Urban Vulnerability Assessment for the Health and Infrastructure Sectors

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Mission and Key Activities

Explore regional vulnerabilities to climate variability and change in urban areas using an end-to-end approach that combines:

1) statistically downscaled projections from CMIP phases 3 and 5 global climate models from GISS and the wider ensemble

2) impact assessment based on empirical approaches and analysis of the infrastructure (e.g., energy, transportation, and water) and health (e.g., heat-related mortality) sectors, and

3) inventory of adaptation strategies in the infrastructure and health sectors, and testing of adaptation and mitigation strategies to reduce risks associated with heat waves.

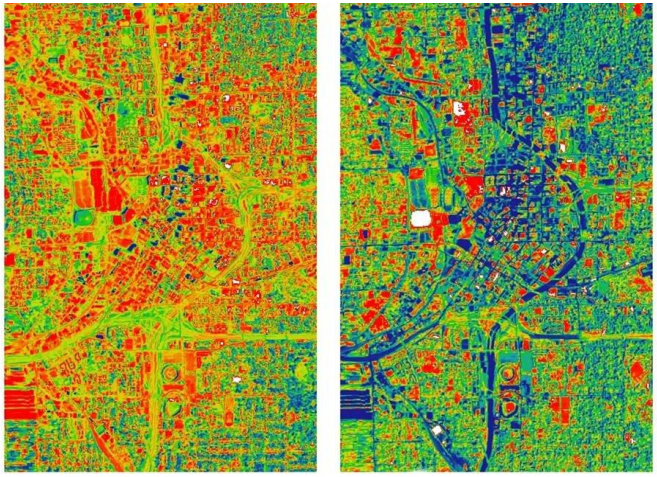


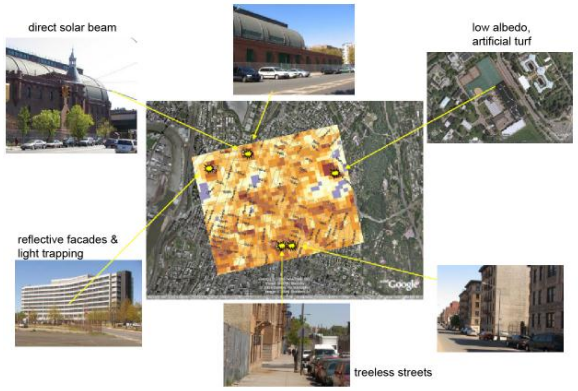
Figure 1. The image on the left illustrates daytime surface heating for urban surfaces across the Atlanta Georgia Central Business District (CBD) as derived from NASA aircraft data. White and red colors indicate very warm surfaces (~40-50°C). Green relates to surfaces of moderately warm temperatures (~25-30°C). Blue indicates cool surfaces (e.g., vegetation, shadows) (~15-20°C). Surface temperatures are reflected in the albedo image on the right where warm surfaces are dark (i.e., low reflectivity) and cooler surfaces are in red and green (i.e., higher reflectivity). The images show how urban surface characteristics influence temperature and albedo as UHI drivers (Quattrochi et al., 2000).

Integration with NASA Products and Activities

- Integration of local land use and microclimatic data on urban heat islands and extreme precipitation into the regional downscaling and scenarios generation framework, incorporating retrospective (Re-)analyses such as the NASA GMAO MERRA, and satellite products including MODIS.

- Application of a risk management and adaptation approach that has successfully been implemented at NASA Centers to the infrastructure and health sectors in urban areas nationwide.

- Advancement of an Indicators and Monitoring Program for infrastructure and health, based on NASA products that have been identified through the center inventories developed as part of the Climate Adaptation Science Investigator Work Group (CASI) Phase I activities.



