

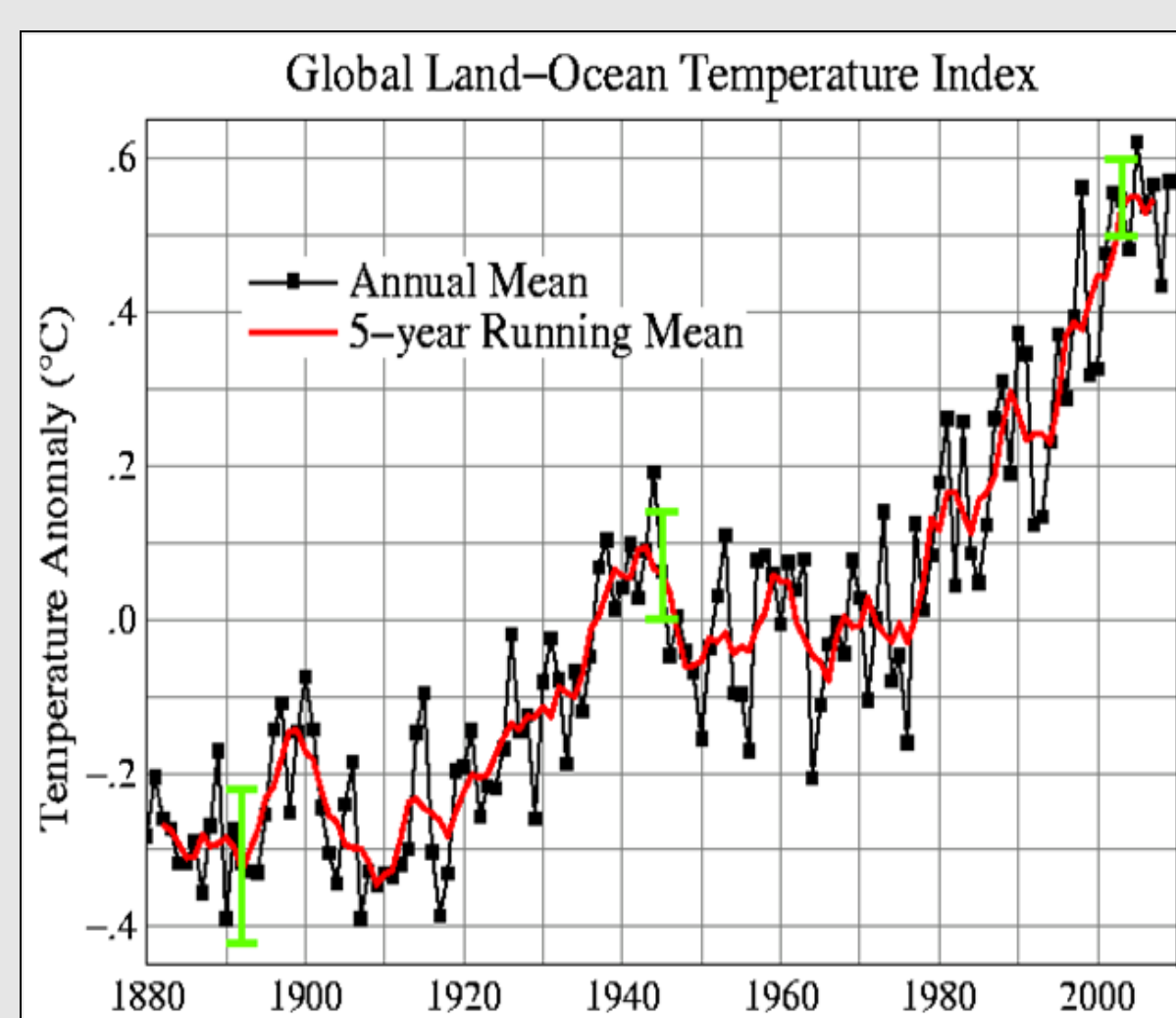


Statement of Task: This report, part of the *America's Climate Choices* suite of studies requested by Congress, discusses past, present and future climate change, including its causes and impacts, and recommends steps to advance our current understanding.

