From Risk to Opportunity:
Insurer Responses to Climate Change

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Our atmosphere is as thin -- in proportion to the Earth's diameter -- as a film of condensation on a steel ball.

Tectonic Shifts

- "In recent years, science has deepened our understanding of climate change ...The United States takes this issue seriously."

  - George W. Bush Administration (2007)

- "Greenhouse gasses are air pollutants"

  - U.S. Supreme Court (2007)

- "Climate change and abuse of the environment is against God's will"

  - The Vatican (2007)

For Insurers, Climate Change is an Emerging Risk to be Managed...

Insurers are....

- messengers
- integrators
- risk assessors
- risk managers

but...

- vulnerable
- flying partly blind
- selective

and....

- part of the solution

The Scientific Consensus

Nobel Peace Prize: 2007

Intergovernmental Panel on Climate Change
~1500 Authors;
1000 Reviewers
Unanimously adopted by 100 + nations (including U.S.)

IPCC Fourth Assessment Report
Co-Recipient of the 2007 NOBEL PEACE PRIZE

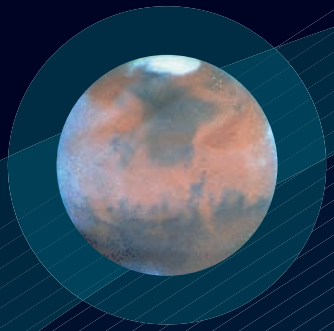
http://www.ipcc.ch

Warming of the climate system is unequivocal, with human activity the primary cause.

- No credible alternative theory
- Impacts observable today
- Change is *accelerating*
- Inaction is *more* costly than action
- Not "too late": Solutions possible (and affordable)
- Must adapt *and* reduce emissions

Planets and atmospheres

Mars
Thin atmosphere
(All CO_2 in ground)
Average temperature : - 50°C



Earth
0,03% of CO_2 in the atmosphere
Average temperature : + 14°C

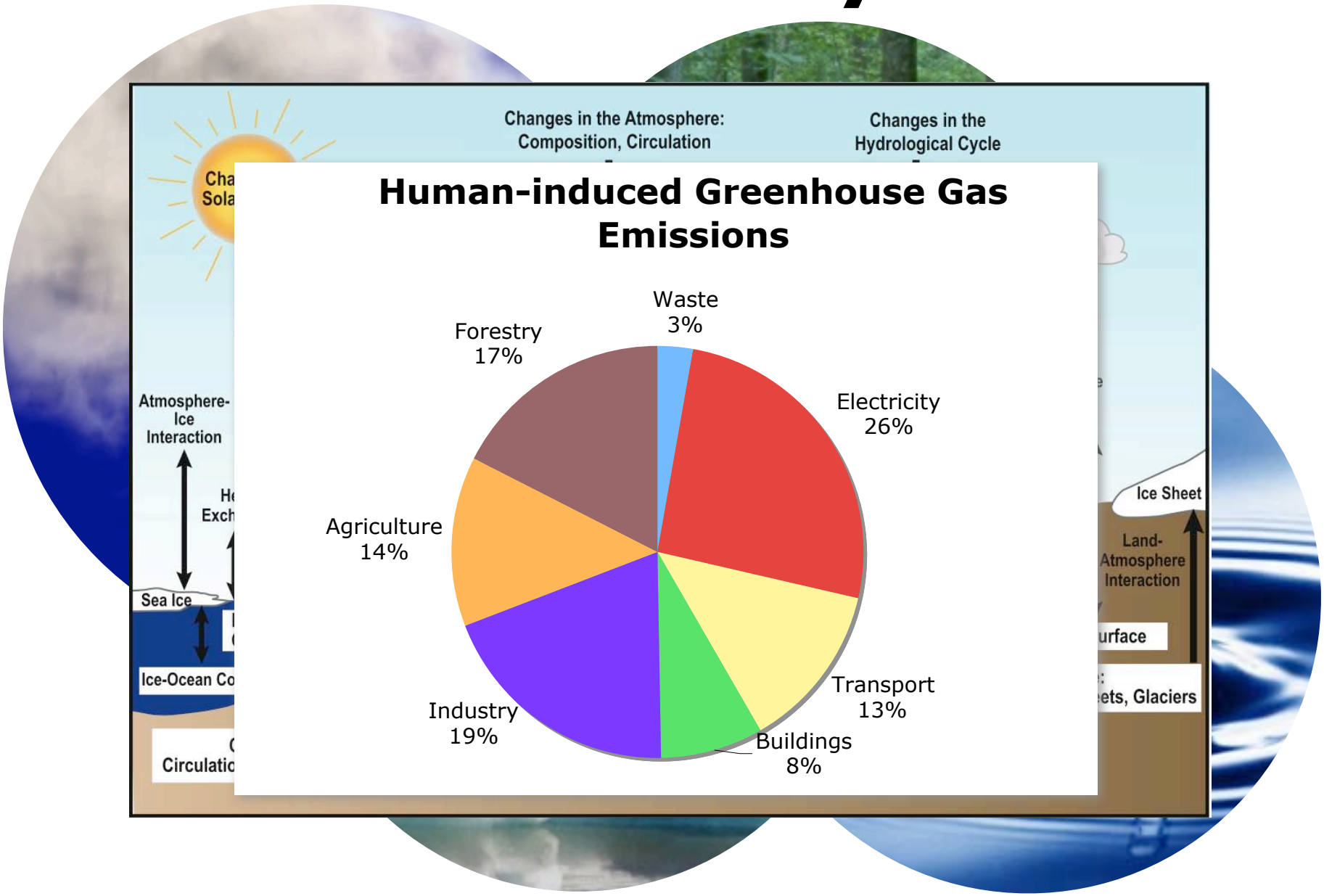
Venus
Thick atmosphere
containing 96% of CO_2
Average temperature : + 420°C

GRID Arendal UNEP

GRAPHIC DESIGN : PHILIPPE REKACEWICZ

Sources: Calvin J. Hamilton, Views of the solar system, www.planetscapes.com; Bill Arnett , The nine planets, a multimedia tour of the solar system, www.seds.org/billa/tnp/nineplanets.html

The Climate System



Source: Intergovernmental Panel on Climate Change, Fourth Assessment Report, WG1 (2007)

