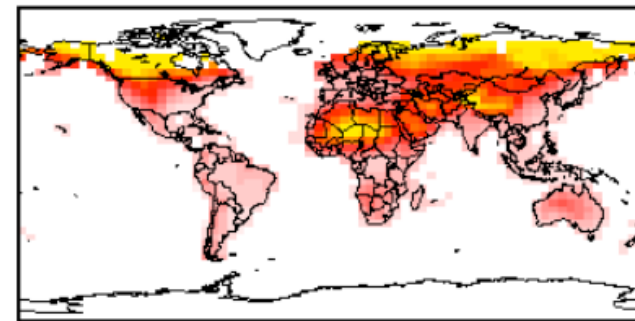
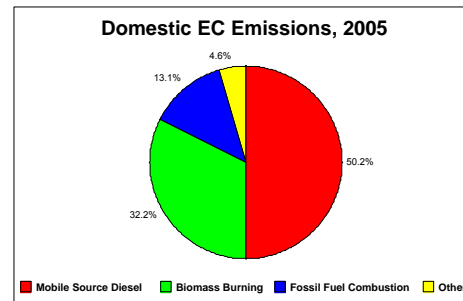
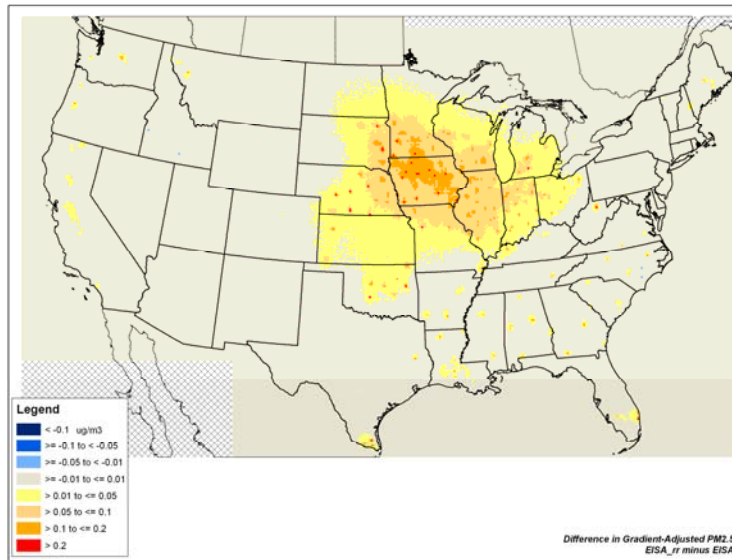


Current SLCF Activities at USEPA

- Air Office
- Research Office

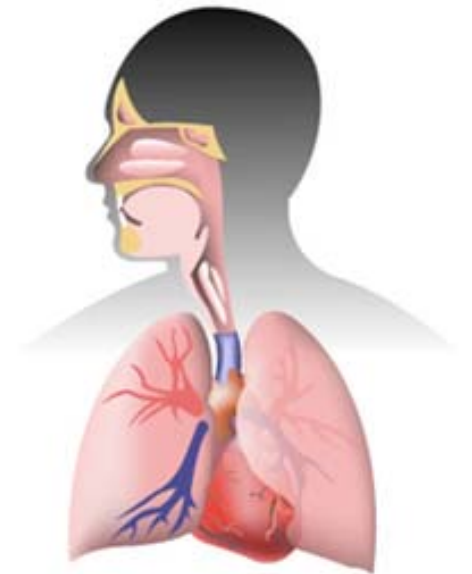


Current SLCF Activities in EPA's Air Office

- Health Co-Benefits
- Modeling
- Emissions and Future Emission Projections
- Source Measurements
- Mitigation

Health impacts co-benefits

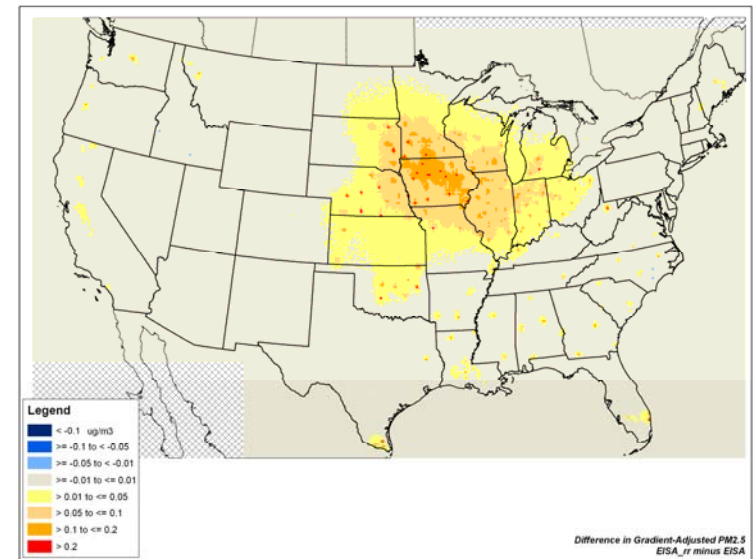
- EPA is reviewing the PM air quality standards
 - Elemental carbon is a component of PM_{2.5}
 - Studies found evidence for an association between EC and cardiovascular hospital admissions and cardiovascular mortality
 - Overall, the results indicate that many constituents of PM can be linked with differing health effects
 - The evidence is not yet sufficient to allow differentiation of those constituents or sources that are more closely related to specific health outcomes



*Source: EPA's PM Integrated Science
Assessment for Particulate Matter, 12/09*

Currently modeling air quality impacts of criteria pollutant effects of climate programs

- Several national AQ modeling simulations to assess health impacts of climate-based policies
- Recent climate programs analyzed:
 - Renewable Fuels Standard-2 rule (2/10)
 - Light-duty greenhouse gas rule (3/10)

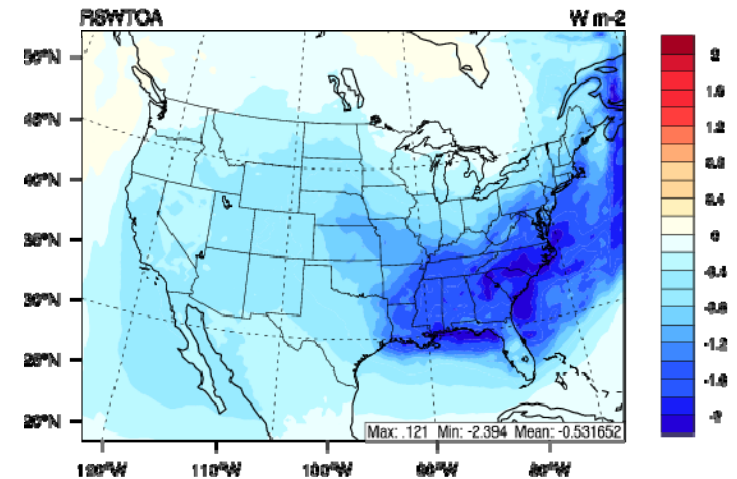


US EPA (2010)

