EPA's Air, Climate, and Energy Research Program:

Research Priorities and Opportunities

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US Environmental Protection Agency
Office of Research and Development
National Center for Environmental Research
Air, Climate, and Energy Research Program
Matrix Interface

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Overview

- Air, Climate, and Energy Research Program
- ACE extramural research
- Health Effects Institute

ORD National Research Programs

Air, Climate & Energy

Sustainable & Healthy Communities

Homeland Security

Chemical Safety for Sustainability

Human Health Risk Assessment

Safe & Sustainable Water Resources

FY16-19 Strategic Research Action Plan Themes

Climate Impacts Vulnerability and Adaptation	*Assess the impacts of climate change on the environment and public health to inform the development of sustainable approaches to prepare for climate change*
Emissions and Measurements	*Develop innovative technologies and approaches to characterize source emissions and ambient air pollutants*
Atmospheric and Integrated Modeling Systems	*Develop and apply air quality and cross-media models to support regulatory and community-based decisions*
Protecting Environmental Public Health and Wellbeing	*Develop solutions-oriented approaches to assess multipollutant exposures and resulting human and ecological effects of air pollutant mixtures to inform policy and public health practices*
Sustainable Energy and Mitigation	*Assess the environmental impacts and those factors affecting energy sectors choices from extraction to end-use*

Common Goals

- **NASA Applied Sciences Program:**
  - The Health & Air Quality Applications area encourages the use of Earth observations in air quality management and public health, particularly involving environmental health and infectious diseases.
  - The area addresses issues of toxic and pathogenic exposure and health-related hazards and their effects for risk characterization and mitigation.
  - The area promotes uses of Earth observations data and models regarding implementation of air quality standards, policy, and regulations for economic and human welfare.
  - The area also addresses effects of climate change on air quality and public health to support managers, policy makers, and ultimately the public with health-related decisions and actions.

FY16-19 Strategic Plan Themes

Climate Impacts Vulnerability and Adaptation

Emissions and Measurements

Atmospheric and Integrated Modeling Systems

Protecting Environmental Public Health and Wellbeing

Sustainable Energy and Mitigation

Assess the impacts of climate change on the environment and public health to inform the development of sustainable approaches to prepare for climate change

Signature Project:

Systems-based Approaches for Sustainable Solutions

Providing science, data, and tools for climate-smart EPA programs and practices to support sustainable solutions for global climate change challenges in multimedia systems.

FY16-19 Strategic Plan Themes

Climate Impacts Vulnerability and Adaptation

Emissions and Measurements

Atmospheric and Integrated Modeling Systems

Protecting Environmental Public Health and Wellbeing

Sustainable Energy and Mitigation

Develop innovative technologies and approaches to characterize source emissions and ambient air pollutants

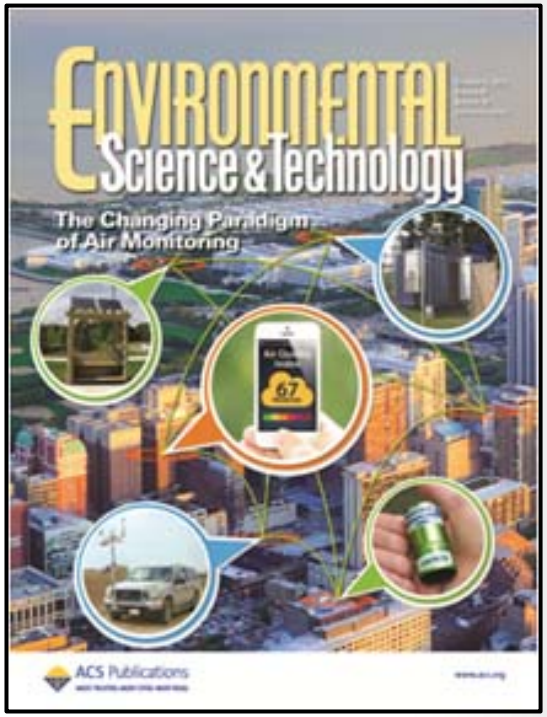
Signature Project:

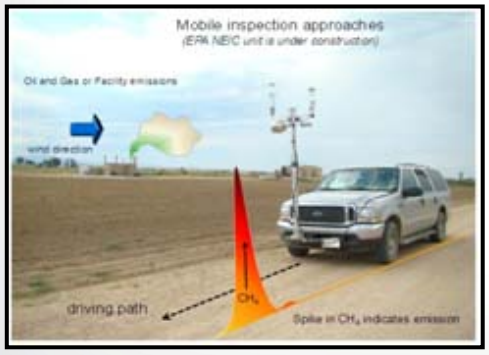
Changing the Paradigm for Air Pollution Monitoring

Evaluating the efficacy of next generation monitoring technologies – from sensors to satellites – to complement and enhance air quality assessment and forecasting.