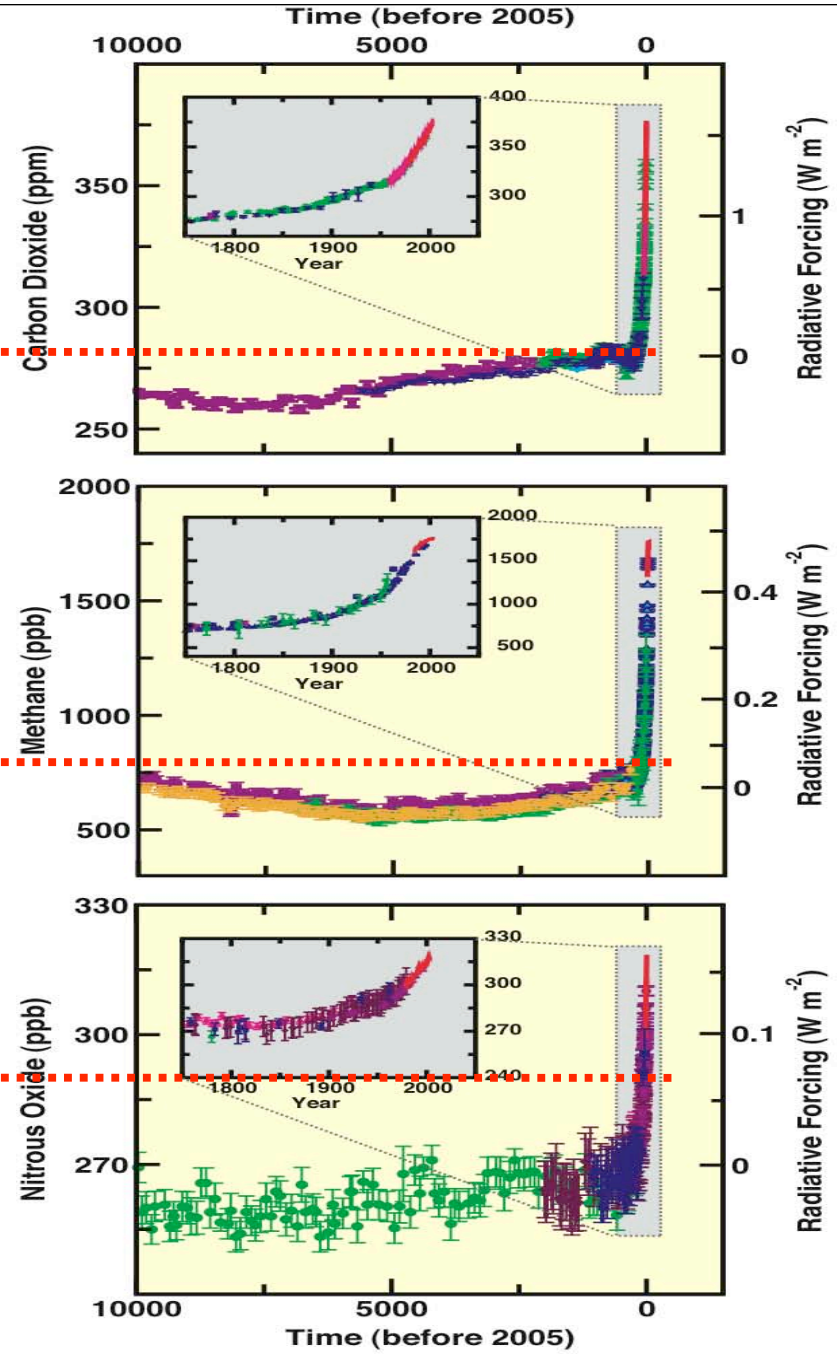
Key Gases

Carbon Dioxide

Peak natural variability over the previous 650,000 years

Methane

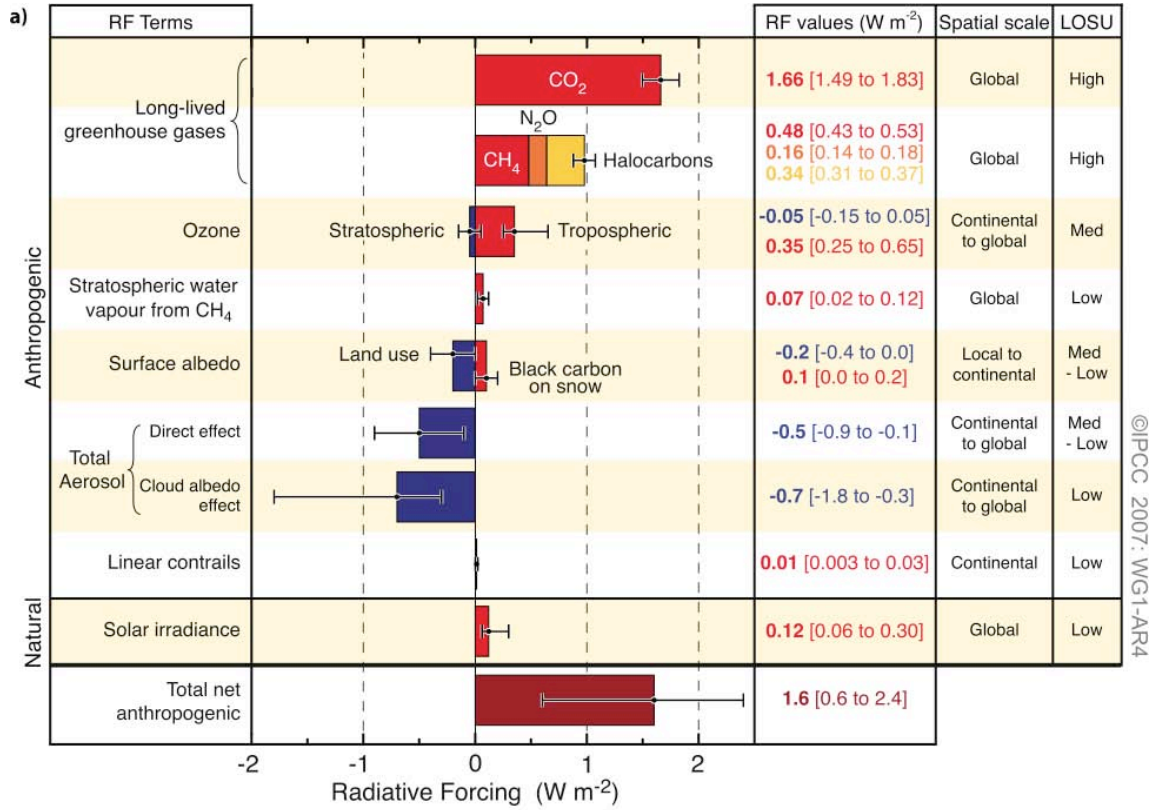
Nitrous Oxide

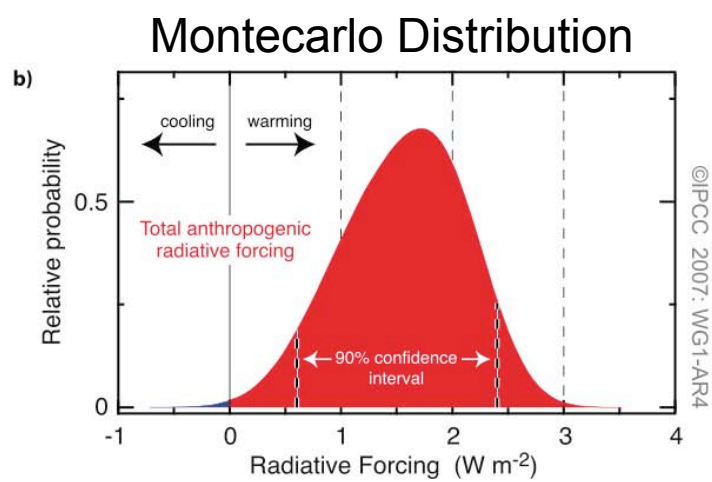


Source: Intergovernmental Panel on Climate Change, Fourth Assessment Report, WG1 (2007)

Net effect of cooling + warming influences...

...is *warming*





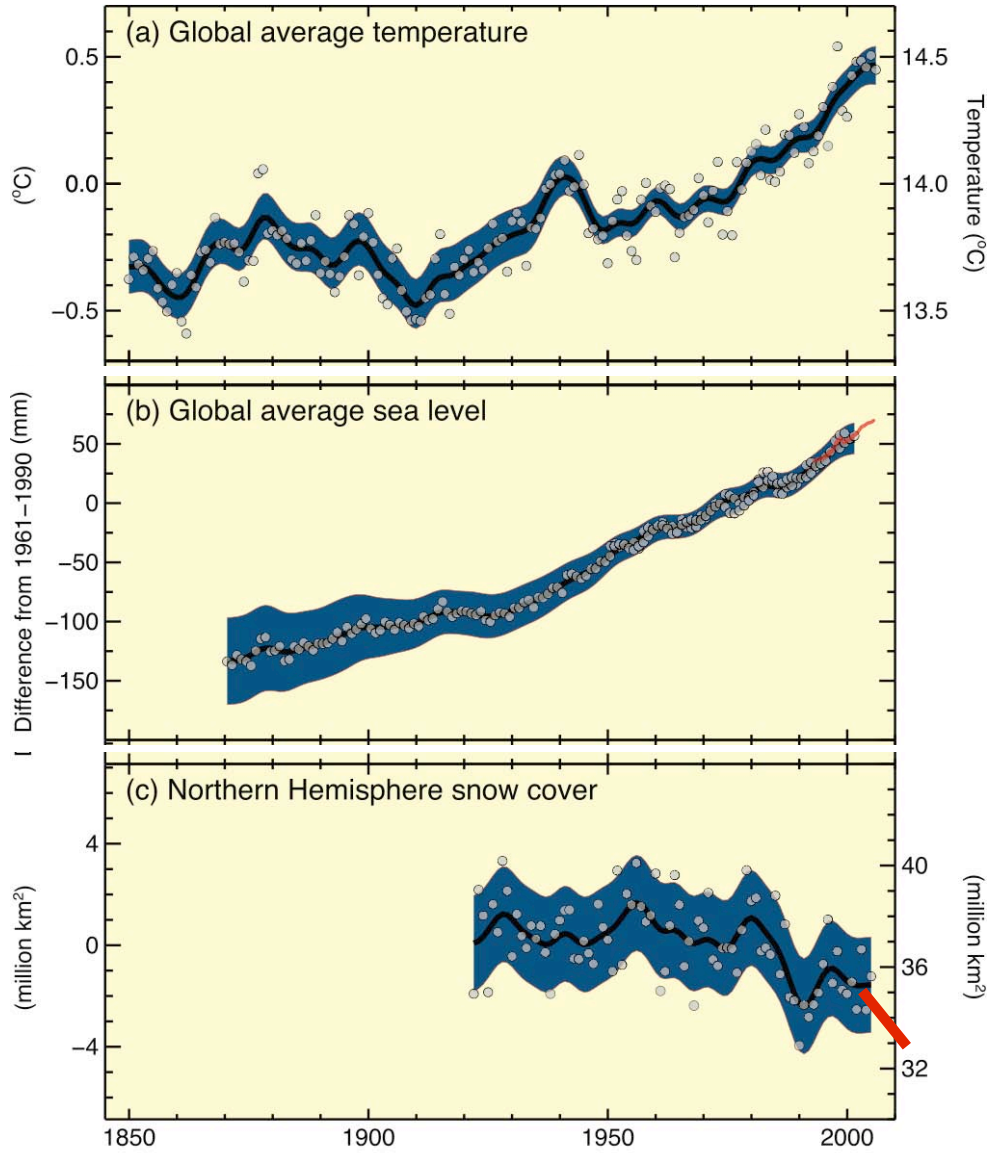
Source: Intergovernmental Panel on Climate Change, Fourth Assessment Report, WG1 (2007)

FINGERPRINTS...
Recent Indicators of Climate Change

Global average temperature (*accelerating*)

Global average sea level

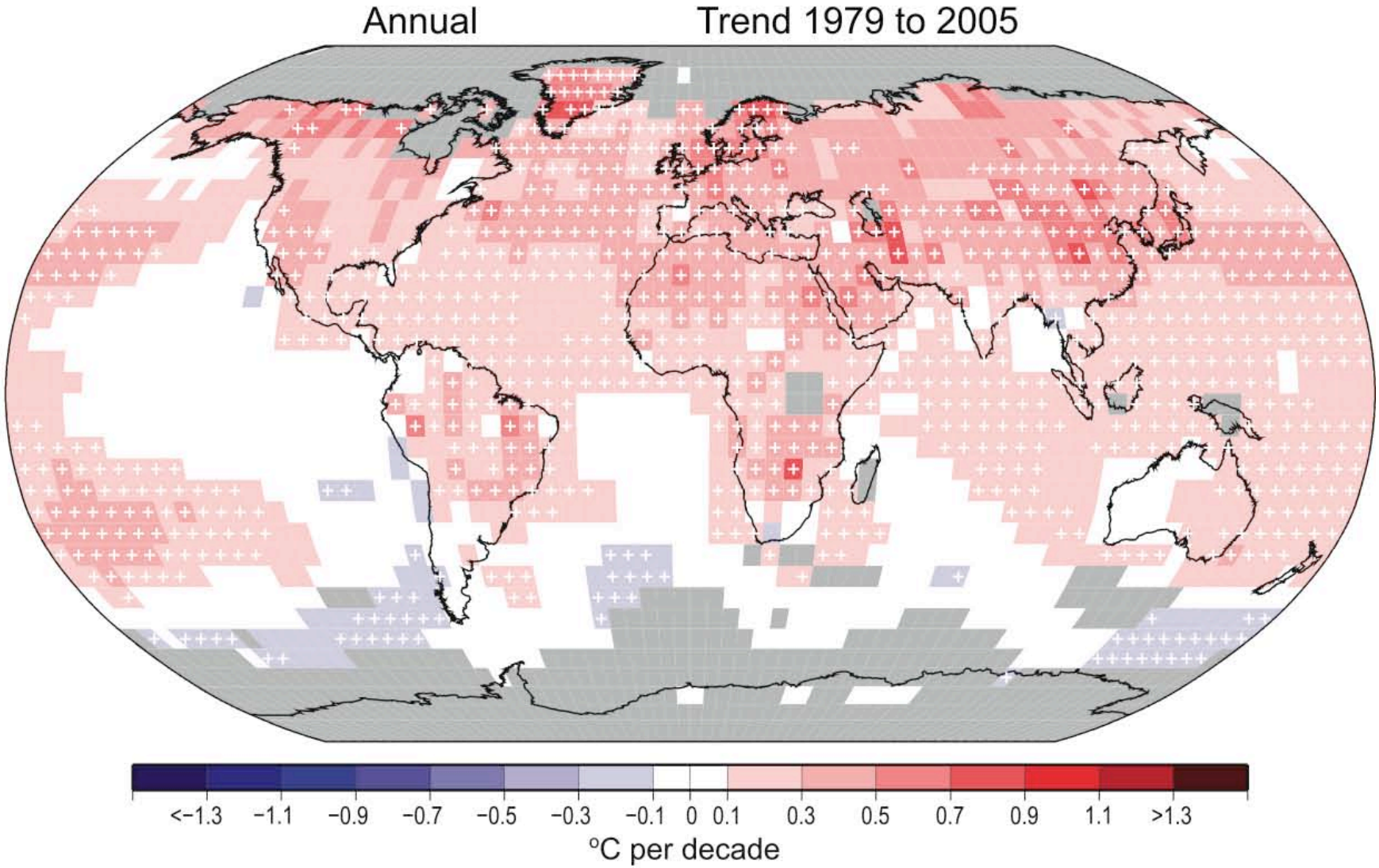
Northern hemisphere snow cover (*accelerating*)



