Leveraging Climate Change Research to Support Policy Analysis and Risk Communication

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Research Forum: Extreme Event Impacts on Air Quality and Water Quality with a Changing Global Climate

Improved analytic capabilities support evolving policy/programmatic needs

- How do we assess, manage, avoid, and adapt to climate threats?
- How do we measure the benefits (i.e. avoided impacts and risks) of potential GHG mitigation and adaptation options?
- How do we improve current tools and develop metrics to best inform a wide audience?
  - Within the analytic and scientific communities
  - For the public and policy makers

EPA's 2009 GHG Endangerment Finding*

EPA determined that GHGs threaten public health and welfare from a voluminous scientific record. Supporting evidence regarding extreme events included…

Peer-reviewed, comprehensive assessments of the state of the science	"The evidence concerning how human-induced climate change may alter extreme weather events also clearly supports a finding of endangerment…"
Quantitative assessments of health and economic impacts	"In addition to the direct effects of temperature on heat- and cold-related mortality, the Administrator considers the potential for increased deaths, injuries, infectious diseases, and stress- related disorders and other adverse effects associated with social disruption and migration from more frequent extreme weather"
Understanding changes in risk, particularly for vulnerable populations	"…the Administrator considered direct temperature effects, air quality effects, the potential for changes in vector-borne diseases, and the potential for changes in the severity and frequency of extreme weather events. In addition, the Administrator considered whether and how susceptible populations may be particularly at risk."

* Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule

What research on extreme weather events is needed for further policy analyses?

Peer-reviewed, comprehensive assessments of the state of the science	Research that demonstrates the relationship between climate change and changes in extreme weather and climate events
Quantitative assessments of health and economic impacts	Research that demonstrates the relationship between changes in extreme weather and the impacts on human health and welfare
Understanding changes in risk, particularly for vulnerable populations	Research that demonstrates the relationship between impacts and probabilistic changes in risk and vulnerability

What aspects of climate change research are most useful for further application in economic valuation, policy analysis, and communication efforts?

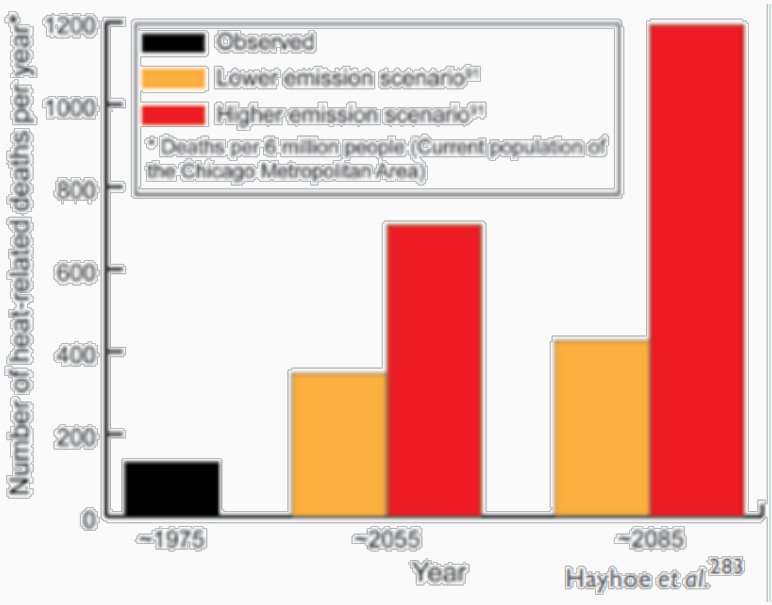
- *Quantitative* analyses
- Risk management and probability-based outputs
- Clear and simple communication of risk, including confidence