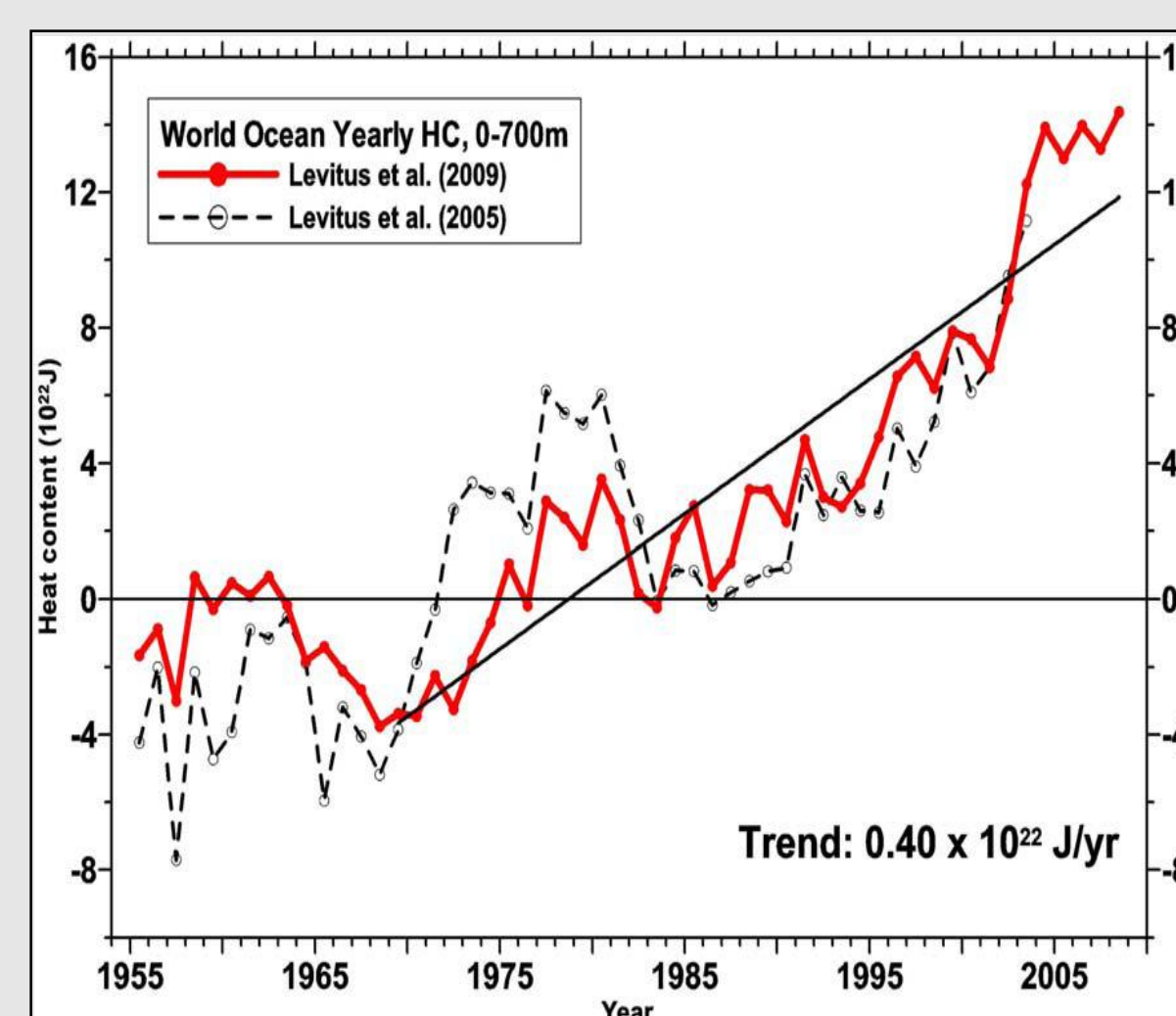
Committee Members: Pamela Matson (Chair), Thomas Dietz (Vice Chair), Waleed Abdalati, Antonio Busalacchi, Ken Caldeira, Robert Corell, Ruth DeFries, Steven Gaines, Inez Fung, George Hornberger, Maria Lemos, Susanne Moser, Richard Moss, Edward Parson, A.R. Ravishankara, Raymond Schmitt, B.L. Turner II, Warren Washington, John Weyant, David Whelan

“Climate change is occurring, is caused largely by human activities, and poses significant risks for a broad range of human and natural systems.”