Source: IPCC 4th Assessment (2007)

Linear Warming Trend

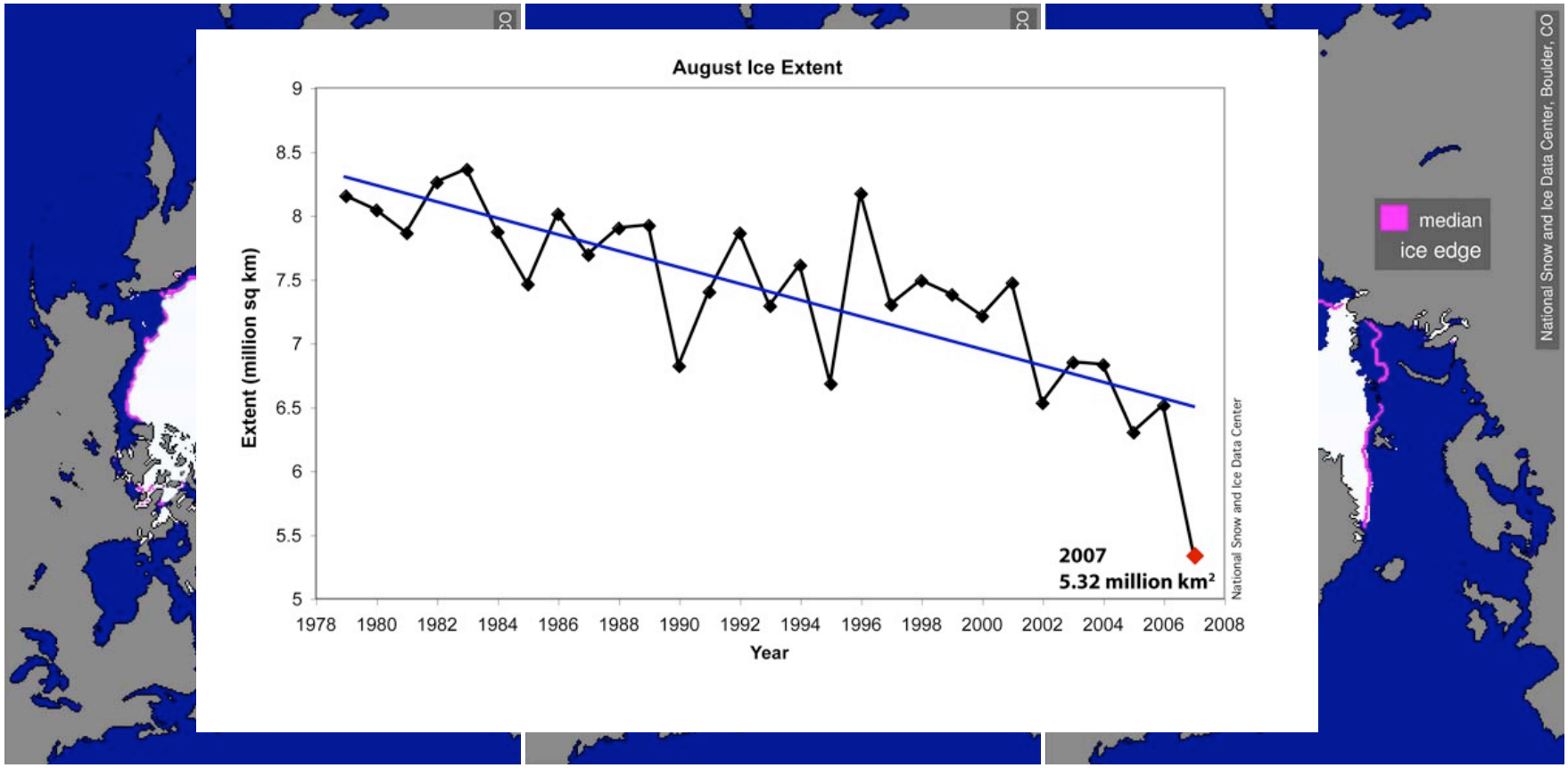
Areas with a "+" significant at the 5% level



Source: IPCC: grey indicates insufficient data, 18-years of data used to compute trend.

FINGERPRINTS ... Polar ice

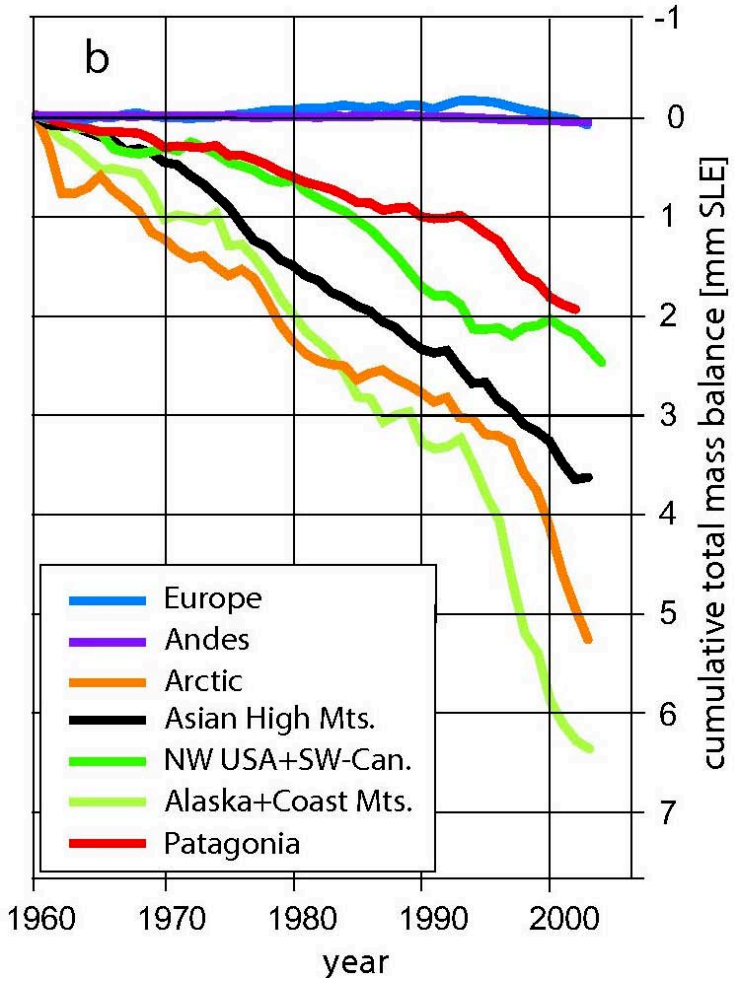
Median 1979-2000 September 21, 2005 September 16, 2007



6.74 M square km 5.32 M square km 4.13 M square km

The difference between median minimum arctic ice coverage and the extent on Sept. 16, 2007 is **equal to the area of Alaska and Texas combined (**2.61 M sq. km or 1 M sq. miles). http://nsidc.org/news/press/2007_seaiceminimum/20070810_index.html

FINGERPRINTS ... Glaciers

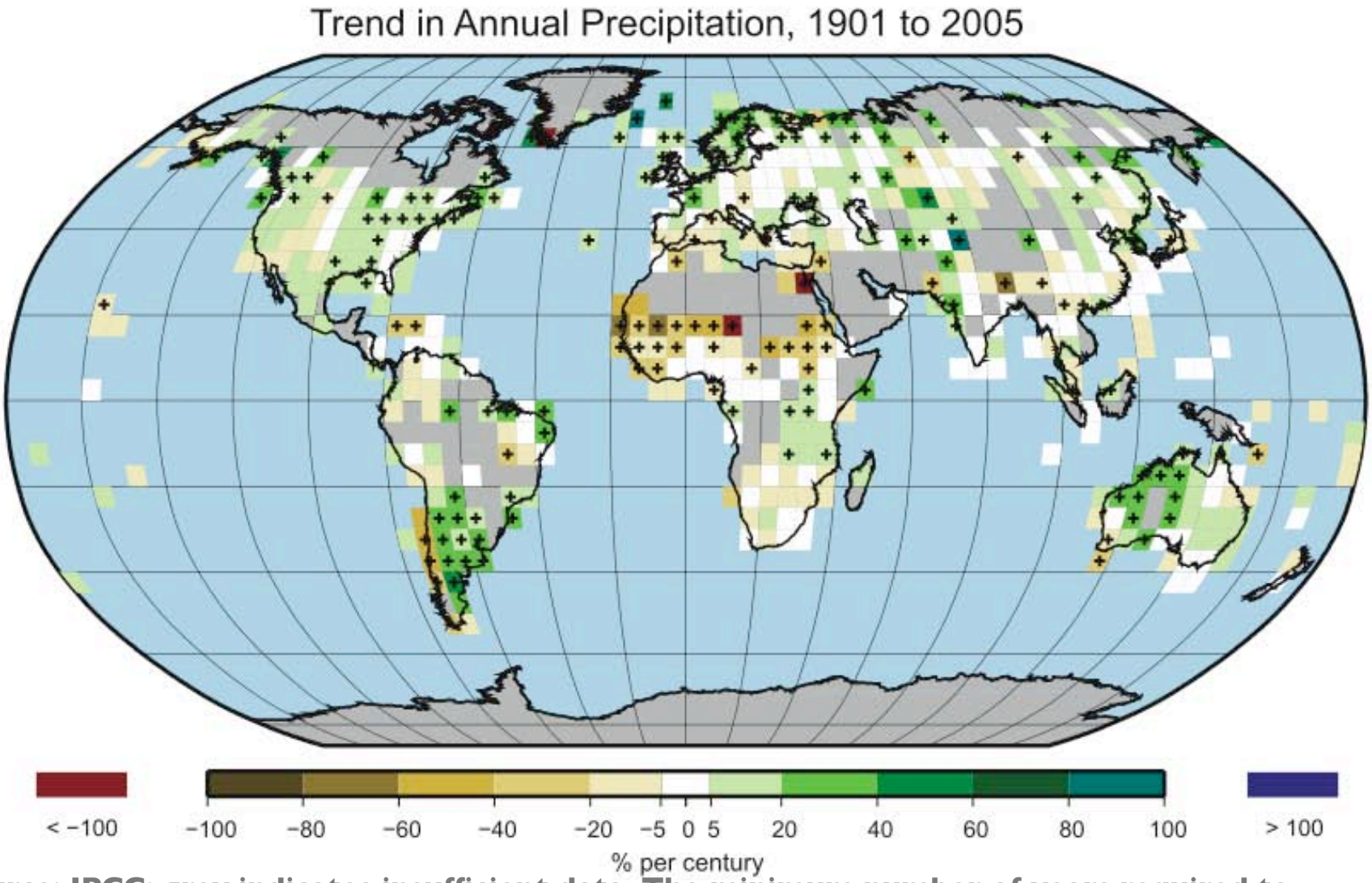


Loss *Accelerating* since early 1990s

Source: IPCC 4th Assessment (2007)

