

EPA's Global Change Research Program:

***Assessing the Consequences of Global Change for
Air Quality in the United States***

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Program Focus

Evaluation of consequences

Assess the potential consequences of **global change** in the U.S.

Adaptation strategies

Focus on adaptation – to reduce risks and take advantage of opportunities presented by global change

Areas of focus

- air quality
- water quality
- ecosystems
- human health
- place-based integration

Decision support

Provide scientific information to support decision making by policy makers, resource managers, and other stakeholders.



“What does it all add up to?”

Focus: On those issues of greatest concern to our clients/stakeholders

Timeliness and usefulness: Meeting the needs of our clients/stakeholders in a timely fashion

Meaningful outcomes: Protection of human health and the environment



Consistency of Program with NRC Recommendations

The Science of Regional and Global Change: Putting Knowledge to Work
(National Research Council, 2001)

- Key actions recommended by NRC:
 - Define and carry out programs of *regional and sectoral multiple-stress research*
 - Develop *improved assessment capabilities* for integrating scientific knowledge into effective decision support systems
 - Ensure an “intimate connection” between research, operational activities, and the *support of decision making*
 - Participate in and support *interdisciplinary research*
- **September 2005:** Dr. Ralph Cicerone [President, NAS] urged CCSP Principals to focus on “low hanging fruit” and understand consequences of climate change at a regional scale



EPA's Well-Defined Role within the CCSP

- EPA is part of a larger family of 13 federal agencies
- All program activities consistent with, and coordinated by, the CCSP (consistency with 2003 CCSP *Strategic Plan*)
- EPA's well-defined role: assessment of consequences for decision makers, evaluating adaptation options, and developing decision-support tools
- Close coordination and leveraging of activities through CCSP Work Groups, e.g.,
 - cooperation with DOE/PNNL on downscaling efforts
 - ecosystem research
 - multi-year joint solicitation focusing on human health (with NOAA, NASA, NSF and EPRI)
 - 2005 joint solicitation focusing on ecosystem thresholds (with DOE)



How We Conduct Our Work: Integration of Intramural and Extramural Expertise

- Extramural expertise engaged through competition:
 - STAR grants
 - Cooperative agreements
 - Contracts
- Augment areas in which the program has expertise
- STAR grants provide ongoing, long-term support for selected topic areas
 - Focused on limited number of topic areas consistent with long-term *Research Strategy*
 - Air quality, ecosystems, and human health





Global Change & Air Quality

Long-term Goal

Enhance the ability of air quality managers to consider global change in their decisions through improved characterization of the potential impacts of global change on air quality.

- What we promised:
 - Interim Assessment (FY 2007): Effects of **climate change** on air quality (feeding into CCSP Synthesis & Assessment Report 4.6)
 - Final Assessment (FY 2010): Effects of **global change** on air quality

Unique within CCSP: Focus on the effects of climate change on air quality – rather than the effects of air quality on climate change



Motivation for Climate Change/Air Quality Assessments

- Meteorology plays essential role in whether or not a metropolitan area meets the NAAQS (particularly ozone and particulate matter)
 - For example, air quality managers understand, intuitively, that high temperatures and stagnation events affect the number of high ozone days
- IPCC 2007: A warming climate will lead to significant changes in regional meteorological patterns
- What is not known: How a changing climate affects air quality for a given metropolitan area – *and its future success in attaining and maintaining attainment of the NAAQS*
- Multiple-stressor context: Climate change must be evaluated in the context of other anticipated global changes, *e.g.*,
 - Land-use
 - Population
 - Economic growth