Next Generation Air Monitoring

- Sensors and new technologies are rapidly advancing and revolutionizing regional, community, fence-line, and personal monitoring
  - Working with OECA, OAR, Regions and States thru e-Enterprise to plan and foster evaluation and use of new technologies
  - Championing cutting-edge research
  - Promoting community science, outreach and education
  - Stimulating technology developments through STAR grant program, SBIR funding for small businesses, Open Source Challenges





Mobile monitoring for geospatial mapping of pollutants (GMAP)

"Village Green" park bench monitors air quality

Jointly funded Innovation Project with NIEHS

FY16-19 Strategic Plan Themes

Climate Impacts Vulnerability and Adaptation

Emissions and Measurements

Atmospheric and Integrated Modeling Systems

Protecting Environmental Public Health and Wellbeing

Sustainable Energy and Mitigation

Develop and apply air quality and cross-media models to support regulatory and community-based decisions

Signature Project:

Integrated Multimedia, Multi-stressor Systems Model Development

Advancing the “one-environment” modeling paradigm to address both land use and climate changes, and to move toward a more inclusive “one-biosphere” treatment

FY16-19 Strategic Plan Themes

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Emissions and Measurements

Atmospheric and Integrated Modeling Systems

Protecting Environmental Public Health and Wellbeing

Sustainable Energy and Mitigation

Develop solutions-oriented approaches to assess multipollutant exposures and resulting human and ecological effects of air pollutant mixtures to inform policy and public health practices

Signature Project:

Local and Regional Characteristics Influencing Public Health Impacts in Healthy and At-Risk Populations

Improving our understanding of factors influencing observed heterogeneity in air quality impacts, population exposures, and health responses - now and in the future.

FY16-19 Strategic Plan Themes

Climate Impacts Vulnerability and Adaptation

Emissions and Measurements

Atmospheric and Integrated Modeling Systems

Protecting Environmental Public Health and Wellbeing

Sustainable Energy and Mitigation

Assess the environmental impacts and those factors affecting energy choices from extraction to end-use

Signature Project:

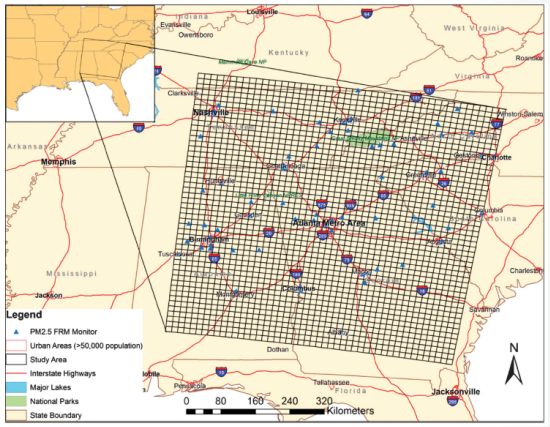
Energy and the Environment: Improving Human and Ecosystem Health in an Evolving Energy Landscape

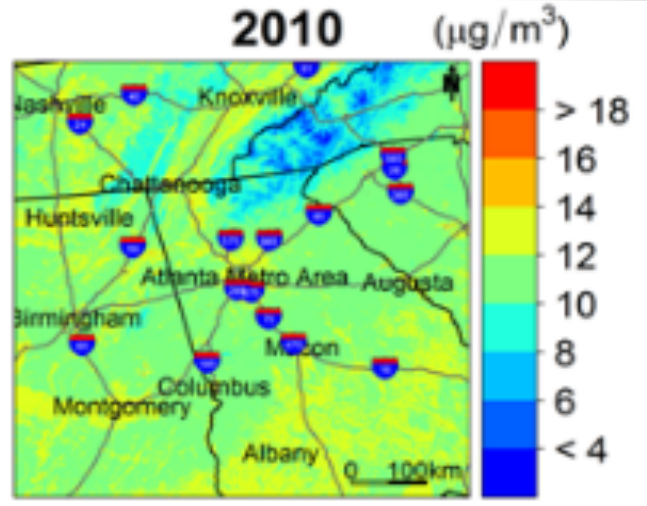
Evaluating and assessing the broader impacts of energy production and use from resource supply to end-use.

