Overview of EPA's Role in Climate Science and Research

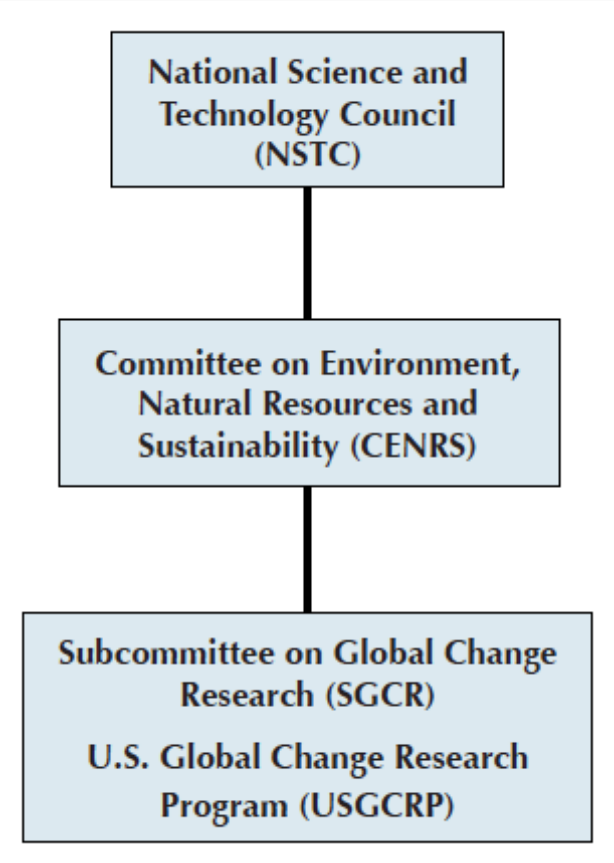
Andy Miller
Associate Director for Climate
Air, Climate, and Energy Research Program
Office of Research and Development

Presentation Overview

- Focus: Coordination and interactions at Federal, EPA, and ORD levels; identifying priorities and developing results
- US Global Change Research Program
  - Role of EPA
  - Interagency working groups
- National Climate Assessment
  - EPA participation and activities
- Internal coordination and interactions
  - Research planning and communication
- Identifying future directions

US Global Change Research Program

- USGCRP is the operational component of the Subcommittee on Global Change Research, under the Committee on Environment, Natural Resources, and Sustainability
- SGCR develops broad strategy and priorities for Federal global change research across 13 agencies
- More detailed research coordination through interagency working groups



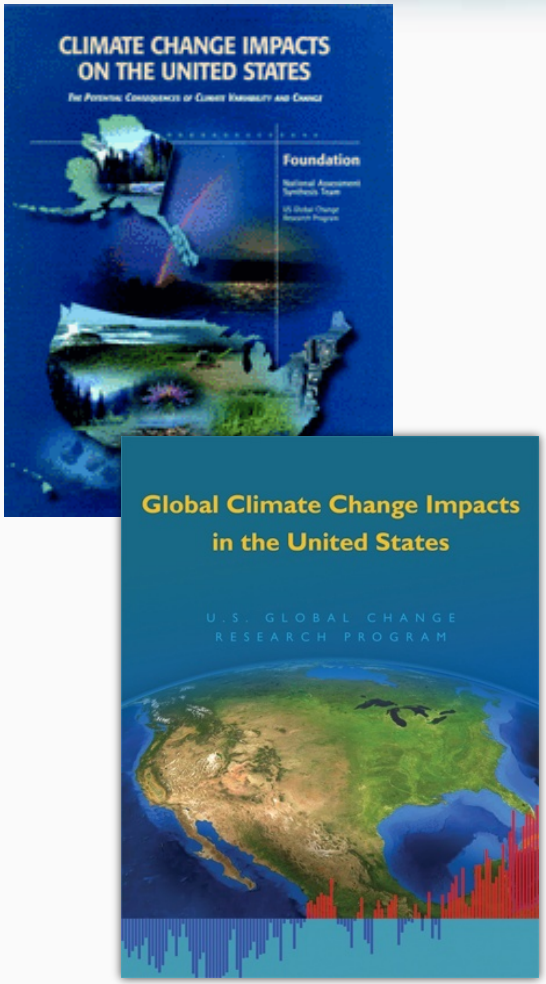
USGCRP: EPA Roles

- Major consumer of research; strong voice in setting priorities and directions
- Experience in conducting research to inform decisions
  - Deputy Executive Director on detail from ORD/NCEA
- Active engagement in interagency working groups
- Solid connections with ORD and OAR at staff level; with ORD and OP at program level