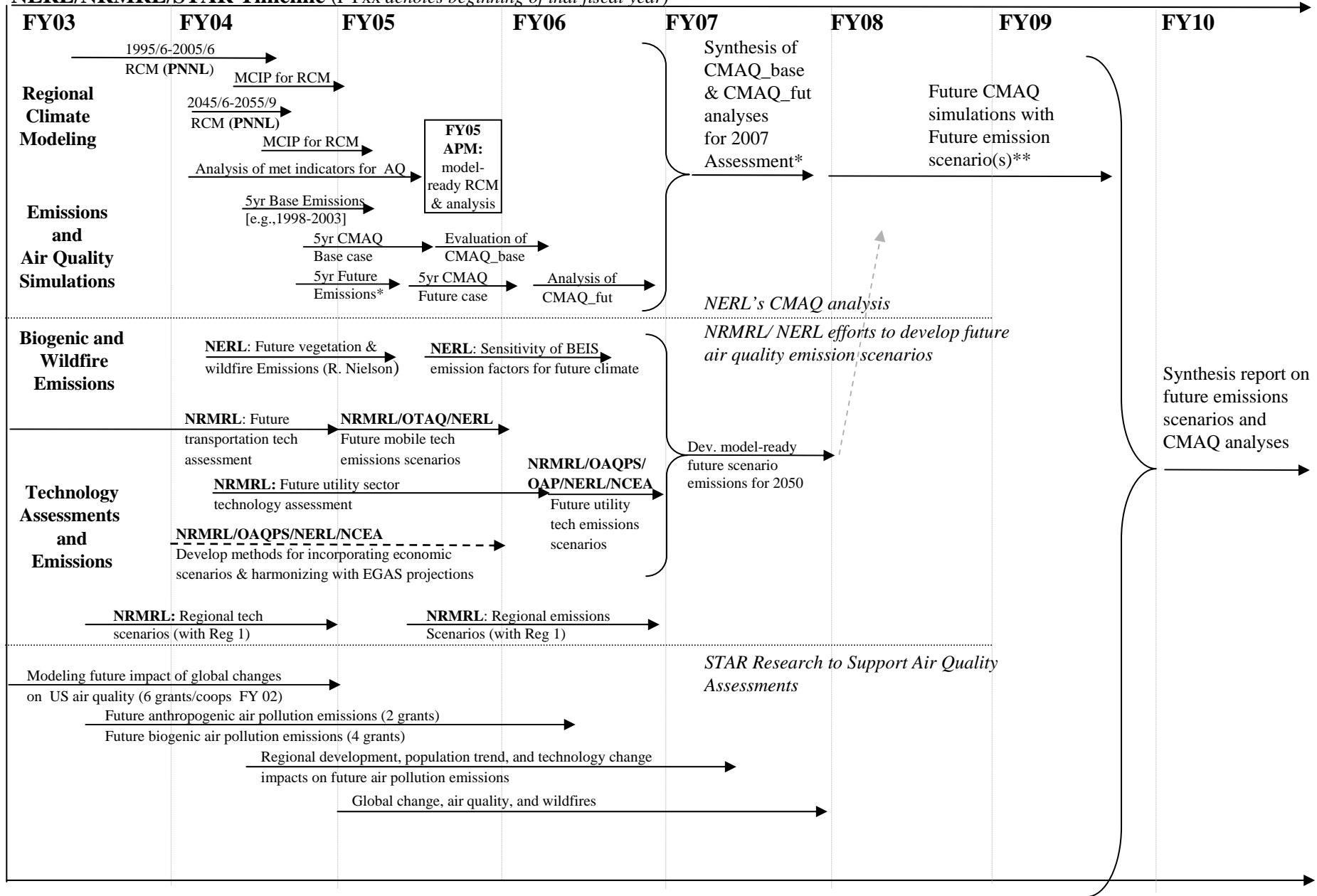


Planning of Air Quality Assessments

- Early planning by small EPA team (1999-2000)
- Two early STAR grants (Columbia, JHU) from broad solicitation on impacts
- 2001: Expert Workshop held in RTP, NC to review our approach and identify research gaps
- Integration of research and assessment activities into EPA/ORD planning process, including coordination with OAR and CCSP
 - 2007 Interim Assessment
 - 2010 “Global” Assessment



NERL/NRMRL/STAR Timeline (FYxx denotes beginning of that fiscal year)



*For 1st incremental CMAQ analysis, the future emissions will be based on base NEI inventory, but must be reprocessed for temperature-dependencies.

** For 2nd series of CMAQ analyses, plans are to incorporate future emission scenarios developed by NRMRL as resources permit.

Partners in Production of Air Quality Assessments

- Global Chemistry Modeling
- Harvard University
- Carnegie Mellon
- U of Ill - Urbana

Regional Climate Modeling

- PNNL
- U of Ill - Urbana,
- Washington State
- Columbia University

Regional Air Quality Modeling

- NERL
- Georgia Tech
- Carnegie Mellon
- U of Ill – Urbana
- UC-Berkeley
- Washington State
- Columbia University

Regional Development

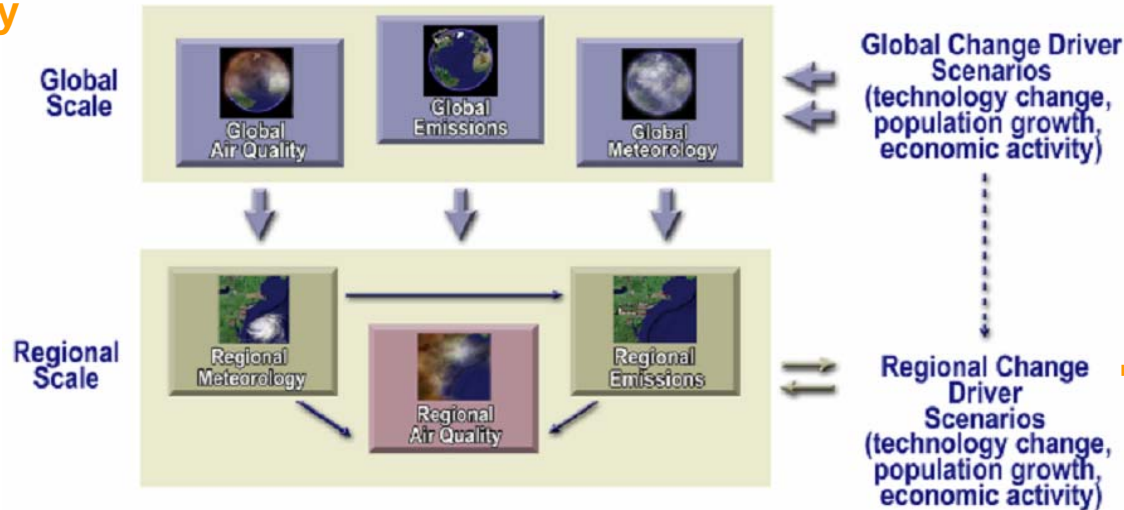
- Georgia Tech
- U of CA - Davis
- RFF
- U of TX - Austin
- U of WA - Seattle
- U of Ill – Urbana
- U of NC – Chapel Hill
- SUNY - Buffalo
- U of WI - Madison
- Columbia University

