Using NASA Data and Models to Improve Heat Watch/Warning Systems for Decision Support

NASA Public Health Review, 2010

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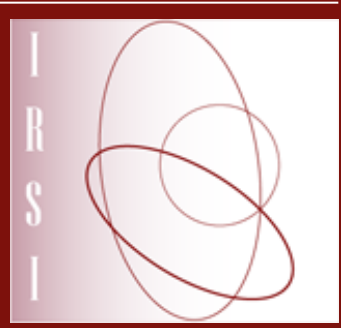
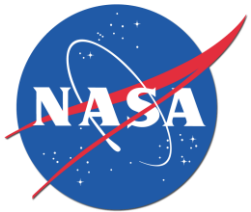


September 28, 2010



INDIANA UNIVERSITY

Collection of Data for Further Analysis

UPDATE ON ACTIVITIES FOR PAST YEAR

Collection of Mortality from Analog EHE's

- Mortality data collected for all our cities
  - All geocoded for Dayton
  - In process of geocoding for Philadelphia
  - Issues with Phoenix…

Imagery Collected

- Landsat TM and ETM+
  - -Philadelphia: 2 ETM+
  - -Dayton: 2 ETM+
  - -Phoenix: 3 ETM+

Imagery Collected

- MODIS
  - -Philadelphia and Dayton are in the same scene: 104 images
  - -Phoenix: 428 images
- ASTER
  - -Issues with finding appropriate ASTER data during our timeframe
  - -Considerations for next summer…

Community Outreach

- There has been overwhelming positive response to our activities in each city
- Series of focus groups for each city with appropriate organizations/personnel
  - Dayton: September 10, 2010
  - Phoenix: October 5, 2010
  - Philadelphia: October 14, 2010

Community Outreach

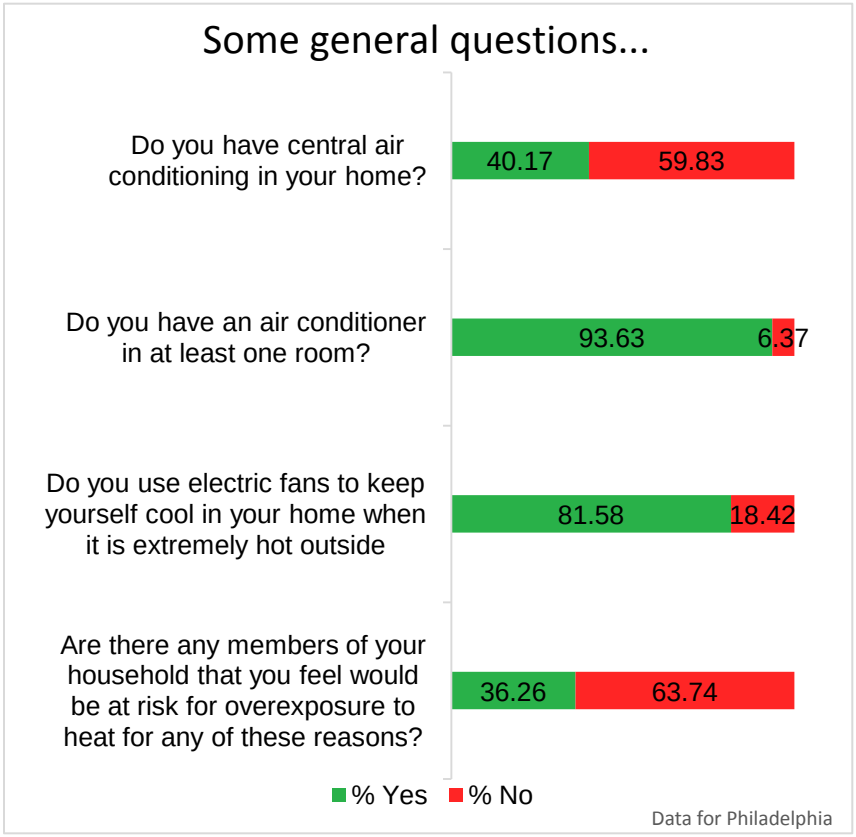
- Dayton: 7 agencies / 18 participants
- Phoenix: 4 agencies / 15 confirmed participants
- Philadelphia: 3 agencies / 10 confirmed participants