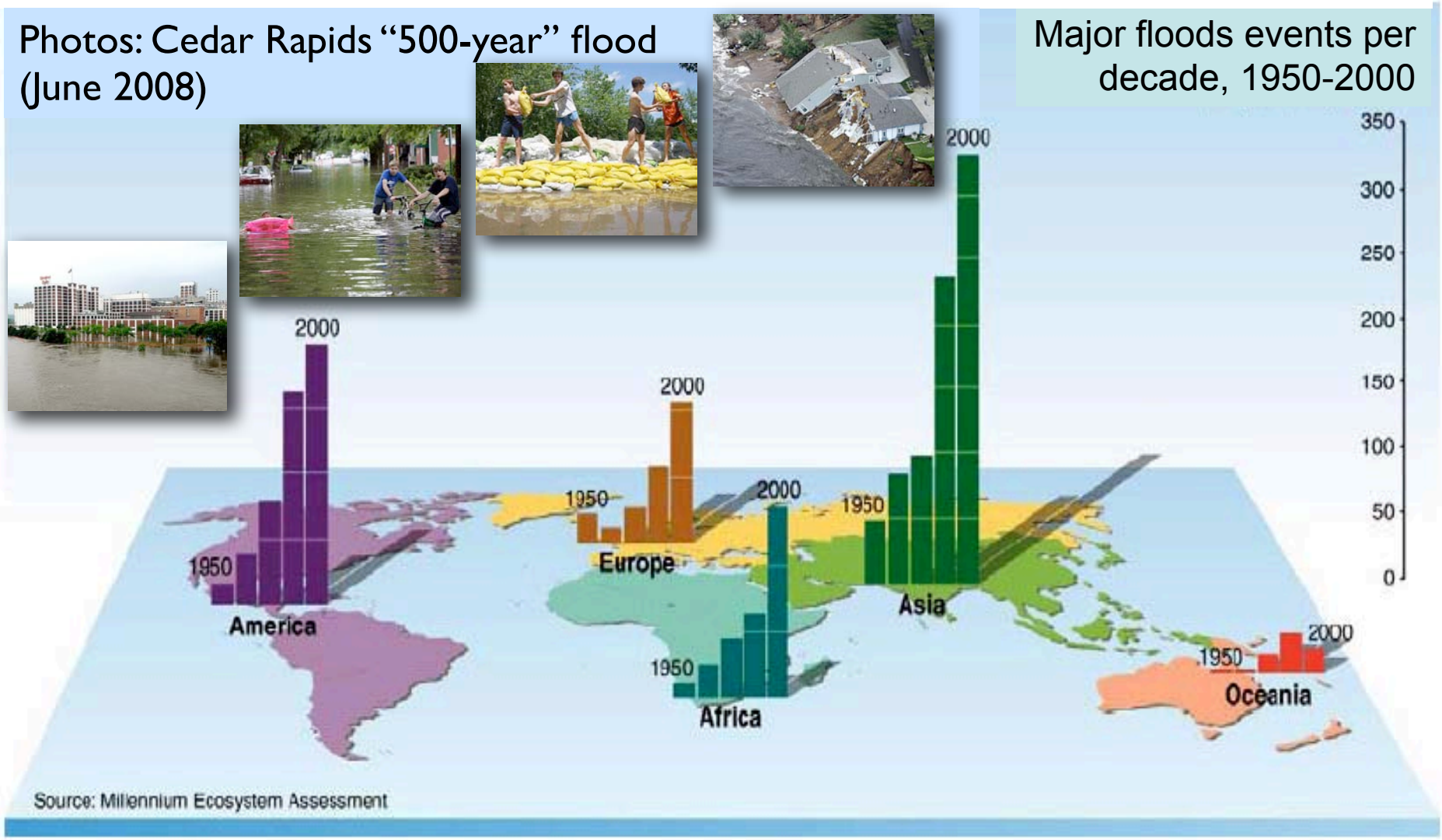
Linear Land Precipitation Trend

Areas with a "+" significant at the 5% level



Source: IPCC: grey indicates insufficient data. The minimum number of years required to calculate a trend value is 66 for 1901 to 2005 and 18 for 1979 to 2005. Baseline 1961-1990

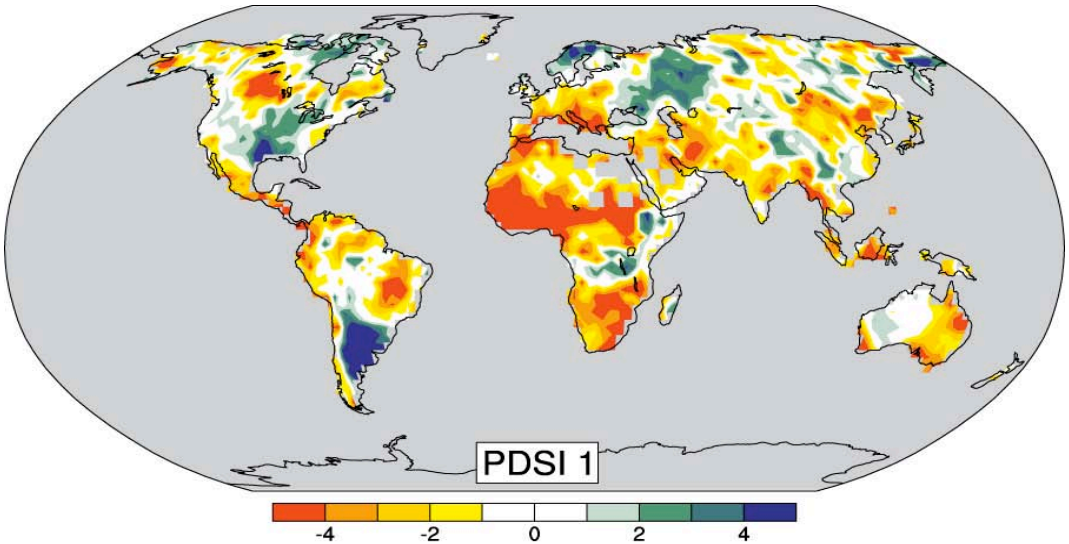
FINGERPRINTS ... Floods



There's a consistent 50-year upward trend in every region except Oceania.

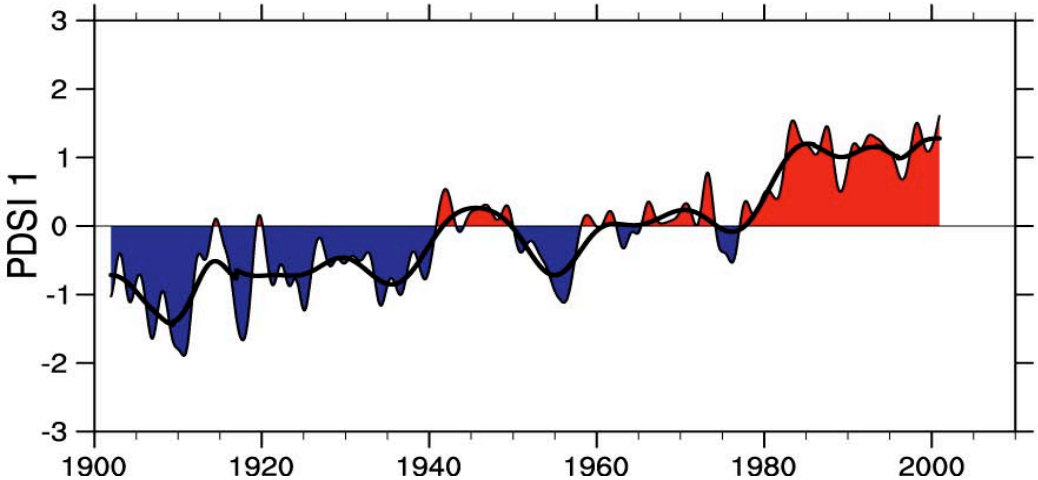
FINGERPRINTS ... Drought

Change in Palmer Drought Severity Index (PDSI) for 1900 to 2002



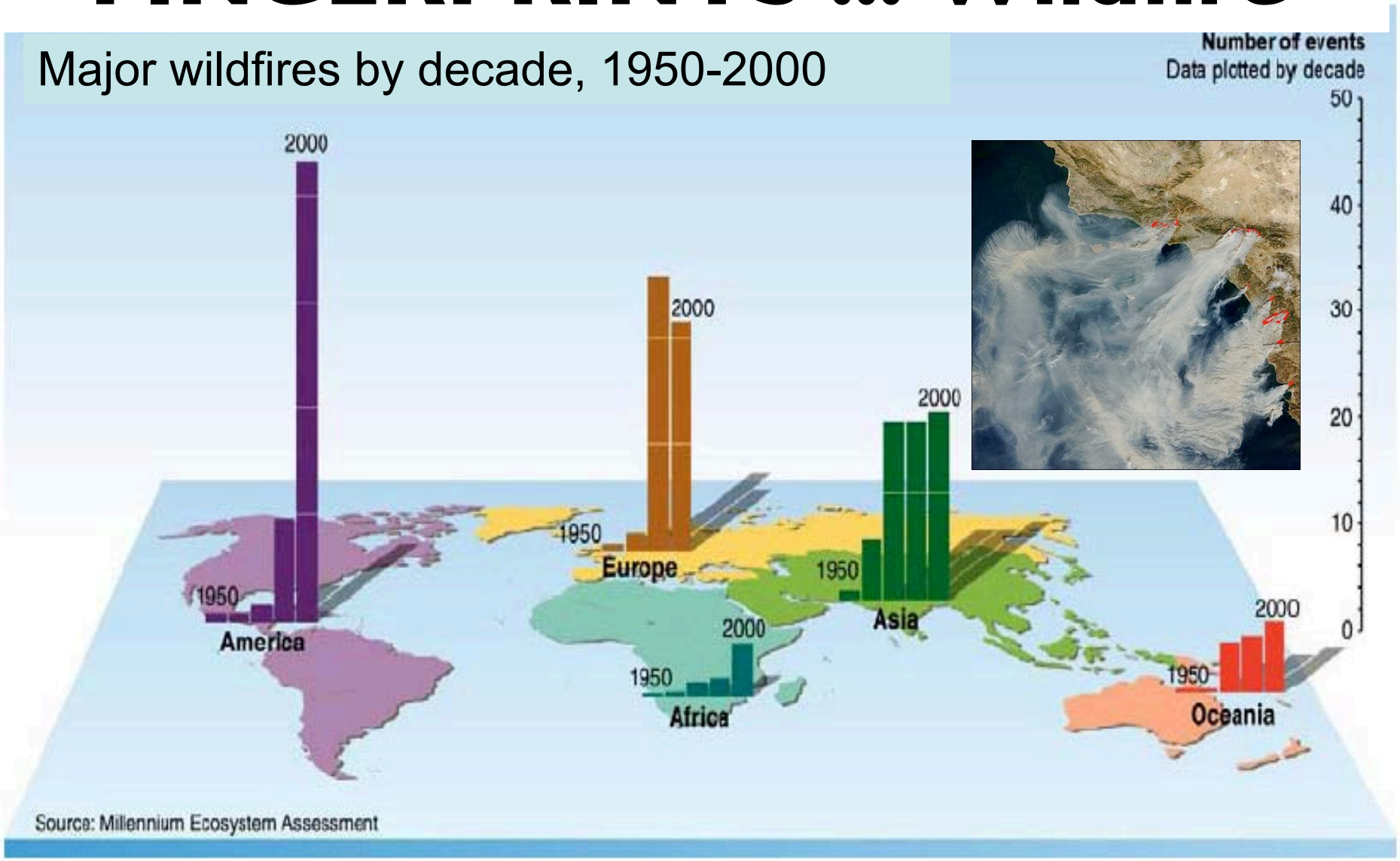
Proportion of land area in extreme drought predicted to increase from 1-3% to 30% by 2090s.