A Few Examples of Recent Work by STAR Grantees

Emory/GaTech CLARC

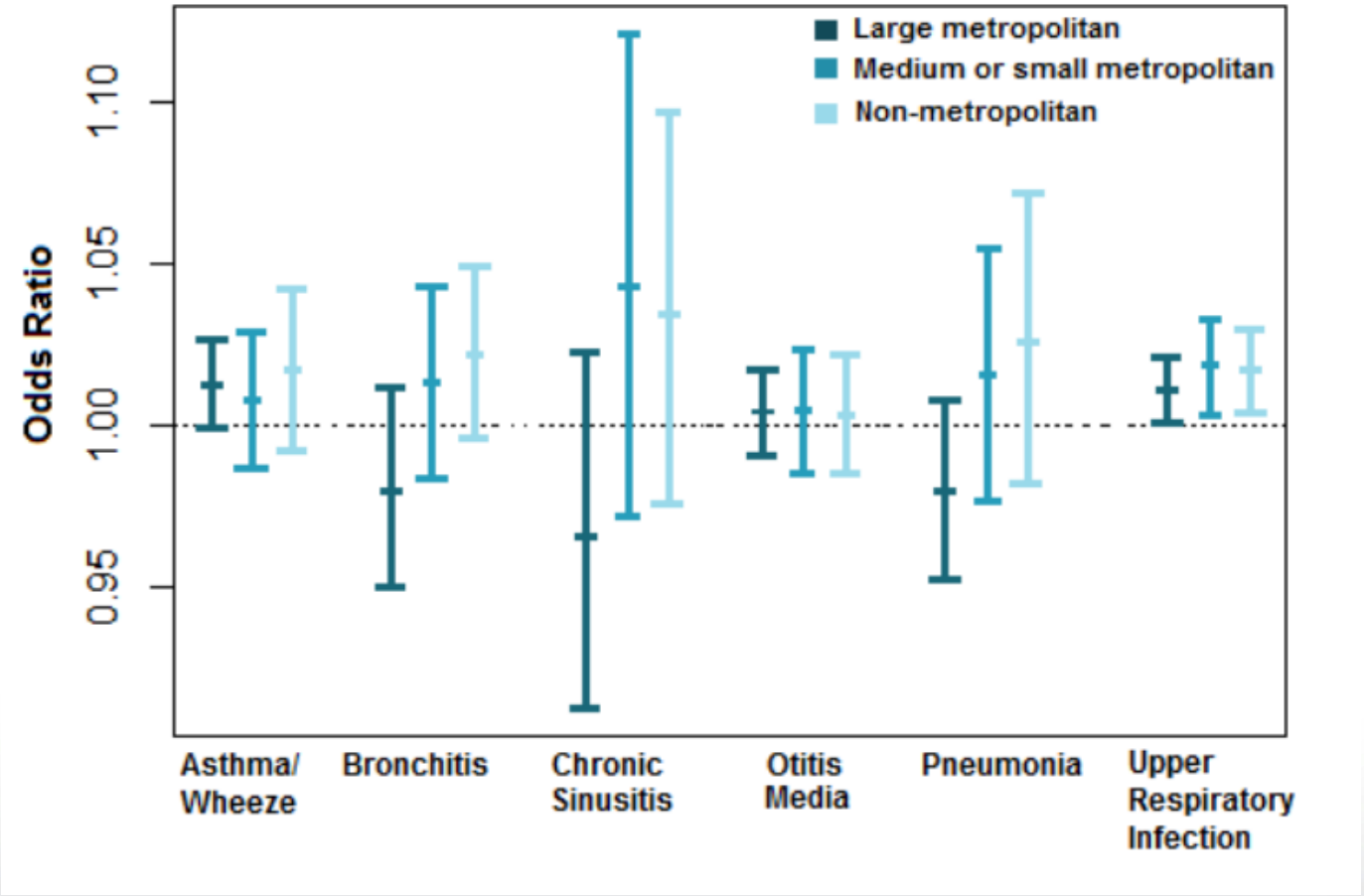
- Satellite-retrieved cloud fraction and cloud optical thickness used to predict PM2.5 (Yu et al., 2015)
- Combining downscaling and modeling techniques with AOD increases accuracy of PM2.5 predictions compared to ground measurements (Chang et al., 2014)
- The decade long satellite data used to develop accurate PM2.5 concentration in the Southeastern US and assess regional trends (Hu et al. 2014)



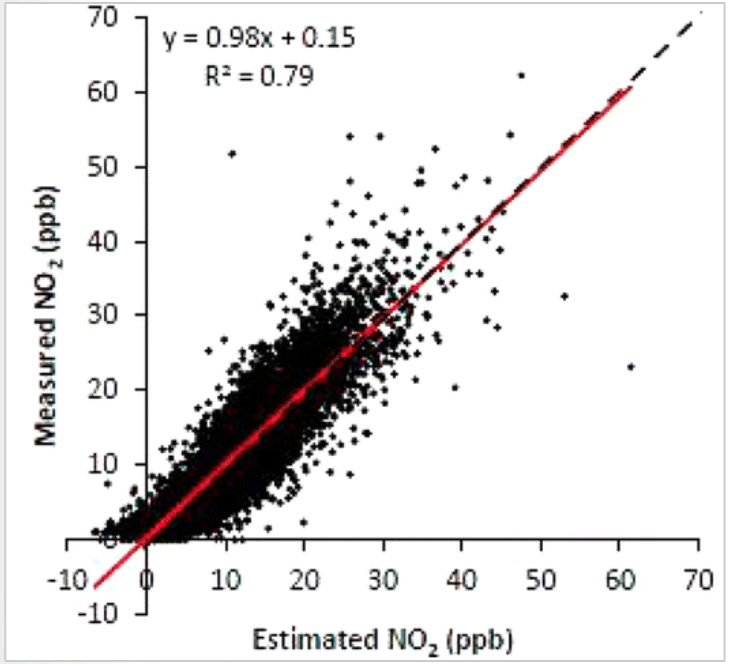


Emory/GaTech CLARC

- Satellite-based estimates of PM2.5 were used with a Georgia cohort to determine associations with pediatric respiratory disease (Strickland et al. 2016)