Community Outreach

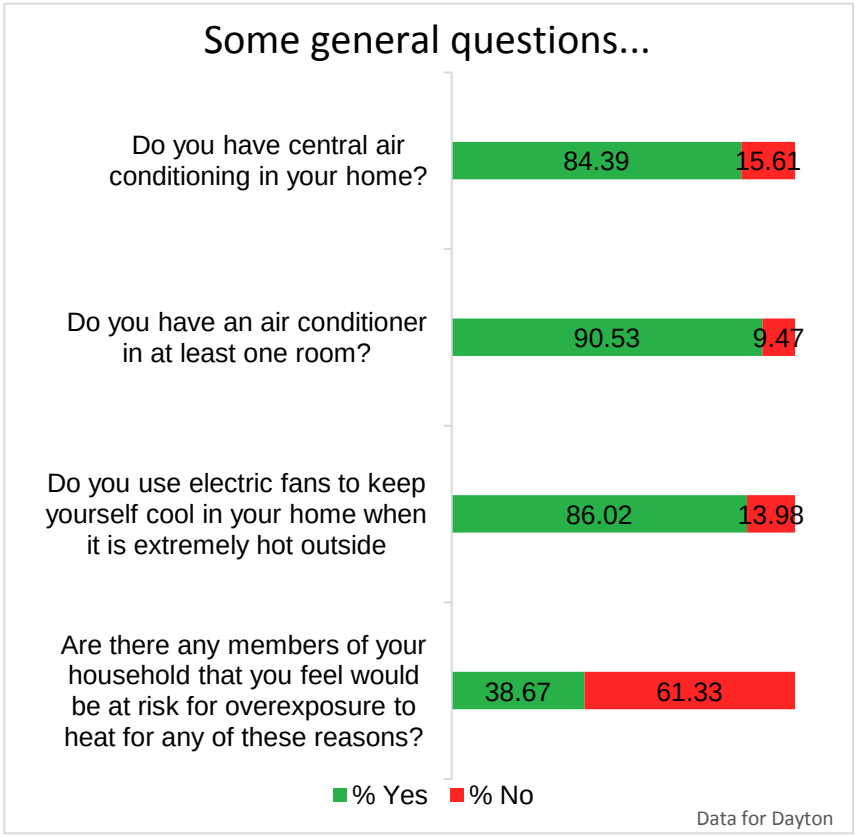
- Phone call surveys completed for each city
- Each city separated into quartiles based on our preliminary vulnerability assessment
- N = 600 per city

