

# Environmental Public Health Applications Using Remotely Sensed Data

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**Universities Space Research Association at NASA Marshall Space Flight Center**

**National Space Science and Technology Center**

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## NASA/MSFC Environmental Public Health Team Members

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### ❖ The Focus of NASA Public Health Program:

The Public Health application area focuses on Earth science applications regarding *environmental health issues, infectious disease, and emergency preparedness and response*. The application explores issues of toxic and pathogenic exposure, as well as natural and man-made hazards and their effects, for risk characterization/mitigation and improvements to health and safety.

### ❖ MSFC Previous and Current Projects:

- Health and Environment Linked for Information Exchange in Atlanta (HELIX-Atlanta) (Partners: CDC, Kaiser Permanente)
- Linking NASA Environmental Data with a National Public Health Cohort Study (REGARDS) to Enhance Public Health Decision Making (University of Alabama at Birmingham; CDC)
- Integration of NASA research results to enhance a decision support tool for asthma surveillances, prediction and intervention (Partners: University of Mississippi Medical Center, CDC)
- Enhancing Environmental Public Health Tracking (EPHT) with Satellite-Driven Particle Exposure Modeling and Epidemiology (Partners: Emory University; CDC)
- Using NASA Data and Models to Improve Heat Watch Warning Systems for Decision Support (Partners: Indiana University - Purdue University Indianapolis; CDC)
- Integration of Airborne Dust Prediction Systems and Vegetation Phenology to Track Pollen for Asthma Alerts in Public Health Decision Support Systems (Partners: University of Arizona; University of New Mexico; CDC)
- Development and Implementation of a Climate Change Module for EPHT Utilizing Remote Sensing Data (Partners: CDC)
- Asthma and Air Quality in the Presence of Fires: A Foundation for Public Health Policy in Florida (Partners: University of Florida, CDC)
- Managing Runoff: A Tool to Evaluate Potential Impacts of Climate and Land Change on Pathogen and Nutrient Concentrations in Weeks Bay (Partners: Battelle, Weeks Bay National Estuarine Research Reserve; Alabama Coastal Foundation; Baldwin County SWCD)
- Development of National Future Extreme Heat Scenarios to Enable the Assessment of Climate Impacts on Public Health (Partners: CDC)
- Environmental Context of Health Disparities (Partners: Meharry Medical College, University of Tennessee-Knoxville, and Tulane )
- UAB Laboratory for Global Health Observation (LGHO) and DEVELOP Projects (ex. Predictive Risk Modeling of Vector-Borne Infectious Diseases such as West Nile Virus and Lyme Disease by means of NASA Earth Observation Systems )

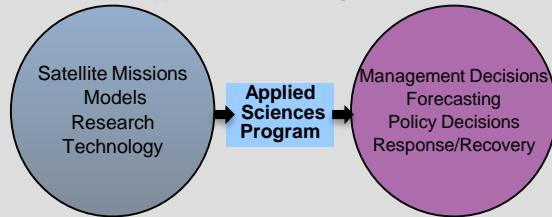


# NASA Applied Sciences Program

## Purpose

Lead efforts in building knowledge and developing abilities to effectively apply Earth observations;  
 Develop applications knowledge for applying Earth science to serve society;  
 Assist in transitioning applied knowledge to organizations that can directly apply it to solve societal issues.

## NASA Applied Sciences Program Architecture



## Emphasis in 4 Applications Areas



Health & Air Quality



Water Resources



Disasters

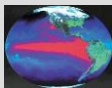


Ecological Forecasting

## Opportunities to Expand and Crosscut



Agriculture



Climate



Weather



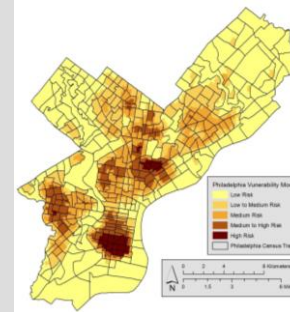
Energy



Oceans

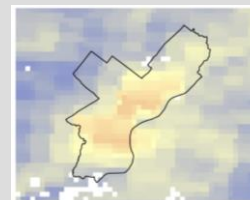
# Public Health Applications: Urban Heat Vulnerability

Heat within a city is not uniform. In fact, large temperature differences exist due to the location of parks, urban forests, water bodies and the highly developed urban core. Fine-scale mapping of temperature variations is proving useful for assessing areas where residents are most vulnerable to the effects of heat.

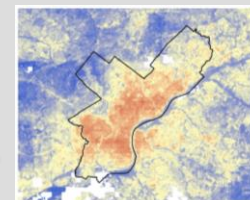
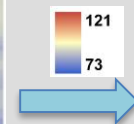


Heat vulnerability map for Philadelphia, PA based on surface temperatures and socio-economic data.

USRA scientists have worked with colleagues at Indiana University to combine fine-scale satellite data with socio-economic data to map heat vulnerability across cities.



Temperature (degrees F)



USRA scientists have developed a method for extracting finer-scale land surface temperature information from NASA satellite data. Left panel: MODIS temperature data. Right panel: result of 'sharpening' the image, resulting in the ability to differentiate areas of relative coolness and heat.

# Relationships Between the Environment and Dengue Fever in Mexico

USRA scientists worked with CDC and the University of Veracruz, Mexico to develop a habitat suitability model for the *Aedes aegypti* mosquito, the primary transmitter of Dengue Fever in Mexico. Using inputs such as winter temperatures and terrain height (right), the model indicates the likelihood of *Aedes aegypti*, and therefore Dengue Fever, across Mexico.



Mean winter minimum temperature



Terrain height



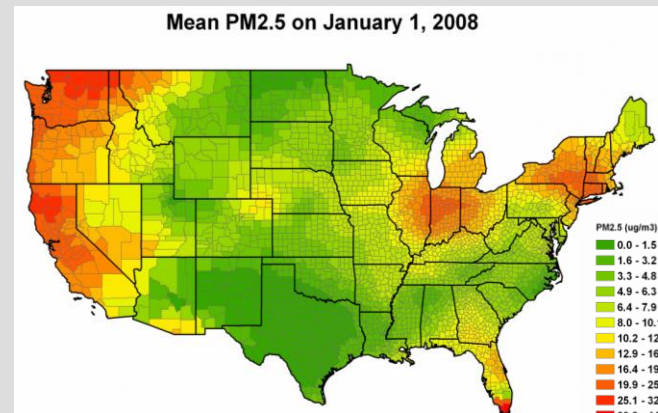
This map shows habitat suitability for a typical year in the current climate. Green areas are most suitable, while brown is unsuitable. Habitat is very sensitive to elevation and temperature.



# NASA Satellite Data and Models Enhance Air Pollution Monitoring for Public Health

Air pollution has very serious public health impacts in the U.S. One type of pollution – fine particulate matter or PM<sub>2.5</sub> – has particularly adverse effects on respiratory and cardiovascular diseases and conditions. USRA scientists use a novel method to combine data from NASA satellites and ground monitors to provide daily estimates of PM<sub>2.5</sub> across the U.S.

This map shows daily averages of PM<sub>2.5</sub> at the county level for January 1, 2008. Note the very high levels in the Midwest and the West Coast.



PM<sub>2.5</sub> (ug/m<sup>3</sup>)

# Thanks!

## **Presenter's Contact Information:**

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