



Fresh Energy

Climate Change and Water Resources Management

May 18, 2011

J. Drake Hamilton
Science Policy Director

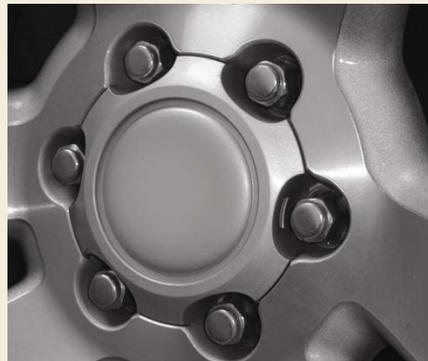
Fresh Energy – our core goals

Healthy economy

Healthy people

Healthy environment

Energy independence



Fresh Energy – our core goals

Healthy economy
Healthy people
Healthy environment
Energy independence

Fresh Energy promotes public policy to create an energy system that sustains our economy, our people, and our planet.

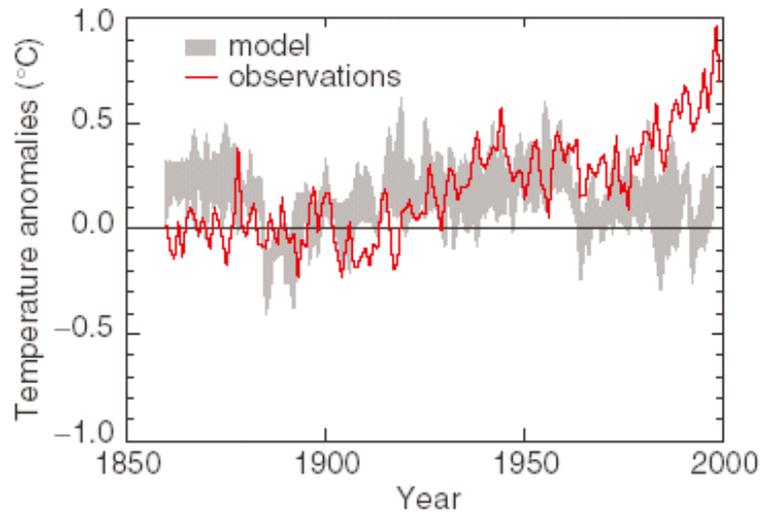


The National Academy of Sciences, May 2010

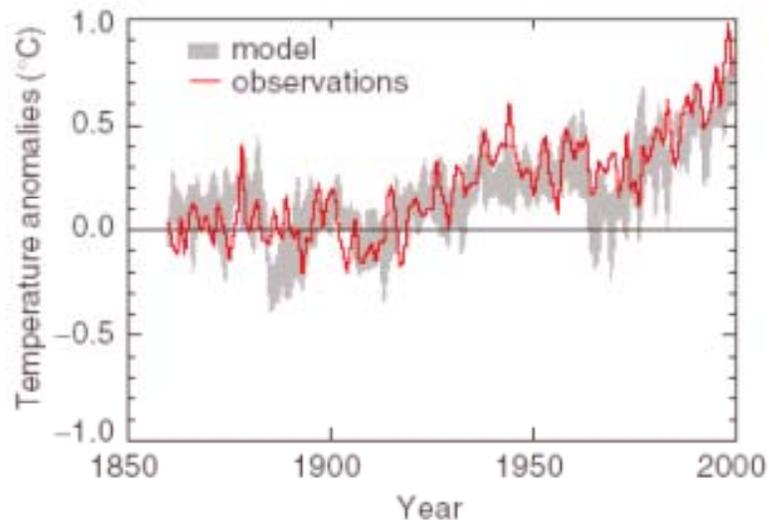
“Climate change is occurring,
is caused largely by human
activities.....

and in many cases is already affecting
a broad range of human and natural
systems.”

Temperature rise due to human emissions of greenhouse gases



Climate change due to natural causes (solar variations, volcanoes, etc.)