- Building screening models to provide faster assessments of expected AQ impacts from climate policies

Modeling projects/partnerships

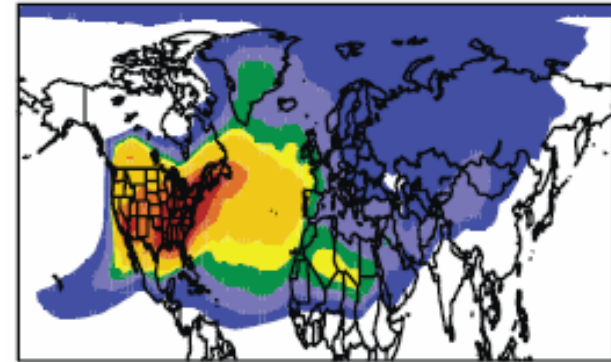
- Global modeling to assess integrated climate & health benefits from reductions of BC and ozone precursors
 - MOZART-IV modeling (w/ UNC)
 - Sensitivities by region and sector
 - Results by Fall 2010
- Standalone radiative transfer modeling to assess the regional, direct RF resulting from domestic AQ policy.
 - WRF-Chem radiative transfer (w/ NCSU)
 - Expect results by Fall 2010
- Engaging with long-term climate modeling community (e.g., IPCC/EMF) to incorporate SLCFs into modeling frameworks alongside greenhouse gases



Work in progress US EPA

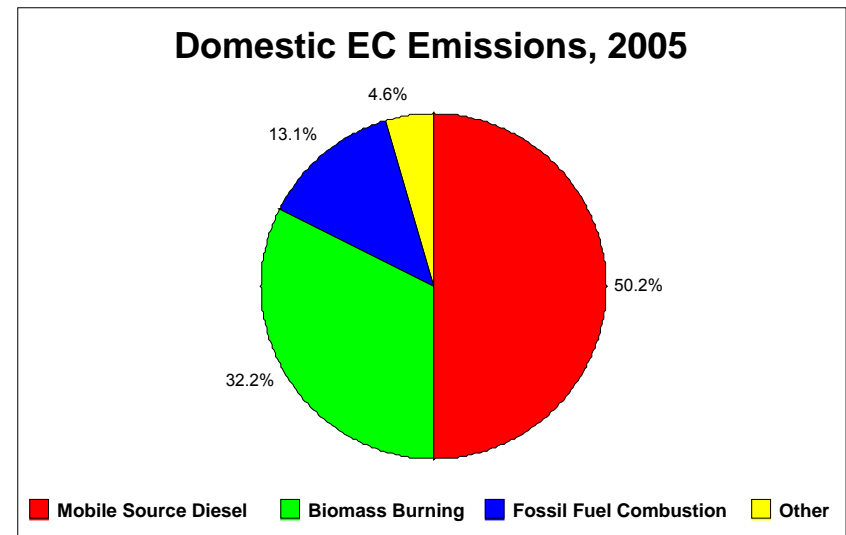
Assessing potential AQ policy implications of climate change and intercontinental transport

- Update guidance to States on how to account for climate change in AQ planning process
- Conduct three years of global modeling to provide boundary conditions for U.S. AQ modeling.
 - GEOS-Chem modeling (w/ U TN & Harvard)
 - Assess impacts of intercontinental transport
 - Expect results by Fall 2010



BC/EC emission inventory improvements

- BC estimates are developed by application of speciation profiles to PM_{2.5} inventories, however
 - Reliable BC profile data exist only for some source categories
 - PM_{2.5} inventories are sometimes based on TSP/PM₁₀ data



- EPA is initiating efforts to investigate and improve speciation profiles for sources that are poorly characterized for BC/OC currently, but are important to both air quality and climate
- EPA expects future PM_{2.5} inventories will improve after PM_{2.5} measurement methodology is finalized in 2010 by EPA

Mobile source testing

- In-use gasoline vehicle testing
 - New test programs will supplement available mobile source BC data
 - Obtain PM mass/speciation and black carbon g/mile data
 - Initial results - August 2010
 - New technology gasoline vehicle testing
 - Testing about 4 new technology gasoline vehicles
 - Obtain PM mass and black carbon data
 - Initial results – July 2010
- Improve mobile source black carbon inventories
 - Will be consistent with official EPA inventories for SIPs and Trends
 - Past, current, and future years
 - Using MOVES model for on-road
 - Using adaptation of NONROAD model for nonroad
 - Also including commercial marine, locomotives, and aircraft
 - Initial results – August 2010

Cook stove testing

- EPA is conducting limited testing of a small number of widely disseminated cookstoves for fuel use and a wide range of emissions in the laboratory (\$60k funding)
 - Partnership between OAR and ORD on laboratory testing for emissions ($PM_{2.5}$, CO, CO_2 , CH_4 , BC, OC, EC, total hydrocarbons) and fuel efficiency
 - Expect initial testing results by Fall 2010

Note: EPA is not currently planning any field testing for BC emissions from cookstoves

U.S residential wood heaters

- EPA is testing and analyzing how BC and GHG emissions differ depending on the type of wood-fired heating appliances and fuel from:
 - Hydronic heaters (testing completed 2009; analysis ongoing)
 - Old wood stoves vs EPA-certified wood stoves (2010)
 - Wood pellet stoves and fireplaces (2010)
- EPA New Source Performance Standard Revision expected to:
 - Expand scope to include all new residential wood heaters and consider expanding to new fireplaces and other new “non-heaters”
 - Tighten PM emission limits for wood stoves
 - Be proposed by May 2011

Methane emission factor improvements

- Large area source methane quantification method development
 - Partner with ORD NRMRL and Waste Management
 - Method development conducted on total landfill emissions on methane
 - Potential use for other large area sources emissions of methane/VOCs
 - Pilot Study conducted in 2009, Larger Scope Study in 2010
- Upstream Oil and Gas Emission Measurement Project
 - EPA-OAQPS partner with ORD NRMRL and EPA Region 8
 - Development of techniques and methodology for VOC and Methane emissions quantification for the upstream O&G production sector
 - Phase 1 completed in 2008, Phase 2 Pilot Study in 2009, Phase 2 scheduled to be performed in 2010