The Earth is Warming.



Source: NASA GISS 2010



Source: Levitus et al, 2009

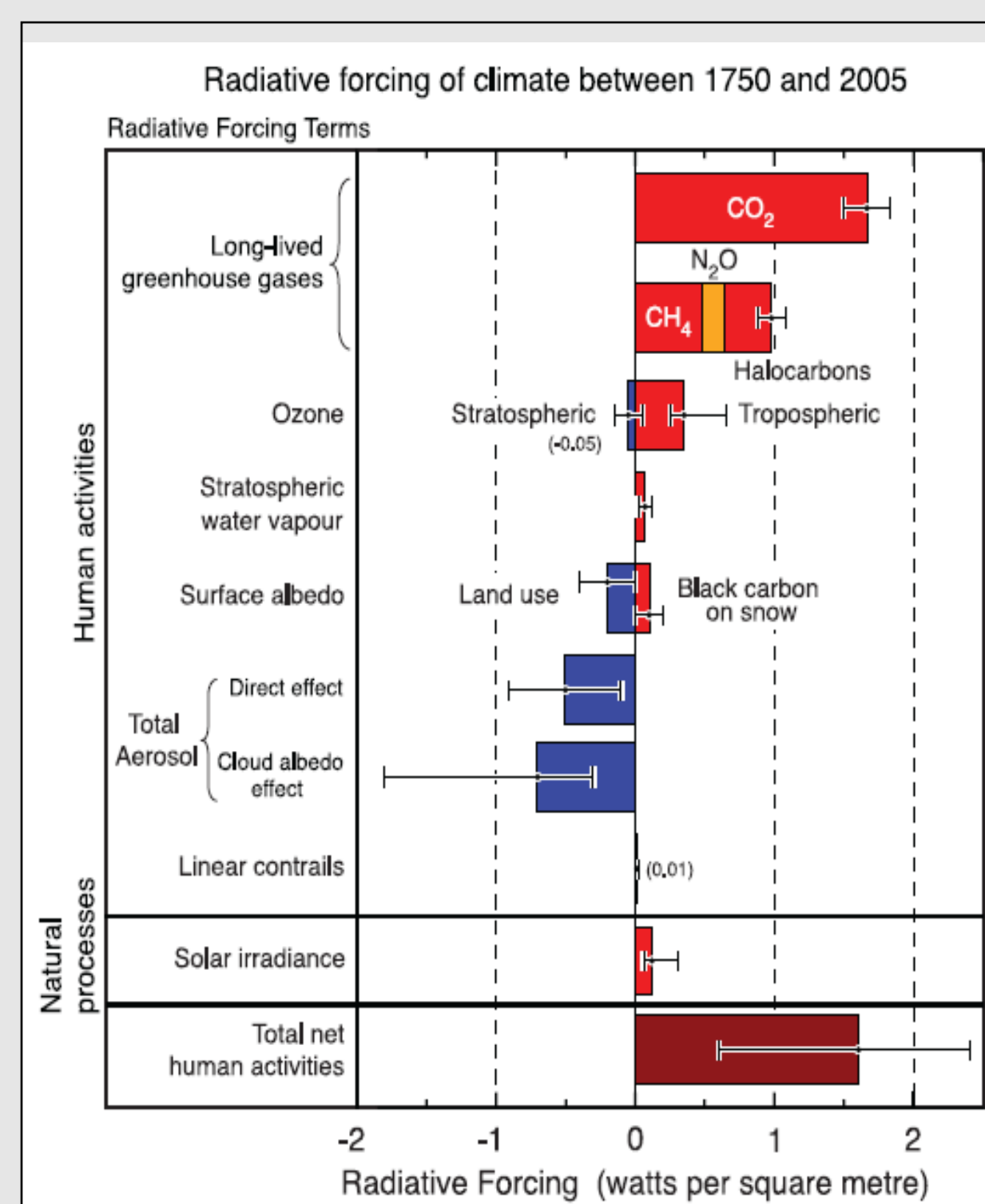
Direct measurements show that Earth's average surface temperature has risen substantially over the past century, and especially over the last three decades. These data are corroborated by a variety of independent observations showing warming in other parts of the Earth system, including the oceans, the lower atmosphere, and ice-covered regions.

