Extreme Heat and Human Health:

Interdisciplinary science, stakeholder engagement and risk communication tools

Olga Wilhelmi, Ph.D.

Research Applications Laboratory
National Center for Atmospheric Research
Boulder, Colorado
olgaw@ucar.edu

Workshop on the Development of Climate Information Systems for Heat Health Early Warning
July 28-30 2015    Chicago
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
Wilhelmi and Hayden (2010)
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

Adopted from Carney et al. (2009)

Wilhelmi and Hayden (forthcoming)
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

*Wilhelmi and Hayden (forthcoming)*
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
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”

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!

Contact:

olgaw@ucar.edu

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