Harvard CLARC

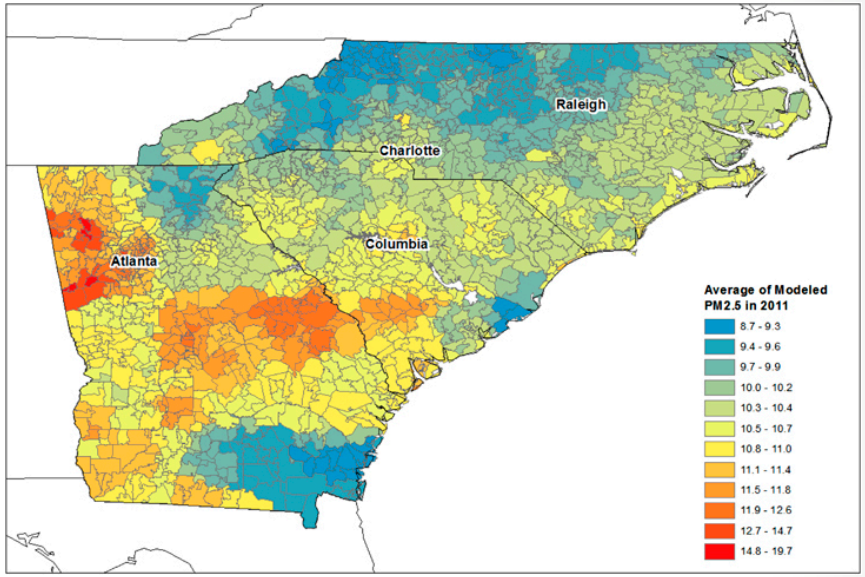


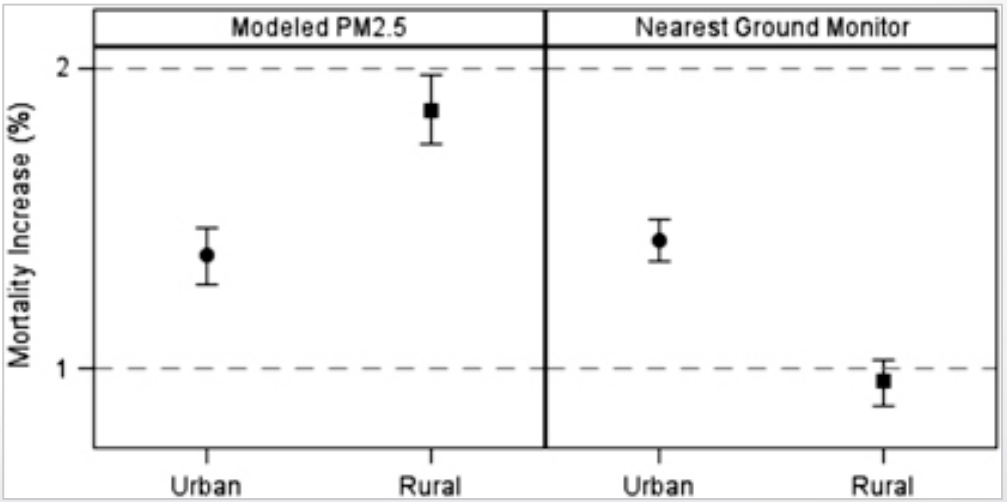
- Multi-Angle Implementation of Atmospheric Correction (MAIAC) algorithm for AOD shows improved correlation to measured $PM_{2.5}$ (Chudnovsky et al. 2014)
- Introduced a model to expand limited spatial coverage of MODIS daily air temperature to high resolution in large geographical areas (Kloog et al. 2014)
- Developed spatially and temporally resolved exposure assessments of NO_2 from a combination of satellite remote sensing and land use regression (Lee et al., 2014b)

Harvard CLARC

- Examined the correlation of mortality with exposure to PM2.5 as estimated from nearest monitors and from a model incorporating AOD from MRIS

- Incorporating AOD, results in stronger effects in rural regions where fewer monitors are present. (Lee, et al. 2016)





Recently Funded STAR Grants

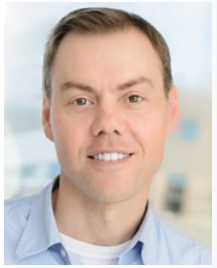
Air, Climate, and Energy Centers: Science Supporting Solutions

- Carnegie Mellon University, *Center for Air, Climate and Energy Solutions (CACES)*

  Directors: Allen Robinson (CMU) and Julien Marshall (UW)


- Harvard University, *Regional Air Pollution Mixtures: The Past and Future Impacts of Emission Controls and Climate Change on Air Quality and Health*