Biogenic Emissions Modeling

- NERL
- US Forest Service
- U of CO - Boulder
- U of NC – Chapel Hill
- U of TX - Austin
- U of NH

Emissions Modeling

- NERMRL
- NERL
- OAR



Population Growth

- NCEA

Economic Activity

- NCEA
- NERMRL
- OAR

Technology Assessment (Transportation, Energy Sector)

- NERMRL
- Johns Hopkins

Over 50 Publications by EPA Scientists (examples)

- Benjey, W.G., E.J. Cooter, A.B. Gilliland, A.E. Grambsch, E.L. Wright, C.D. Geron, C. Gage, and D.A. Winner. Creating an emission inventory for modeling global climate change effects on regional air quality. In The Twelfth International Emission Inventory Conference, San Diego, California, April 29-May 1, 2003. Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC, (2003) Available at <http://www.epa.gov/ttn/chief/conference/ei12/index.html#ses-10>
- Benjey, W.G. and E.J. Cooter. The inter-annual and seasonal variability of meteorologically influenced emissions. In The Fourteenth International Emission Inventory Conference, Las Vegas, Nevada, April 12-14, 2005. Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC, (2005). Available at <http://www.epa.gov/ttn/chief/conference/ei14/index.html#ses11>
- Godar, D.E., Wengraitis, S.P., Shreffler, J.H., and Sliney, D. Average annual solar UV dose of the continental US citizen. Presented at: 13th International Congress on Photobiology, San Francisco, CA, July 2-6, 2000.
- Godar, D.E., Wengraitis, S.P., Shreffler, J.H., and Sliney, D. UV Doses of Americans. Published in: Photochemistry and Photobiology, March 23, 2001.
- Yeh, S., Rubin, E.S., Taylor, M.R. and Hounshell, D.A. (2005) "Technology innovations and the experience curve for NOx control technology," *Journal of the Air and Waste Management Association*, in press.



24 Publications by Grantees

(examples)

- Lynn, B. H., L. Druyan, C. Hogrefe, J. Dudhia, C. Rosenzweig, R. Goldberg, D. Rind, R. Healy, J. Rosenthal, and P. Kinney, Sensitivity of present and future surface temperatures to precipitation characteristics, *Climate Research* 28:53-65, 2005.
- Liang, X.-Z., L. Li, A. Dai, and K.E. Kunkel, 2004: Regional climate model simulation of summer precipitation diurnal cycle over the United States. *Geophys. Res. Lett.*, 31, L24208, doi:10.1029/2004GL021054.
- Solecki, W. D., and C. Oliveri, Downscaling climate change scenarios in an urban land use change model, *Journal of Environmental Management* 72:105-115, 2004.
- Joutz F, Crowley C. Seasonality and weather effects on electricity loads: modeling and forecasting. *Energy Policy*.
- Bell ML, Ellis JH. Sensitivity analysis of tropospheric ozone to modified biogenic emissions for the mid-Atlantic Region. *Atmospheric Environment*. Volume 38, Issue 13, April 2004, Pages 1879-1889.
- Hogrefe, C., B. Lynn, K. Civerolo, J.-Y. Ku, J. Rosenthal, C. Rosenzweig, R. Goldberg, S. Gaffin, K. Knowlton, and P. L. Kinney, Simulating changes in regional air pollution over the eastern United States due to changes in global and regional climate and emissions, *Journal of Geophysical Research - Atmospheres* 109, D22301, (doi:10.1029/2004JD004690), 2004.
- Mickley, L.J., D.J. Jacob, B.D. Field, and D. Rind, Effects of future climate change on regional air pollution episodes in the United States, *Geophys. Res. Lett.*, 30, L24103, doi:10.1029/2004GL021216, 2004.
- Knowlton, K., J. E. Rosenthal, C. Hogrefe, B. Lynn, S. Gaffin, R. Goldberg, C. Rosenzweig, K. Civerolo, J.-Y. Ku, and P. L. Kinney, Assessing ozone-related health impacts under a changing climate, *Environmental Health Perspectives* 112: 1557-1563, 2004.



2005 Peer Review by Board of Scientific Counselors: Conclusions

“The Subcommittee concludes that the Program has provided substantial benefits to the nation and that it is on course to make significant further contributions to societal outcomes by informing and facilitating decisions by the public and private sector actors who must consider the prospects of global change.”



2005 BOSC Peer Review: Conclusions (cont.)

“The overall conclusion of the Subcommittee is that the Program on the whole has done the “right work” and that it has done it “well.”