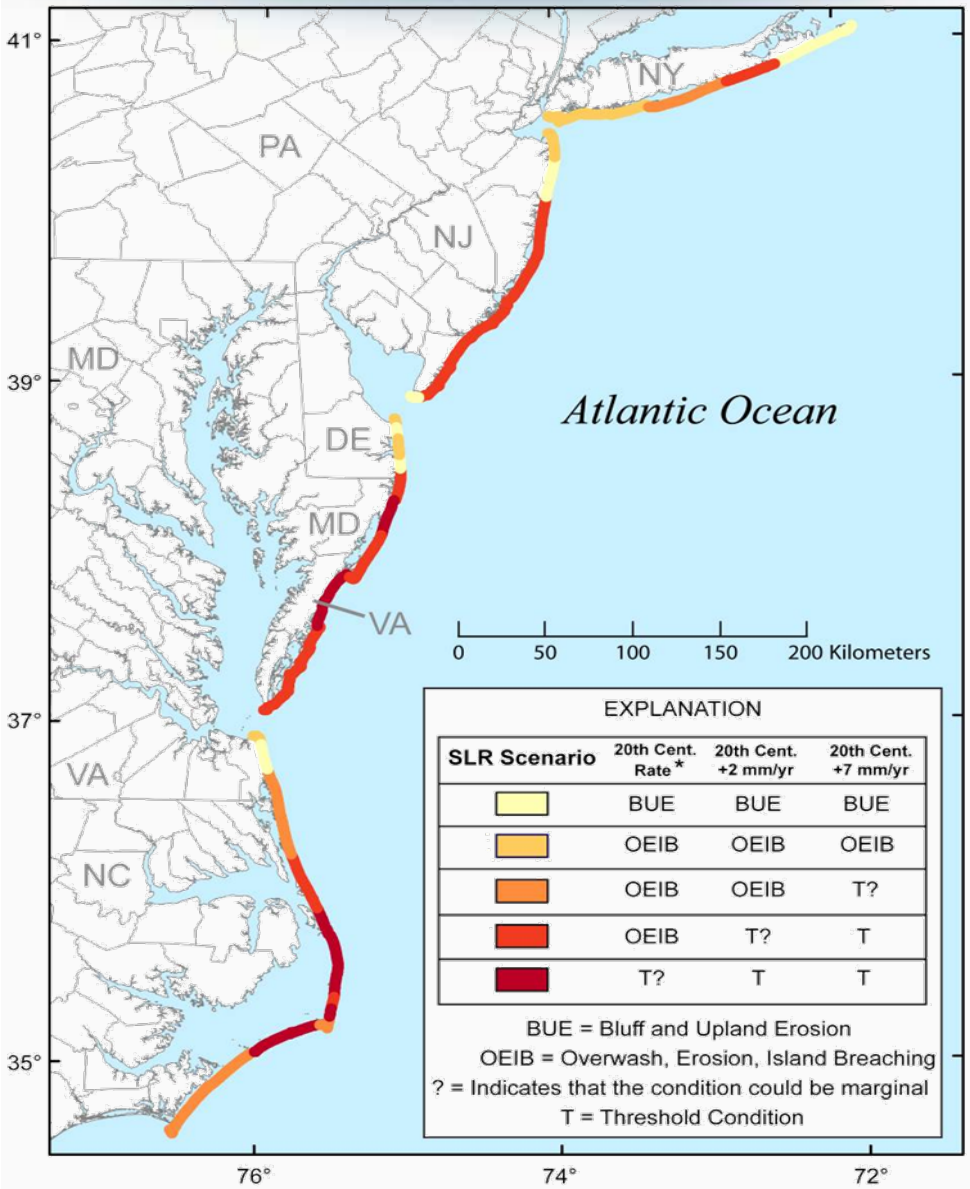
Quantitative Analyses

How do we assess, manage, avoid, and adapt to climate threats?

- *Quantitative* studies are crucial to the development of policy analyses.
- Different impacts across sectors require multiple modeling approaches. Quantitative research that produces impact metrics allows us to potentially monetize and therefore compare impacts across sectors.
- Though not all climate impacts can be quantified “apples to apples”, what are the opportunities to better communicate changes in risk?