BC mitigation analysis

- EPA, in collaboration with members of the Arctic Task Force on SLCF under the Arctic Council, preparing BC
 - Inventories and projections
 - Analysis of mitigation options
 - Including developing marginal abatement cost curve paper for US diesel and biomass burning with Research Triangle Institute
 - Estimate draft by November 2010 and final by April 2011
- EPA is contributing mitigation analysis to BC "bounding paper"
- As part of PM AQ standard review, EPA is analyzing PM mitigation measures

*For further information on noted
SLCF activities contact*

- Health Impacts: Hasset-Sipple.Beth@epa.gov
- Modeling: Dolwick.Pat@epa.gov
- Emission Inventory: Rao.Venkatesh@epa.gov
- Residential Wood Heaters: Wood.Gil@epa.gov
- Source Testing:
 - Methane: DeWees.Jason@epa.gov
 - Mobile: Somers.Joseph@epa.gov
 - Stoves: Moss.Jacob@epa.gov
- Arctic Council/Mitigation: DeAngelo.Ben@epa.gov

Short Lived Climate Forcers:

interactions between air quality management
and climate change mitigation

Rob Pinder

Atmospheric Modeling and Analysis Division
Office of Research and Development

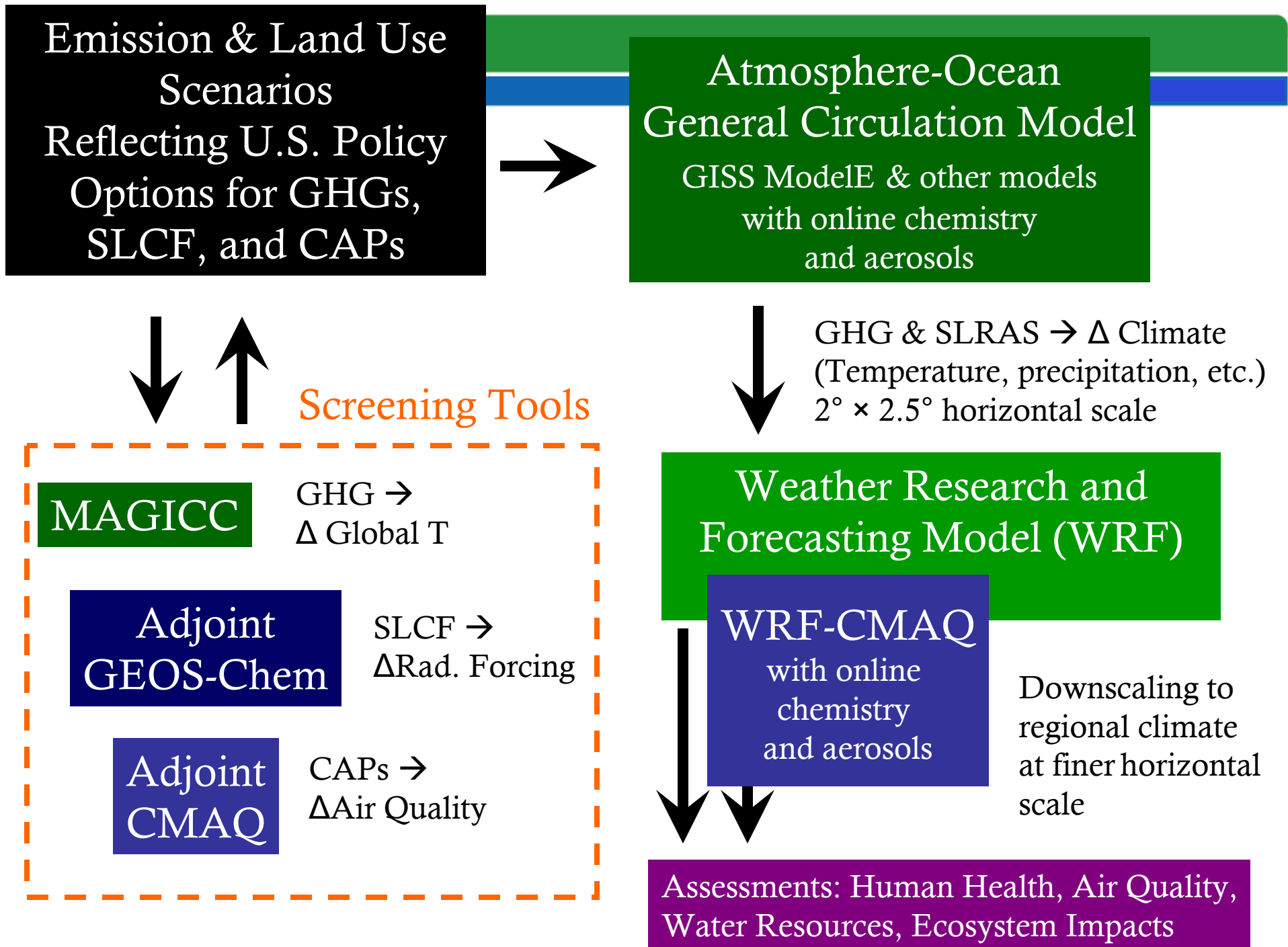
Key Question:

What is the impact of US emission reductions on climate change mitigation and air quality benefits?

Our Role:

Developing tools for technical analysts
and decision makers

Facilitating technology transfer

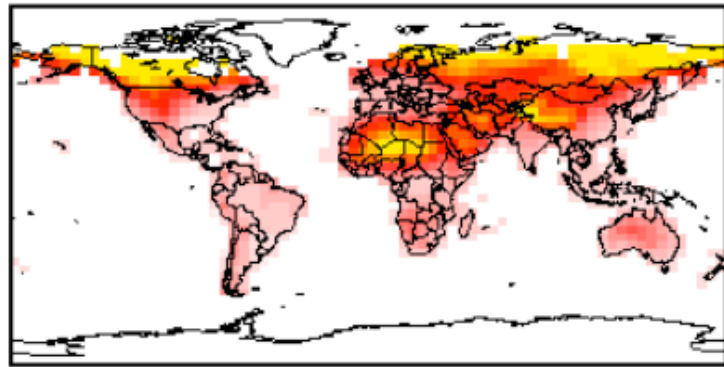


Decision support tools

Emission reductions that are most effective towards achieving our air quality and climate change mitigation goals

