

Availability and Affordability of Insurance Under Climate Change

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Acknowledgements

- Eugene Lecomte*
 - 50-year insurance veteran
 - President Emeritus, IBHS
 - Fmr. President & CEO
 - National Committee on Property Insurance
 - Property Insurance Plans Service Office
 - Fmr. President of the Massachusetts Automobile and Workers Compensation Rating Bureaus & The Earthquake Project
- Richard Roth, Jr.*
 - Fmr. California Assistant Insurance Commissioner ('84-'90)
 - Fmr. P&C actuary in California, 20 years
 - Active in NAIC
 - Expert witness on catastrophe issues
- Paul Epstein, MD**
 - Harvard Medical School (Ctr. Hlth. Global Env.)
 - Leader Climate Change Futures study

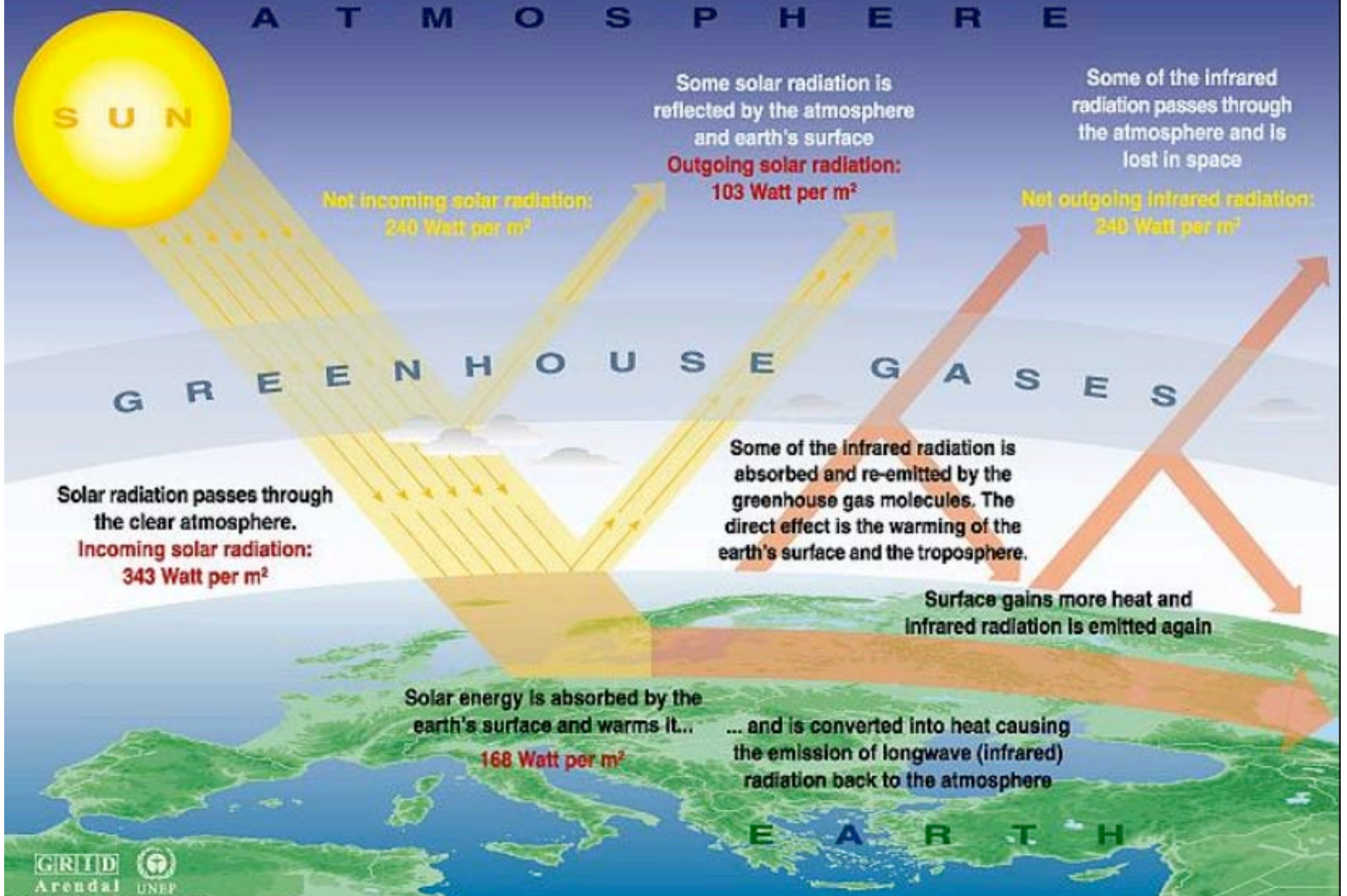
• Research sponsors

- U.S. Department of Energy
- U.S. Environmental Protection Agency
- U.S. Agency for International Development
- UNDP • Swiss RE • Ceres

* Ceres White Paper

** Climate Change Futures Study (Swiss Re/UNDP)

The Greenhouse effect



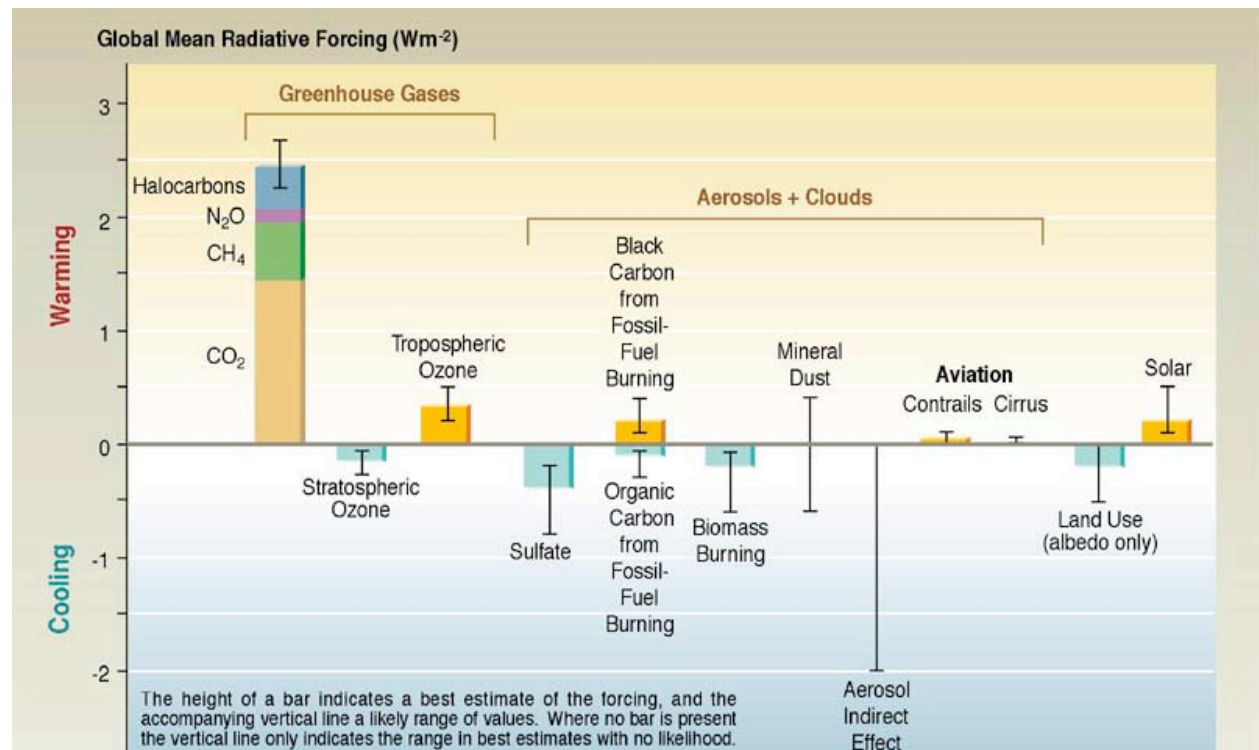
Causes of Global Warming (and Cooling)

Influences: Natural

- Solar activity
- Volcanoes
- Biological

Influences: Human

- Fossil fuels
 - GHGs
 - Particulates
- Agriculture, Cattle
- Deforestation
- Aircraft contrails



Sources and "Sinks"

Climate change leads to a range of important impacts

Physical Processes

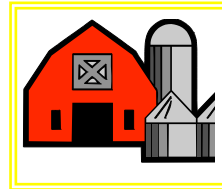
- Air & water temperatures
- Ice
- Precipitation
- Soil moisture
- Ocean currents
- Sea level
- Permafrost
- Weather

Human Relevance



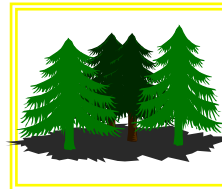
Health Impacts

Weather-related mortality/heat stress
Infectious diseases
Air quality-induced respiratory effects



Agriculture Impacts

Crop yields and commodity prices
Irrigation demands
Pests and weed



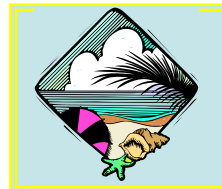
Forest Impacts

Change in forest composition
Shift geographic range of forests
Forest health and productivity



Water Resource Impacts

Changes in water supply and timing
Water quality
Increased competition for water



Coastal Area Impacts

Erosion of beaches
Inundation of coastal wetlands
Costs to defend coastal communities

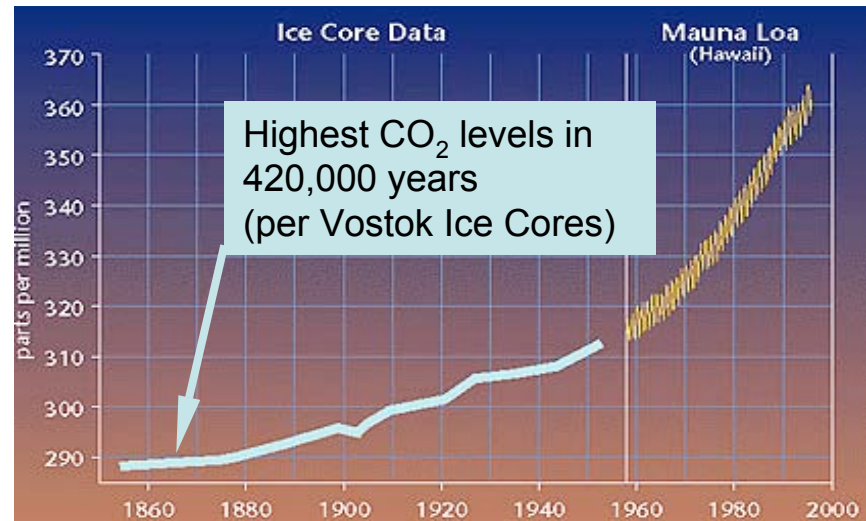


Ecosystem Impacts

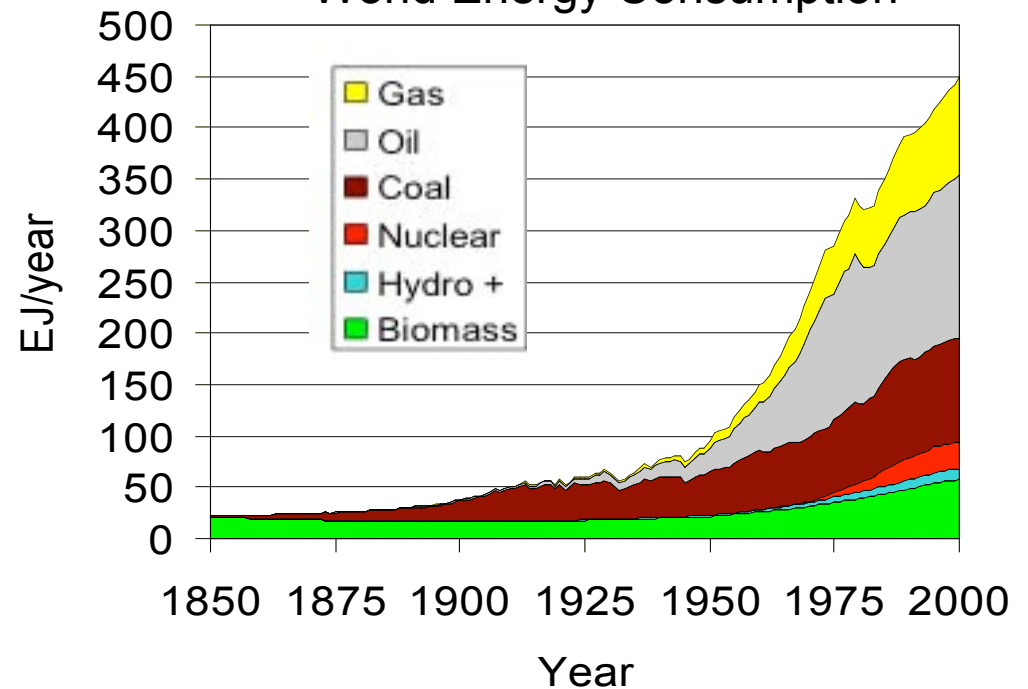
Shifts in ecological zones
Loss of habitat and species
Coral reefs threatened