Projected Increase in Heat-Related Deaths in Chicago





Risk of fundamental changes to barrier islands and back-barrier estuaries

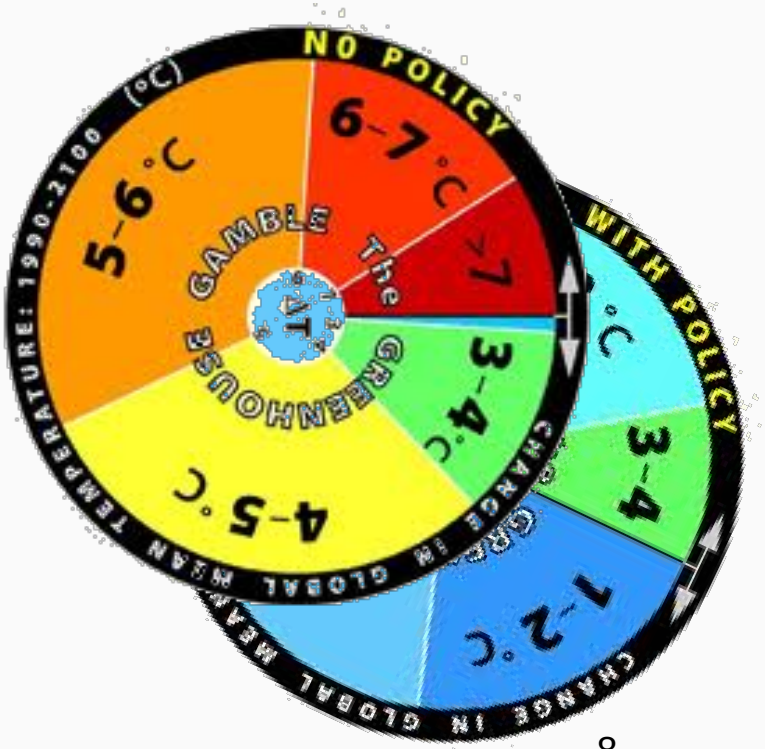
- Color scheme explains the potential landform responses to three sea-level rise scenarios
- Decision-makers need to understand the implications of shore protection policies. As sea level rises, should they allow nature to take its course or implement policies to sustain barrier islands?
- For policy analysis, **we still need to know** :
  - Impact of sea level rise on estuaries and threatened species
  - Change in flood and erosion risk
  - Comparative costs of lost property and species loss vs. shore protection policies

U.S. CCSP SAP 4.1, 2009

Risk management and probability-based outputs

How do we measure the benefits (i.e. avoided impacts and risks) of potential mitigation and adaptation options?

- Probability-based metrics are used to quantify and communicate changes in risk under different future scenarios
- Probabilistic outputs allow for clear and simple communication of uncertainty and confidence
- Development of models that estimate the specific benefits of GHG reductions is needed to inform mitigation policies



Sokolov et al., 2009

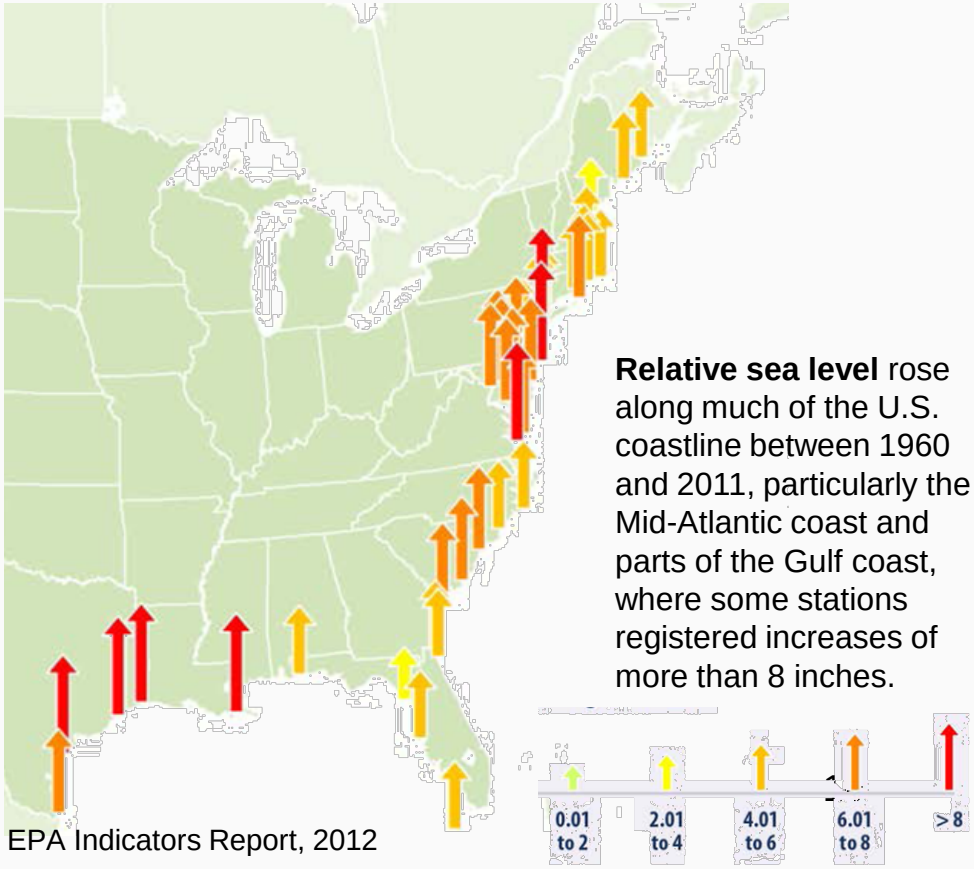
Climate Change Impacts and Risk Analysis