Radiative Forcing

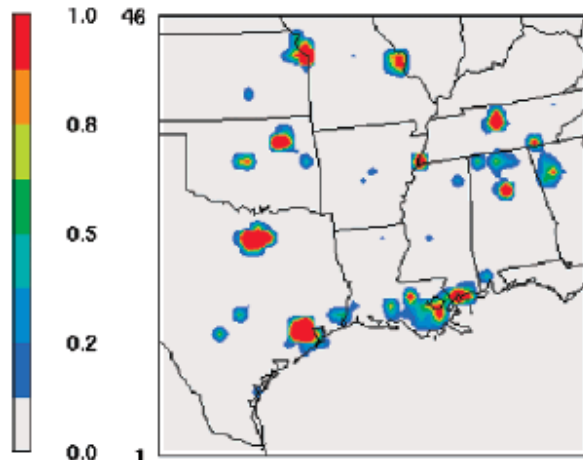
% change in direct RF per unit of black carbon emissions



Source: Henze et al., 2009, GEOS-Chem User's Meeting

Air Quality

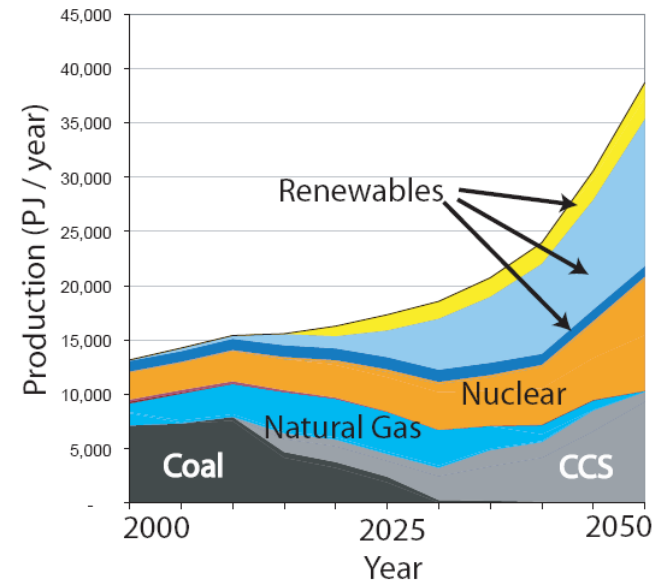
Contribution of NO_x emissions to O₃ exposure



Source: Hakami et al., 2007, The Adjoint of CMAQ, ES&T

EPA 9 Region MARKet ALlocation

Electricity Production by Technology



What technologies are most cost-effective for achieving those goals

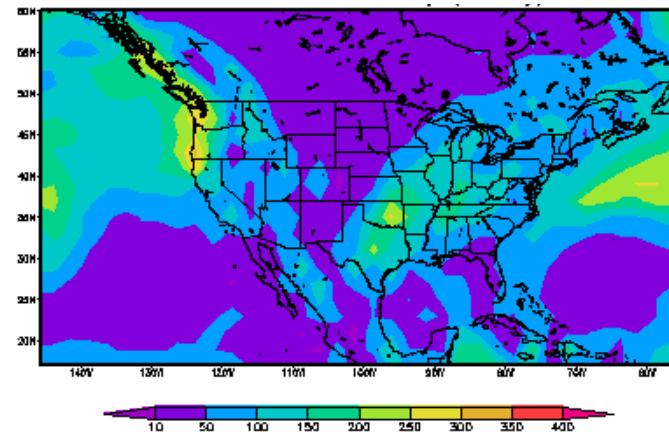
Regional downscaling

understanding human-scale impacts of climate change

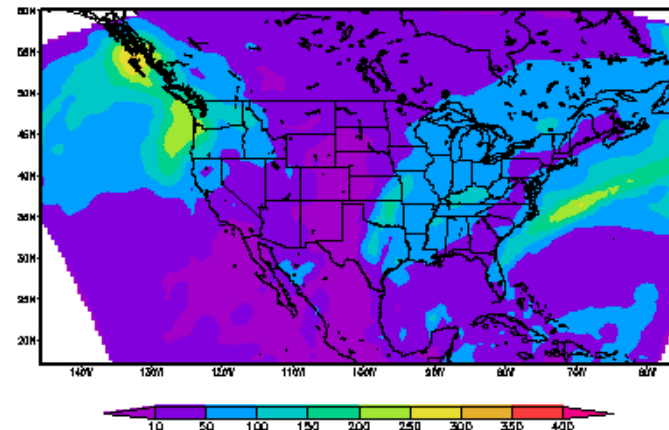
- Dynamical downscaling from AR5 simulations
- Resolve features important for characterizing extreme events
- Stay true to the trends in the global models
- Further downscaling using statistical methods

January Precipitation

ModelE

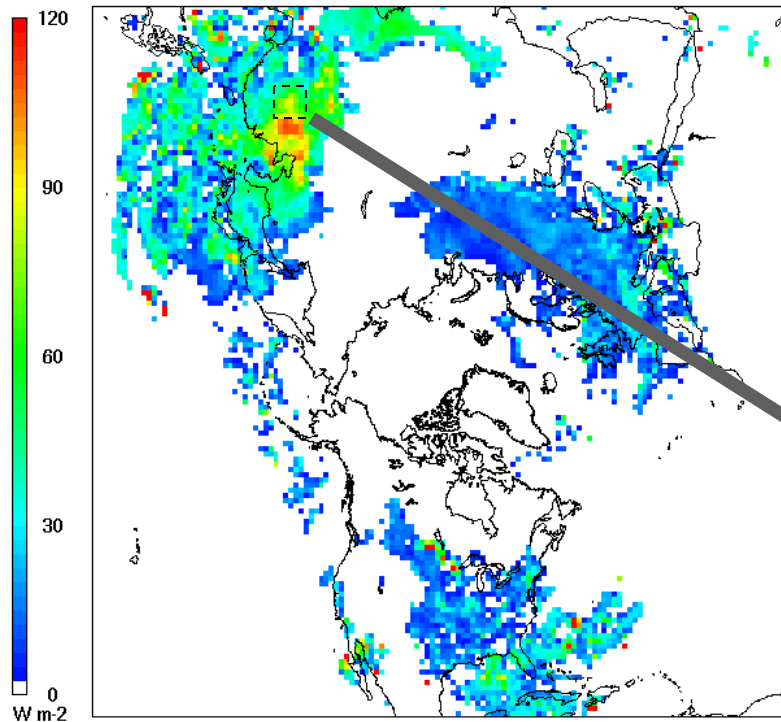


WRF (Analysis Nudging)