The Primary Human Influence is Fossil Fuels Combustion

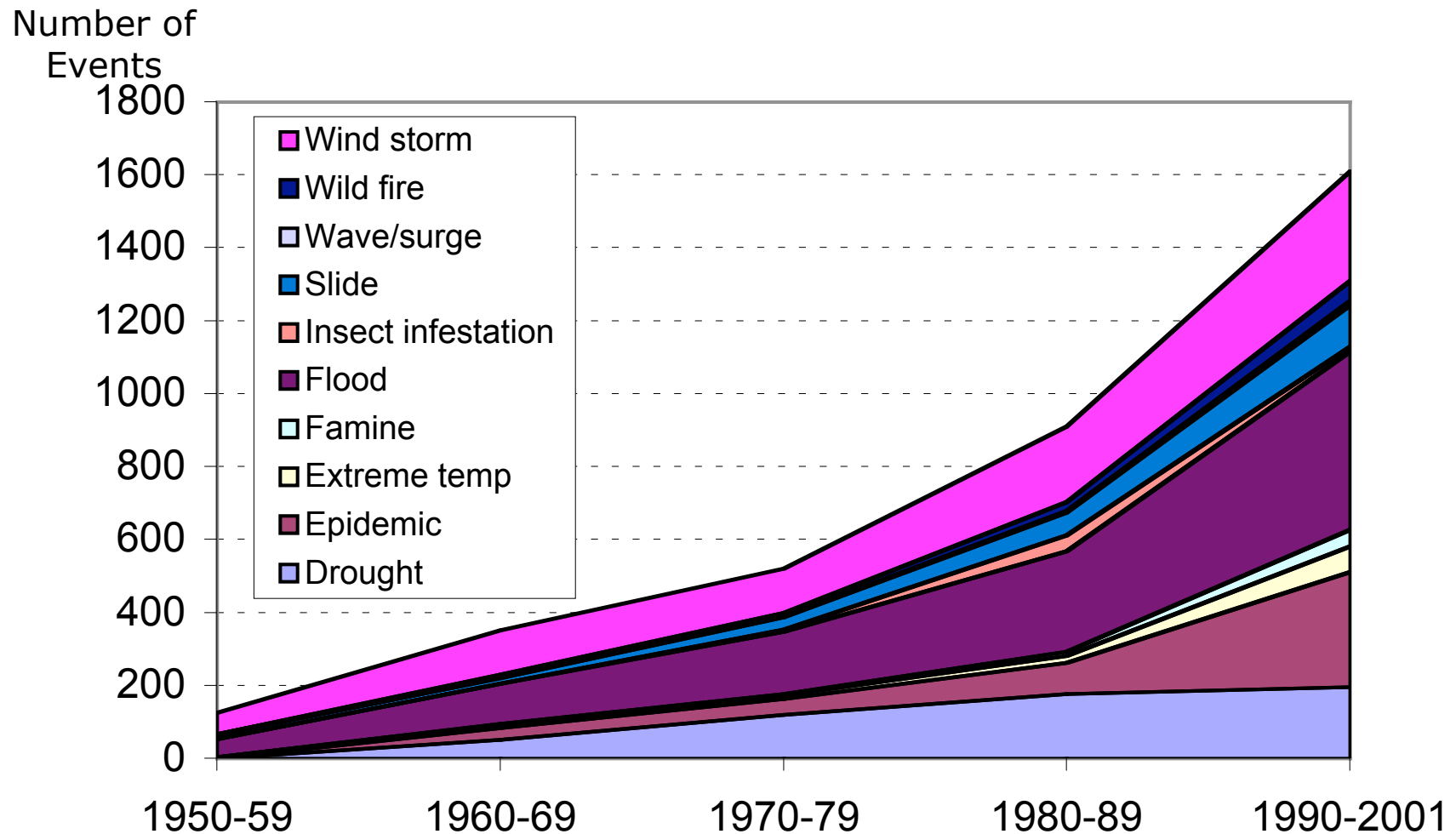
World Carbon Dioxide Concentrations



World Energy Consumption



Fingerprint: Rise in Number and Change in Mix of Weather/Climate Disasters



Source: Center for Research in the Epidemiology of Disasters (CRED)

The Scientific Consensus

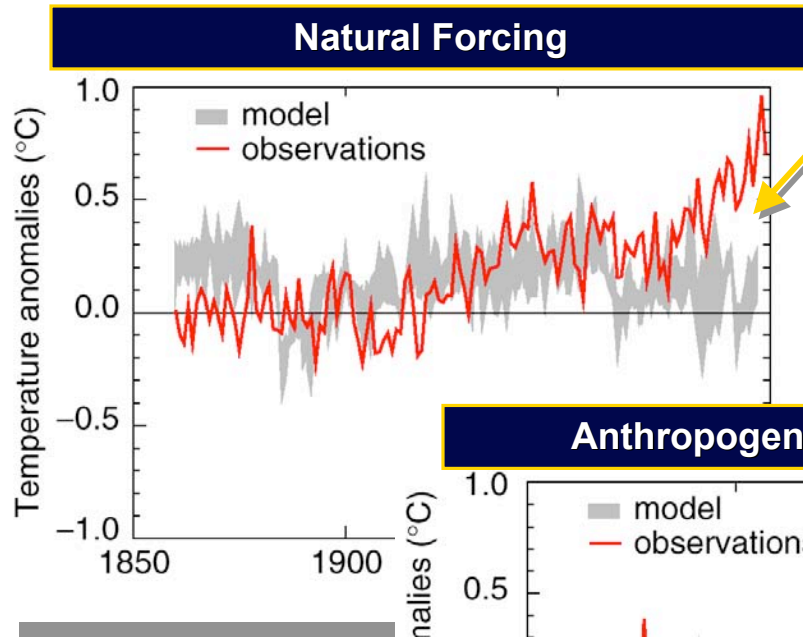
Intergovernmental Panel on Climate Change

1300 Authors; 1100 Reviewers
Unanimously adopted by 100+
nations (incl U.S.)

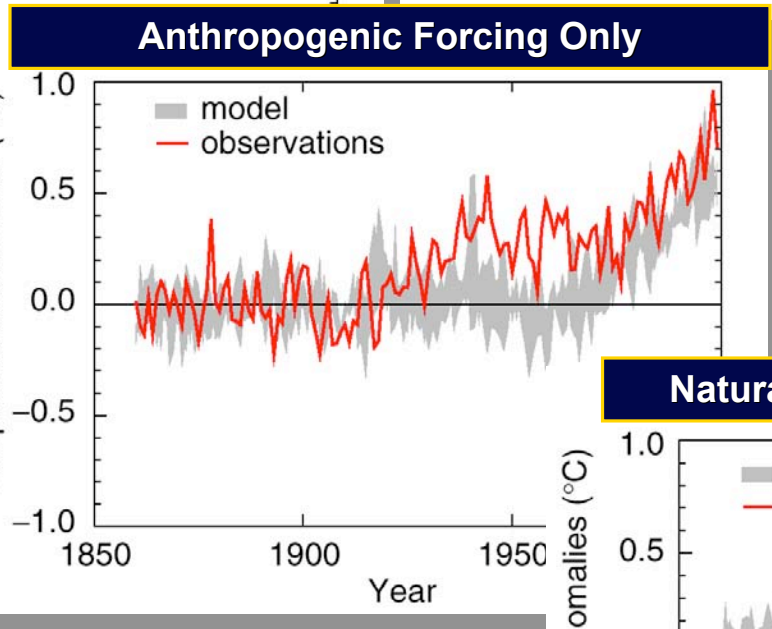
IPCC

National Academies of Science:

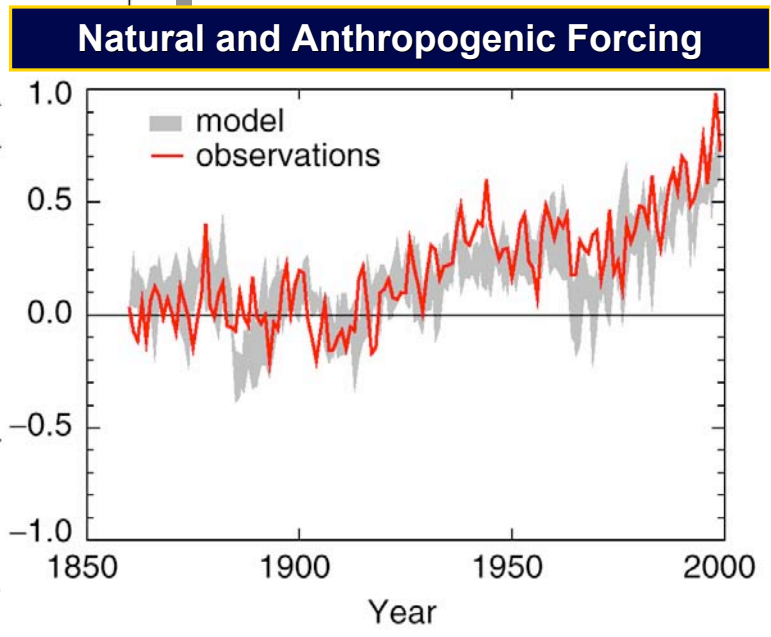
- Brazil
- Canada
- China
- France
- Germany
- India
- Italy
- Japan
- Russia
- United Kingdom
- United States of America



- Natural (solar + volcanic) forcing alone does not account for warming in the past 50 years.



- human influences alone (greenhouse gases and sulfate aerosols) brings the models and observations into pretty good agreement.



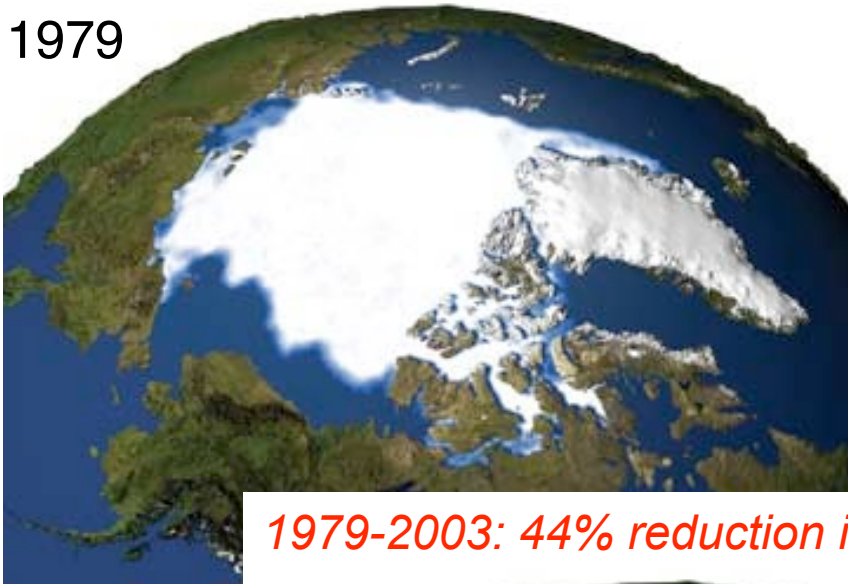
Fingerprint:
 Temperatures higher than in past 1000 years, and increasing at fastest rate over this period

Prime cause of observed warming is human activity (IPCC 2001)

*“Warming Commitment” is even greater:
 Most of warming temporarily locked in the oceans*

Fingerprint: Loss of Ice & Snow Cover

1979



1979-2003: 44% reduction in thickness

2003

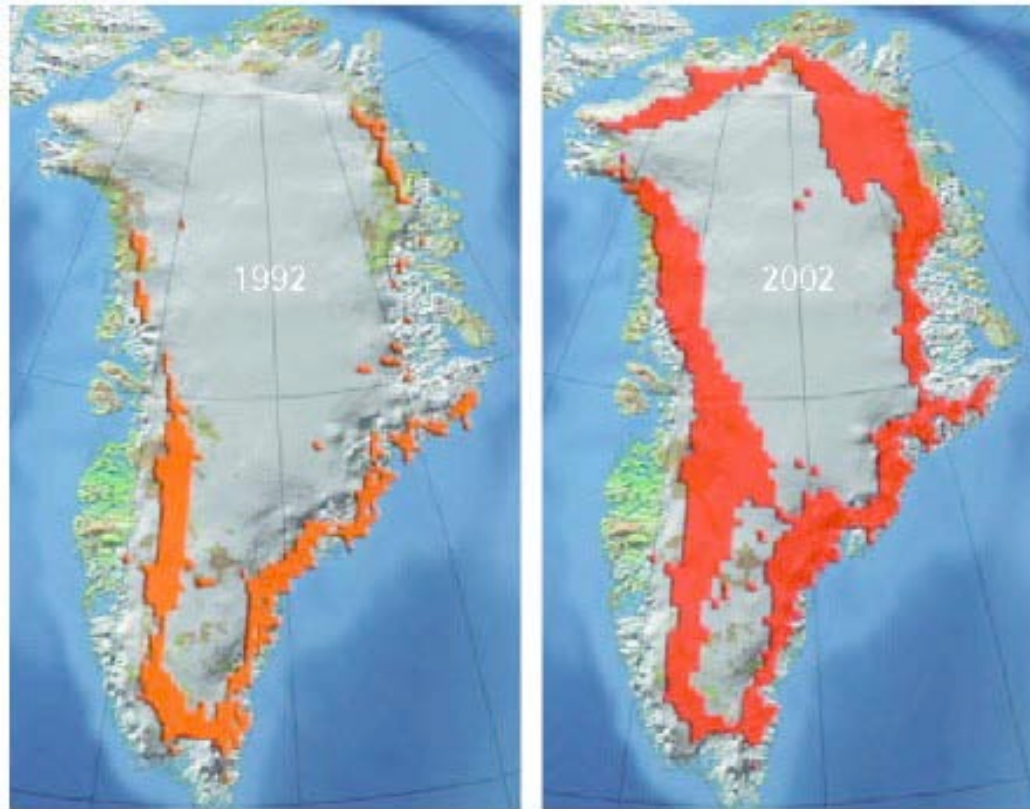


- Contributes to sea-level rise
- “Darkens” Earth’s surface [undesirable feedback]
- “Freshens” northern oceans
- Melting permafrost