Climate change due to natural causes and human-generated greenhouse gases

Climate change affects:

- availability of water
- productivity of farms, forests, & fisheries
- prevalence of oppressive heat & humidity
- formation & dispersion of air pollutants
- geography of disease
- damages from storms, floods, droughts, wildfires
- property losses from sea-level rise
- expenditures on engineered environments
- distribution & abundance of species

Climate change puts all of these at increased risk.

Prof. John Holdren's 2008 keynote address to the National Council on Science and Environment

http://belfercenter.ksg.harvard.edu/files/2008_1-17_NCSE_final.pdf

Global Climate Change Impacts in the United States

U.S. GLOBAL CHANGE RESEARCH PROGRAM



Global Climate Change Impacts in the United States



Global Climate Change Impacts in the United States

How has climate already changed?

How is it likely to change in the future?

How is climate change affecting us now
where we live and work?

How is it likely to affect us in the future?

What are our options for responding?

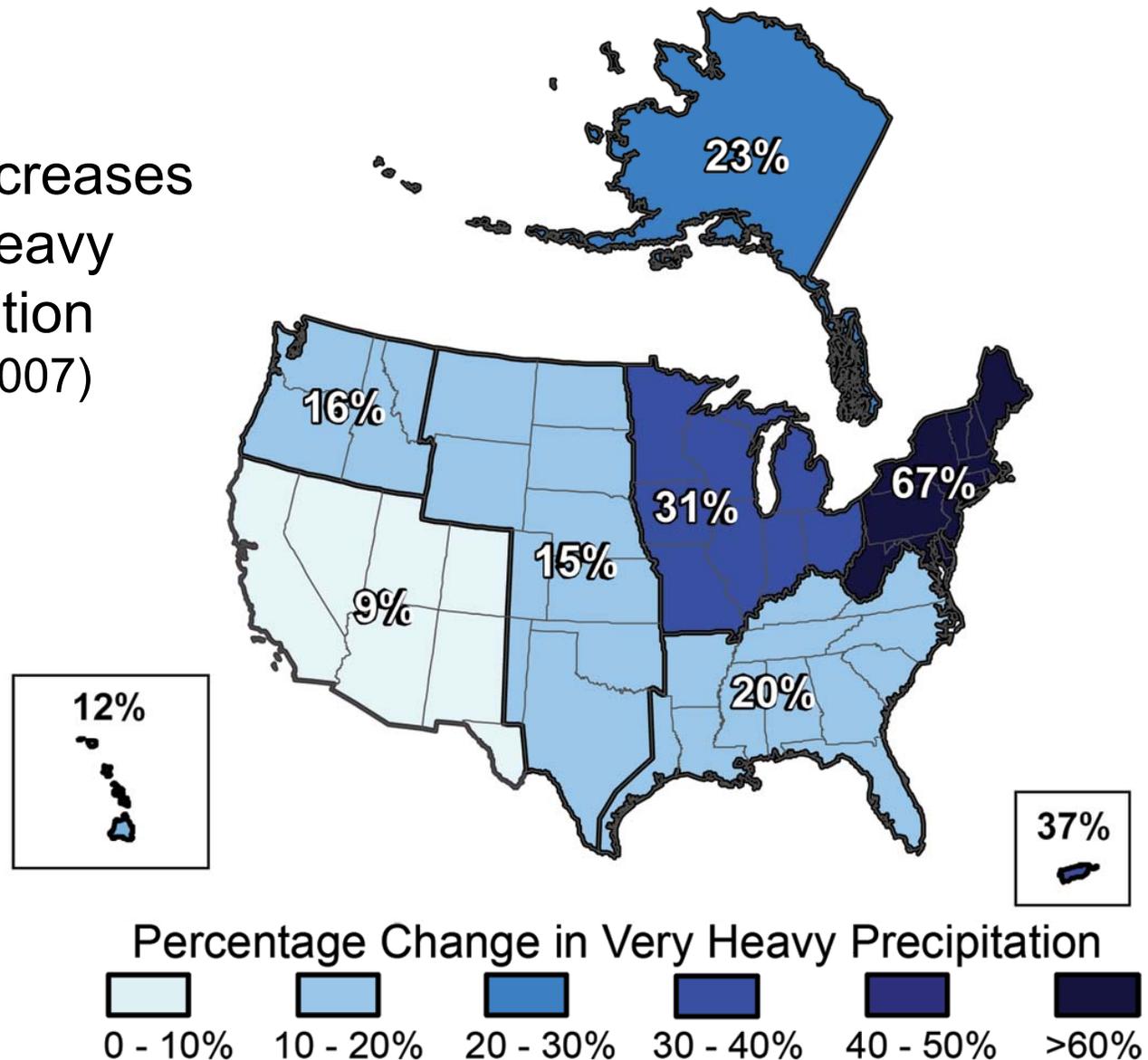
Climate changes are underway now in the U.S., and are projected to grow