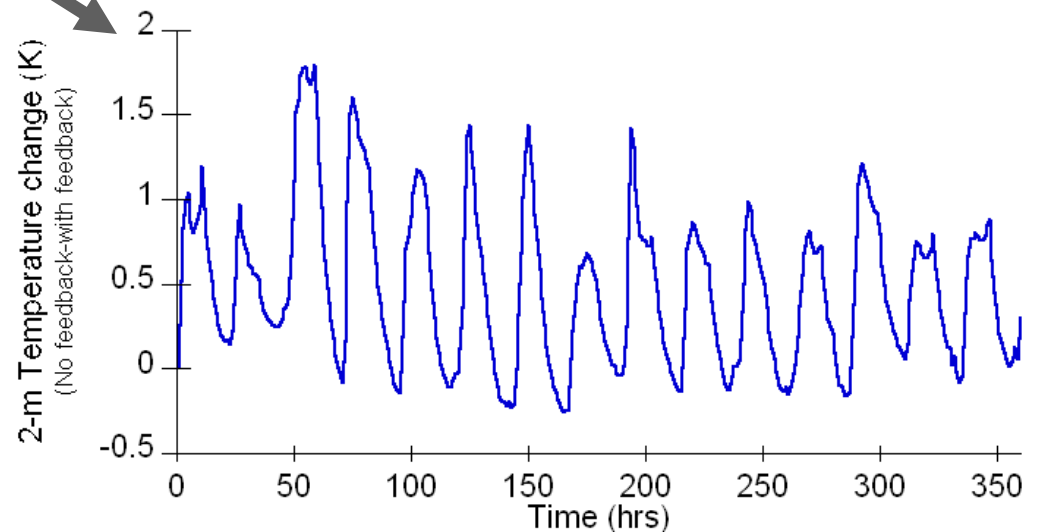
Coupled meteorology and atmospheric chemistry

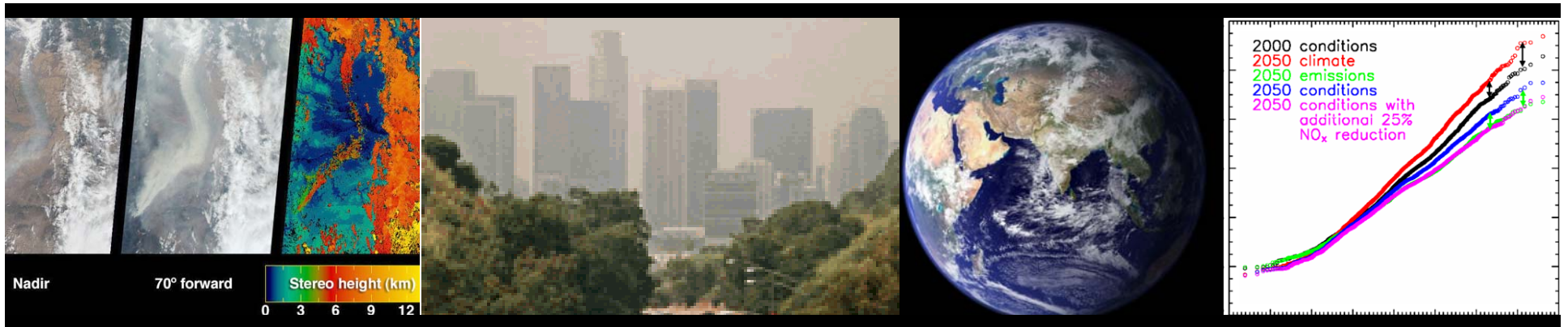
Avg. Reduction in SW Radiation: “Dimming”



Hemispheric modeling to resolve long-range transport and improve lateral boundary conditions

Improved simulation of regional climate by capturing local changes in radiative forcing





Researching the consequences of global change
on air quality, human health, ecosystems and
social well-being

STAR Global Change Research Program

Bryan Bloomer
US EPA
Office of Research and Development
STAR Program

March 3, 2010

RTP Black Carbon Workshop

A Bridge between Science and Policy:

Directing research with policy relevant science questions

NCER conducts global change research through a **competitive grants program:**
STAR (Science To Achieve Results).



By leveraging **in-house expertise** and **inter-department knowledge**, the global change program drives research with policy relevant science questions.

NCER STAR Global Research: Integrating across labs, centers and programs. **Delivering** policy relevant **results**.

**“The emissions of Green House Gases
cause or contribute to endangerment
of public health and welfare.”**

“The evidence concerning adverse air quality impacts
provides strong and clear support
for an endangerment finding.”

The Administrator relied upon the contributions of over **10 years**
of research, primarily extramurally funded research through the
ORD **STAR grant program**, to arrive at this central conclusion

Citation Analysis:

TSD: 146 total citations. 13 individual author citations

There were 11 air quality related citations and

6 of those citations were EPA/ORD Funded work through the STAR
grant program

(with individual author citations from the open literature accounting
for 10 of the 13 total individual cites being related to air quality).

The other is an EPA/ORD led assessment report which relied
heavily upon ORD/STAR funded publications in it's citation list.



Administrator Lisa Jackson signing the Proposed
Endangerment and Cause or Contribute Findings
for Greenhouse Gases under the Clean Air Act

NCER STAR Global Research:
Operating Time Scale

1 to 2 years:

Policy Office

2 to 3 years:

