Air Quality and Public Health: Applications and Needs for Earth Science Data in Environmental Public Health Practice

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Outline

- Agency overview
- Public Health Applications of Air Quality Data
- Public Health Air Quality Needs
- Discussion
CDC's Role

- Detecting and responding to new and emerging health threats
- Tackling the biggest health problems causing death and disability for Americans
- Putting science and advanced technology into action to prevent disease
- Promoting healthy and safe behaviors, communities and environment
- Developing leaders and training the public health workforce, including disease detectives
- Taking the health pulse of our nation

Source: http://www.cdc.gov/about/organization/mission.htm
NCEH established in 1980
- “… [CDC’s] commitment to solving health problems related to the environment”

1983: ATSDR becomes a separate agency

Vision:
- Healthy people in a healthy environment
Mission

NCEH/ATSDR protects people's health from environmental hazards that can be present in the air we breathe, the water we drink, and the world that sustains us.

We do this by investigating the relationship between environmental factors and health, developing guidance, and building partnerships to support healthy decision making.

Protecting children and adults from health risks related to short- and long-term exposure to air pollutants

Cross-cutting issue
AIR QUALITY AND PUBLIC HEALTH ACTIVITIES

TRACK ♦ RESEARCH ♦ RESPOND ♦ PREVENT
Tracking Air Quality and Health Effects
National Environmental Public Health Tracking Network

- Health and environmental information together in one easy to access website
  - [www.cdc.gov/ephtracking](http://www.cdc.gov/ephtracking)
- 25 state and NYC networks
- Uses:
  - Understand burden and trends
  - Direct and evaluate prevention and control
  - Facilitate policy development
  - Generate new research
  - Improve our understanding of health-environment link
- Purpose: Data for Action
AQ Estimates for Public Health

- Limited coverage of air quality monitors
  - ~20% of counties in the U.S. are monitored
  - ~30% of the population resides in counties with no monitors

Model-based Estimates

Characterizing population-level exposure in places with no monitors

Modeling Complexity

- Ambient Data
- Space-Time Interpolation
- Deterministic Modeling
- Data Fusion
- Exposure Modeling

Reliability of exposure estimates

Monitoring Data
- Land-Use Data
- Meteorological Data
- Emissions Data
- Personal Behavior/Time Activity
- Microenvironmental Characteristics
Partnerships: EPA

- Memorandum of understanding (MOU) signed in 2002
  - Public Health Air Surveillance Evaluation (PHASE) Project
    - Link air quality measurements and modeled estimates of PM$_{2.5}$ and ozone with health outcome data (e.g., asthma and occurrences of myocardial infarction)

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>2004</td>
<td>EPA-CDC collaboration on evaluating AQ models for public health</td>
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<td>2005</td>
<td>Hierarchical Bayesian (HB) data fusion model developed by EPA for the Eastern U.S.</td>
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<td>2007</td>
<td>HB model coverage expanded to the CONUS domain</td>
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<td>2010</td>
<td>EPA and its partners develop a Bayesian DownScaler (DS) model for the Eastern U.S.</td>
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<td>2012</td>
<td>DS model expanded to the CONUS domain and available at census tract centroids</td>
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Partnerships: NASA

- MOU signed in 2004
  - Collaboration started in 2005 with a linkage project, HELIX- Atlanta
  - Used Aerosol Optical Depth (AOD) to predict PM$_{2.5}$ concentrations in the Metropolitan Atlanta area

- Current effort - Climate and Health
  - Heat event identification tool
  - Heat stress hospitalizations and mortality
Partnerships: Universities

- Collaborated with NASA and Emory University on enhancing spatial coverage of PM$_{2.5}$ in the Southeast
  - AOD-based PM$_{2.5}$ estimates available on the Tracking Network

- Characterizing daily PM$_{2.5}$ source impacts over the CONUS domain
  - Ongoing project with Georgia Tech
Research: Air Pollution Epidemiology

- PM$_{2.5}$, ozone, and air toxics
  - Example: Using air quality and cardiovascular effects data from the Tracking Network
    - Awards to University of California at Berkeley, University of Pittsburgh, Rutgers (formerly UMDNJ)
    - Results will be published in special journal issue of Environmental Research
  - Sources: traffic, biomass burning, ports

- Impacts of Air Pollution-related interventions
  - Cookstove evaluation in Kenya

- Indoor: CO, formaldehyde, other
  - Children’s Health After the Storm
  - Green Housing
Traffic, Built Environment, and Health

- Atlanta Commuter Study
- Demographic and social disparities among populations residing within 150m of a major highway
- Meta-analysis on residential proximity to roadways
- Examination of urban sprawl as a potential modifier of air pollution and respiratory, CVD mortality
Responding to Environmental Concerns

- Wildfires in California
- Volcanic emissions in Hawaii
- Prescribed crop burns in Kansas
- Gulf Oil Spill
- Unconventional Oil and Gas Production (ATSDR)
Preventing AQ-related Health Impacts
Serving the Needs of Public Health

Earth science resources
- Satellites
- Suborbital platforms
- Models

Air Quality Management Needs
- Pollution monitoring
- Exposure assessment
- AQ forecasting
- Source attribution of events
- Quantifying emissions
- Assessment of natural and international influences
- Understanding of transport, chemistry, aerosol processes
- Understanding of climate-AQ interactions

Public Health Needs
- Measures or reliable estimates of population exposures
  - Past, present, and future
  - Timely
  - Flexible spatial scale
  - Translatable
  - Sustainable
- Uncertainty estimates

Goal - to understand and reduce health impacts

http://acmg.seas.harvard.edu/aqast/what_is_aqast.html
Looking Forward – Opportunities for Collaboration

- Characterize exposure, vulnerabilities, and health impacts to take action
  - Wildfires
  - Prescribed burnings: forest; agricultural
  - Traffic-related pollutants
  - Disasters

- Build efforts in assessing the effectiveness of policy and other interventions on reducing health impacts:
  - Quantify changes in AQ concentrations/sources, in places with no monitors
  - Provide tools to quantify (with uncertainty) health benefits associated with interventions – local, state, regional, and national