- Temperature rise
- Increase in heavy downpours
- Less snow and earlier snowmelt lead to changes in river flows



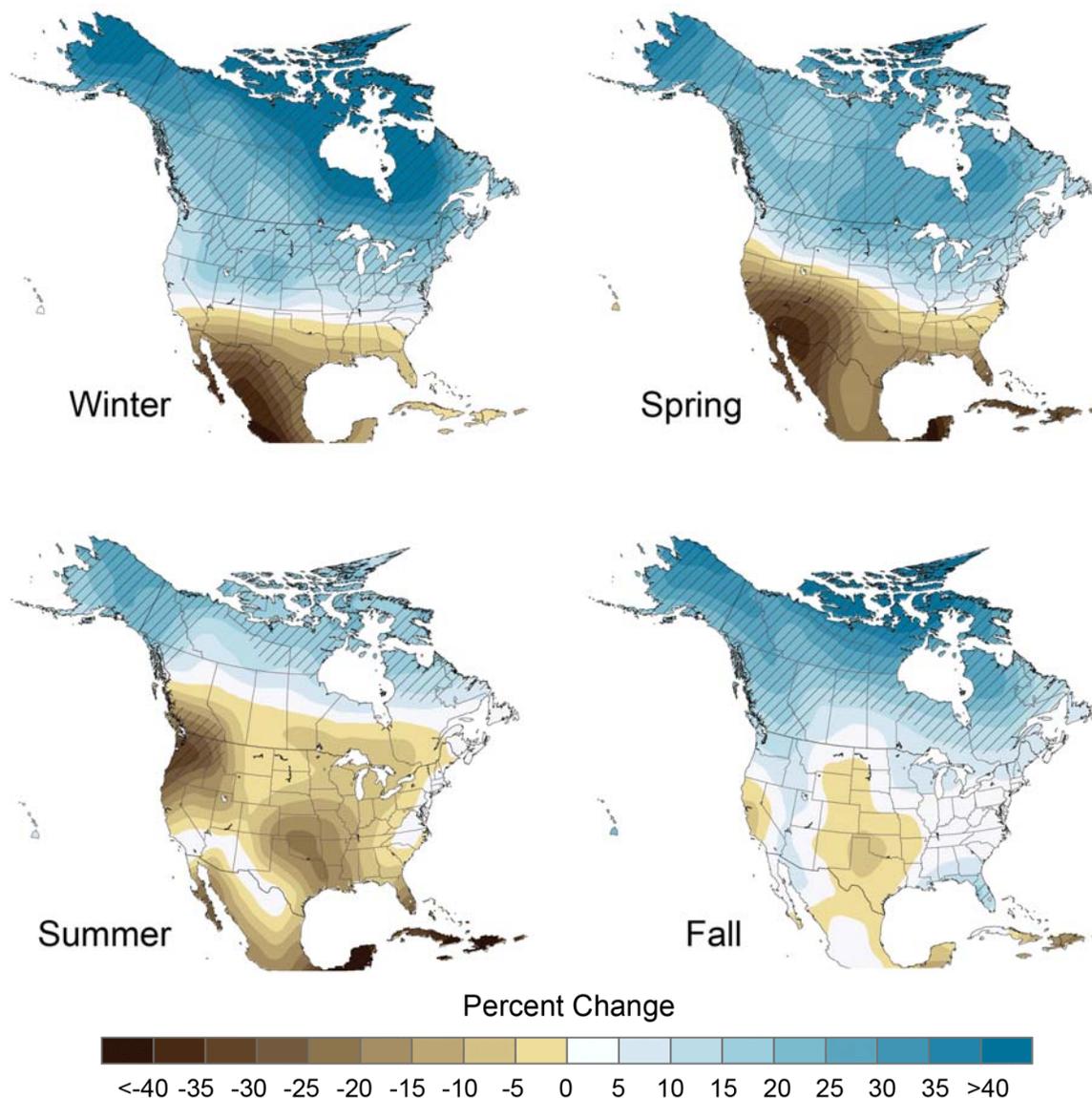
Heavy downpours have increased across the nation and are projected to increase further.