90 deg N
August 7, 2004
Harvard University expedition to
North Pole



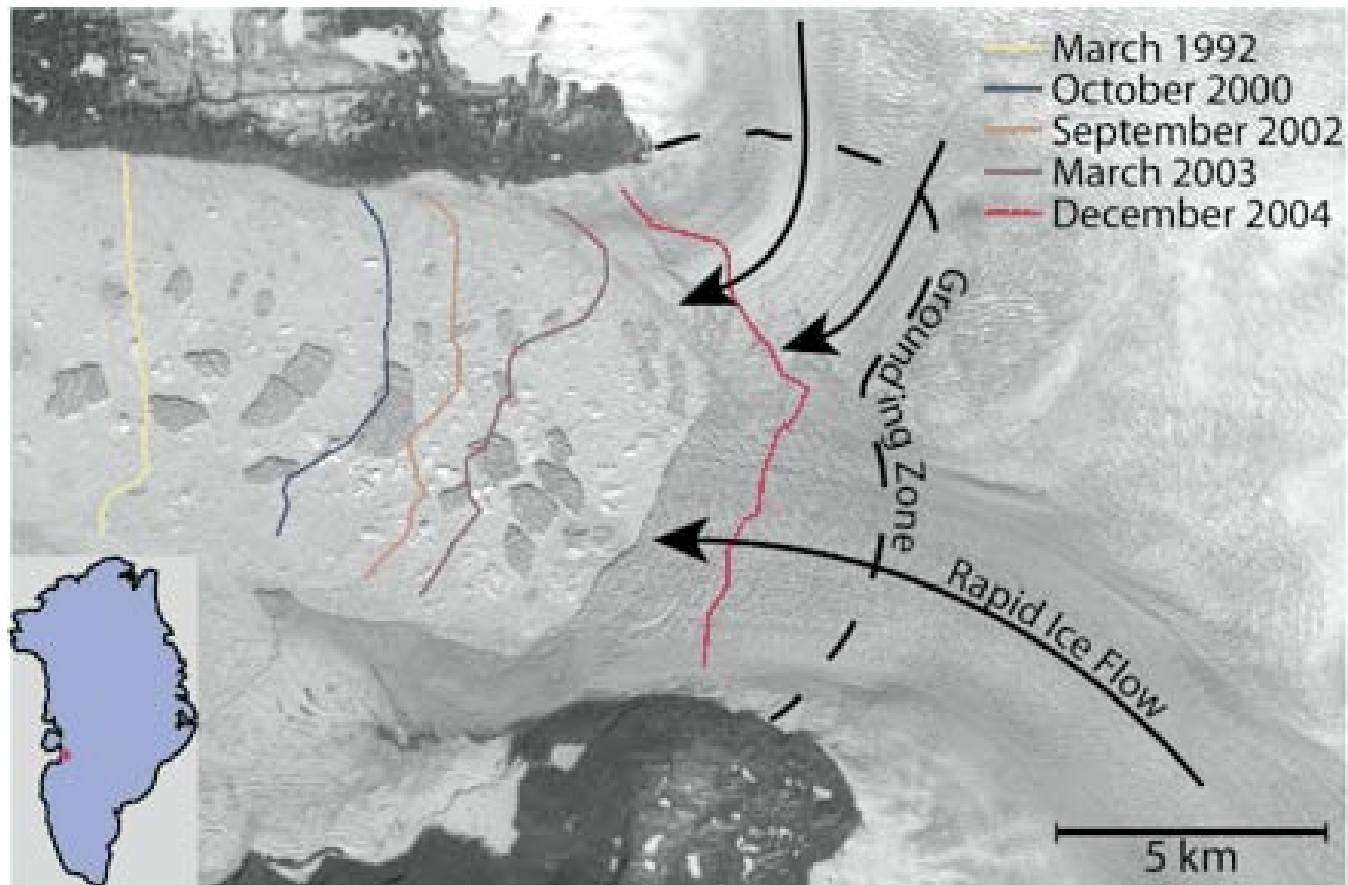
The Greening of Greenland



Source: Alley et al. *Science* (21 October 2005)

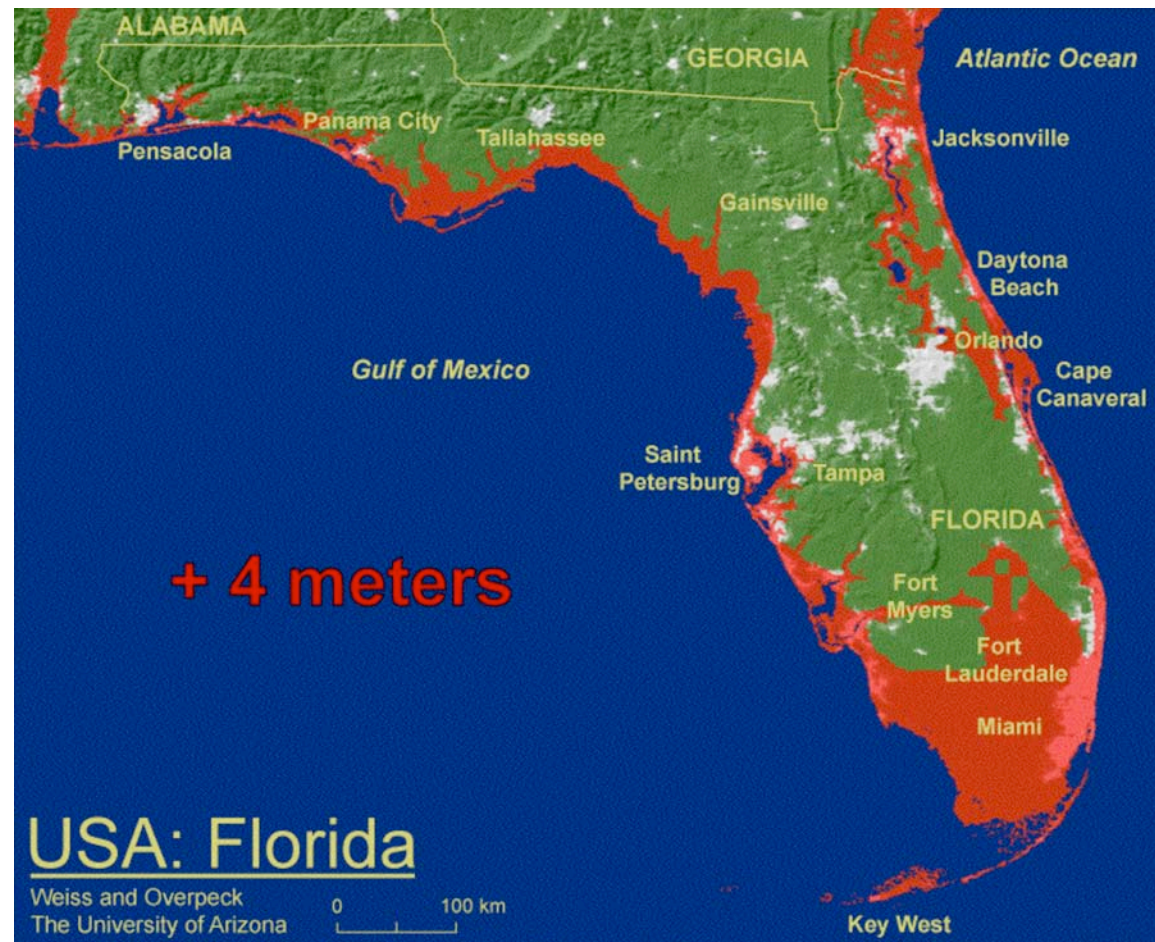
Fingerprint: Melting Land Ice

Near complete disintegration of Jakobshavn Isbrae, Greenland's largest outflow glacier

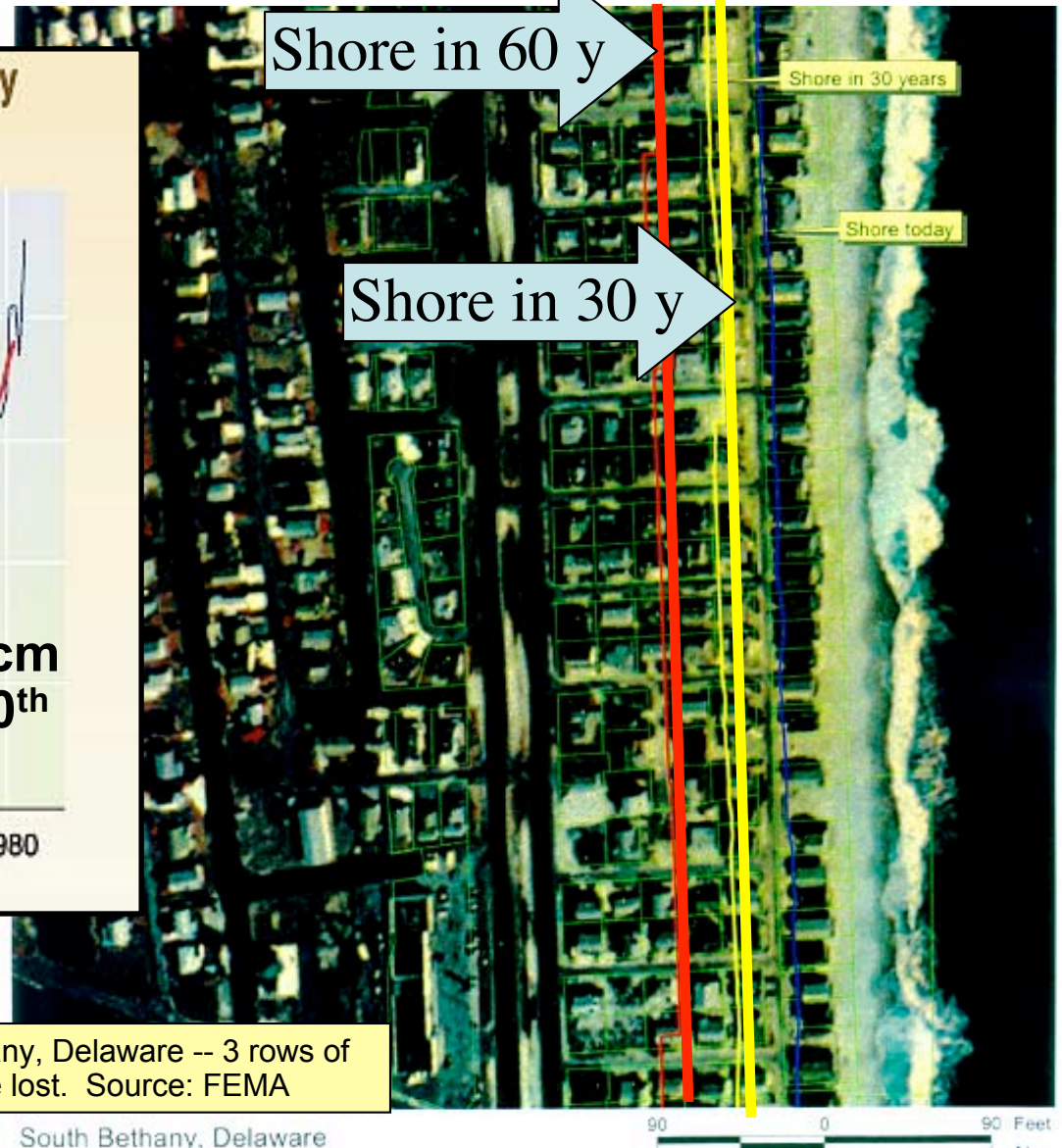
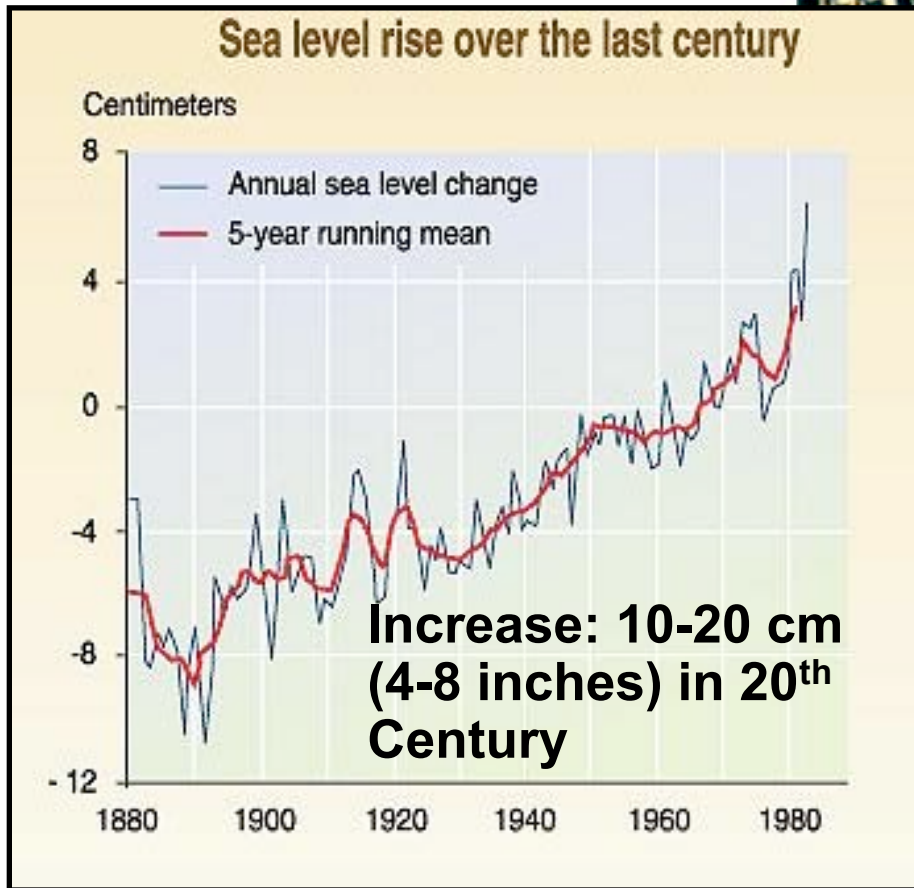