USGCRP: Importance

- EPA relies on USGCRP for “big climate science” – investigating the relationships between changing GHG concentrations and the responses of Earth systems (atmosphere, oceans, cryosphere, etc.)
- USGCRP provides a critical forum for communicating research needs of importance to EPA to other agencies
- USGCRP also provides the opportunity to incorporate EPA science into other agency work
- EPA based its 2009 GHG endangerment finding on the assessments of USGCRP, as well as IPCC and NRC

National Climate Assessment



- Developed under the guidance of USGCRP, required by Global Change Research Act (1990)
- Quadrennial report of understanding of climate change and impacts to US
- Developed by external authorship teams under guidance of Federal advisory committee
- Synthesis provides part of foundation for policy development

National Climate Assessment

- Major, concrete example of cross-EPA participation in interagency research
- EPA provides strategic guidance through SGCR and Interagency NCA Working Group
- EPA scientific contributions:
  - Regional technical input documents
  - Foundational research products (ICLUS)
  - Chapter authorship
- Scientific guidance by EPA:
  - 700+ comments during scientific review stage
  - On-going discussions through INCA WG

National Climate Assessment: Future Directions

- NCA advisory committee recommends a "sustained assessment" effort to better evaluate and communicate climate impacts
- EPA is participating in discussions about future of NCA; potential to set directions for climate research more broadly
  - Fundamental purpose; role and scope of social sciences; integration of mitigation and adaptation; navigating the science-policy interface
- EPA playing a key role in NCA special assessment on climate and health w/HHS and others

Purpose and scope of ORD's climate research

- ORD's mission is to provide the scientific and technical information to fulfill EPA's mission
  - Immediate need is research to support adaptation of EPA's programs to climate change as required by the Climate Adaptation Plan
- Research scope focuses on:
  - Adaptation to understand impacts to water quality, air quality, aquatic ecosystems
  - Measurement methods for methane, black carbon, N_2O
  - Impacts of mitigation, such as changing water demand, changes to air emissions

Adaptation Research

- Strong emphasis on water adaptation
  - Impacts to water utilities and watersheds
  - Inform development of design, operational, and policy options to prepare for changing conditions
- Substantial efforts to understand climate impacts on air quality
  - Downscaling global model results to regional scale
  - Evaluating impacts to formation (chemistry, emissions, transport)
  - Studies to understand potential mitigation co-benefits

Adaptation Research

- Adaptation closely connected to mitigation
  - Research uses scenario approaches to evaluate land use and energy futures
  - Examining water impacts and climate connections in both cases
  - Energy-water nexus: energy for water; water for energy
- Social factors of importance to full response
  - Increasing social science capabilities and awareness; recent hire of postdoctoral fellow to investigate community climate response capacity
- Work is guided by needs of the EPA Climate Adaptation Plan and Office Implementation Plans

Example Publications

Atmospheric Environment 77 (2013) 767–780

Contents lists available at SciVerse ScienceDirect

Atmospheric Environment

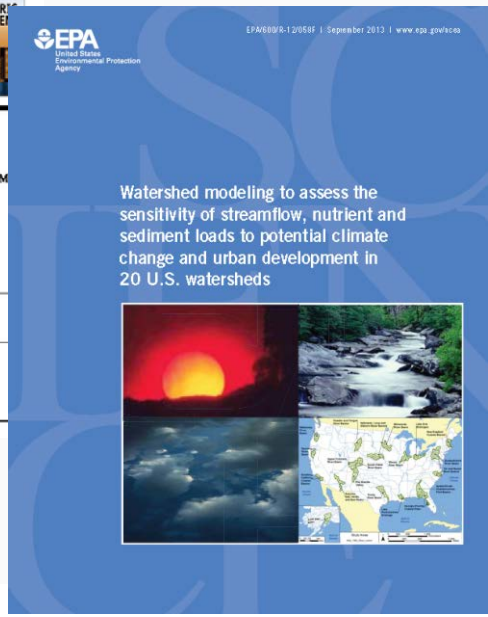
journal homepage: www.elsevier.com/locate/atmosenv

Ensemble projections of wildfire activity and carbonaceous aerosol concentrations over the western United States in the mid-21st century

Xu Yue [a,*], Loretta J. Mickley [a], Jennifer A. Logan [a], Jed O. Kaplan [b]

ambridge, MA, USA
ique Fédérale de Lausanne, Switzerland

output from 15 GCMs.
terization for fire predictions.
ad by the midcentury.
century.