Drought duration expected to increase 6-fold.



Source: IPCC 4th Assessment (2007)

FINGERPRINTS … Wildfire



The trend has been sharply upward everywhere; CO2 *feedback* is significant

Overwhelming Correlations

IPCC Synthesis of Scientific Literature on *Observed* Changes 1970-2004

577 studies reviewed by IPCC

- 765 observed **physical** changes (94% consistent with warming)

- 28,671 observed **biological** changes (90% consistent with warming)

Source: IPCC 4th Assessment (2007)

“Frequently Asked Questions”

- **“Why worry, aren’t we going into another ice age anyway?”**
  - Yes, but not for 10’s of thousands of years. Meanwhile, the earth is dangerously warming over a timeframe of decades.
- **“Isn’t there ‘global warming’ on Mars, too?”**
  - Not global, regional (just at south pole)
  - Caused by dust storms; cycles a lot each year
  - Sunspots change climates on any planet, but effect is swamped by CO2 on earth
- **“In geological history, didn’t CO2 increases *follow* temperature?”**
  - No, actually largely simultaneous.
  - Other processes (e.g. biomass die-offs, ocean circulation, Milankovitch cycles, etc.) often start a warming process, which often mobilizes CO2, which then amplifies the warming
  - In any case, we know without a doubt that last 100 years of warming has followed emissions extremely tightly, and validated models tell us this will continue
- **“Yeah, but you guys used to say we had global cooling.”**
  - Mostly northern hemisphere, not global
  - Caused by sulfate aerosols temporarily masking CO2 induced warming & suppressing hurricane activity
- **Have you read David Chrichton’s book?**
  - If I need brain surgery, I’m not going to go to a podiatrist!

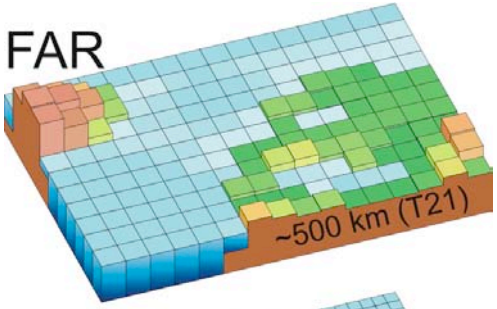
http://www.realclimate.org/

Donuts Exist Despite the Holes

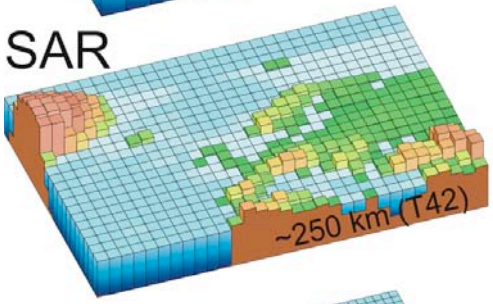
Source: Krispy Creme

Climate Modeling Has Become Far More Precise

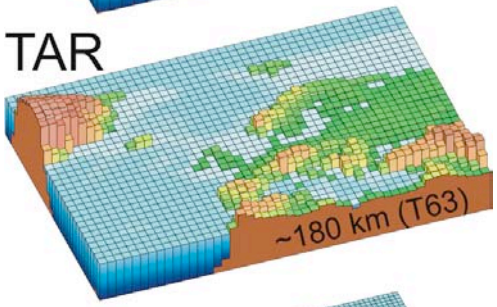
1990



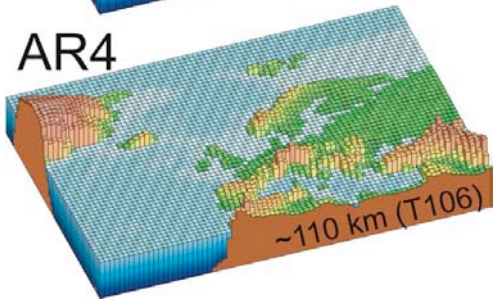
1995



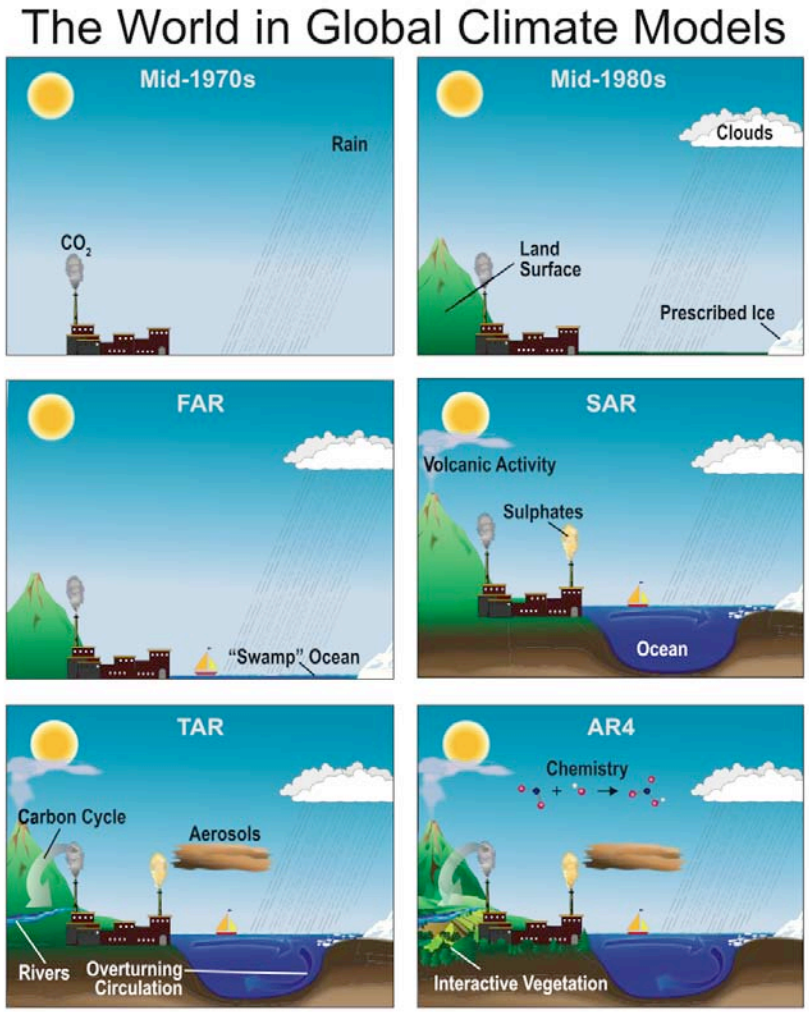
2000



2005



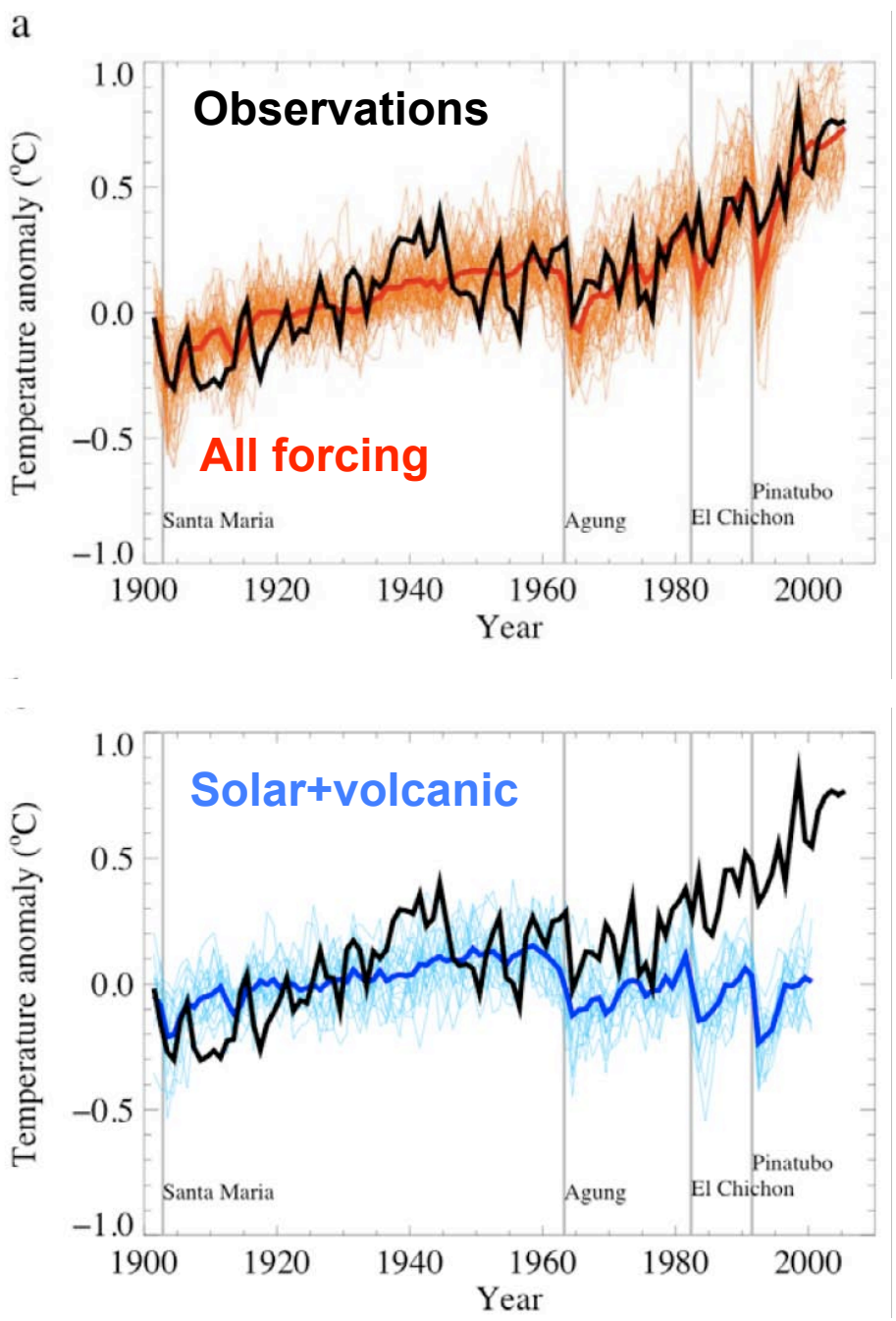
25x improved resolution!