Some Preliminary Findings from Surveys

Philadelphia

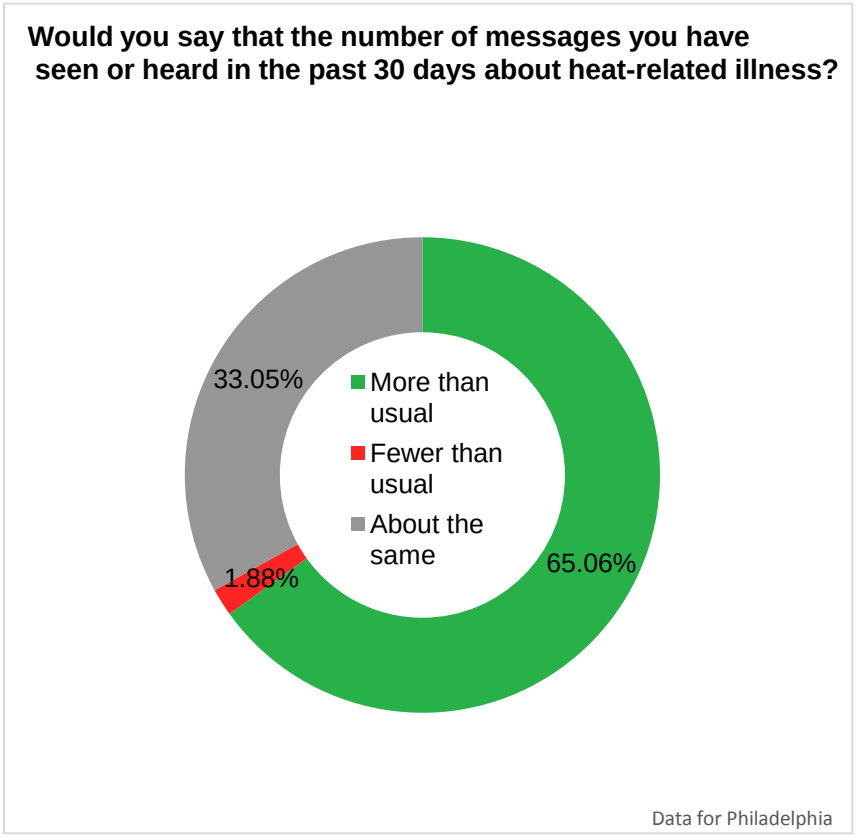


Dayton

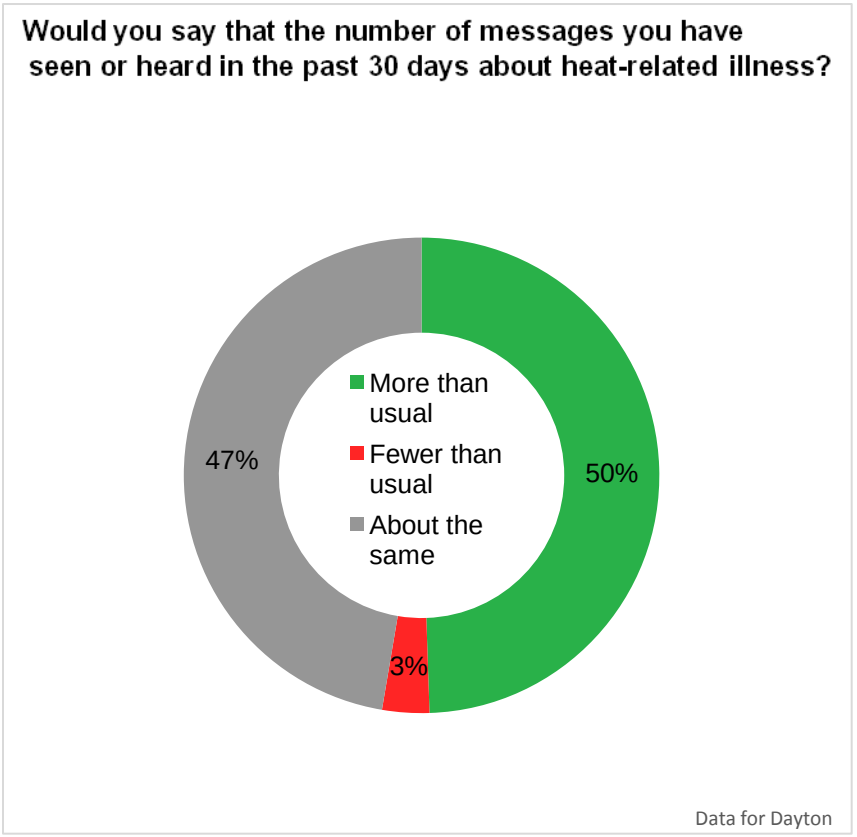


Some Preliminary Findings from Surveys

Philadelphia



Dayton



Current Heat Health Alert Systems are Deficient

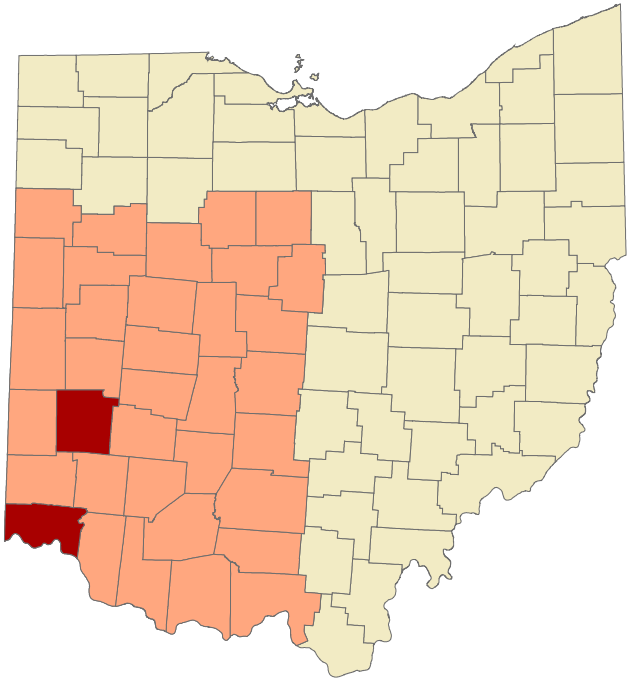
- Much of the deficiency has to do with spatial specificity. Where