The Role of Human Activities.

Most recent warming can be attributed to fossil fuel burning and other human activities that release greenhouses into the atmosphere.

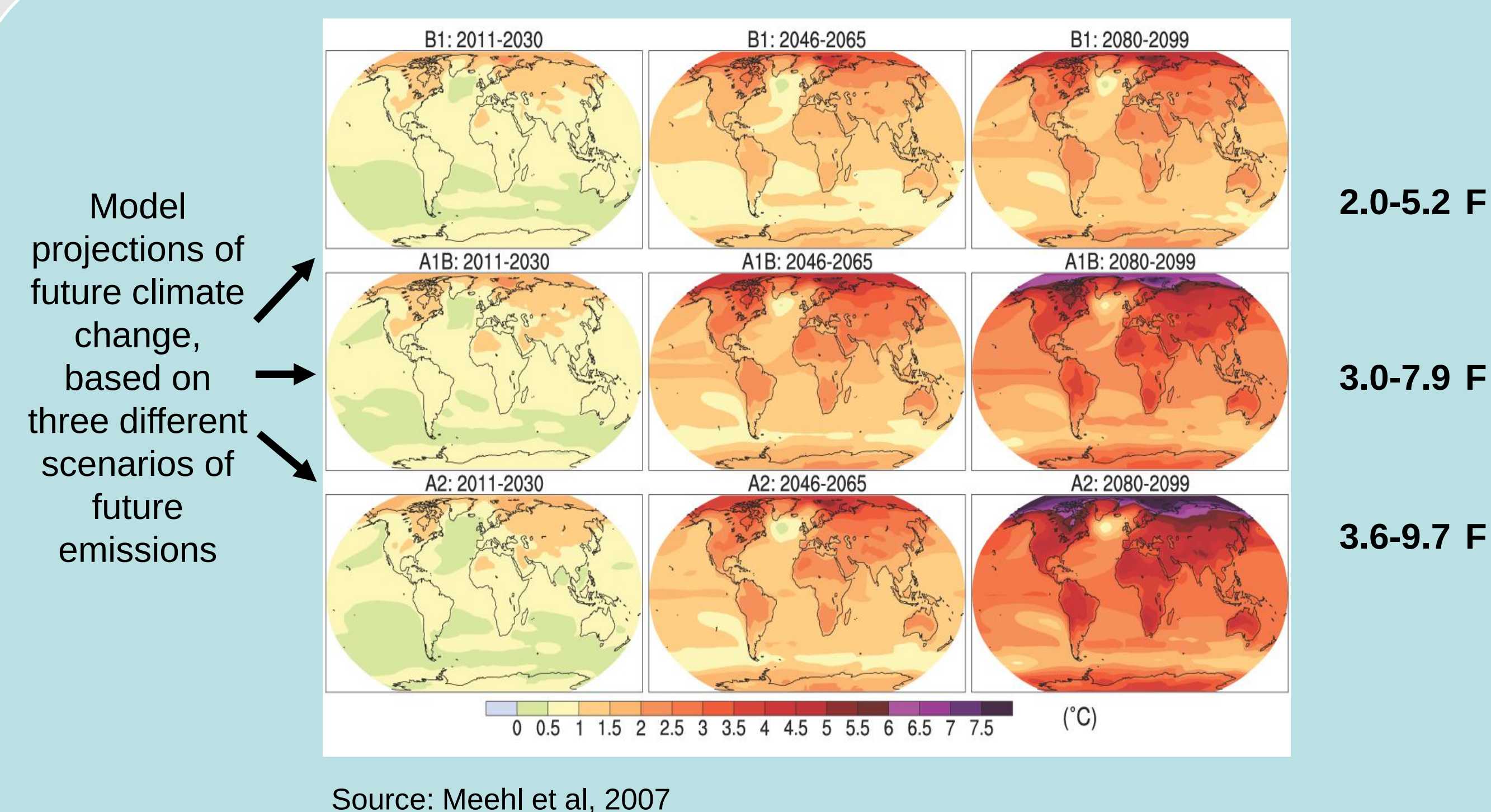
Human activities have also resulted in an increase in particulate matter in the atmosphere which on average has a cooling effect, but not strong enough to offset the warming associated with GHG increases.