ORD Intramural and Labs

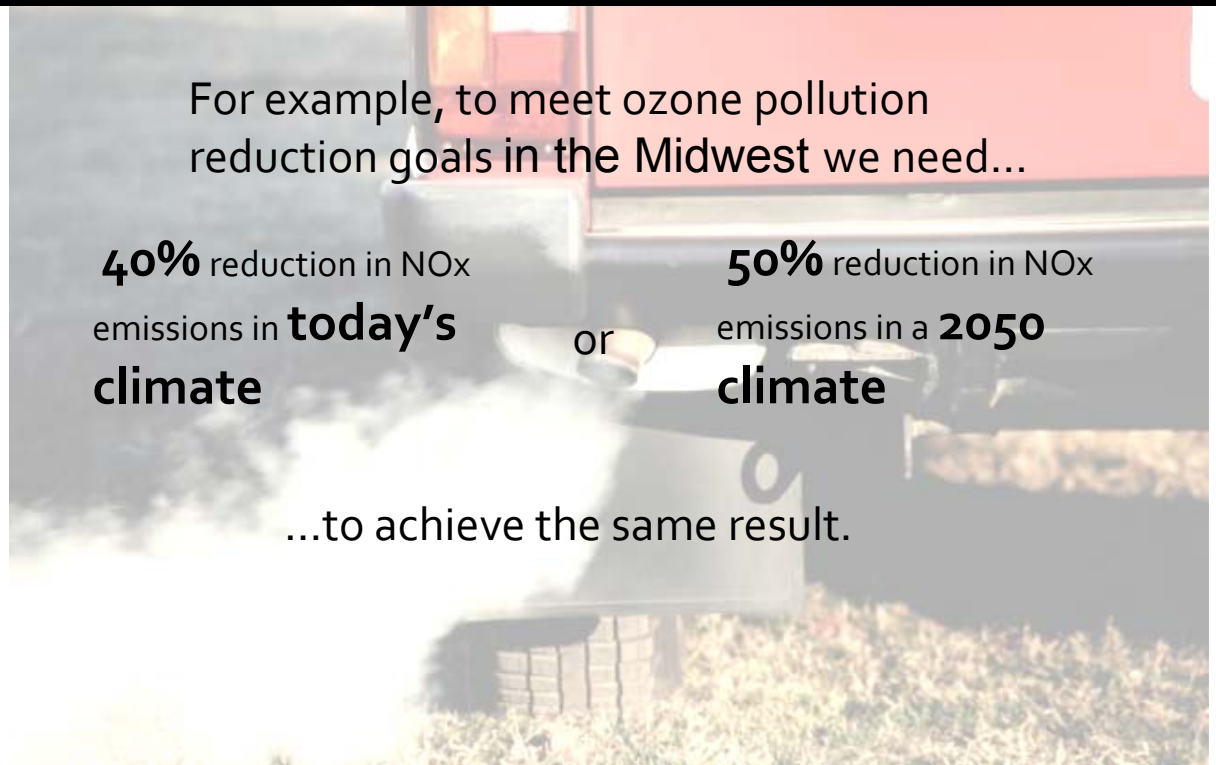
3 to 7 years:

ORD Extramural STAR research

Transformational Research: Impact of climate change on U.S. air quality

Climate Change's Effect	Ozone	Particulate Matter
↑ Stagnation	↑	↑
↑ Temperature	↑	↓
? Mixing Depth	=	↑
? Precipitation	=	↑
? Cloud Cover	↓	↓
? Humidity	=	↑

Meteorology → Air Quality



Source: Jacob and Winner 2009, "Effect of climate change on air quality."

Because **climate change exacerbates ozone pollution**, and potentially also particulate matter pollution, **stronger emissions controls will be needed to achieve current air quality standards in the future.**

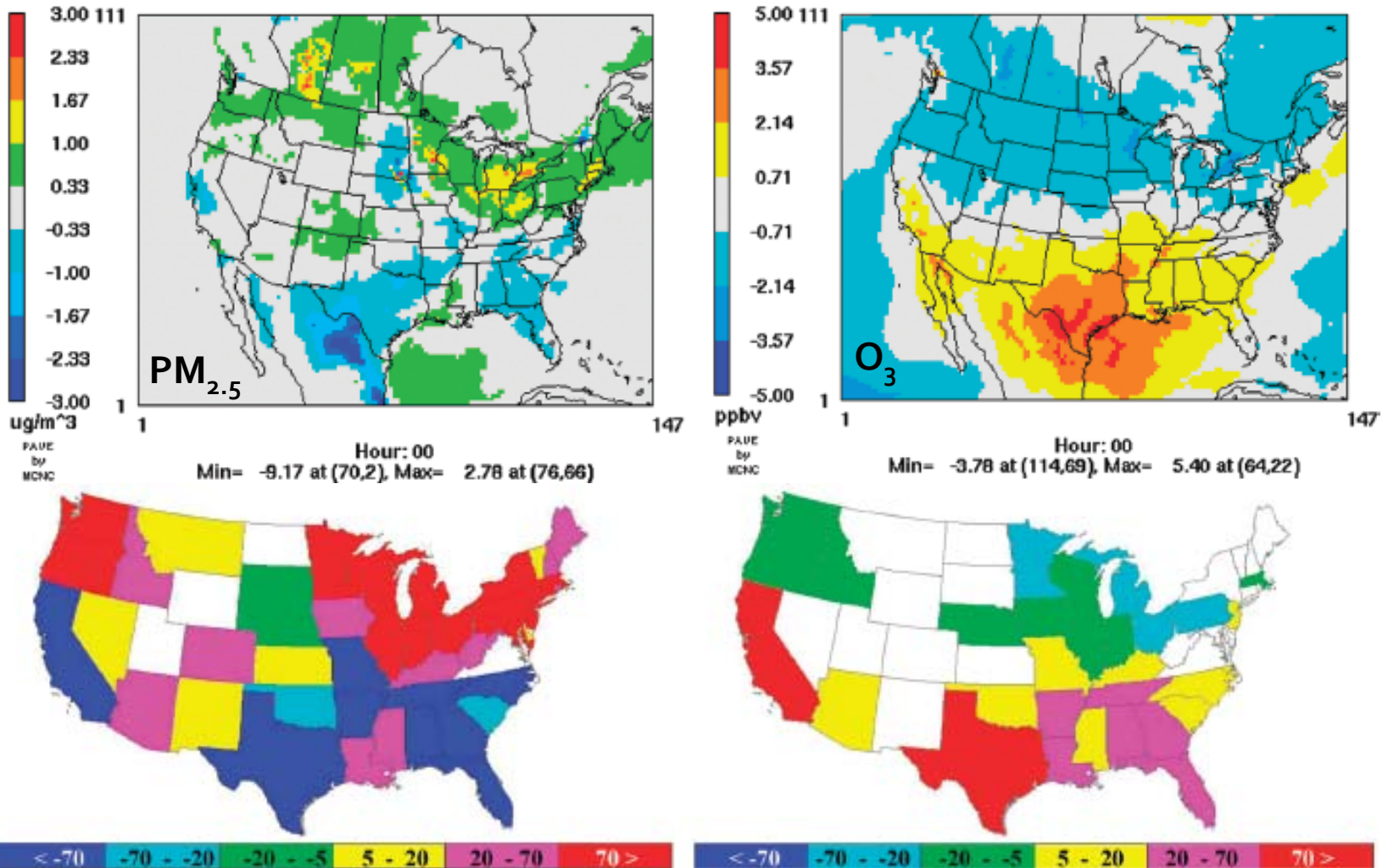
Climate Change, Air Quality and Human Health: Studying future trends in air pollution-related diseases