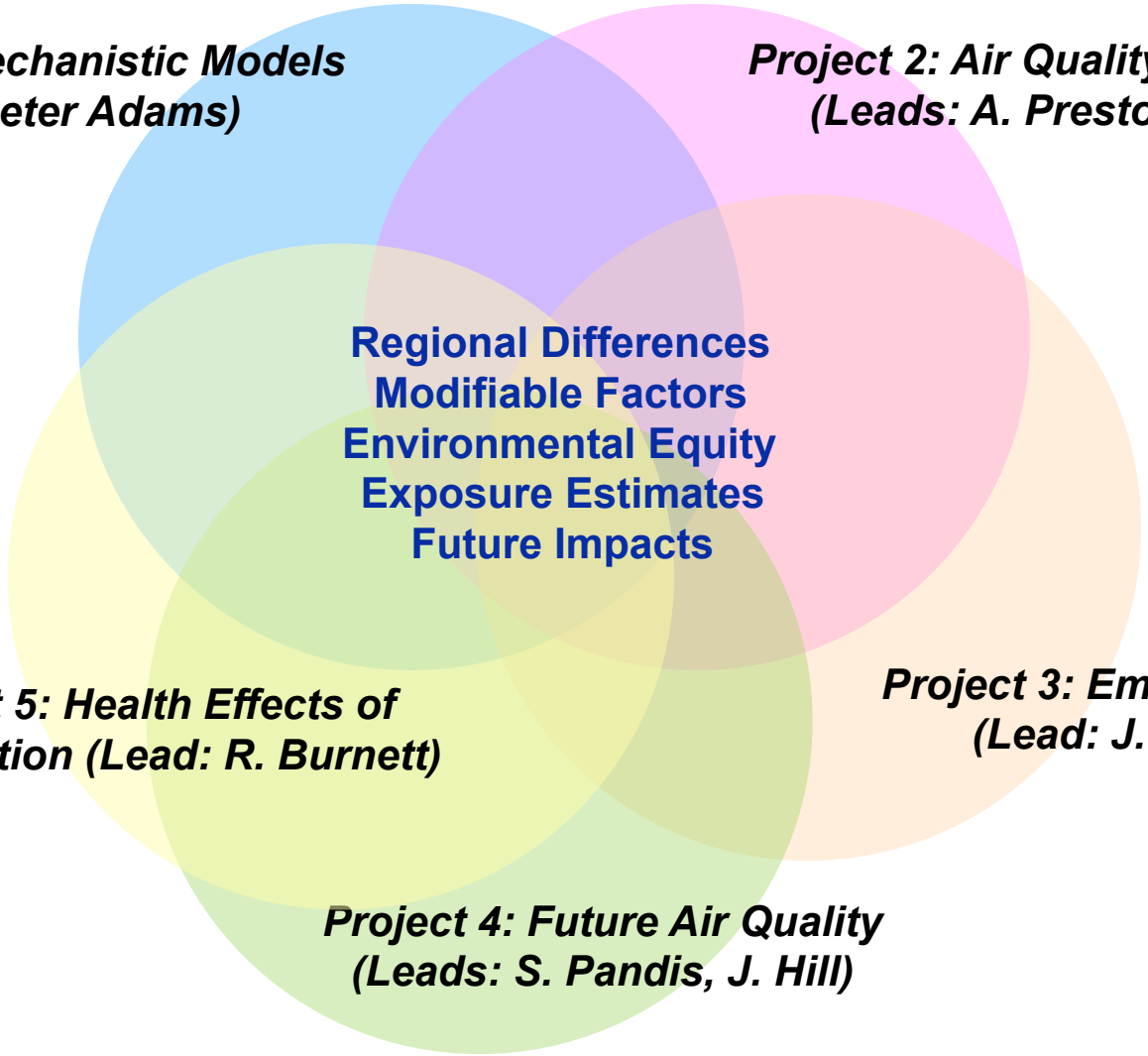
  Directors: Petros Koutrakis and Brent Coull