Alley *et al.*, *Science* (21 October 2005) -- Landsat

Florida under 4m Sea-level Rise



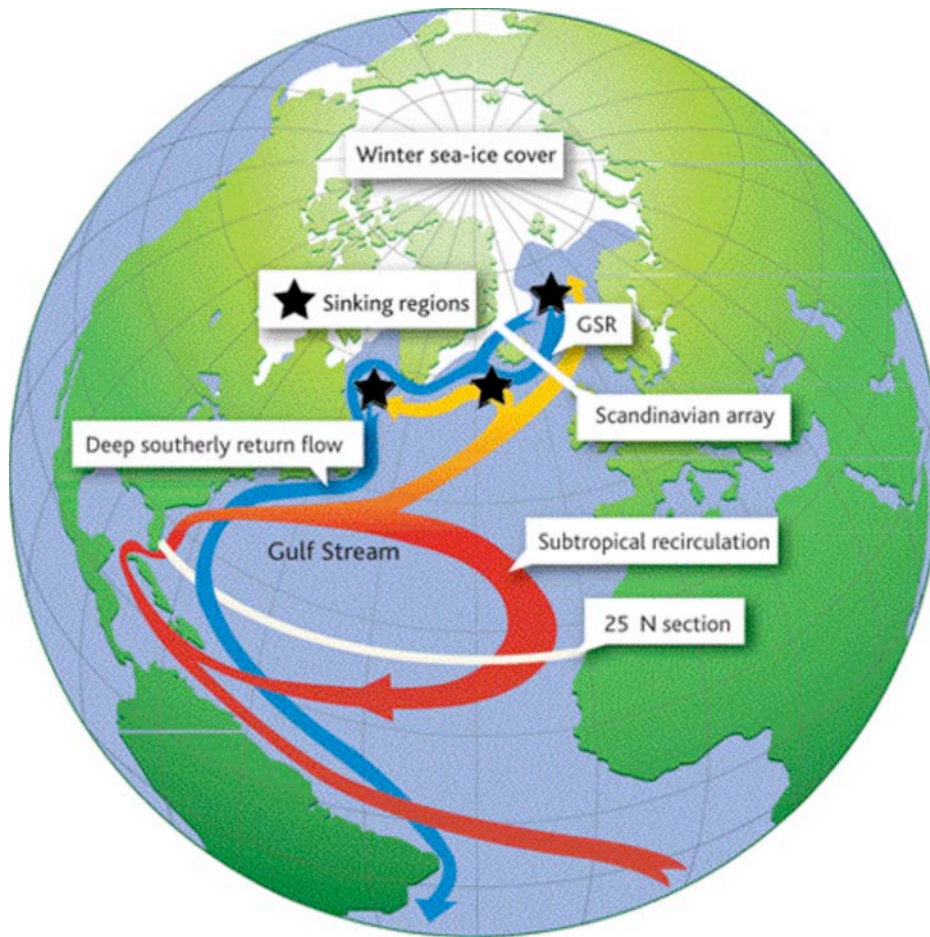
Fingerprint: Sea Level Rise



South Bethany, Delaware -- 3 rows of homes to be lost. Source: FEMA

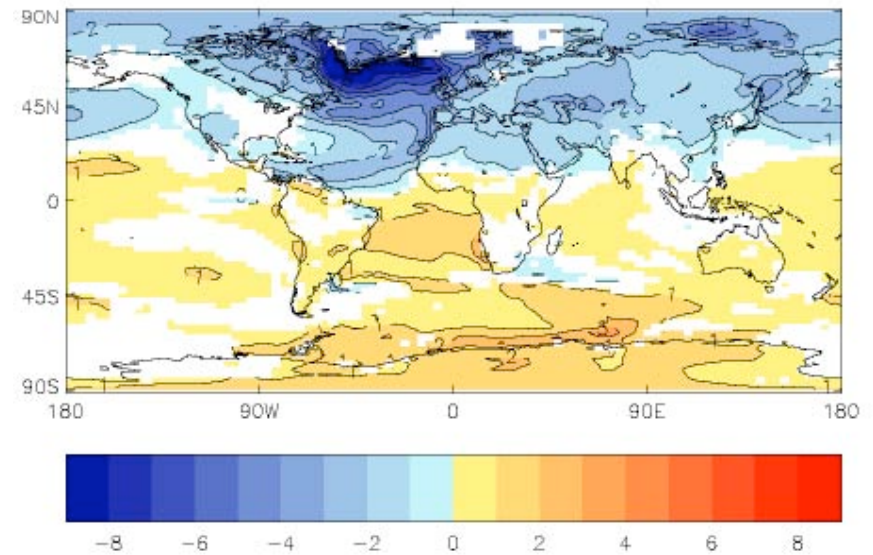
South Bethany, Delaware

The Ocean Conveyor Belt



Climate change can be abrupt

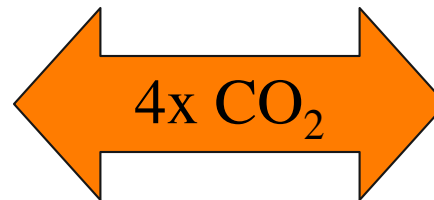
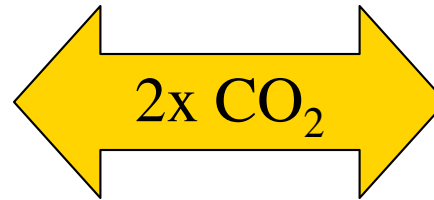
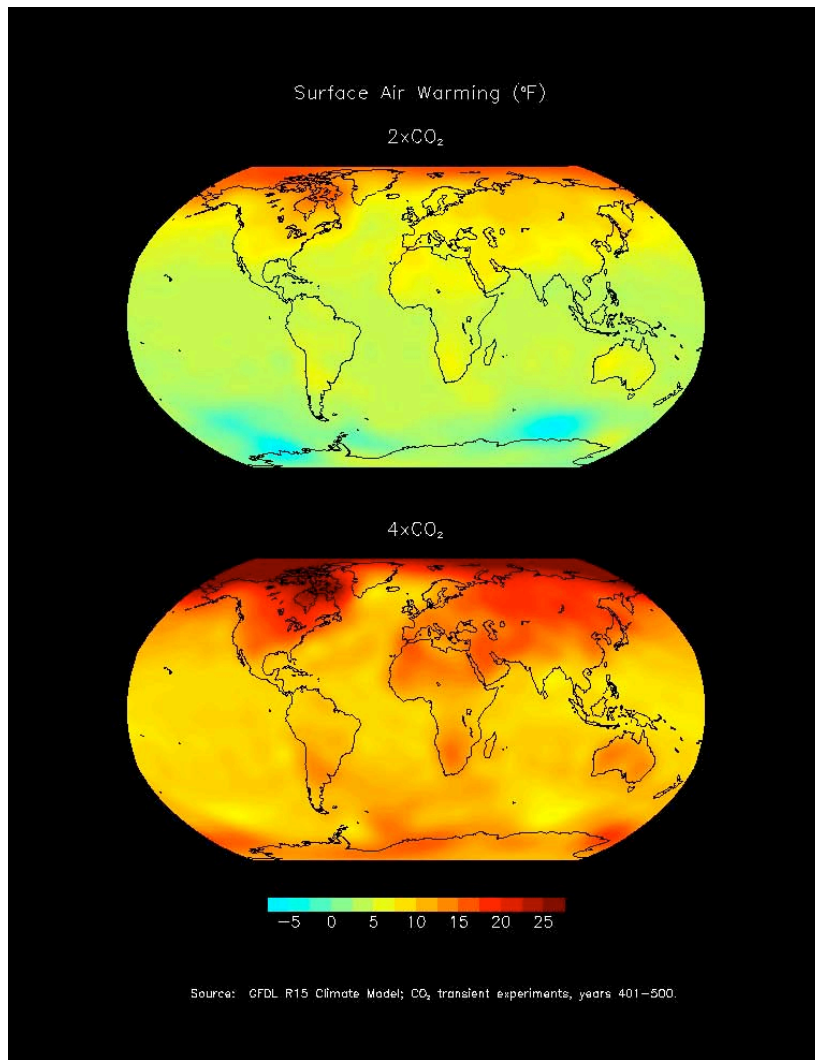
Temperature change if
shut down



In this week's *Nature*: 1998-2004 30% reduction in observed flow @ 25°NL = Heat equivalent of 500,000 power plants (Bryden et al.)

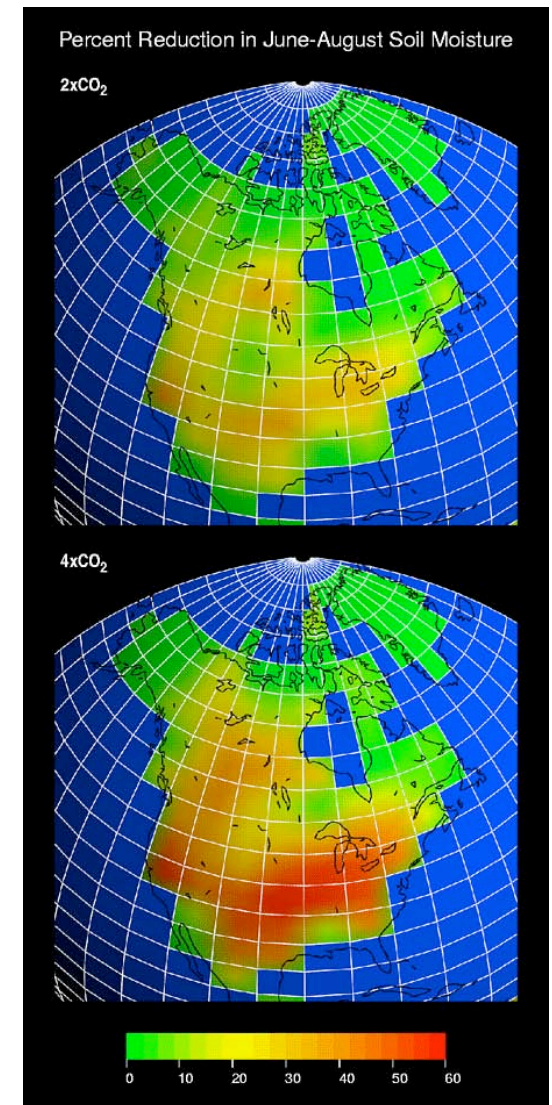
We'll pass the 2xCO₂ Milestone ~2050

Air Temperatures



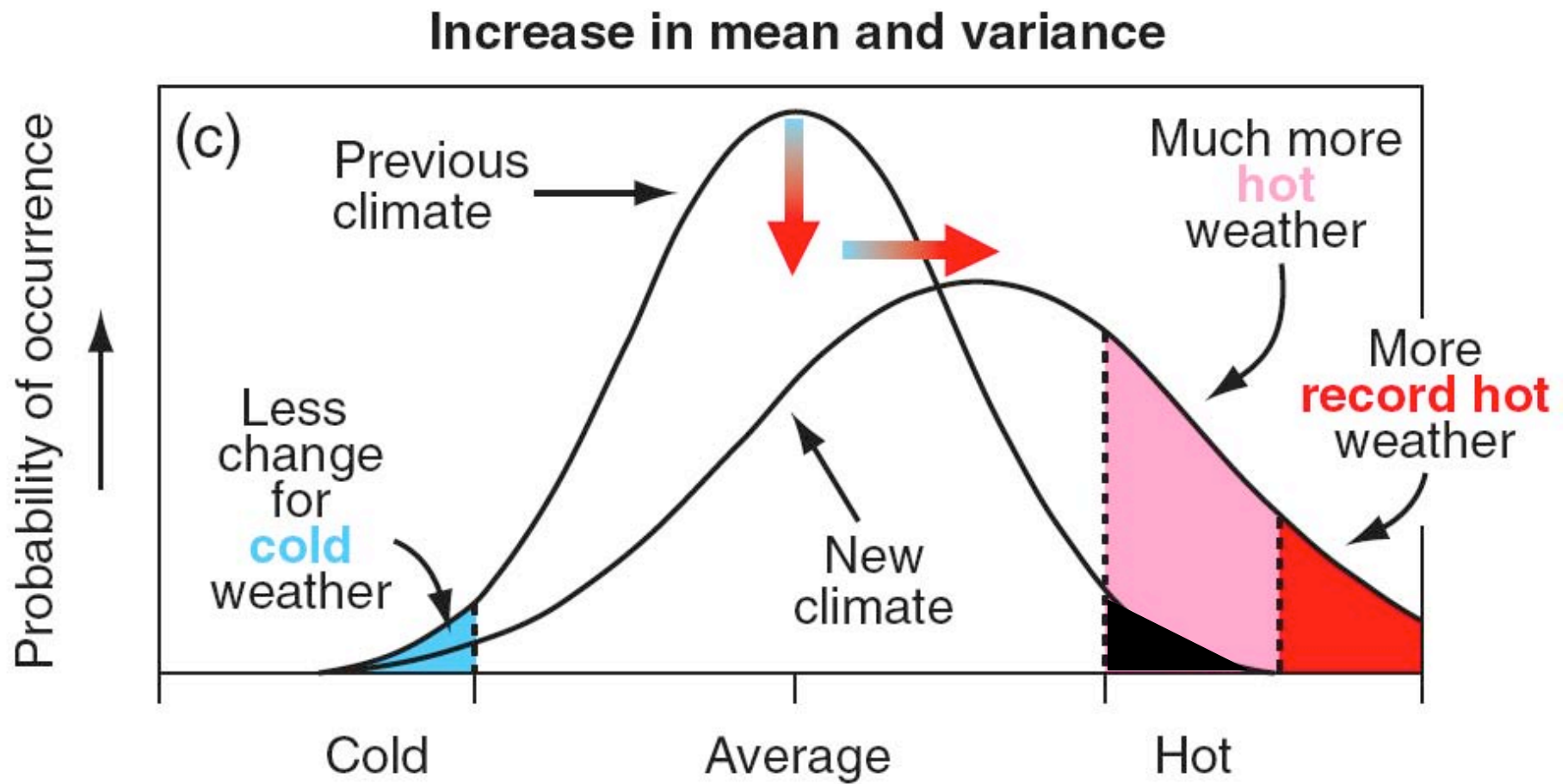
**With increased
warming, net
impacts become
increasingly
negative**