Change in pollution for projected 2050 climate



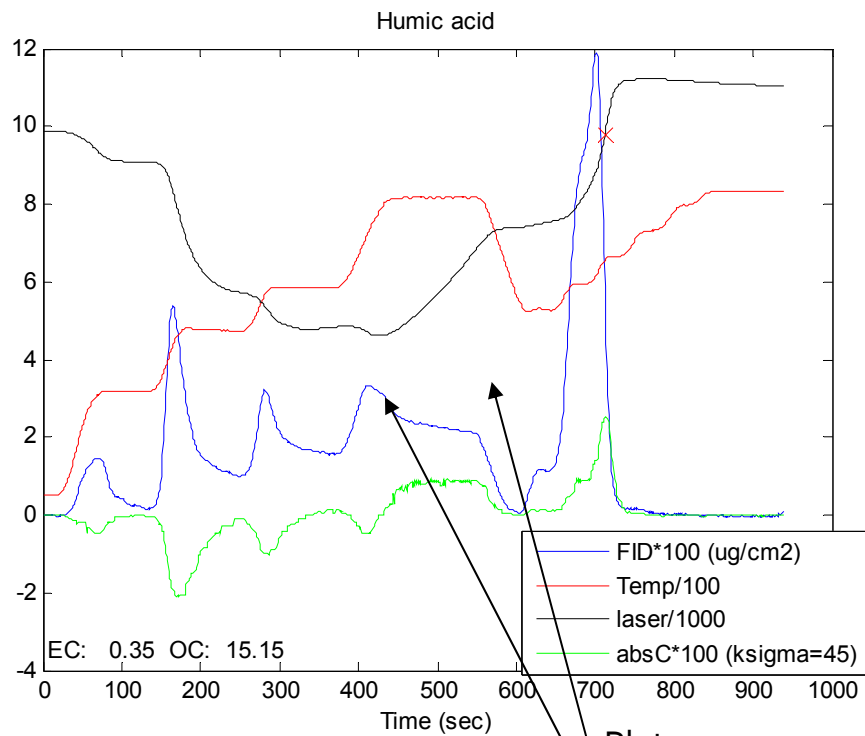
Projected change in mortalities

PI: Ted Russell,
Georgia Tech

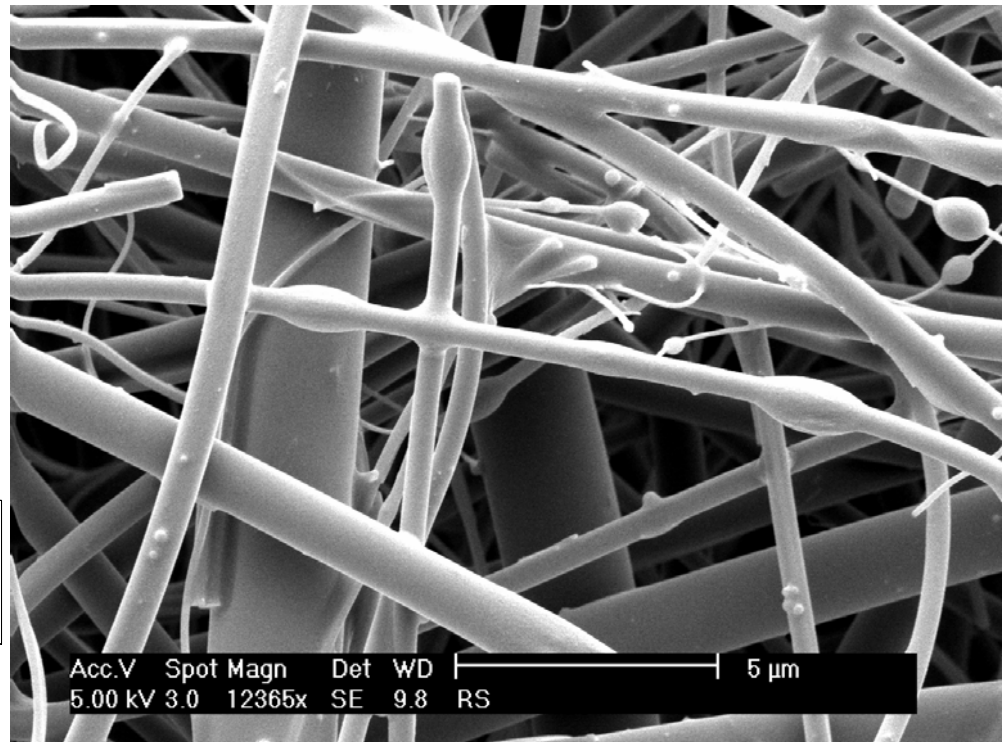


Images adapted from Tagaris et al 2009, "Potential Impact of Climate Change on Air Pollution-Related Human Health Effects."

Cutting Edge Research in New Areas: Monitoring black carbon with thermal and optical properties