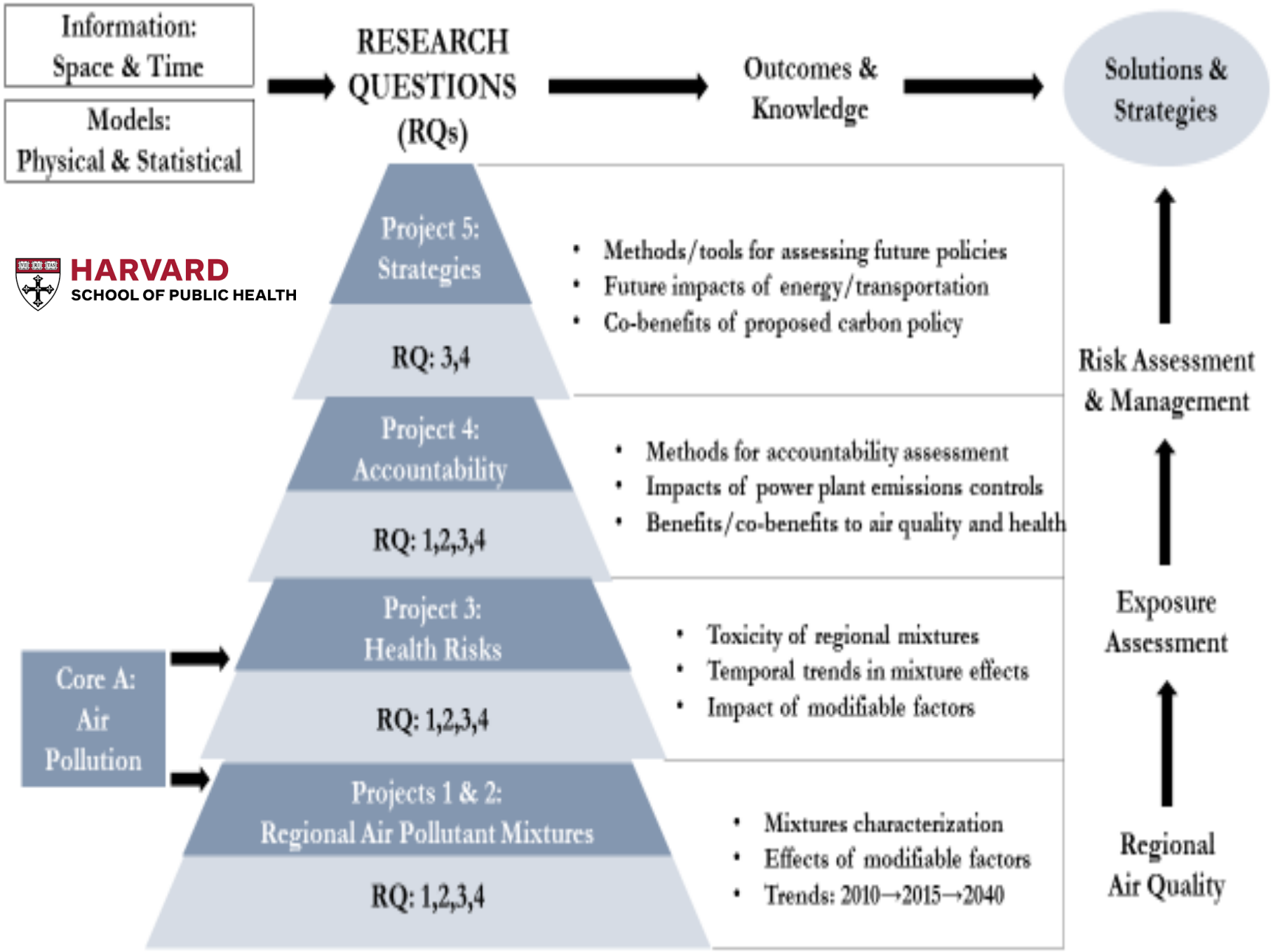
- Yale University, *SEARCH: Solutions for Energy, AiR, Climate and Health*

  Directors: Michelle Bell and Roger Peng


CMU-UW Center for Air, Climate, and Energy Solutions (CACES)