Soil Moisture



Source: NOAA (Geophysical Fluid Dynamics Laboratory)

Changes in Averages Create Even Greater Changes in Extremes



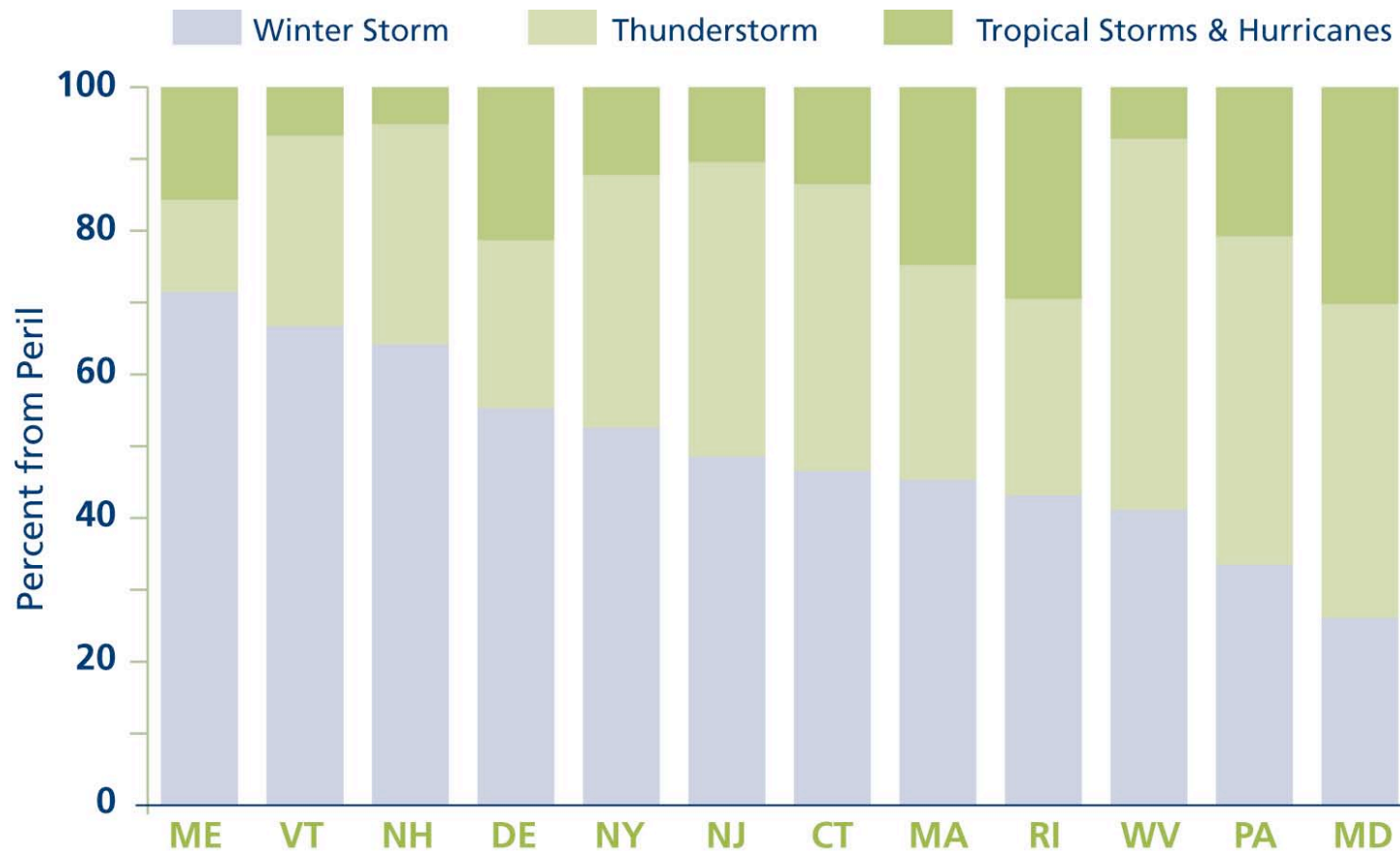
Small-scale, Gradual, Diffuse, and Indirect Events Often Overlooked

Greater combined impacts than CATs in an average year

- Blackouts
- Crop damages
- Drought
- Equipment breakdown
- Eroded air quality
- Eroded water quality
- Hail
- Ice Storms
- Infectious diseases
- Lightning
- Mudslides
- Sea-level rise/Coastal erosion
- Sinkholes
- Subsidence
- Thunderstorms
- Tornados
- Vehicle damages/injuries
- Wildfire
- Winterstorms

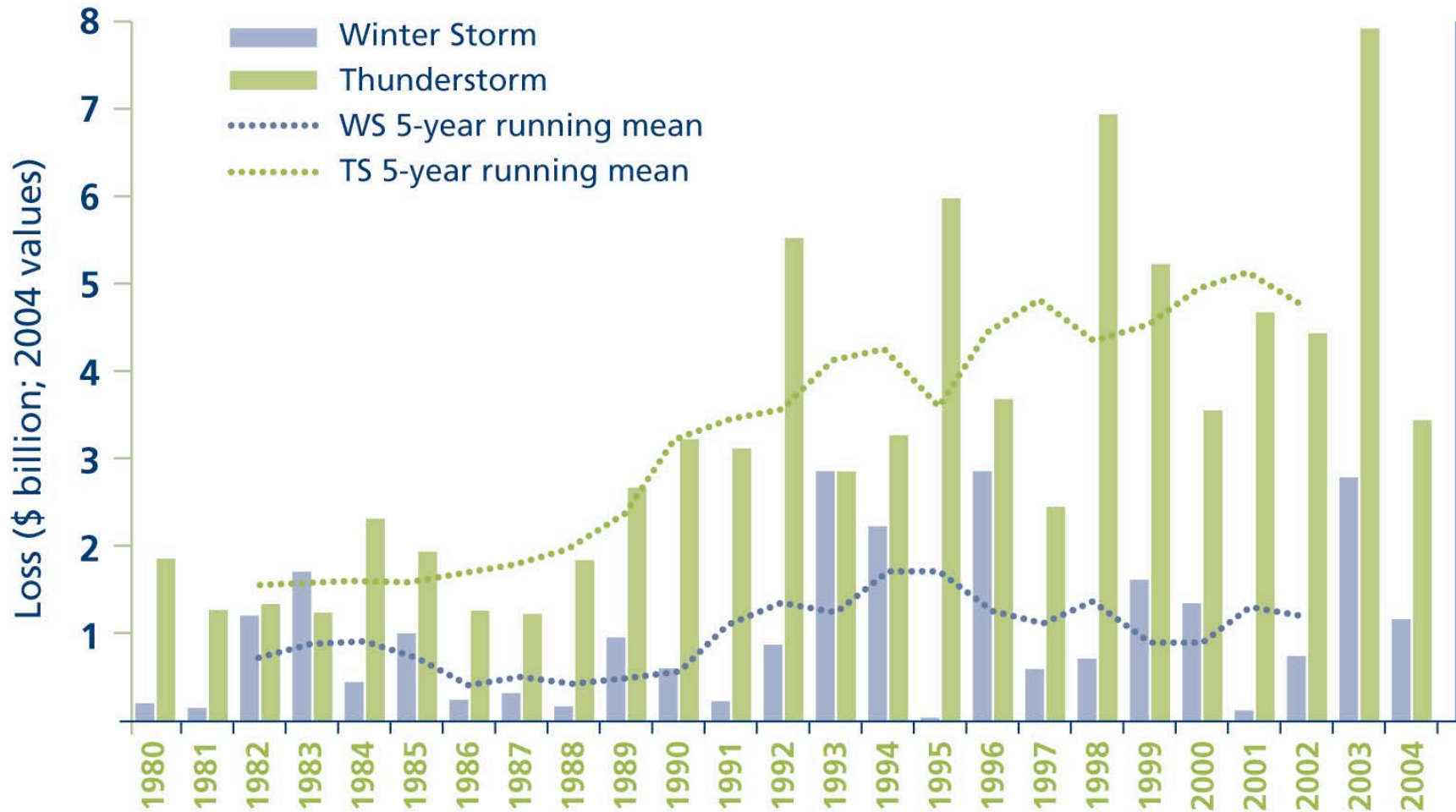


Weather Events: Multiple Regions and Types

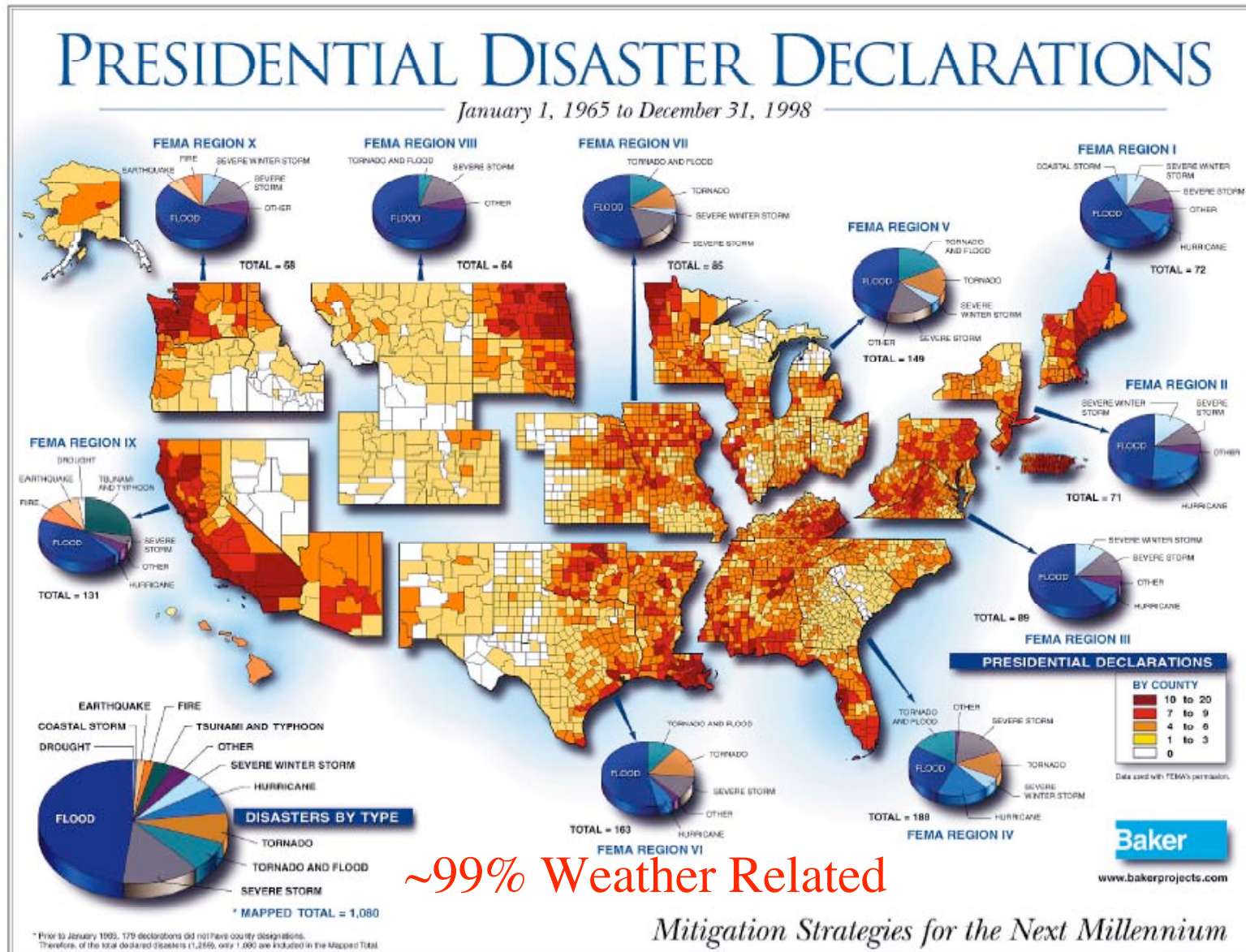


Source: American Re (2005) -- data for 1980-2004

Inflation-Corrected U.S. Loss Trends



Disasters Not Just a “Coastal” Issue



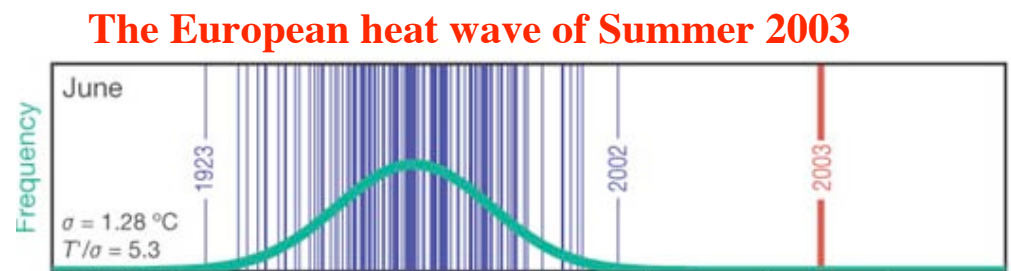
Health Impacts

- **Human Systems**

- Heat stress
- Respiratory disease
 - Pollen
 - Mold
 - Smoke and particulates
 - Urban air pollution
- Infectious diseases
- Food poisoning
- Water quality
- Injury/death from disasters
- Environmental contamination