Observed Increases
in Very Heavy
Precipitation
(1958 to 2007)



Water resources will be affected by changing precipitation patterns and increasing temperatures.

Projected Change in Precipitation by 2080-90s



Key Messages

- Climate change has already altered, and will continue to alter, the water cycle
- Increase in heavy downpours (more than 66 percent increase in 2 inch rainfalls in MSP)
- Floods and droughts are likely to become more common and more intense
- Precipitation and runoff are likely to increase in the Midwest in winter and spring

Key Messages

- Surface water quality and groundwater quality will be affected
- Climate change will place additional burdens on already stressed water systems
 - Aging infrastructure
 - Changing water demands
- **The past century is no longer a reasonable guide to future water management.**

Response Strategies

“Mitigation” – reducing the amount of climate change, for example, by reducing heat-trapping emissions or increasing their removal from the atmosphere

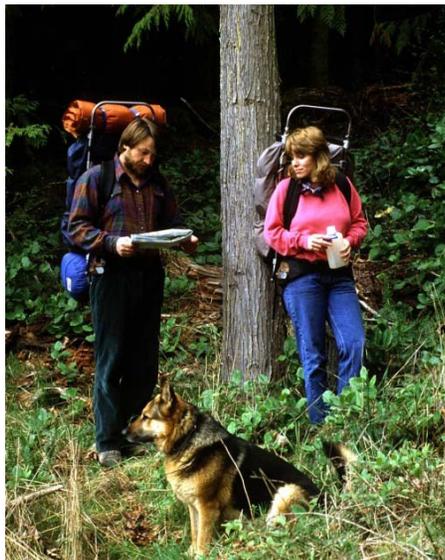


“Adaptation” – improving our ability to cope with or avoid harmful impacts



Both will be needed.