- Different impacts require different modeling approaches; the *challenge is bringing them together in a consistent fashion*
- We strive to bring together multiple sectoral benefit models in an integrated and consistent fashion to estimate the benefits of reducing GHGs
- Our approach is to design an analytical framework to:
  - Estimate the degree to which risks and damages may be lowered across multiple impact sectors in the U.S. under various mitigation scenarios, and to
  - Clearly communicate projected risks and damages of climate change, potential benefits of mitigation, and key sources of uncertainty to diverse audiences
- We focus on impact sectors that affect people– that get to what people care about– such as: health (extreme heat, air quality), agriculture, forestry, water resources, energy, infrastructure, coastal systems, and ecosystems

Clear and simple communication of risk

How do we improve current tools and develop metrics to best inform a wide audience?

- Information on changing risks and vulnerabilities needs to be made accessible to both:
  - Analytic and scientific communities
  - Public and policy makers
- Developing physical metrics that supplement economic benefits estimates will allow for better communication of risk to policymakers and the public



Relative sea level rose along much of the U.S. coastline between 1960 and 2011, particularly the Mid-Atlantic coast and parts of the Gulf coast, where some stations registered increases of more than 8 inches.

EPA Indicators Report, 2012

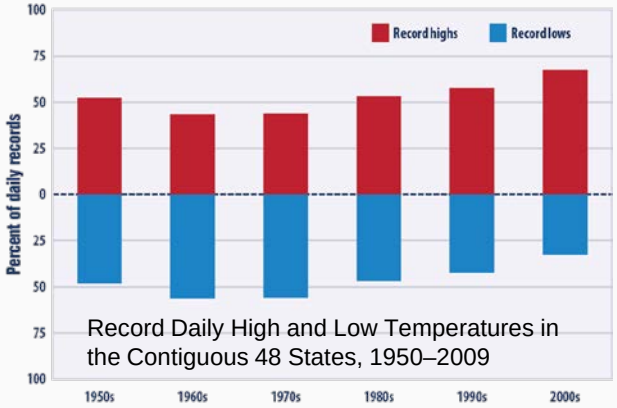
Climate Change Indicators in the United States, 2012

- The report uses indicators to communicate the causes and effects of climate change in an easy-to-understand way
  - Communicates what climate change 'looks like'
  - Helps explain why these changes matter to people (e.g. changes in extreme weather frequency or intensity, more extreme temperatures, etc.)
  - Needs more quantitative data on health impacts
- Consists of 26 indicators in five chapters. Extreme weather related indicators include: extreme heat and heat-related deaths, heavy precipitation, drought, and tropical cyclones
- Relies on publicly-available, peer-reviewed data sets

Highlights and full report available at:

www.epa.gov/climatechange/indicators

Climate Change Indicators in the United States, 2012



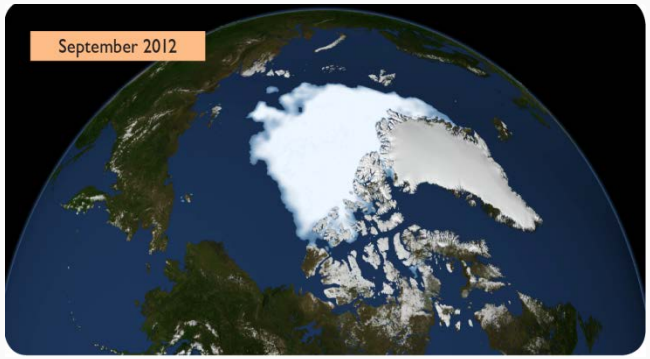
Record Daily High and Low Temperatures in the Contiguous 48 States, 1950–2009

In the U.S., unusually hot summer temperatures have become more common, and **daily record high temperatures** now outnumber record lows by 2 to 1

Since 1995, **ragweed pollen season** has grown longer at eight of the 10 locations studied.

Change in Ragweed Pollen Season, 1995-2011

The 2012 record low **Arctic sea ice extent** was 1.3 million sq. miles less than the historical average (an area five times the size of Texas)



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the take-away messages:

OAR is largely the 'client' of your analytical science and we need research that:

- Provides *quantitative* analyses that can be further applied in valuation and policy analyses
- Develops risk management and probability-based outputs to support benefits analysis (i.e. avoided impacts and risks) of potential mitigation and adaptation options
- Allows for clear and simple communication of changes in risk, including confidence

Thank You!

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