Contents lists available at ScienceDirect

Global Environmental Change

journal homepage: www.elsevier.com/locate/gloenvcha

Multiple adaptation types with mitigation: A framework for policy analysis

Tyler Felgenhauer [a,*], Mort Webster [b]

[a] Office of Research and Development, Environmental Protection Agency, 109 T.W. Alexander Drive, MD E305-02, Research Triangle Park, NC 27711, USA
[b] Engineering Systems Division, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E40-235, Cambridge, MA 02139-4307, USA

The impacts of climate change on ecosystem structure and function

Nancy B Grimm[1*], F Stuart Chapin III[2], Britta Bierwagen[3], Patrick Gonzalez[4], Peter M Groffman[5], Yiqi Luo[6], Forrest Melton[7], Knute Nadelhoffer[8], Amber Pairis[9], Peter A Raymond[10], Josh Schimel[11], and Craig E Williamson[12]

Recent climate-change research largely confirms the impacts on US ecosystems identified in the 2009 National Climate Assessment and provides greater mechanistic understanding and geographic specificity for those impacts. Pervasive climate-change impacts on ecosystems are those that affect productivity of ecosystems or their ability to process chemical elements. Loss of sea ice, rapid warming, and higher organic inputs affect marine and lake productivity, while combined impacts of wildfire and insect outbreaks decrease forest productivity, mostly in the arid and semi-arid West. Forests in wetter regions are more productive owing to warming. Shifts in species ranges are so extensive that by 2100 they may alter biome composition across 5–20% of US land area. Accelerated losses of nutrients from terrestrial ecosystems to receiving waters are caused by both winter warming and intensification of the hydrologic cycle. Ecosystem feedbacks, especially those associated with release of carbon dioxide and methane release from wetlands and thawing permafrost soils, magnify the rate of climate change.

Front Ecol Environ 2013; 11(9): 474–482, doi:10.1890/120282

GEOPHYSICAL RESEARCH LETTERS, VOL. 39, L24809, doi:10.1029/2012GL054031, 2012

Introducing subgrid-scale cloud feedbacks to radiation for regional meteorological and climate modeling

Kiran Alapaty,[1] Jerold A. Herwehe,[1] Tanya L. Otte,[1] Christopher G. Nolte,[1] O. Russell Bullock,[1] Megan S. Mallard,[1] John S. Kain,[2] and Jimy Dudhia[3]

Received 26 September 2012; revised 12 November 2012; accepted 14 November 2012; published 21 December 2012.

[1] Convective systems and associated cloudiness directly influence regional and local atmospheric radiation budgets, as well as dynamics and thermodynamics, through feedbacks. However, most subgrid-scale convective parameterizations in regional weather and climate models do not consider cumulus cloud feedbacks to radiation, resulting in biases in several meteorological parameters. We have incorporated this key feedback process into a convective parameterization and a radiation scheme in the Weather Research

the investigation of the observed nature of the fractional cloudiness of cumulus convection began at least two decades earlier [*Malkus*, 1958; *Krishnamurti*, 1968]. While explicitly-simulated, resolved-scale clouds were allowed to impact radiation, subgrid-scale cumulus clouds (or parameterized convective clouds) were not. Such radiatively-passive cumulus clouds were prolific at the horizontal resolution used by most global climate models, yet several studies recognized the importance of the radiative impacts of these clouds on the

Cross-Program Coordination

- Research related to climate change conducted in all ORD research programs
- Work with partners to ensure priorities are addressed to extent possible, regardless of which program has lead
- Hold monthly calls, more frequent detailed discussions to ensure close coordination
- Cross-program reviews of plans, budgets, and directions identify opportunities, build synergies and avoid gaps

Partner Communication

- On-going communications are critical to health of “research ecosystem” – understanding needs, setting priorities, conducting studies, reporting results
- Enhancing, building connections at all levels
- Formal annual presentations via 1-2 day meetings to hear partner needs, present research results and directions
- Network of connections at all levels to continue dialog, keep understanding current

Setting Priorities and Future Directions

- Work with OP and other Program and Regional Offices to develop cross-Agency adaptation science priorities
  - Strategic goal of EPA Climate Adaptation Plan
- Communicating and discussing future directions of National Climate Assessment
  - Directions have significant implications for future EPA climate research
  - EPA strongly positioned to address and guide issues such as the role of social sciences in climate response

Setting Priorities and Future Directions

- Working to connect research to needs identified in OW climate strategy
  - Proactive OW approach helping ensure cross-program coordination
- Inputs on possible future directions from researchers, partners, other agencies and organizations; priorities set in on-going discussions focused on meeting EPA needs
- Key question – what will the world be in 25 years, and do/will we have the info to respond effectively?

Closing

- Climate Change Adaptation Plan, Climate Action Plan, Executive Order, National Climate Assessment have all been instrumental in setting broad directions
- EPA and ORD have made tremendous strides in developing the “research ecosystem” on climate change response
- Enormous challenges remain, but we are beginning to see strategic national directions