are the vulnerable? Where are the "hot spots"? Both thermal and health-related.
- Current protocols for issuing heat alerts using synoptic weather models are typically very good.
  - However, the example of Phoenix shows some problems. Robinson vs. Kalkstein approaches…

The “Discontinuous” UHI

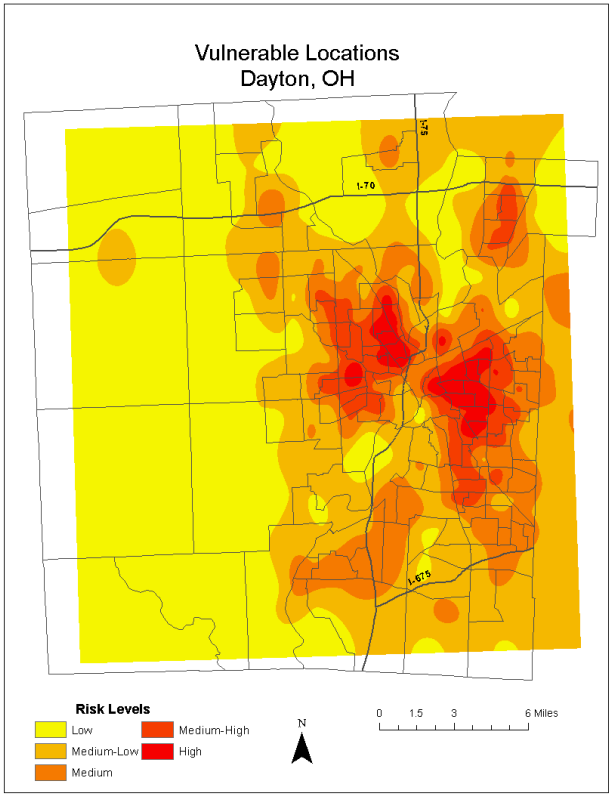
The Micro-UHI Effect (Dayton)