Changes in solar radiation and volcanic activity can also influence climate, but observations show that they cannot explain the recent warming trend.



Source: Forster et al, 2007

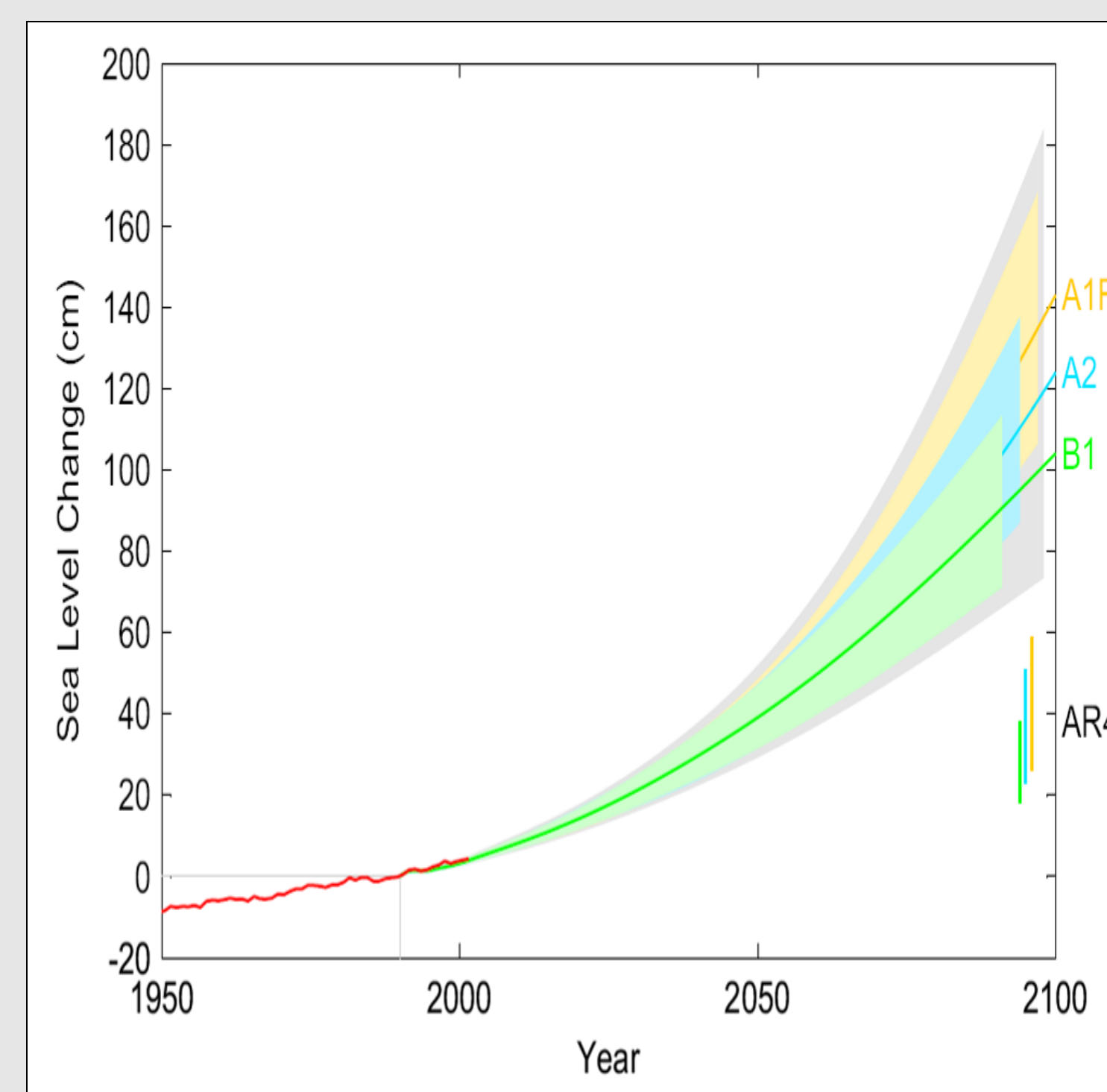
Projections of Future Climate Change.