Source: Intergovernmental Panel on Climate Change, Fourth Assessment Report, WG1 (2007)

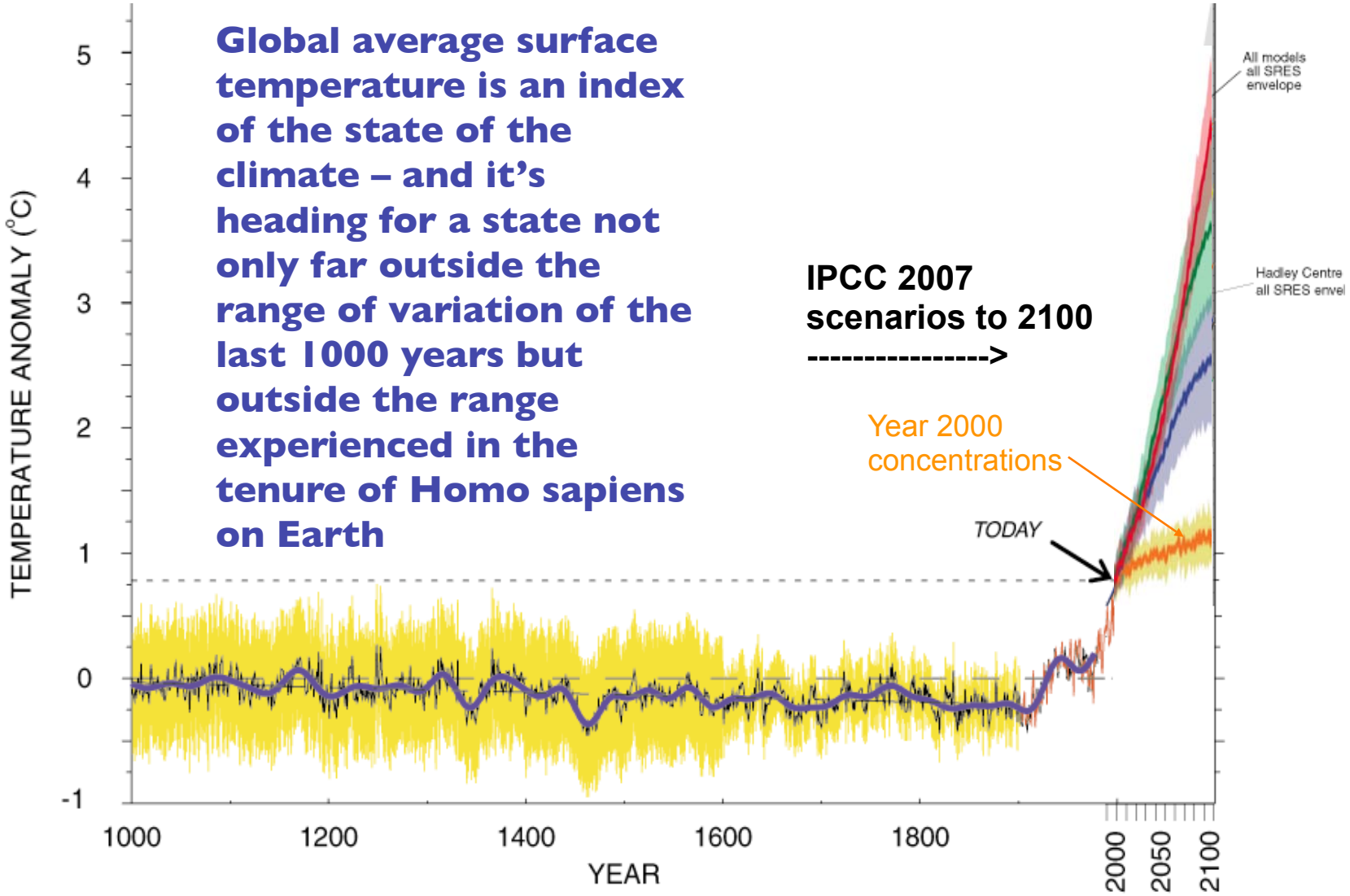
Attribution

Our models predict history very well, so we are confident in their ability to project future impacts



Source: IPCC 4th Assessment (2007)

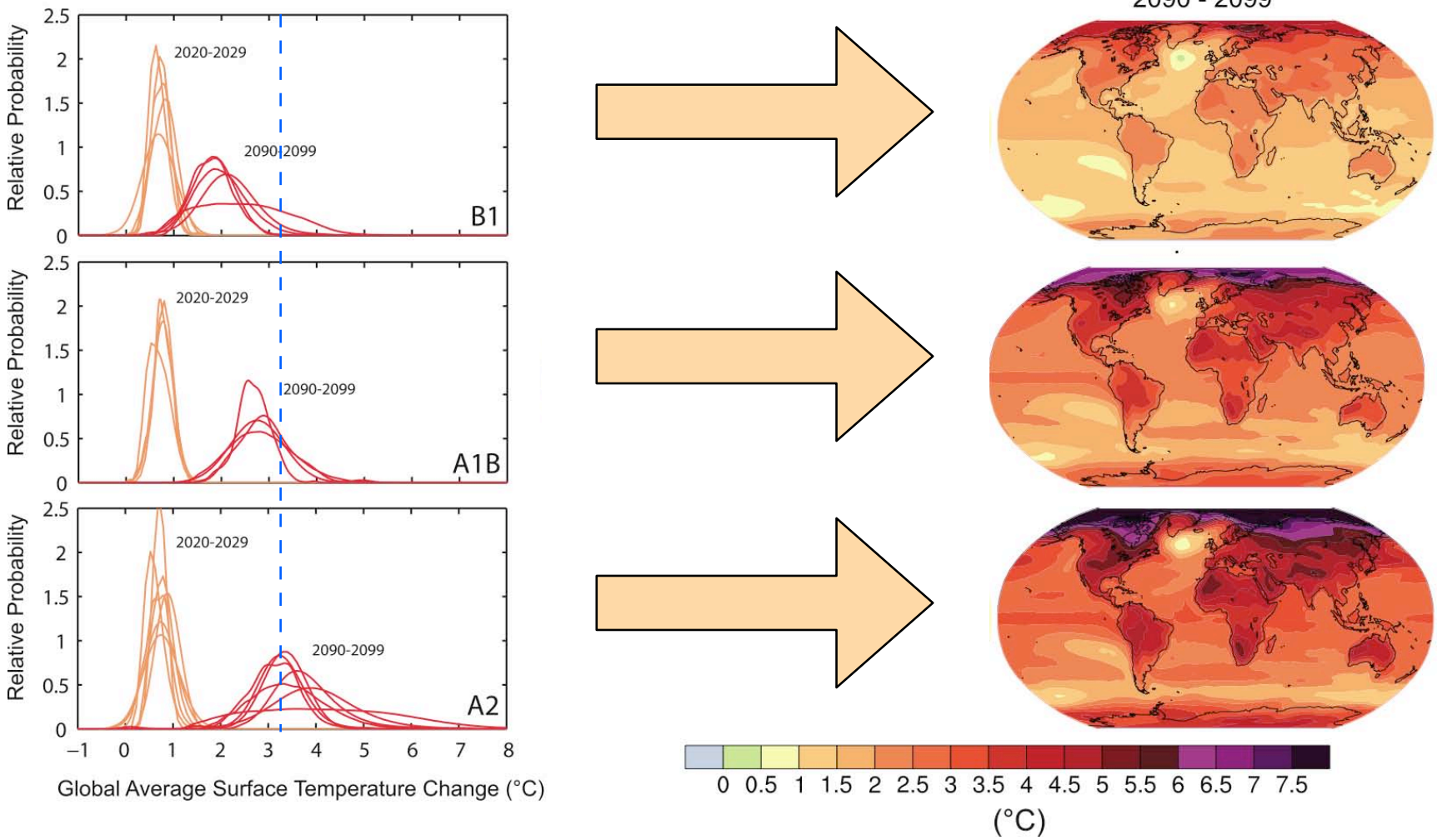
If we don't alter course, we'll end up where we're headed



Source: John Holdren, after IPCC (2007)

Range of Predicted Warming: By Scenario and Timeframe

Extreme differences in "tails"



Source: Intergovernmental Panel on Climate Change, Fourth Assessment Report, WG1 (2007)

Anticipated Insurance Losses

Property

- Property damage
- Marine mishaps
- Mold/moisture
- Forest products
- Agricultural losses
- Fisheries
- Business interruption
- Roadway

Life/ Health

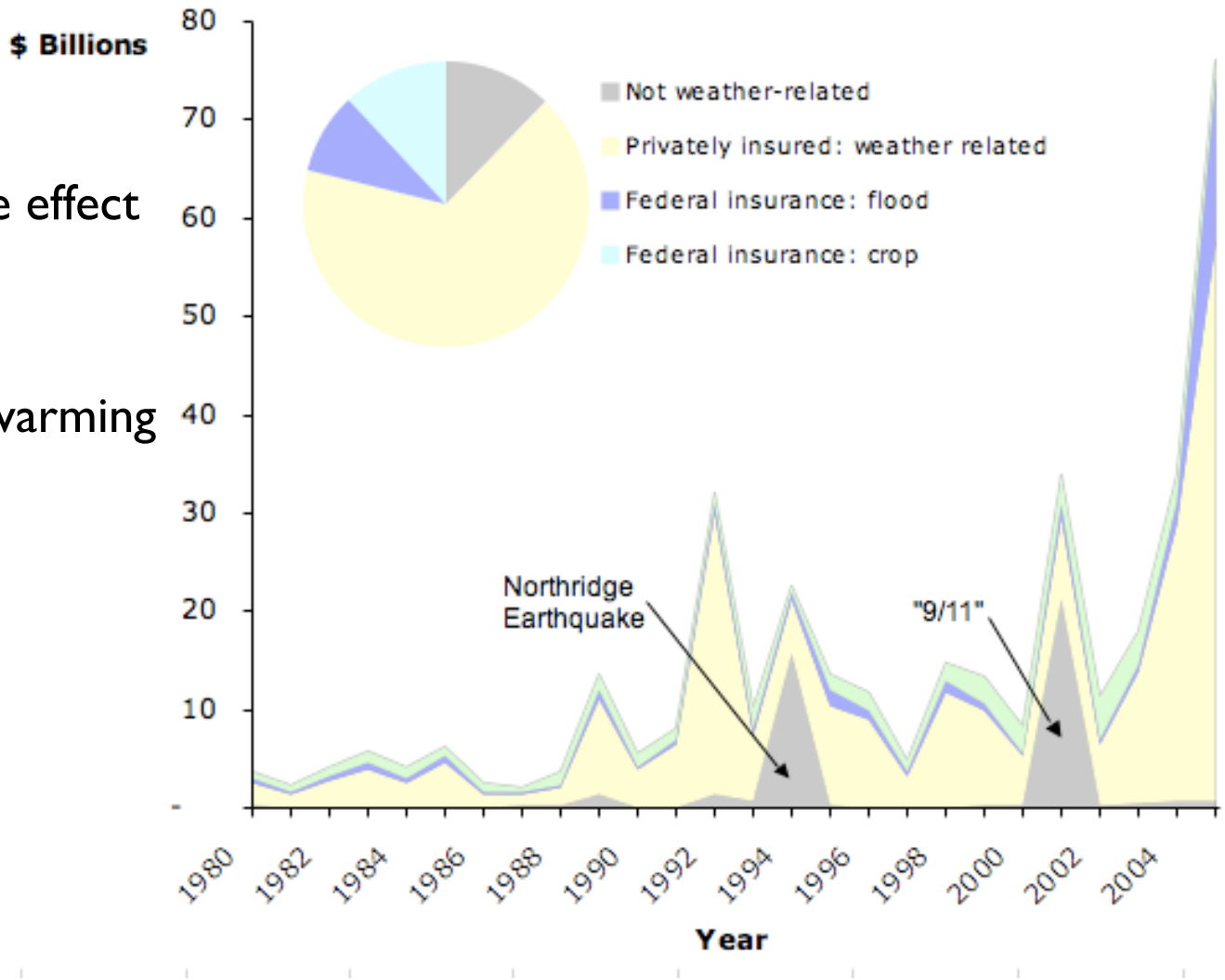
- Injury
- Infectious diseases
- Vector-borne diseases
- Heat stress
- Respiratory
- Pollution release
- Food safety
- Mental health
- Nutrition/water
- Roadway safety