Spatial Specificity in Heat-Related Warnings: The Past and the Future

Current Systems



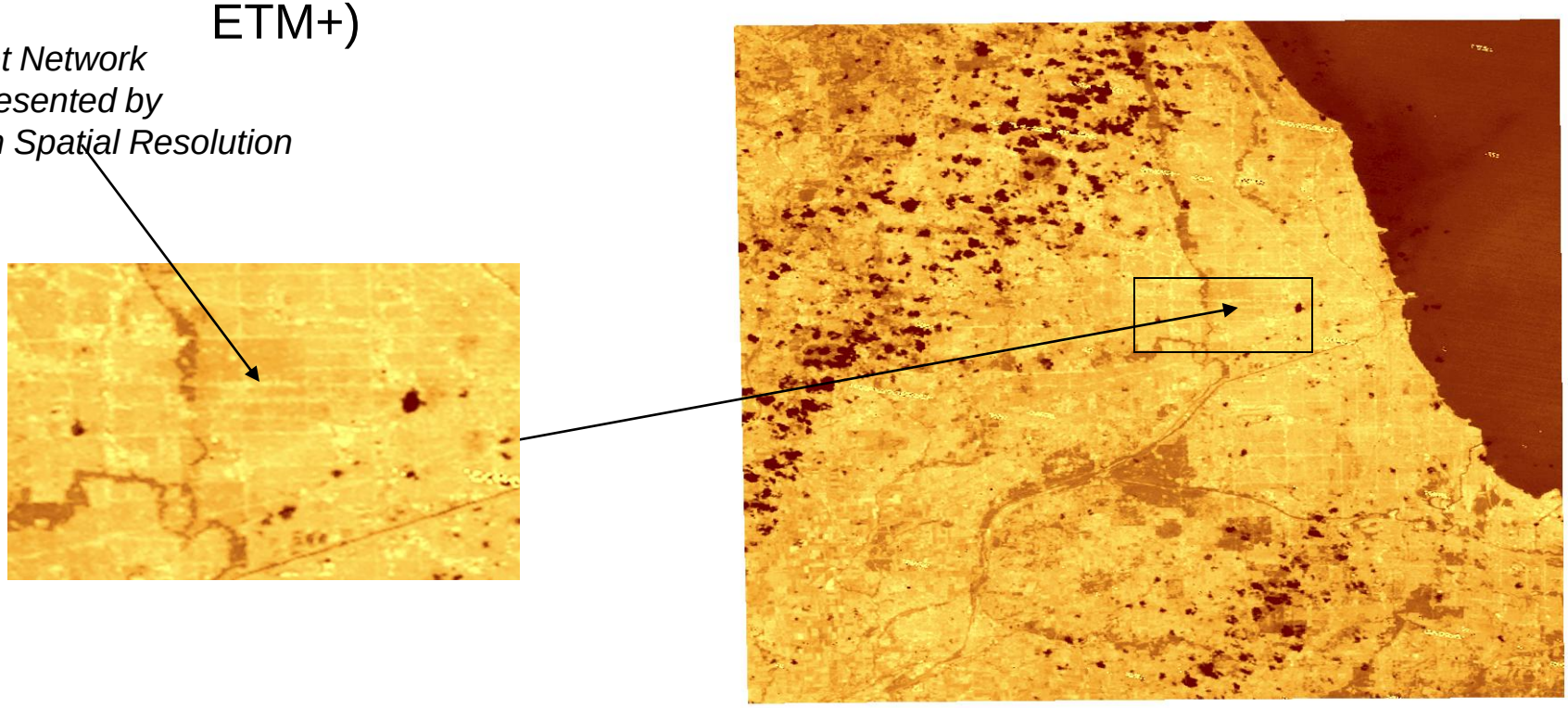
Developing Systems



Important Data Considerations

- Estimated land surface temperature (LST) utilizing remote sensing assets (MODIS, ASTER, Landsat TM, Landsat ETM+)