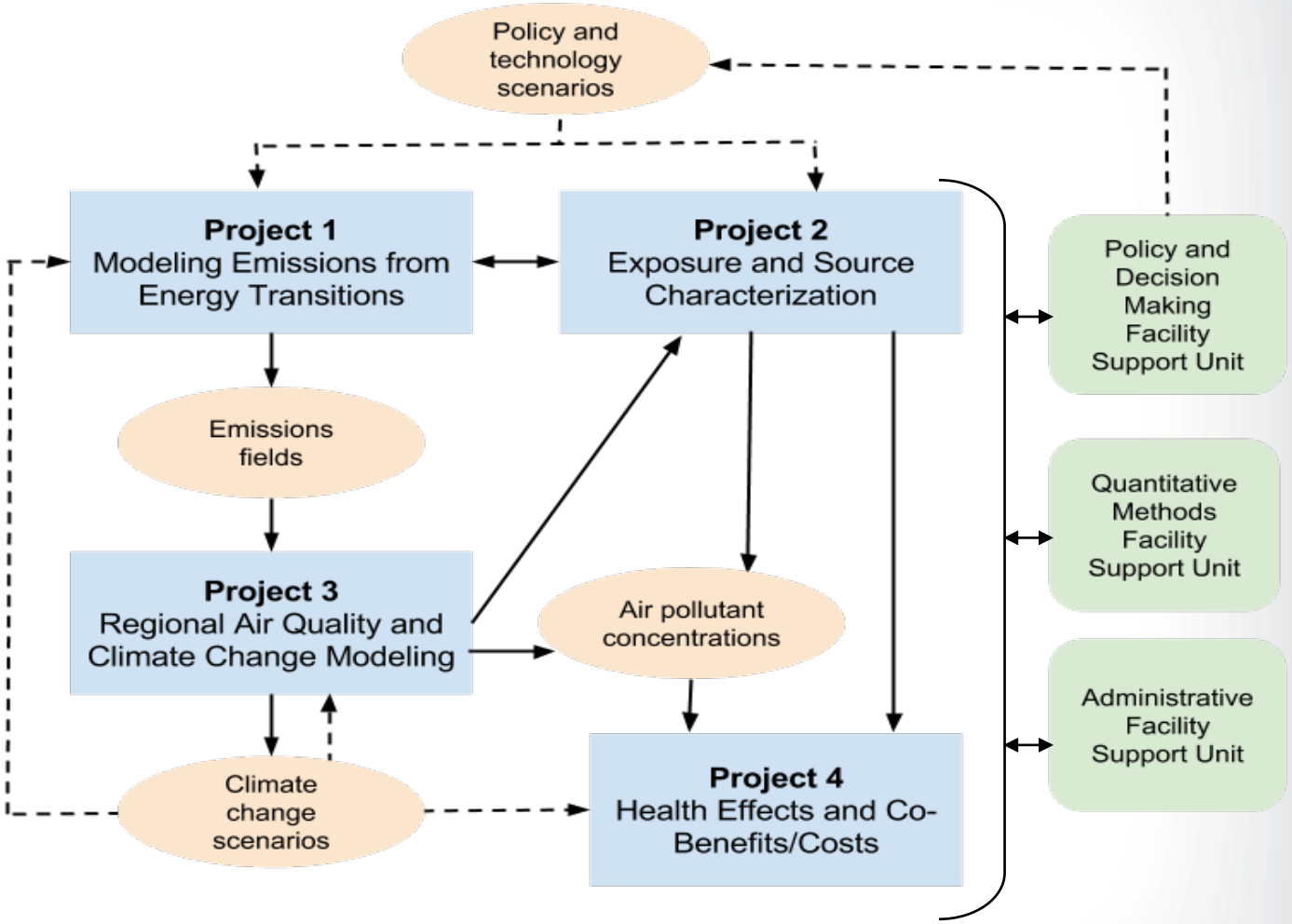


Courtesy of Allen Robinson, CMU


Information:
Space & Time
Models:
Physical & Statistical
RESEARCH QUESTIONS (RQs)
Outcomes & Knowledge
Solutions & Strategies
HARVARD
SCHOOL OF PUBLIC HEALTH
Project 5: Strategies
RQ: 3,4
Methods/tools for assessing future policies
Future impacts of energy/transportation
Co-benefits of proposed carbon policy
Project 4: Accountability
RQ: 1,2,3,4
Methods for accountability assessment
Impacts of power plant emissions controls
Benefits/co-benefits to air quality and health
Project 3: Health Risks
RQ: 1,2,3,4
Toxicity of regional mixtures
Temporal trends in mixture effects
Impact of modifiable factors
Core A: Air Pollution
Projects 1 & 2: Regional Air Pollutant Mixtures
RQ: 1,2,3,4
Mixtures characterization
Effects of modifiable factors
Trends: 2010→2015→2040
Risk Assessment & Management
Exposure Assessment
Regional Air Quality

Yale SEARCH Conceptual Model

Yale University
Johns Hopkins University
North Carolina State University
Northeastern University
Pacific Northwest National Laboratory
Stanford University
University of Chicago
University of Michigan
Centers for Disease Control and Prevention (CDC)



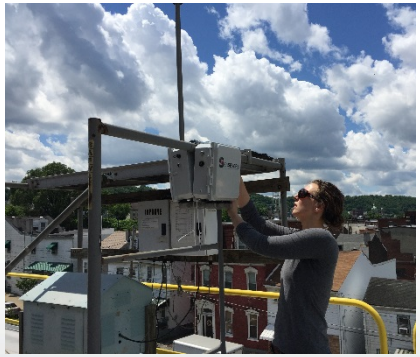
SEARCH
Solutions for Energy Air, Climate & Health

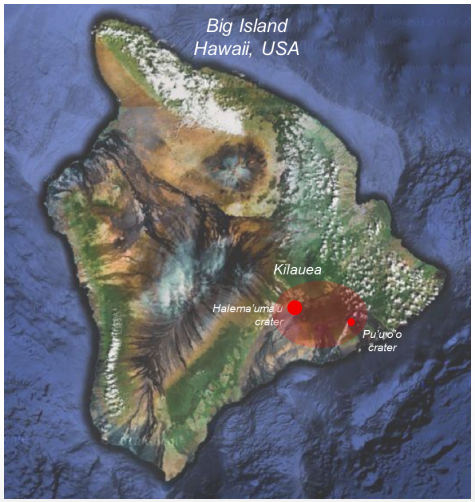
Recently Funded STAR Grants, 2

Air Pollution Monitoring for Communities Projects

- Democratization of Measurement and Modeling Tools for Community Action on Air Quality, and Improved Spatial Resolution of Air Pollutant Concentrations; Carnegie Mellon University, PI: R Subramanian
- Shared Air/Shared Action (SA2): Community Empowerment through Low-Cost Air Pollution Monitoring; Kansas State University, PI: Wendy Griswold
- Hawai'i Island Volcanic Smog Sensor Network (HI-Vog); Massachusetts Institute of Technology, PI: Jesse Kroll