- **Natural Systems**

- Crops & livestock
- Coral reefs
- Forest health
- Biodiversity



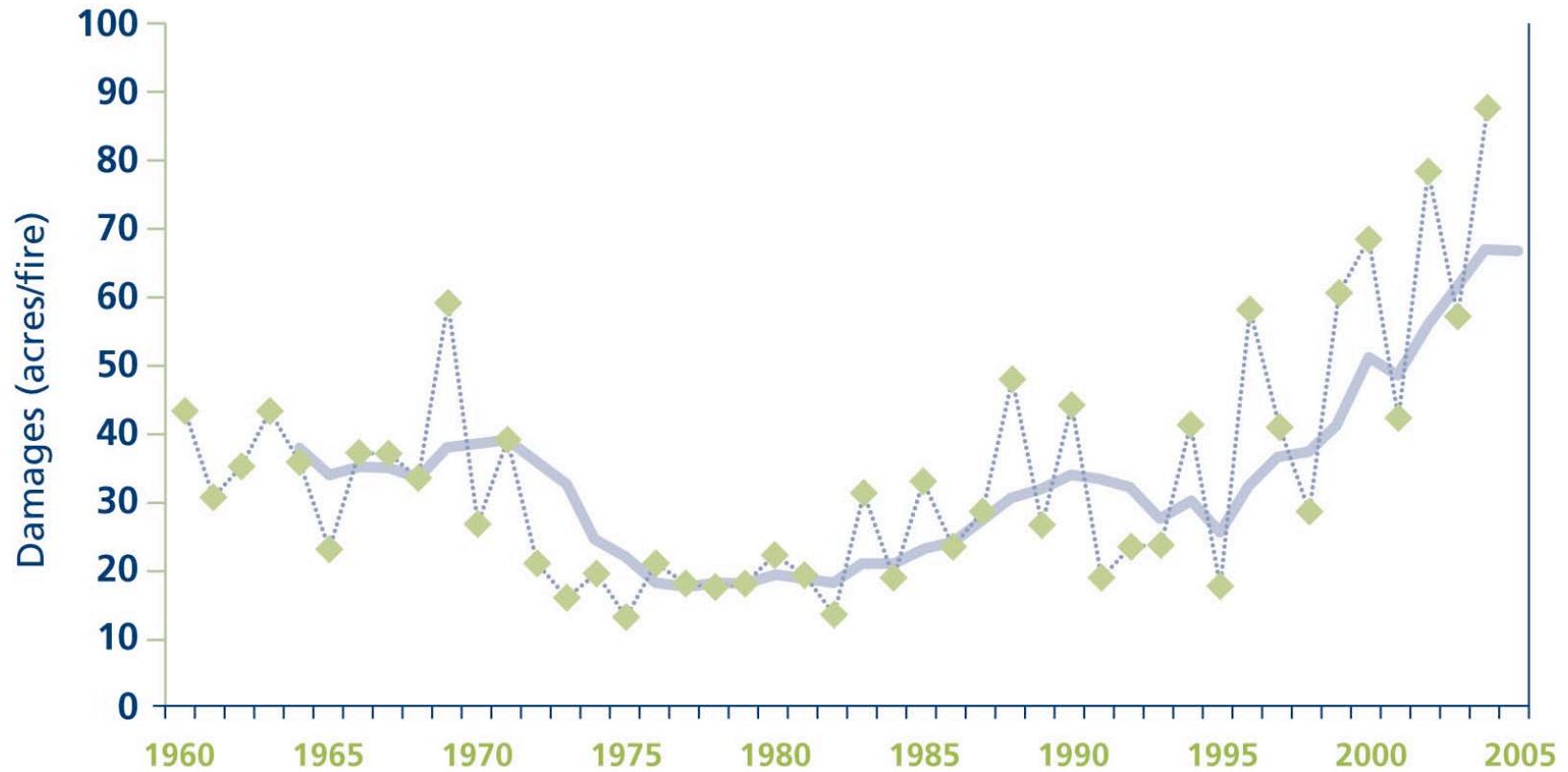
Event was “**six-sigmas**” outside of norm. 16°F above average in France and Germany. Was a 1-in-10,000 event to 1-in-46,000 event



WHO estimates 150,000 human mortalities each year due to current climate change

Fingerprints: Wildfire

(acres burned per fire: U.S. 1960-2004)