Liability (Casualty)

- Products
- Negligence
- Nuisance
- Fiduciary
- Tort / BI
- Environmental
- Roadway liability insurance

US CAT Losses: 1980-2005

- This is <u>not</u> simply the effect of climate change
- Combined effects of demographics **<u>and</u>** warming

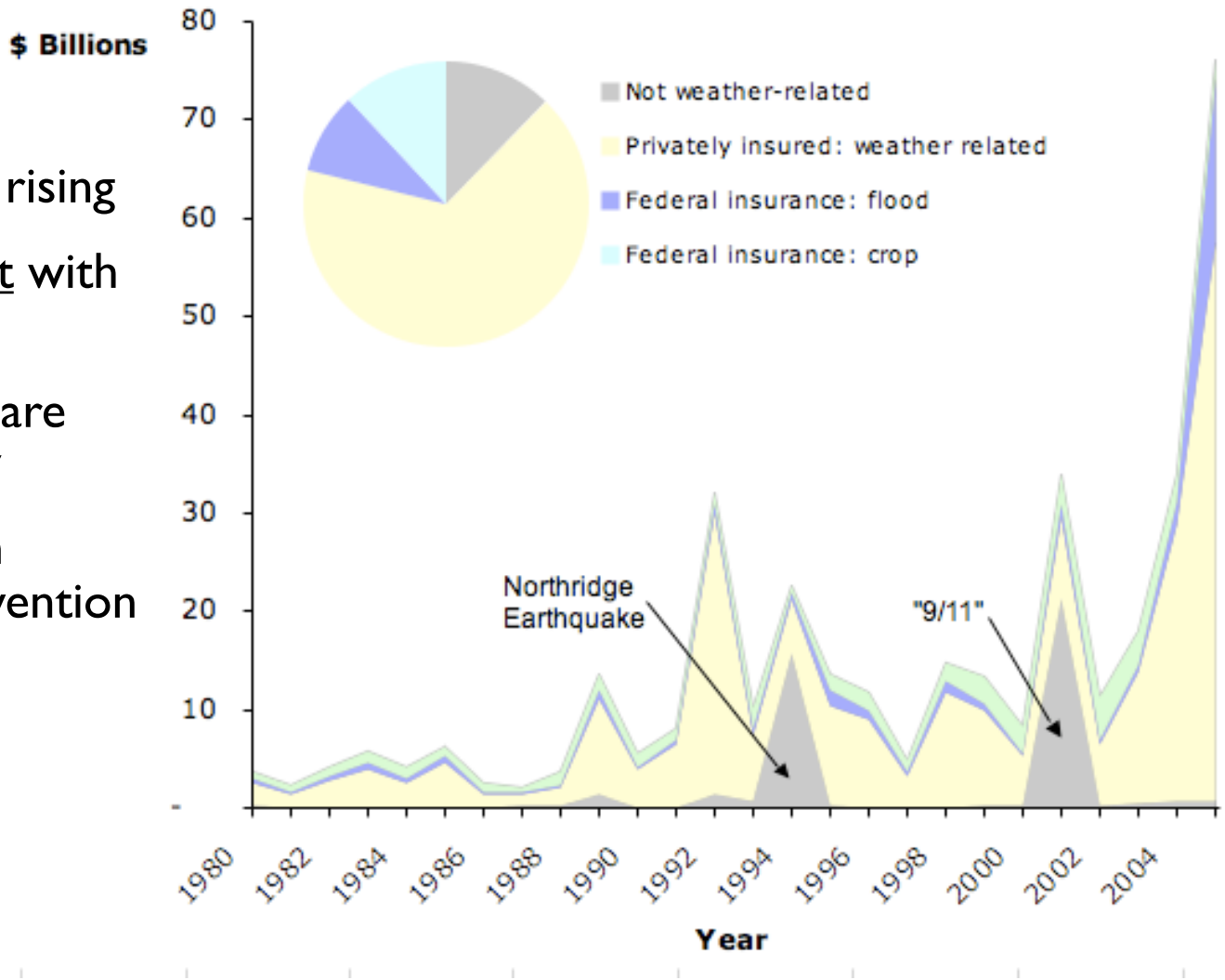


Source: U.S. Government Accountability Office, 2007

US CAT Losses: 1980-2005

but.....

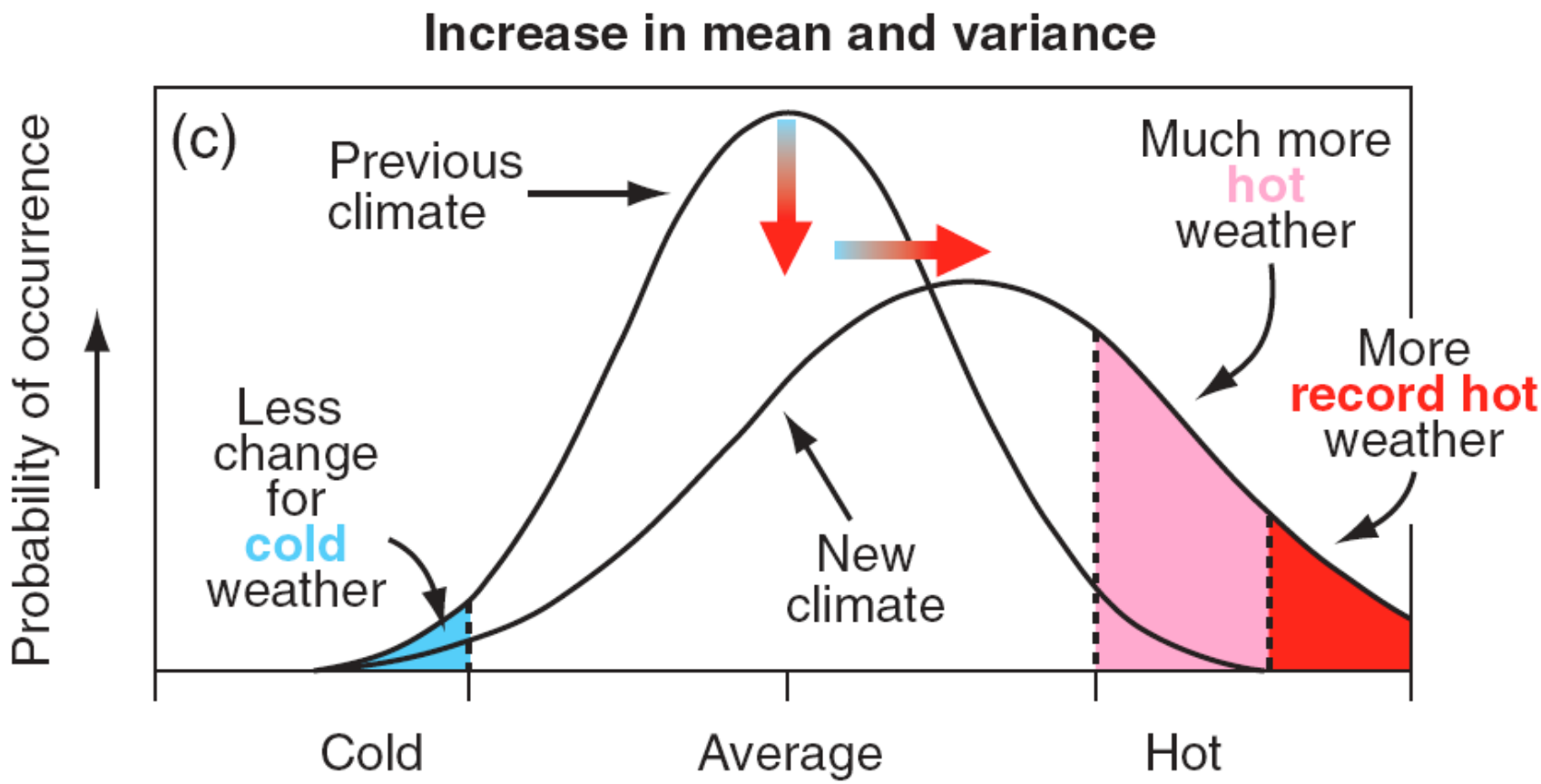
- Number of events is rising
- Trends are consistent with observed change
- Non-weather losses are growing more slowly
- Trend would be even steeper without prevention efforts