globalchange.gov/usimpacts





Fresh Energy

www.fresh-energy.org



Fresh Energy

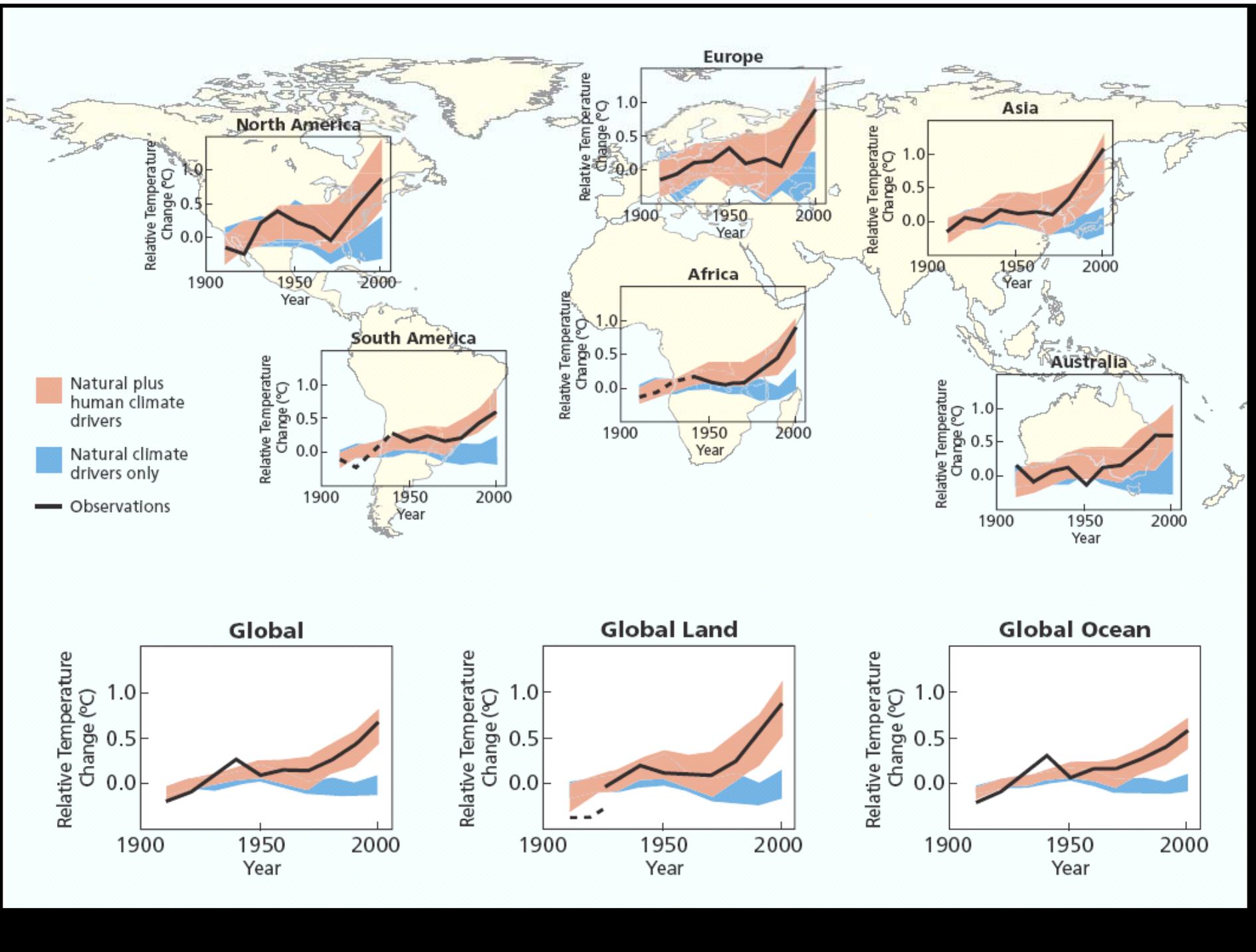
J. Drake Hamilton

Science Policy Director
Fresh Energy

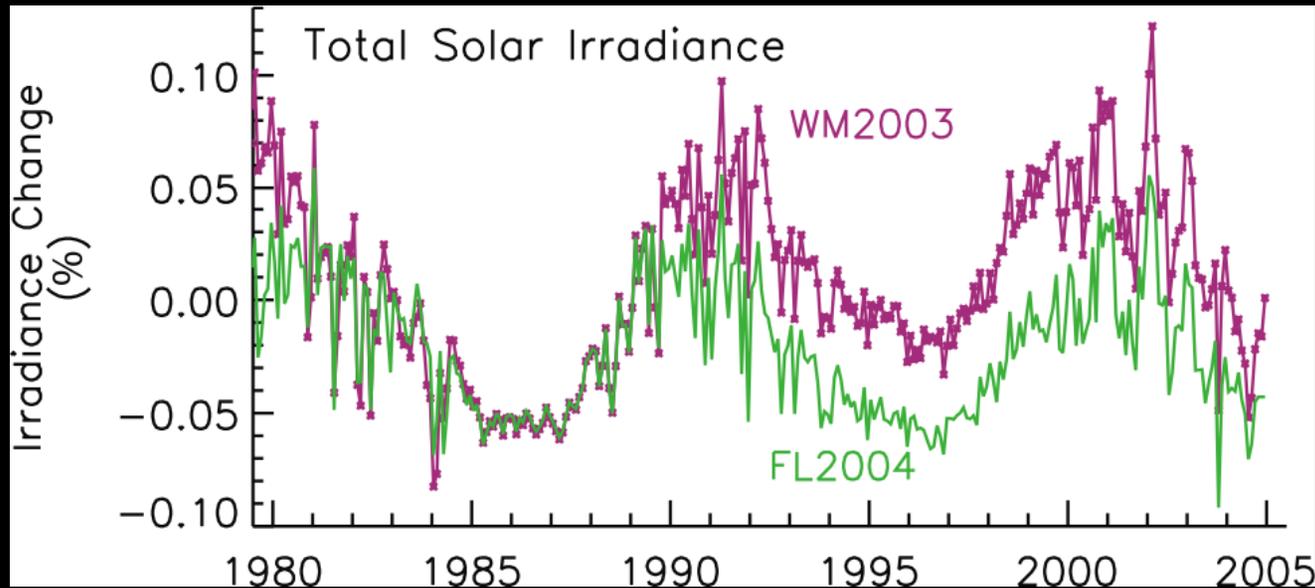
hamilton@fresh-energy.org

www.fresh-energy.org

April 5, 2016



Better and longer satellite data about the Sun



11 Aug 1983



Improved assessment:

a) no observed trend in solar irradiance since 1978 using high quality inter-calibrated data; b) spectral information c) solar magnetic flux model rather than proxy data; d) re-evaluation of variations in Sun-like stars.