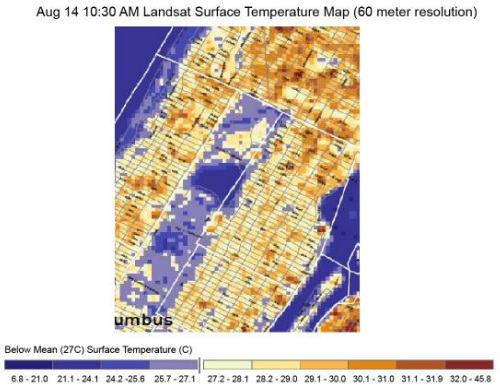
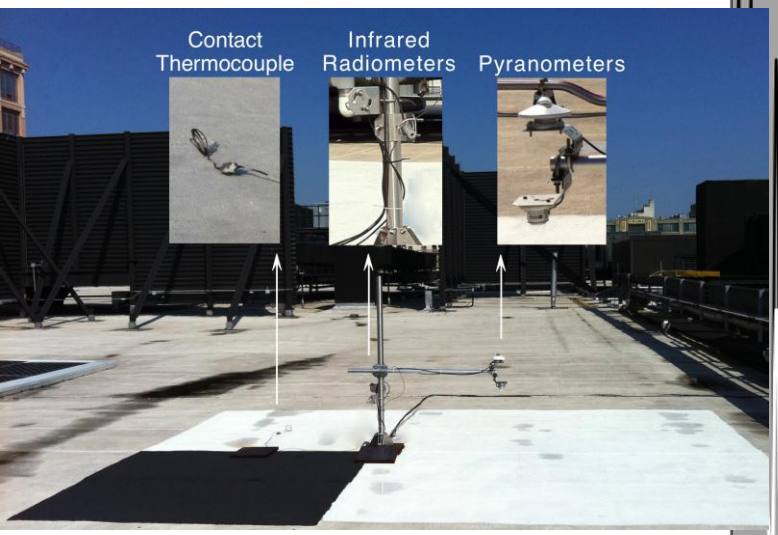
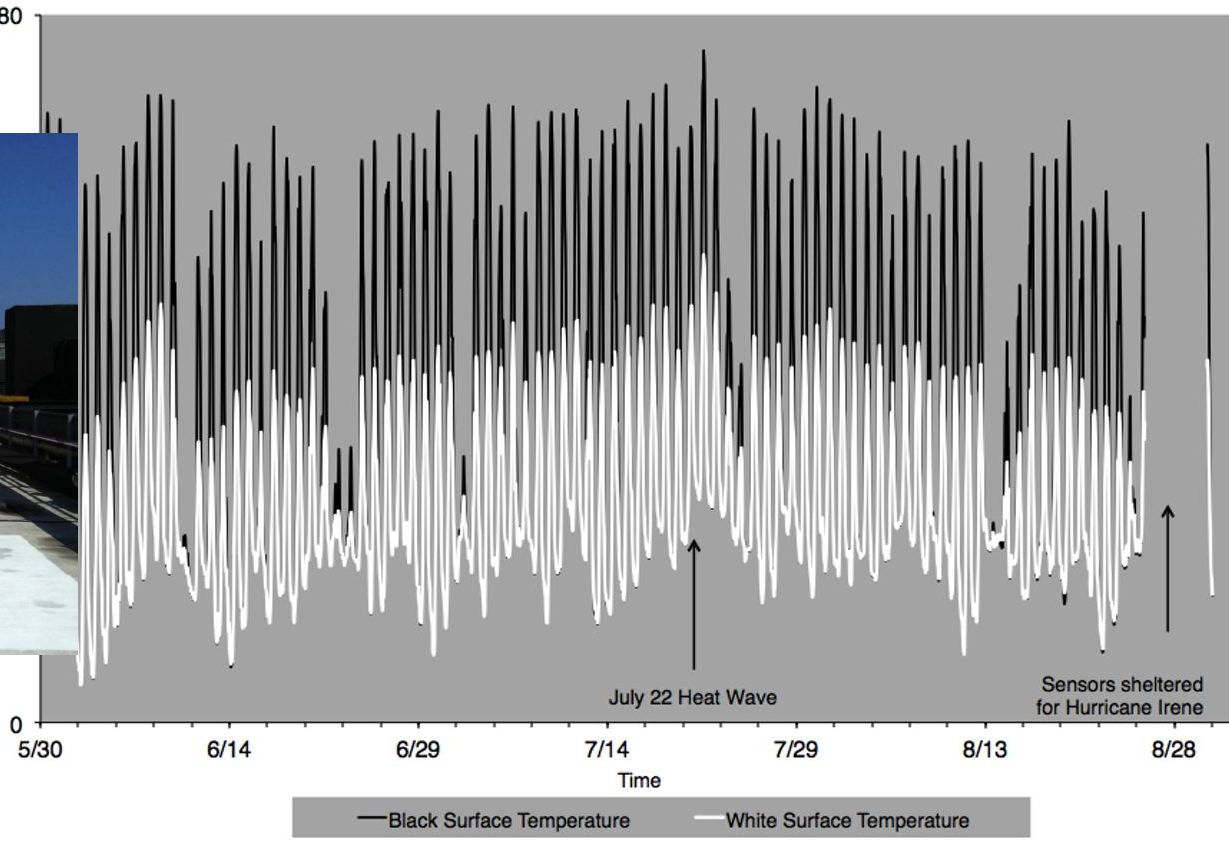


Figure 1: (left) NASA Landsat surface temperature overlay on visual data for Bronx, NY. Field study of hotspots and cool spots, as shown by site visitation photos, reveals the many causative factors for temperature variations, most notably albedo or other light trapping effects and vegetation or lack thereof. (right) Same Landsat image but for Central Park, NY.