Street Network Represented by 120m Spatial Resolution



Important Data Considerations

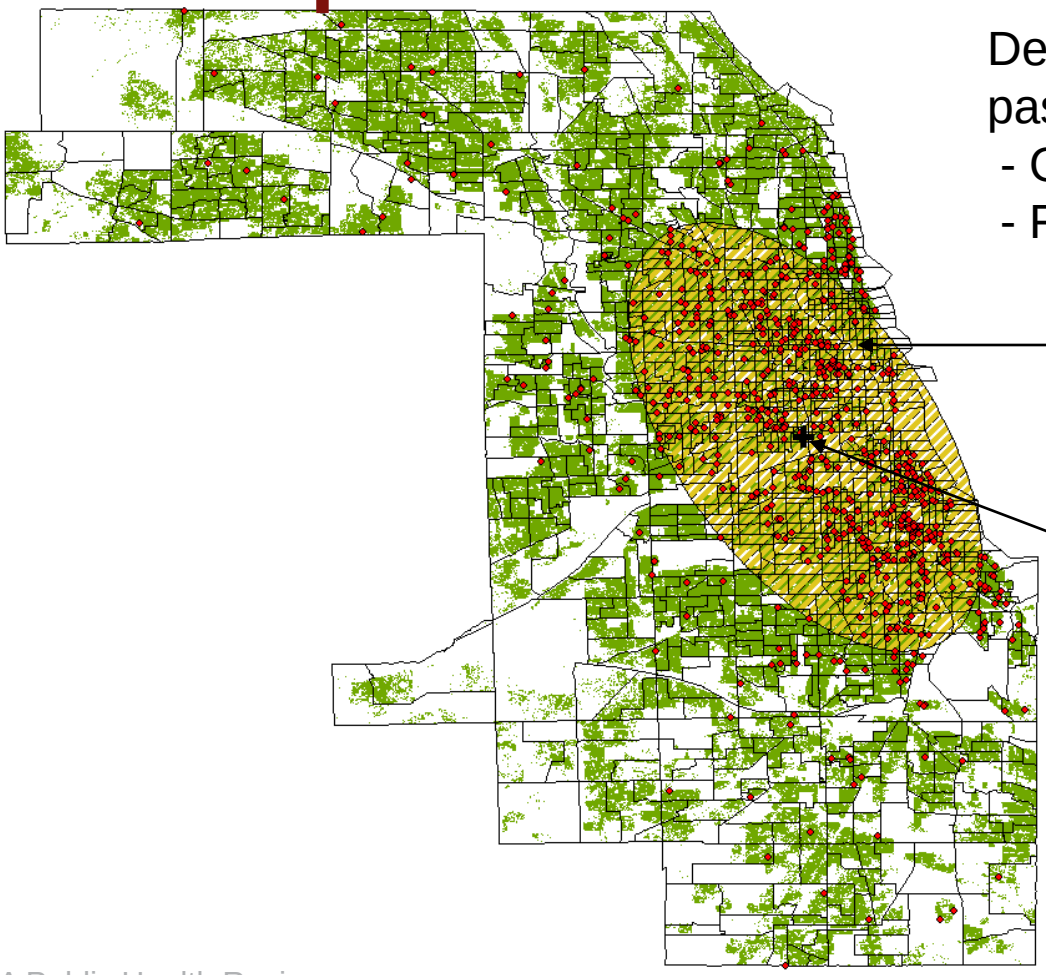
- Currently exploring downscaling MODIS to Landsat ETM+ resolutions
- This will give us the ability to provide daily guidance to each city
- Re-calibrate on each “good” Landsat ETM+

Important Data Considerations

- Use census socioeconomic data at the census tract/block group level
  - -Minority populations, lower income, lower educational attainment, and aged population
  - -Extract residential land use for population density calculation