Source: Meehl et al, 2007

Projections of the future are ALWAYS uncertain. However, this does not mean that nothing is known about how climate change will unfold, or that actions to respond to the risks posed by climate change are premature. The magnitude of climate change and the severity of its impacts will depend on the actions that human societies take to respond to these risks.

Impacts of Climate Change.



Source: Vermeer and Rahmstorf (2009)

The report reviews what is known about potential impacts such as:

- Sea level rise
- Water availability decrease in many areas, particularly those dependant on glacial source or snowpack.
- Larger fraction of rainfall in heavy precipitation, increasing the risk of flooding, and water borne illness.
- Storm surge and intrusion of salt water into fresh water aquifers
- Widespread bleaching of coral reefs due to temperature rise, rising sea levels and ocean acidification.
- Accumulation of CO2 in seawater, leading to ocean acidification

“A new era of climate change research”

The nation needs a comprehensive and integrative climate change science enterprise, one that not only contributes to our fundamental understanding of climate change but also informs and expands America's climate choices.

Recommendations

1. The nation's climate change research enterprise should be integrative and interdisciplinary, including and spanning research in the physical, social and biological, health and engineering sciences. It should focus on use-inspired research that contributes to both improved understanding and more effective decision making.

2. Research priorities for the federal climate change research program should be set within the following seven cross-cutting research themes:

- Climate Forcings, Feedbacks, Responses, Thresholds
- Human Behaviors and Institutions
- Vulnerability and Adaptation Analyses
- Research to Support Strategies for Limiting Climate Change
- Effective Information and Decision Support Systems
- Integrated Climate Observing Systems
- Improved Projections, Models, Analyses, and Assessments

3. The federal climate change research program should work in partnership with other relevant domestic and international bodies, and redouble efforts to develop, and maintain a comprehensive observing system that can support all aspects of understanding and responding to climate change.

4. The federal climate change research program should support and develop advanced models and other analytical tools to improve understanding and assist in decision-making related to climate change. All aspect of the complex problem such as emissions, climate response, biophysical systems, economics, trade, and social impacts should be thoroughly integrated into an overarching framework.

5. A single federal interagency program or other entity should be given the authority and resources to coordinate and implement an integrated research effort that supports improving both understanding of and responses to climate change.

- **The U.S. Global Change Research Program could serve this role, if the following modifications are made:**
- An expanded mission that includes both understanding and supporting effective responses to climate change
- More and better mechanisms for stakeholder interactions
- Improved weaknesses, gaps, and barriers
- High-level, forward-looking leadership mechanisms for identifying and addressing
- Budgeting oversight and authority

6. The federal climate change research program should be formally linked with action-oriented response programs that focus on limiting the magnitude of climate change, adapting to the impacts of climate change, informing climate-related actions and decisions, and developing partnerships with other research and decision-making entities working at local to international scales.

7. Congress, federal agencies, and the federal climate change research program should work with other partners to expand and engage the human capital needed to carry out climate change research and response programs. Relevant partners include universities, state and local governments, the international research community, the business community, and other non-governmental organizations.

The America's Climate Choices reports are available from National Academy Press
(<http://www.nap.edu/>)