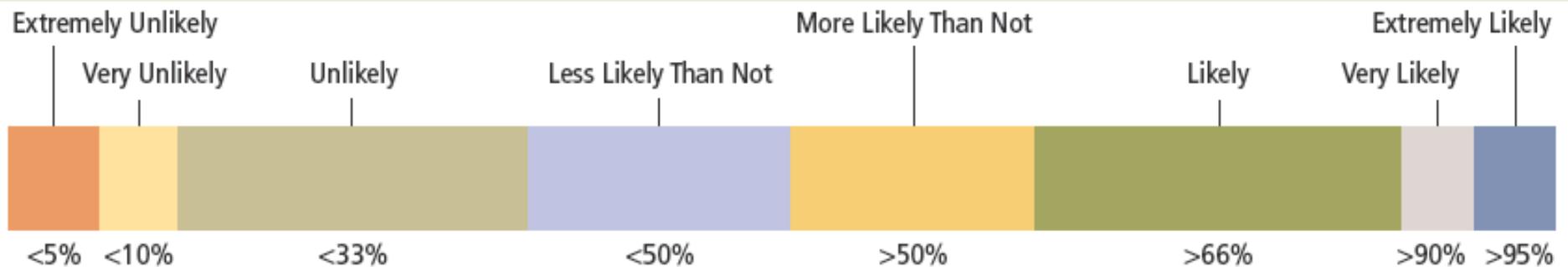
No observed trend in this data. Solar forcing much less than greenhouse gases.

Human Responsibility for Global Warming



Fresh Energy

The IPCC finds that it is “very likely” that emissions of heat-trapping gases from human activities have caused “most of the observed increase in globally averaged temperatures since the mid-20th century.”



Source: IPCC *Climate Change 2007: The Physical Science Basis*—Summary for Policymakers.