Collocated sampling with reference monitors





Kilauea Volcano

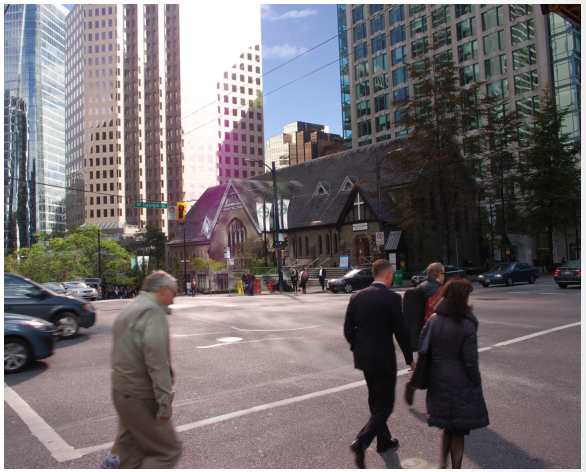
Recently Funded STAR Grants, 3

Air Pollution Monitoring for Communities Projects

- Monitoring the Air in Our Community: Engaging Citizens in Research; Research Triangle Institute, PI: Seung-Hyun Cho
- Engage, Educate, and Empower California Communities on the Use and Applications of Low-Cost Air Monitoring Sensors; The South Coast Air Quality Management District, PI: Andrea Polidori
- Putting Next Generation Sensors and Scientists in practice to reduce wood smoke in a highly impacted, multicultural rural setting; University of Washington, PI: Catherine Karr

The Health Effects Institute

- HEI is a nonprofit corporation chartered in 1980 as an independent research organization to provide high-quality, impartial, and relevant science on the health effects of air pollution.
- HEI typically receives balanced funding from the U.S. Environmental Protection Agency and the worldwide motor vehicle industry.



Dan Greenbaum
President

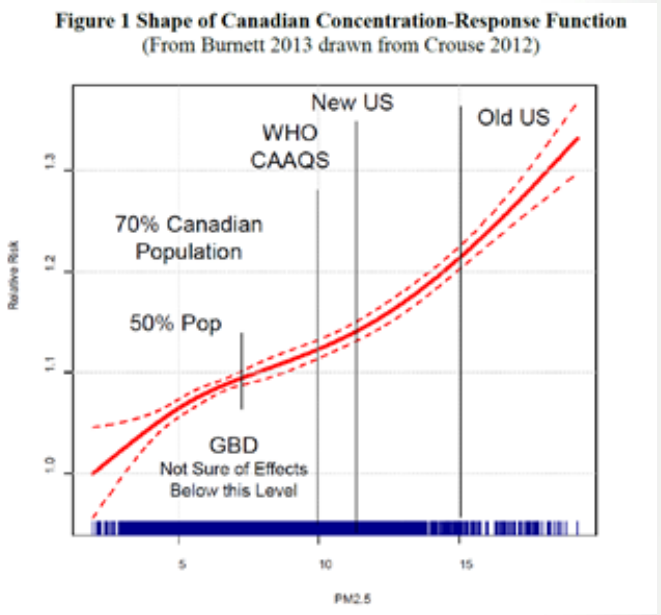
Bob O'Keefe
Vice President

New HEI Studies

Assessing Health Effects of Low Levels of Air Pollution

Three new studies funded, with key features:

- Populations with millions in the US, Canada and Europe; administrative and traditional cohorts
- Satellite data and ground level exposure measurements; high quality exposure assessment models at high spatial resolutions
- Development of new statistical methods
- Investigator teams with prior experience of productive collaboration
- Detailed HEI Oversight



Upcoming Traffic Studies

- **Upcoming RFA**
  - Annual Conference session and small workshop to identify key research questions and methodological challenges, and appropriate research designs
  - Interested in a rigorous examination of potential effects of traffic and other factors (e.g. noise and SES)
  - RFA to be issued – early 2017
  - Studies to begin – early 2018

- **New Review of the Traffic Literature**
  - ***To begin in late 2017***

Resources

Possibly Useful Links

- ACE Strategic Research Action Plan: http://www2.epa.gov/sites/production/files/2014-09/documents/epa_strategic_plan_fy14-18.pdf
- Clean Air Research Centers (CLARCs): https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/outlinks.centers/centerGroup/28
- ACE Centers: https://www.epa.gov/air-research/air-climate-and-energy-ace-centers-supporting-air-quality-and-climate-solutions-0
- Air Pollution Monitoring for Communities grants: https://www.epa.gov/air-research/air-pollution-monitoring-communities-grants
- Health Effects Institute: https://www.healtheffects.org/