Population Density Calculated by ***Area*** of Residential Land Use

Important Data Considerations



Death certificates collected for past analog events

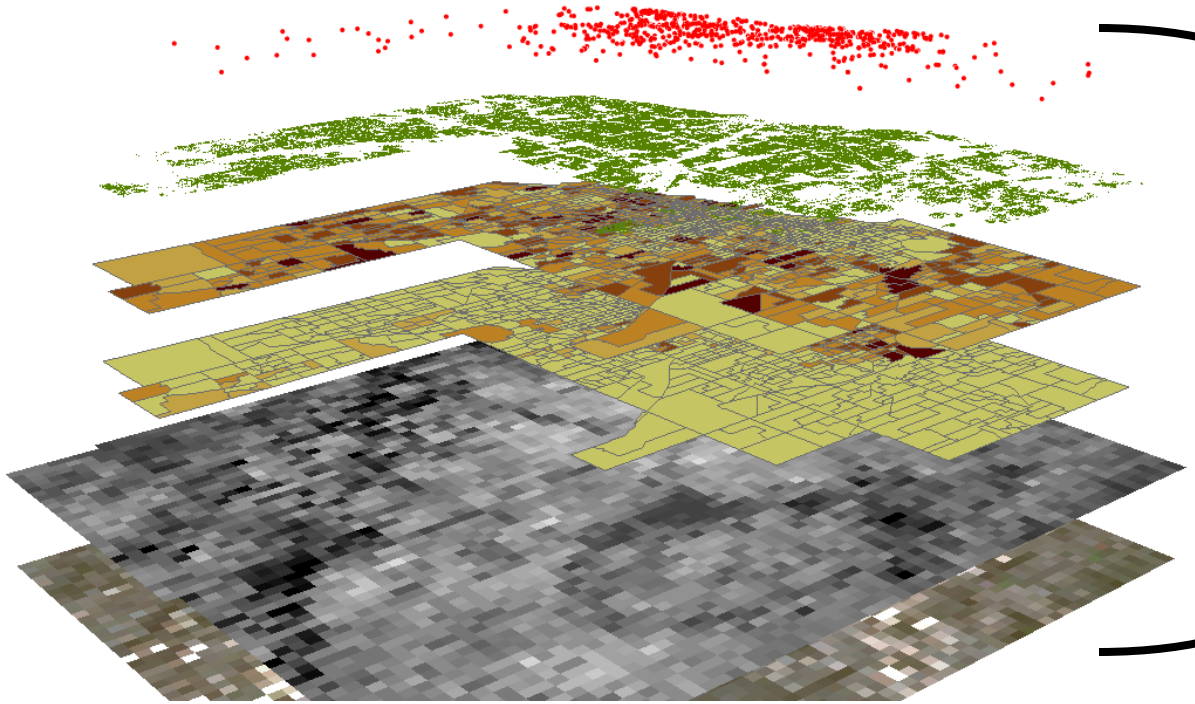
- Geocode locations of mortality
- Further explore spatial distribution

1 SDE for Mortality

Mean Center of Mortality

Mortalities have been randomly offset by 50-100 meters.

Utilizing Environmental, Social, and Health Data to Model Risk



Modeling: What Method?

Risk from Extreme Heat

Current State-of-the-Art

- These techniques will generate valuable information that can be included in mitigation/response strategies.
- It is thought that a system utilizing these approaches can be developed nation-wide and can incorporate newer and more relevant data as it becomes available.

Anticipated Improvement in Emergency Response Capacities

- Improved identification of locations that are particularly vulnerable
- Improved ability to mitigate the health-related impacts. Especially, when coupled with currently developing heat-health communication toolkits. http://extremeheat.org
- Improved communication of events to especially vulnerable individuals/communities

Anticipated Improvement in Emergency Response Capacities

- Improved identification of the “hottest” areas of individual cities and the surrounding municipalities.
- Time-Distance information from central emergency response locations to the most vulnerable areas within a city.

Anticipated Activities for Coming Year

- Continue contact with focus group participants and actively search for needed participants
- Generate the ensemble of models and begin helping with initial implementation in each city
- Collect mortality data for this past summer

Anticipated Activities for Coming Year

- Continue work on MODIS downscaling for daily guidance in each city
  - VIIRS??
- Explore new cities that would be very good test areas for spatial expansion of the system (Indianapolis, Chicago …)
- Explore usage of 911 call data (issues with each city)
- Performance measures for activities…