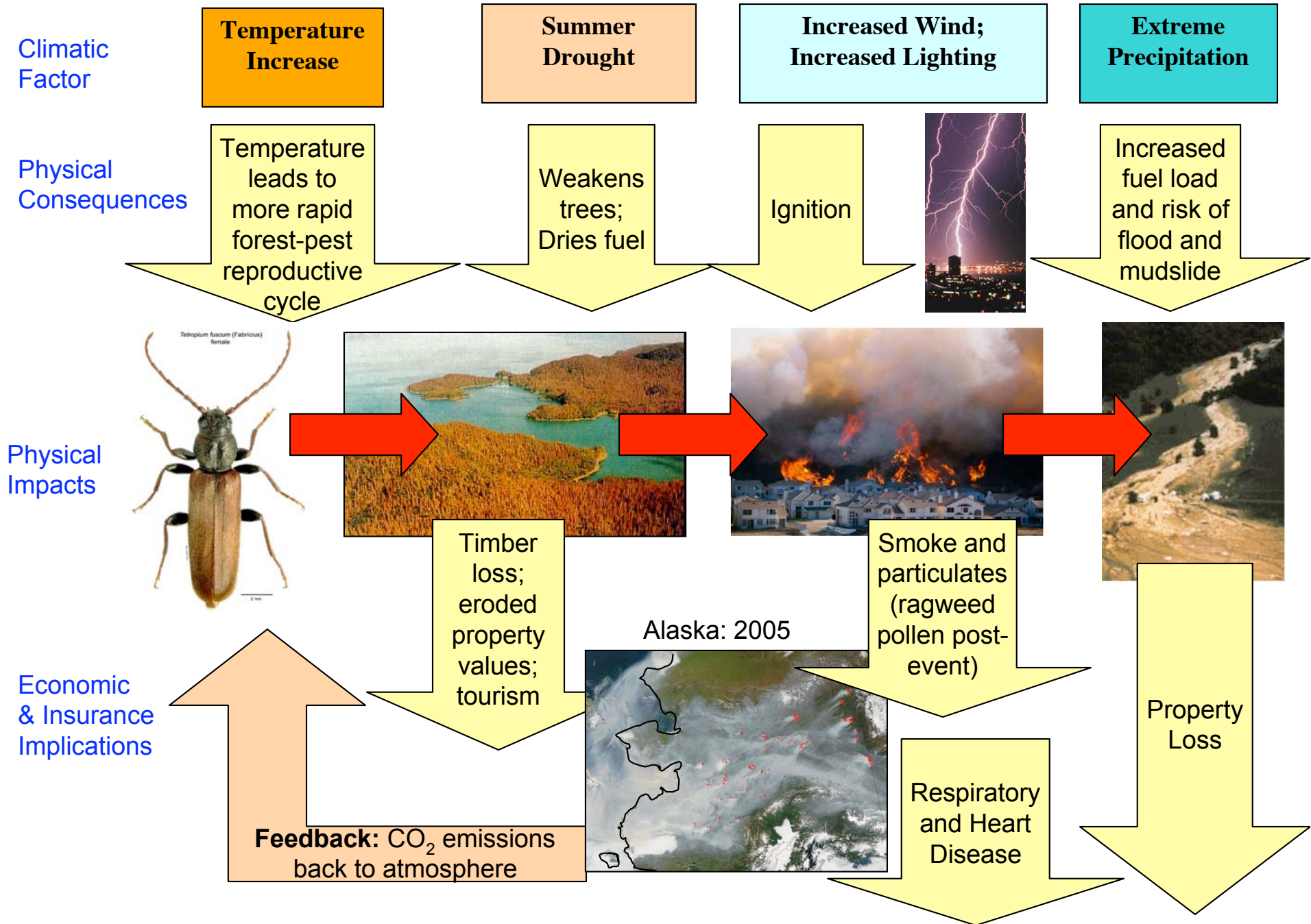


Projected Change in California Wildfires under a Doubling of CO₂

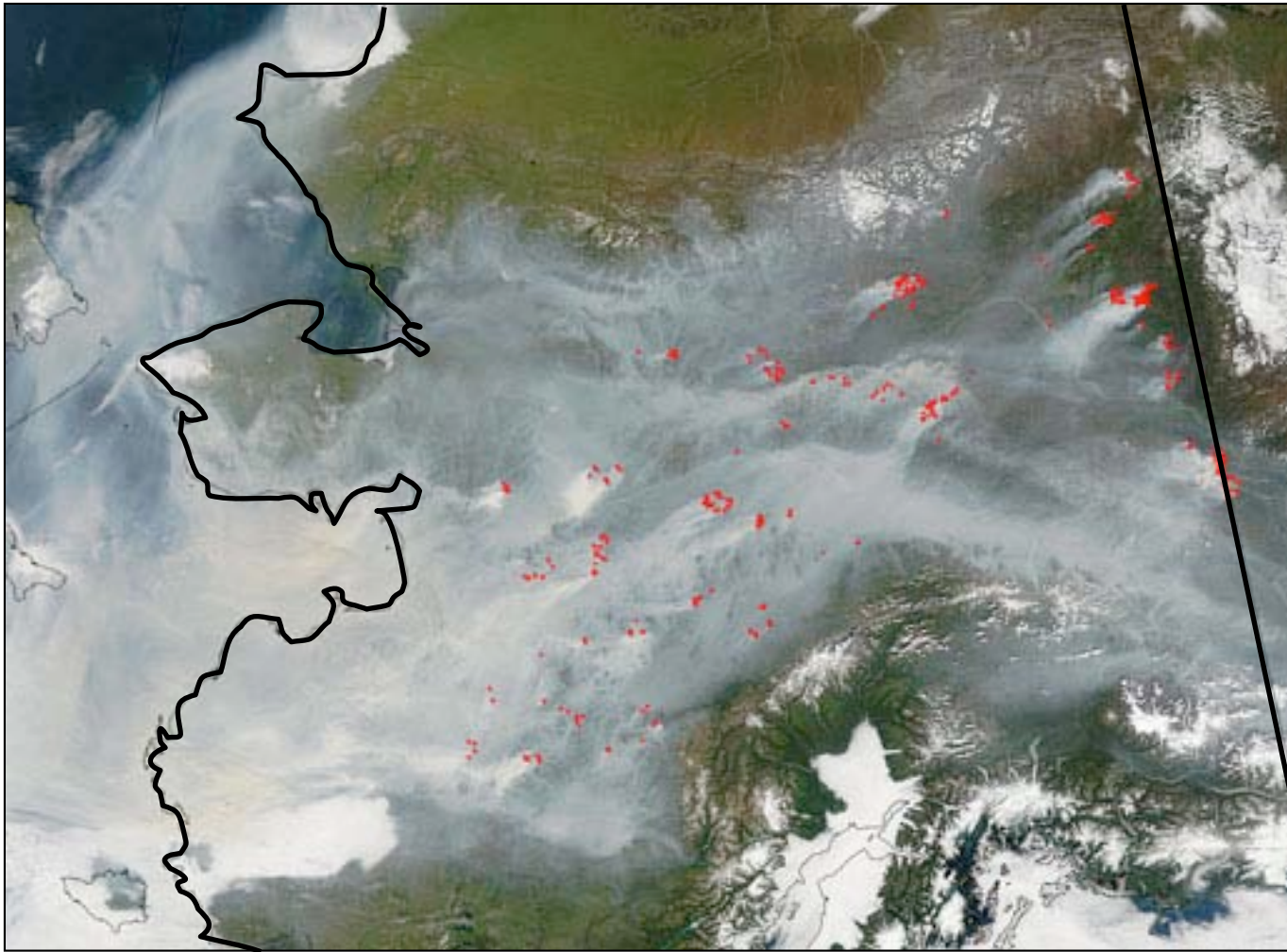


Source: Fried et al, Climatic Change, using CDF models

CLIMATE CONNECTIONS: The Example of Wildfire



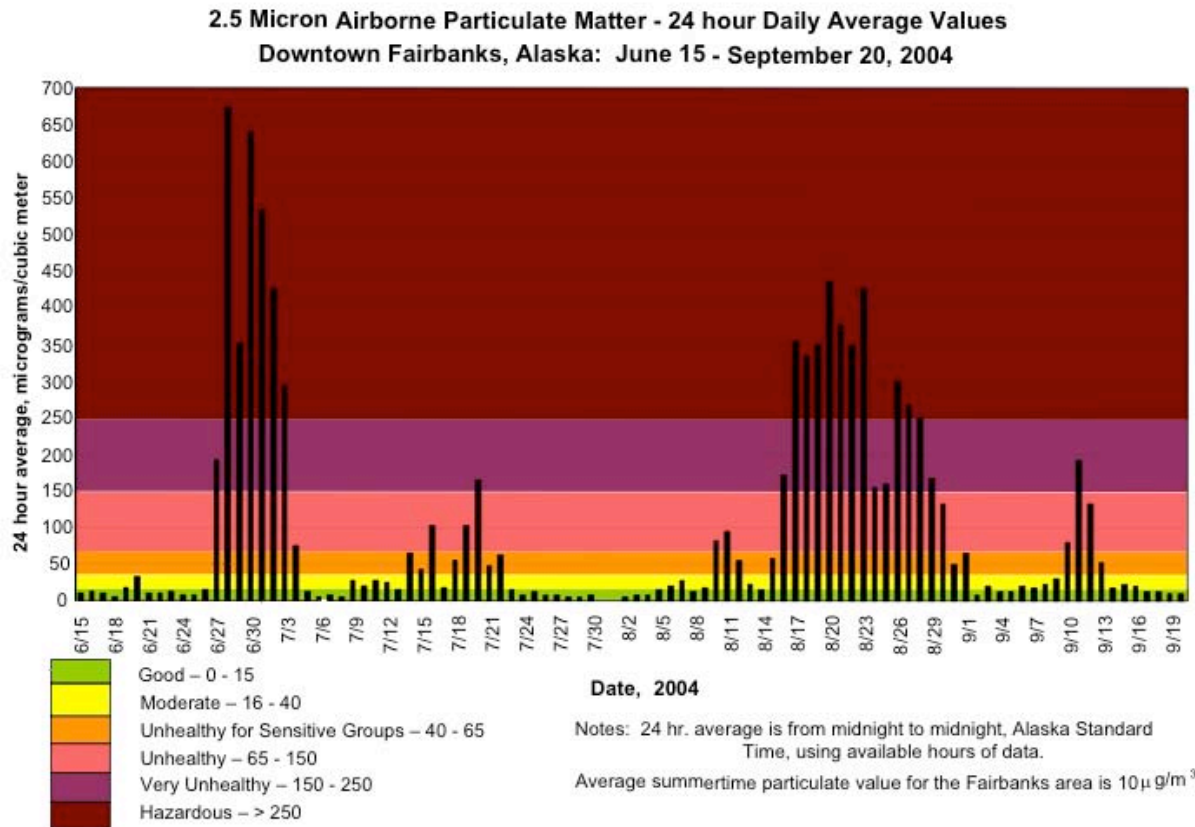
Alaska: Summer 2005



Unhealthy air
conditions over
most of state

← 800 miles →

Wildfire & Air-Quality Links: Alaska: Summer 2004



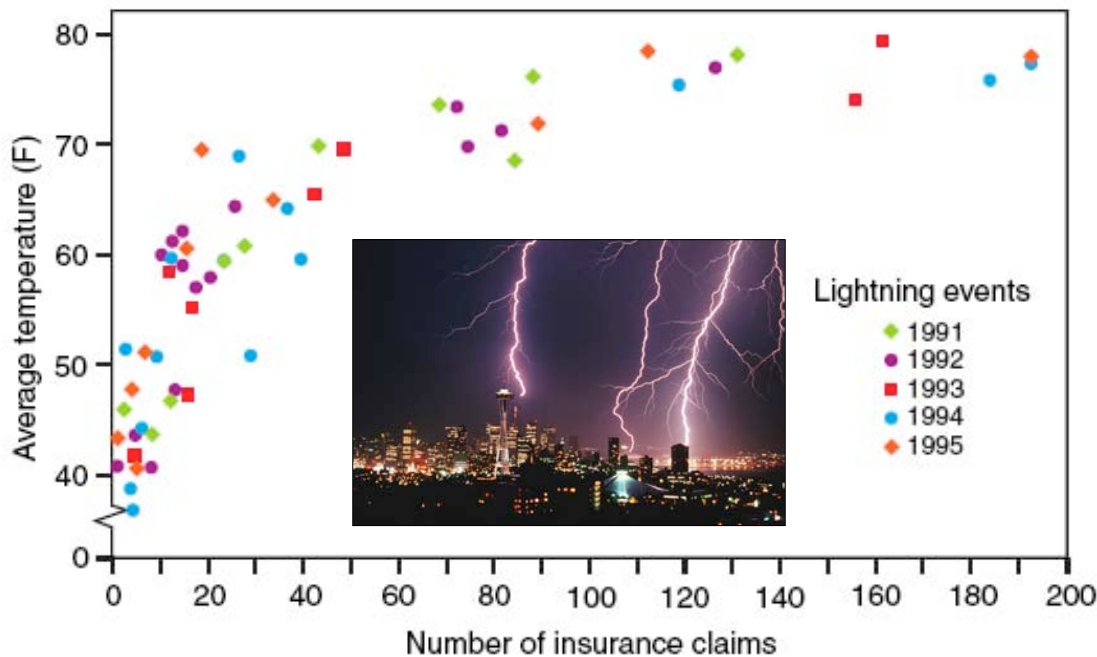
Fairbanks June 28, 2004



July 6, 2004

Fingerprint: Lightning

Lightning-related damages *accelerate* with temperature



Source: Hartford Steam Boiler Inspection and Insurance Co.

Examples of Losses:

State Farm: \$330M/year in claims

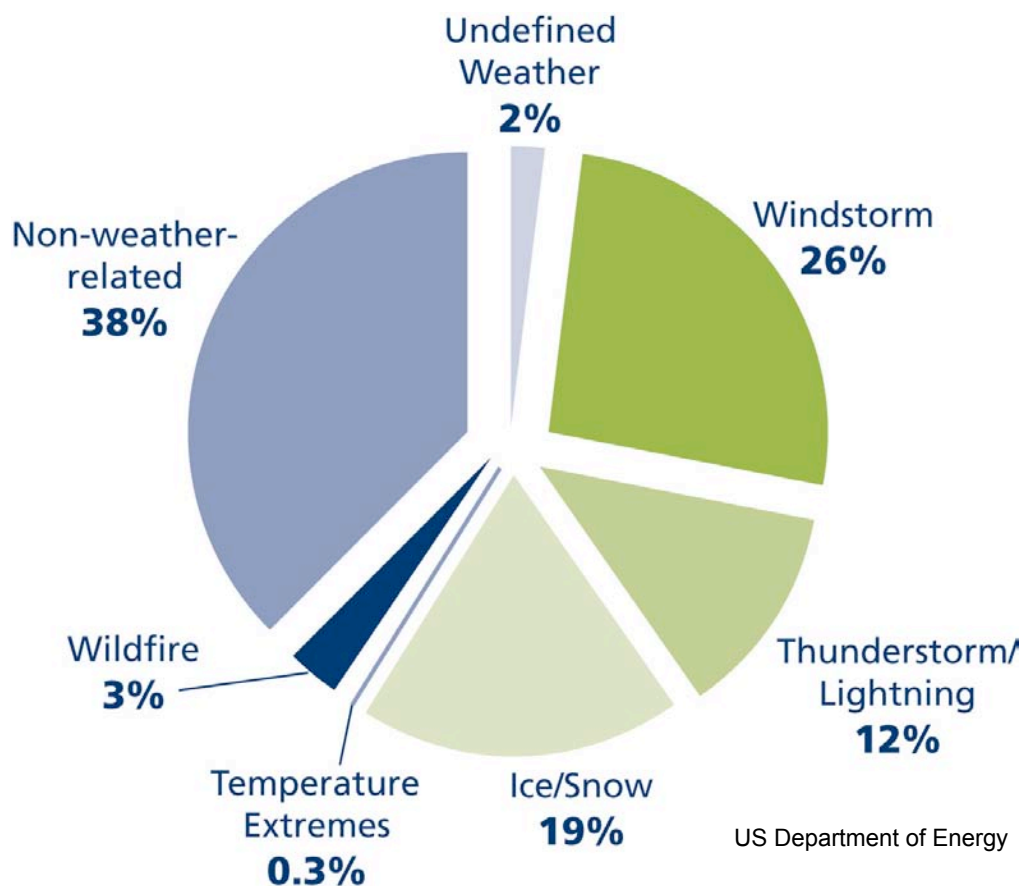
Factory Mutual: 3-4% of claims

- 50% wildfires in western US
- >3000/year: structural, vehicle fires
- 30% of power outages
- 80% of petroleum storage accidents
- 346 incidents, 81 nuclear sites: 1990s
- \$2B/year: airline operating costs
- 100,000/y: desktop computer losses
- Traffic signal outages

Source: www.lightningsafety.com

Power Outages

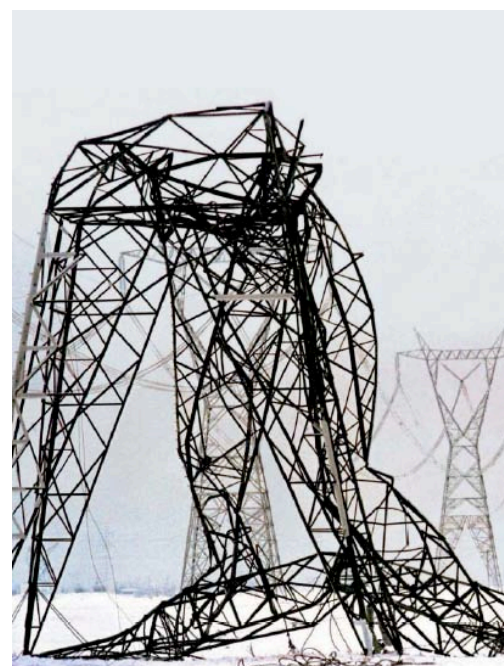
**Bulk Power Disturbances:
52 million customers (1982-2002)**



U.S. total ~\$80B/year

*Current insured portion unknown:
most are below ISO/PCS
threshold for being "worth"
counting*

RMS Scenario: \$2.7B for NY



Power outages were a factor in slowness of draining New Orleans following Katrina. Also important for contingent business interruption.

Uncertainty: Physical Financial

“Catastrophe insurers can't simply extrapolate past experience.”

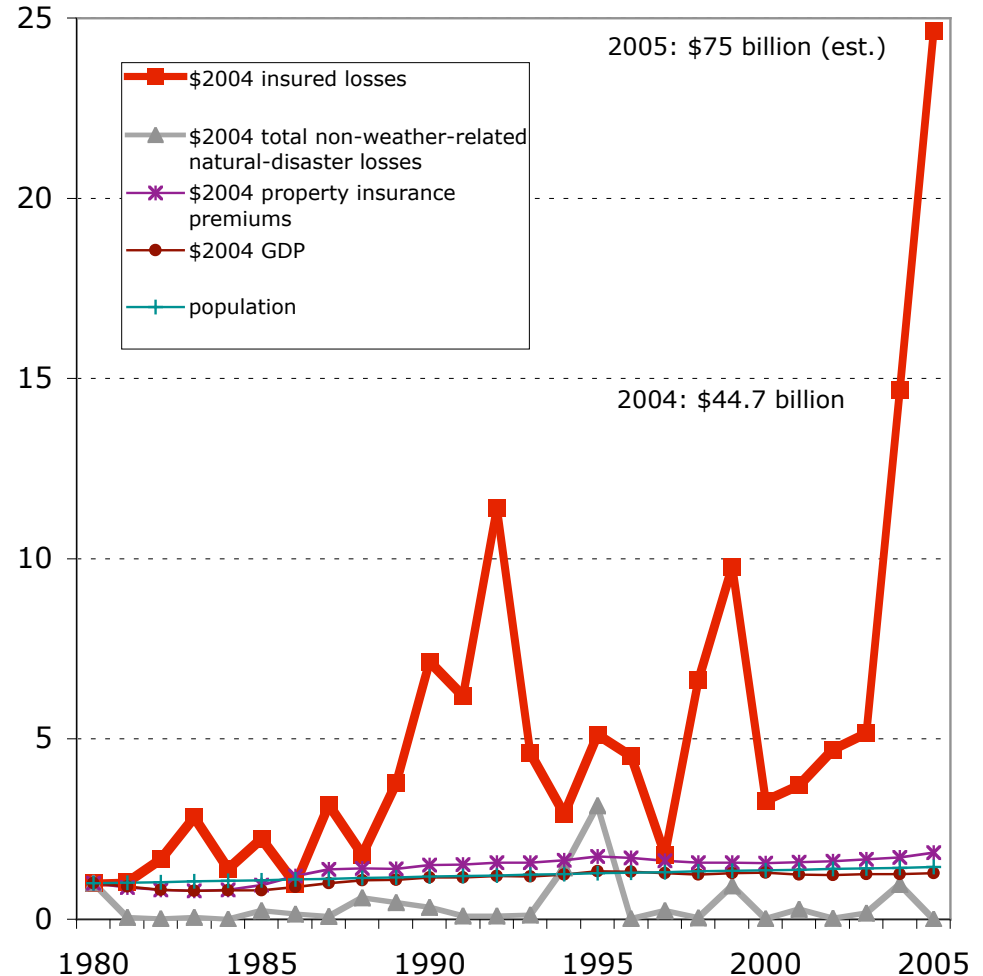
- Warren Buffett (1992)

Non-climate factors are a factor, but...

