help?
- Do they have access to air conditioning?
- Do they know how to keep cool?

Other tips, including: light-colored clothing, staying hydrated, avoiding strenuous activity, and using fans.

<http://gis.ucar.edu/projects/simmer>

Project outcomes: tools for climate adaptation

- ❖ Web-based tool - “Extreme Heat Climate Inspector”
- ❖ Based on the NCAR GIS Program *Climate Inspector* and Oleson et al. 2013



<http://gis.ucar.edu/heatinspector>

<http://gisclimatechange.ucar.edu/inspector>

Thank you!

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<http://gis.ucar.edu/simmer/>