- We are monitoring the first New York City albedo enhancement program using acrylic paint applied to black asphalt rooftops
- The program plans to create 250 Million square feet of white membranes by 2020



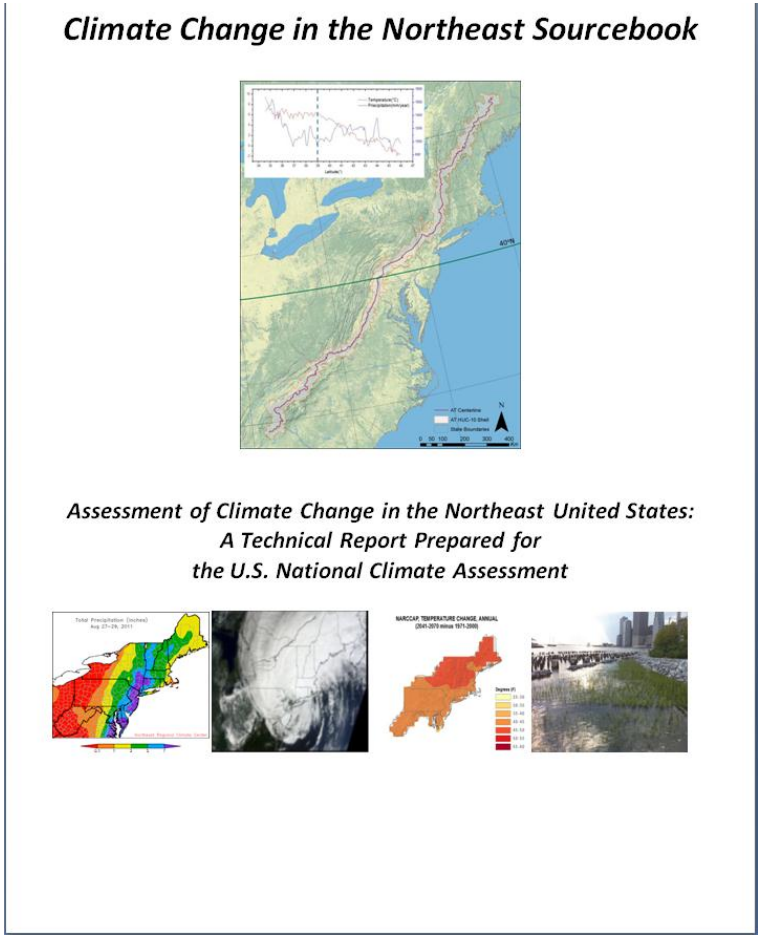


The photos above shows our sensor set-up. The graph shows potential cooling benefits

Gaffin *et al* , 2012 In Press. Env. Res. Lett.

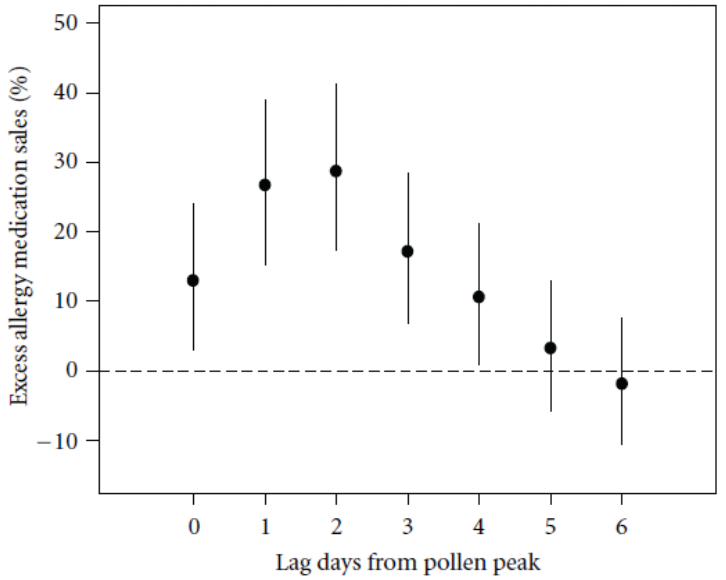
Northeast Report Outline

- I. Introduction
- II. Climate Change Problem-Solving in the NE – A Legacy of Action
- III. Need-to-Know Information for Systems and Sectors
- IV. Climate Change Impacts and Solutions by Sectors and Systems
- V. Climate Change and Regional and Local Identities Within the Northeast: New England, Mid-Atlantic, Appalachia and Western Interior, and the Urban Northeast Corridor
- VI. Climate Change Decision Support Tools and Resources
- VII. Conclusions and Recommendations



Northeast Report

- IV. Climate Change Impacts and Solutions by Sectors and Systems
  - a. Water Resources
  - b. Ecosystems, Forests, and Wildlife
  - c. Agriculture
  - d. Coastal
  - e. Health
  - f. Infrastructure (Transportation, Energy, Telecommunications)
  - g. Urban



Year, Scenario, Assumptions	Mean Summer Daily Temperature (SD)[a]	Total Regional Heat-Related Premature Deaths
1990s	72.9 (5.68)	1418
2050s A2[b]	76.7 (5.51)	2764
2050s A2 with acclimatization	76.7 (5.51)	2376
2050s B2[c]	75.8 (5.67)	2421
2050s B2 with acclimatization	75.8 (5.67)	2087

[a] Mean county-specific decadal summer daily temperature in °F (mean SD). Note that the same summer daily temperature simulations were applied in mortality risk assessments with and without acclimatization assumptions.

[b] A2 scenario assumed rapid human population growth, relatively weak environmental concerns, and a lack of aggressive greenhouse gas regulations.

[c] B2 scenario assumed more-moderate population growth and increased concerns about environmental sustainability, with more aggressive greenhouse gas regulations, compared with A2.