- Trends consistent with observed climate changes
- Without prevention, losses would have been higher
- Only large events included: excludes
 - offshore; aviation
 - health/life losses
 - small-scale events

Variability is increasing

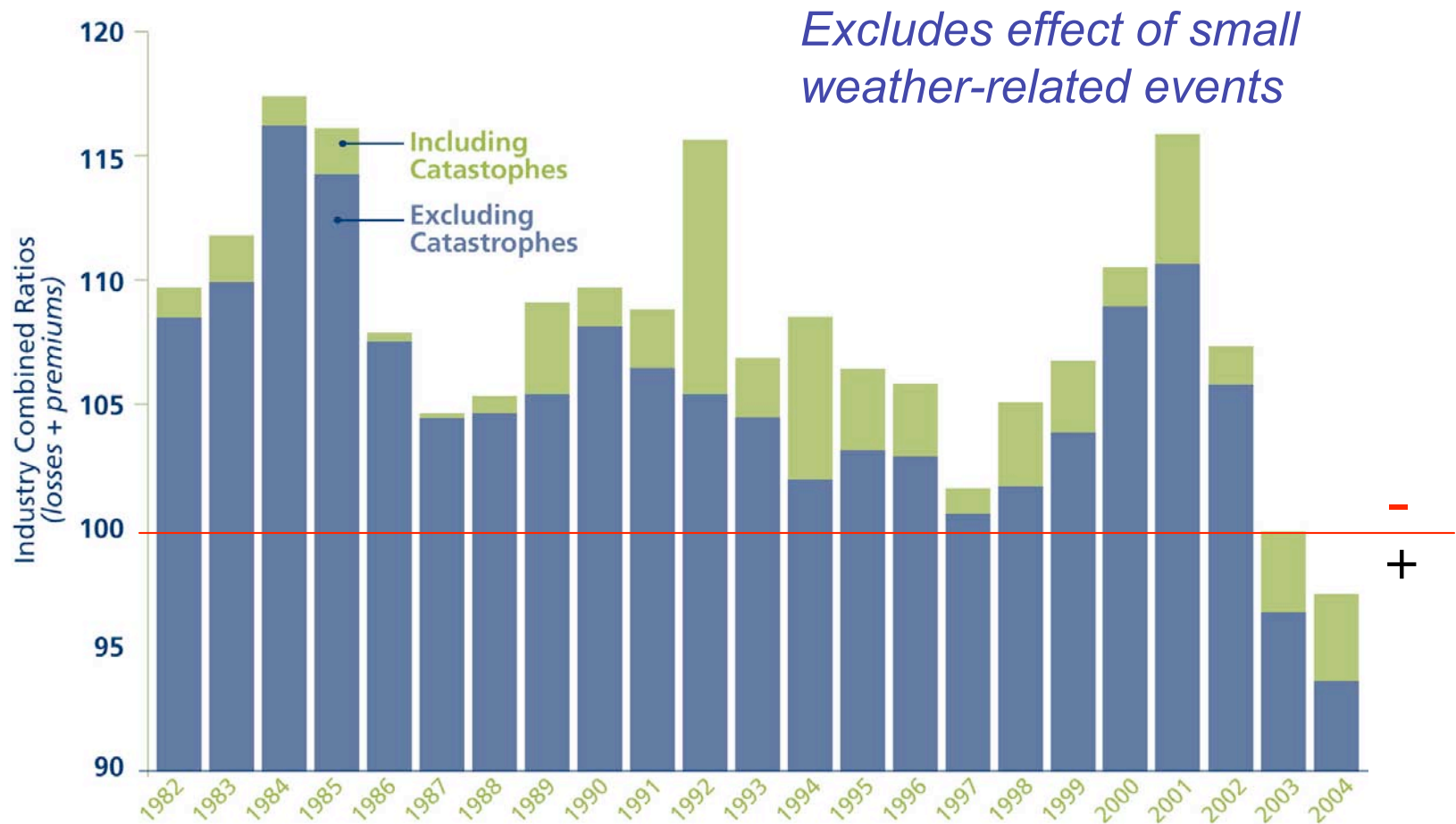
Global Insured Weather-Related Losses
INDEX: Increasing Faster than Premiums, Population, or GDP
1980 = 1.00



Notes: All economic values inflation-adjusted to 2004 levels. Losses from Munich Re NatCat Service; premiums from Swiss Re, *Sigma*. Values for 2005 are LBNL estimates.

CATs Play Key Role in Profitability

P&C Combined Ratios: 1982-2004



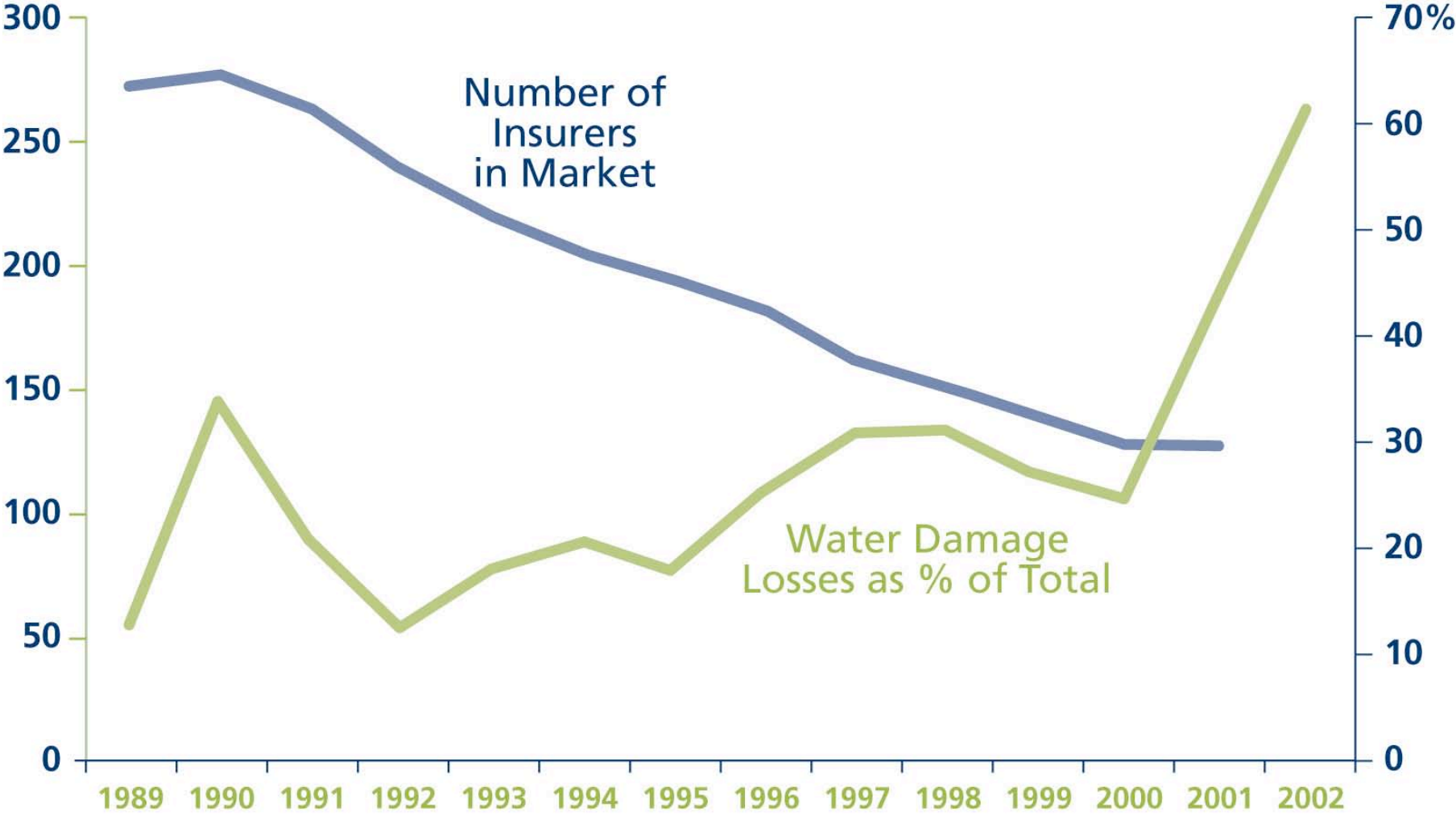
Source: AM Best, Aggregates & Averages

Effected Business Segments

- Most direct lines + Reinsurance [P/C & L/H]
 - Homeowners
 - commercial multi-peril
 - business interruption
 - auto (personal/commercial)
 - inland marine
 - Aviation
 - Crop
 - offshore energy
 - equipment breakdown
 - liability (several forms)
 - life/health
- Surplus lines; Guaranty Funds; Residual Markets; Risk Retention Groups; ART; *and...* public-sector insurance programs

Emerging Markets are a major “hotspot”

Availability Problems



Why Worry? - Underwriting

- Compounds existing insurance problems
 - Mold, Respiratory Disease, Corporate Governance/Liability...
- Complicates catastrophe finance and recovery planning
 - Shorter return periods
 - Increasing variability
 - New types of (unanticipated) losses; shifting locations
 - “Cat-following-Cat” (e.g., windstorm and flood)
 - Unexpected correlation (e.g., power outage + flood)
 - Increases not necessarily predictable or gradual
- Profitability/solvency
- Flying (partly) blind
 - Seriously incomplete, and increasingly proprietary loss data
 - Financial and physical CAT models based on past outcomes

The future will not mirror the past

Why Worry? - beyond underwriting

- Asset Management
 - Weather-sensitivity of investments
 - Real estate holdings
- Operations
 - Ability to function in post-disaster settings
- Market Power
 - Slowed or shrinking market
 - voluntary - withdrawal
 - involuntary - knock-on effects
 - shift from U.S. to Europe/Asia -- where foresight is greater?
 - Reputation risk [and rising shareholder concern]
- Indirect Effects
 - “Dust-bowl plus Depression” syndrome
 - Escalating energy prices & inflation bad for insurance market
 - Impacts of climate change on insurance customers

Recommendations: Insurers

- Improve loss data collection and analysis
- Analyze implications of climate change on underwriting, investments, and customers; share the results with shareholders
- Engage in weather/climate research and modeling
- Create an industry-driven activity improving on the climate change insurance working group that was briefly active in the mid-1990s
- Promote loss prevention (e.g. building codes, preparedness)
- Lead by example in reducing corporate climate footprint
- Develop new products, policy action and technical measures to achieve greenhouse-gas emissions reductions; can have direct collateral benefits for insurance core business

Regulator Concerns

It has become evident that climate change will continue to challenge insurers and state insurance regulators. Inevitably, this will pose a threat to the availability of essential insurance coverage for consumers.

NAIC (2005)

Regulator Concerns

After New Orleans, it's becoming clearer that we are experiencing more frequent and more powerful weather events that pose huge challenges for the insurance industry. ... This is both a coastal issue and a heartland issue.

Tim Wagner, Director Nebraska Department of Insurance (2005)

Recommendations: Regulators

- Review the “standards of insurability” to identify new challenges, domestically *and* abroad
- Incorporate climate risks in solvency and consumer-impact analysis - climate change not priced into market
- Encourage insurers to collect and disclose data on applicable exposures & losses
- Improve catastrophe modeling to include climate change
- Assess exposures of insurer investments to weather extremes and adequacy of capital and surplus
- Identify and remedy undue barriers to constructive insurer activities [ranging from loss prevention to emissions reduction]

Problems Opportunities

The insurance sector has a key role to play in helping to mitigate the effects of climate change by providing financial indemnification, compensation and relief against climate change events and by developing new products and solutions that can support emerging GHG [greenhouse gas] and renewable energy markets.

Marsh & McLennan Companies

"Everybody talks about the weather, but nobody does anything about it."

*- Charles Dudley Warner
Hartford Courant (1897)*

More Information

<http://eetd.lbl.gov/insurance>

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Source Material

- Primary Sources: *Science* magazine, *Nature* magazine, Munich Re, Swiss Re, Insurance Information Institute; PCS/ISO
- United Nations / World Meteorological Organization -- Intergovernmental Panel on Climate Change
- John P. Holdren. Presentation to 2003 UN Investors Summit entitled “Risks from Global Climate Change: What Do We Know? What Should We Do?”
- Paul Epstein, M.D., M.P.H., Harvard Medical School, Center for Health and the Global Environment, presentation entitled “Climate Change Futures” Study (Swiss Re and UNDP)

Related Presentations

- **The Science of Climate Change: Risks and Impacts**
 - (Presented to Connecticut Global Climate Change Summit: Business Risks and Opportunities for Connecticut's Insurance Industry, Hartford, CT, October 27, 2005)
http://eetd.lbl.gov/emills/PRESENTATIONS/Insurance_Climate_Hartford.pdf
- **Climate Change: Observed and Projected Impacts**
 - (Presented at the National Association of Insurance Commissioners Spring Meeting, Salt Lake City, March 12, 2005)
http://eetd.lbl.gov/emills/PRESENTATIONS/Observed_Climate_Change.pdf