Low-temperature biomass burning emissions



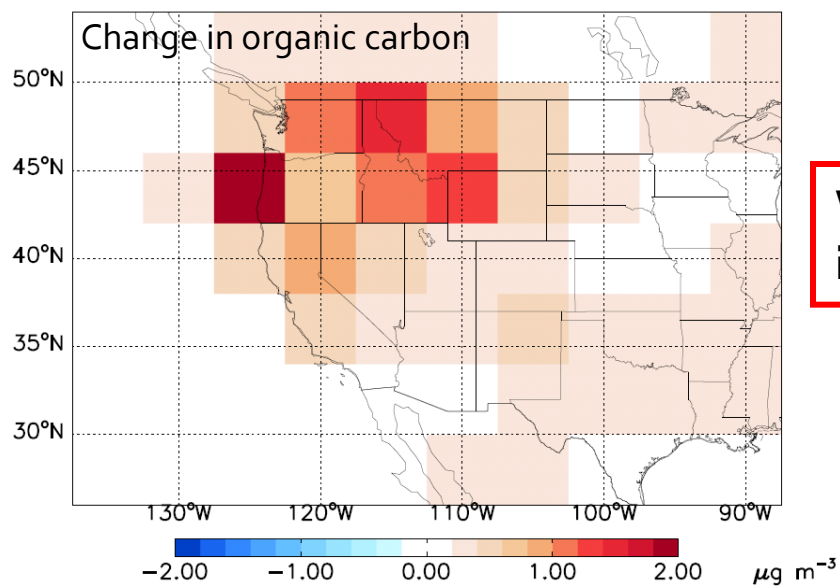
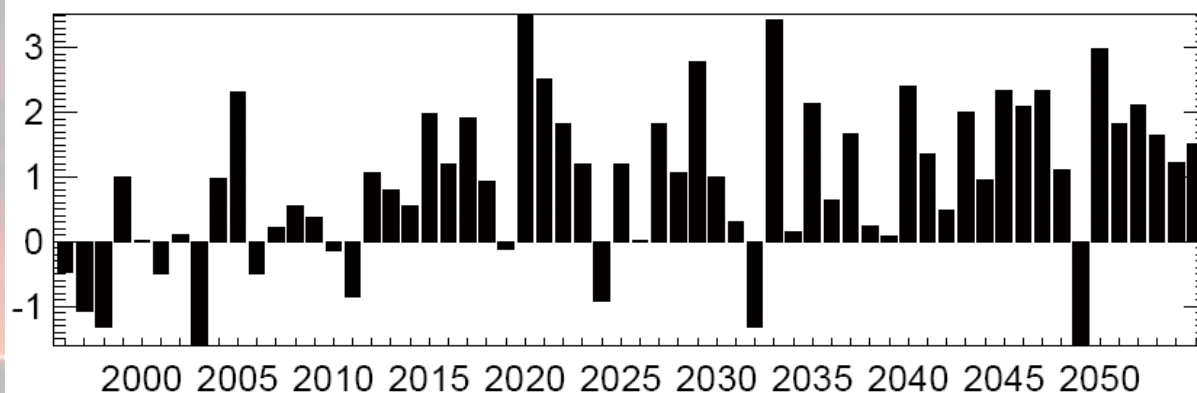
Source: Subramanian et al 2007 "Yellow Beads and Missing Particles: Trouble Ahead for Filter-Based Absorption Measurements."

PI: Tami Bond,
UIUC

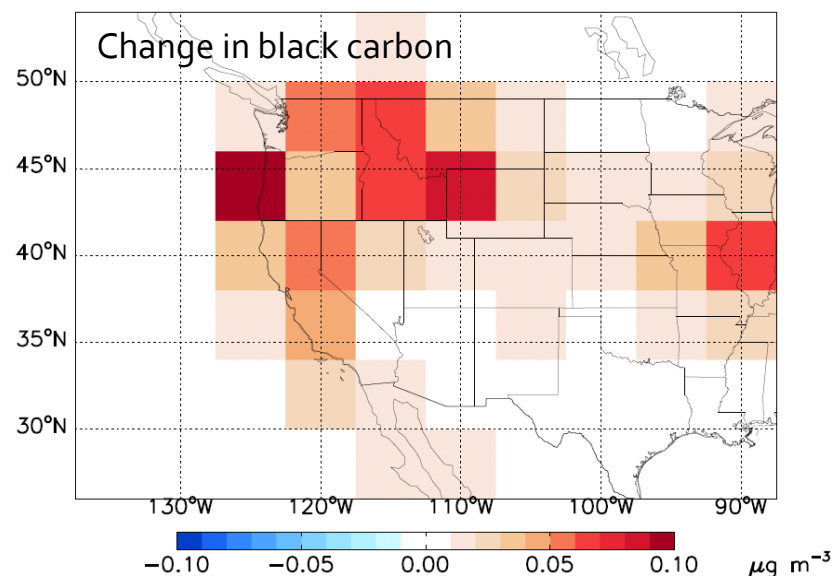
Black carbon is a class of particles that are not well understood and contribute to warming. **Different monitoring techniques work for different types of black carbon.**

Climate Change, Fires and Air Quality: Predicting wild fires and their emissions

Predicted biomass burned by
fires in the West, 1996-2055
(standard deviations from 1995 – 2005
mean)



**Wild fires
in 50 yrs**



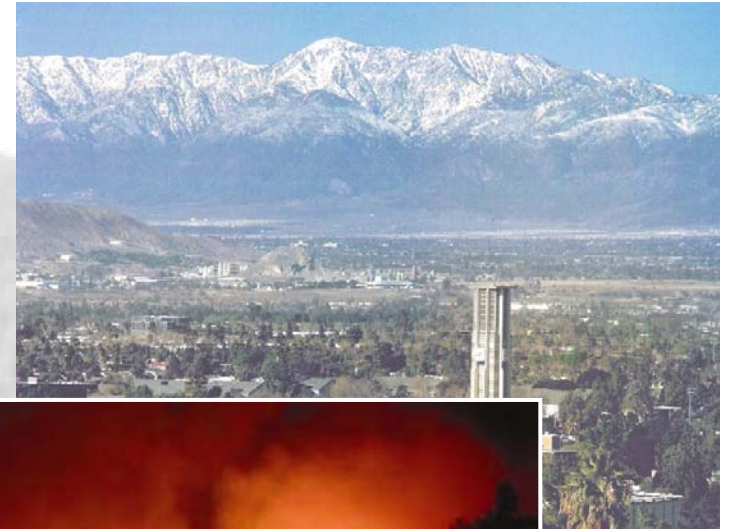
PI: Jennifer Logan,
Harvard

Research

Study of Organic Aerosol in Riverside (SOAR)

- Field study conducted to characterize organic aerosol with a variety of state-of-the-art instrumentation and source apportionment techniques.
- At least 21 papers already

Paul Ziemann, UC Riverside & Jose Jimenez, CU Boulder



Measurement of Fires

- Detailed chemical speciation of emissions from fires
 - Ambient measurements from a prescribed fire
 - Laboratory chamber burns
- Understand emissions from both real world fires and small controlled burns



Ted Russell, GA Tech

New Particle Production Over a Forest

- Characterization of particles and measurement of gases
 - Chemical and size
- Vertical Information

Paul Shepson, Purdue



Future directions:

Cutting edge, collaborative, transformational science

Upcoming RFAs:



Black carbon's Role in Global to Local Scale Climate and Air Quality (opens 2010)



Measurement techniques (predicted 2011)



Extreme air pollution events in a world with global change (predicted 2011)

NCER/STAR Research is policy relevant, collaborative, transformational, cutting edge, multidisciplinary



Contact Info

Dr. Bryan Bloomer

US EPA

Office of Research and Development

Global STAR Program

Phone

202-343-9078

E-mail

Bloomer.Bryan@epa.gov