Source: U.S. Government Accountability Office, 2007

Excludes life/health losses

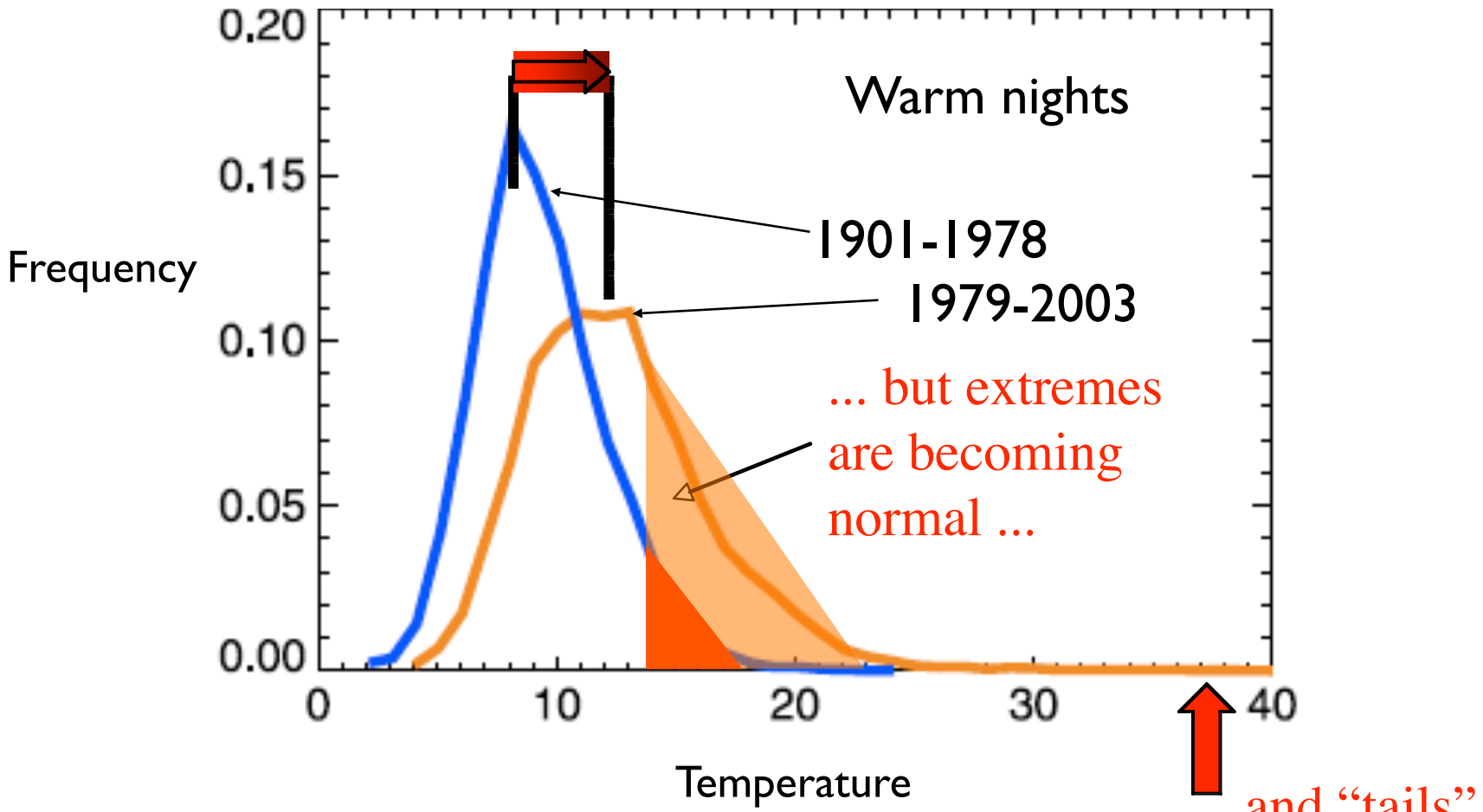
Changes in Extremes



Source: IPCC, Third Assessment Report

Extremes Shift *More* Than Avg

Small changes in averages...



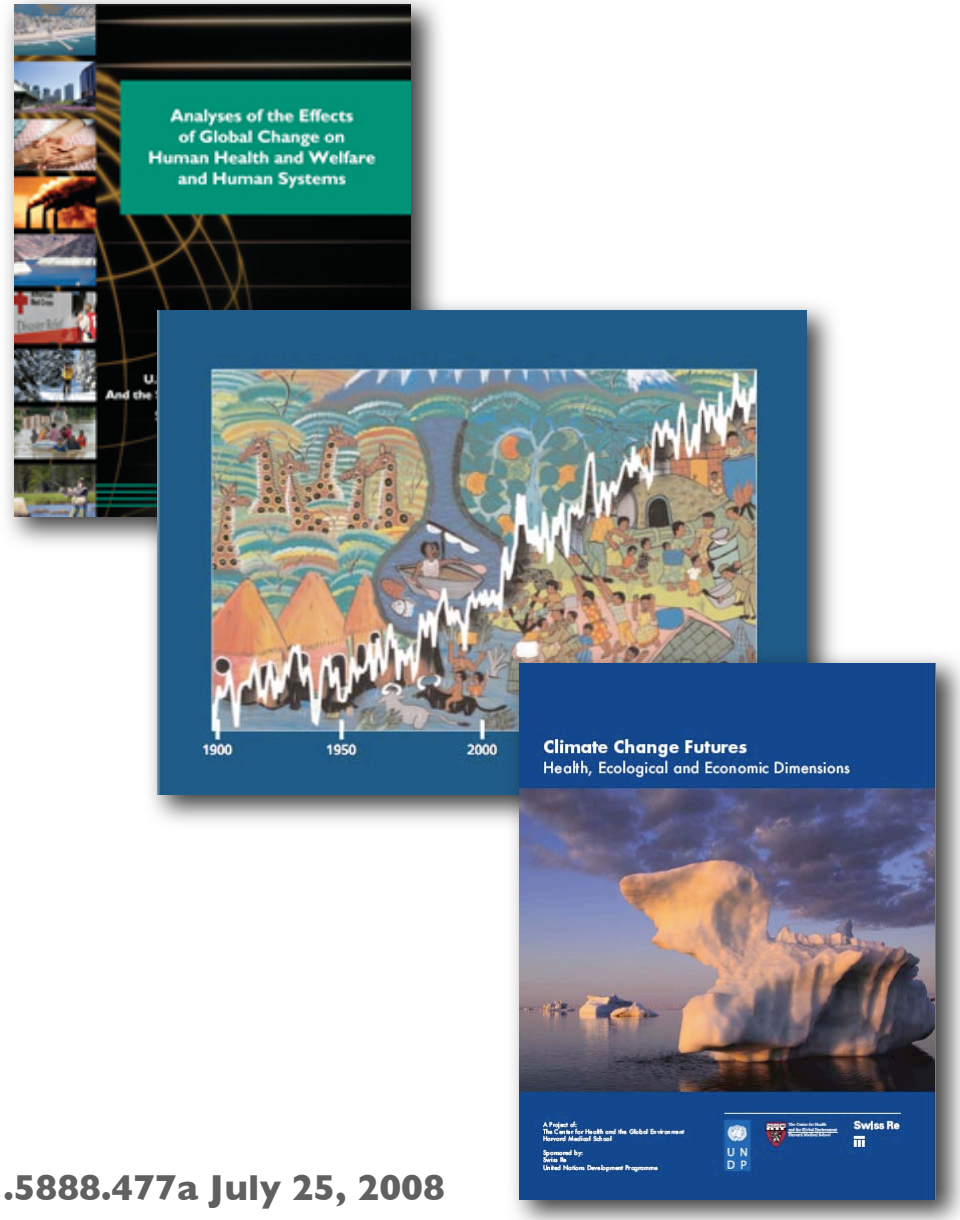
Source: Alexander, et al, J. Geophysical Research, 2005

Life/Health Dimensions

- "The bottom line is that there are very real health risks associated with climate change."*

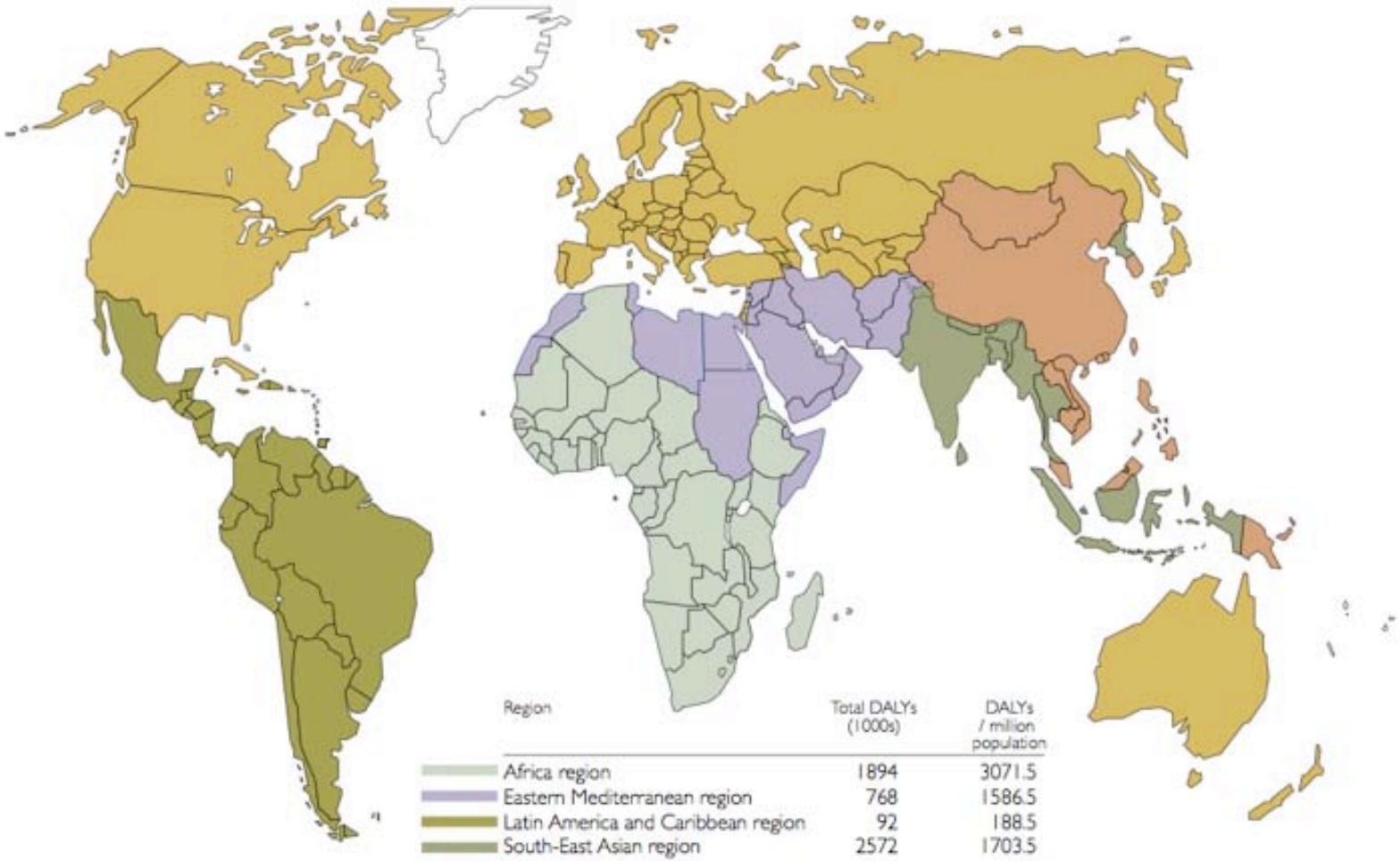
  - *Centers for Disease Control and Prevention (CDC) epidemiologist Howard Frumkin*

- CDC spends less than $1 million per year on climate related programs



*Eli Kintisch, SCIENCE, DOI: 10.1126/science.321.5888.477a July 25, 2008

World Health Organization (WHO) estimates 150,000 yearly deaths from climate change (as of 2000)

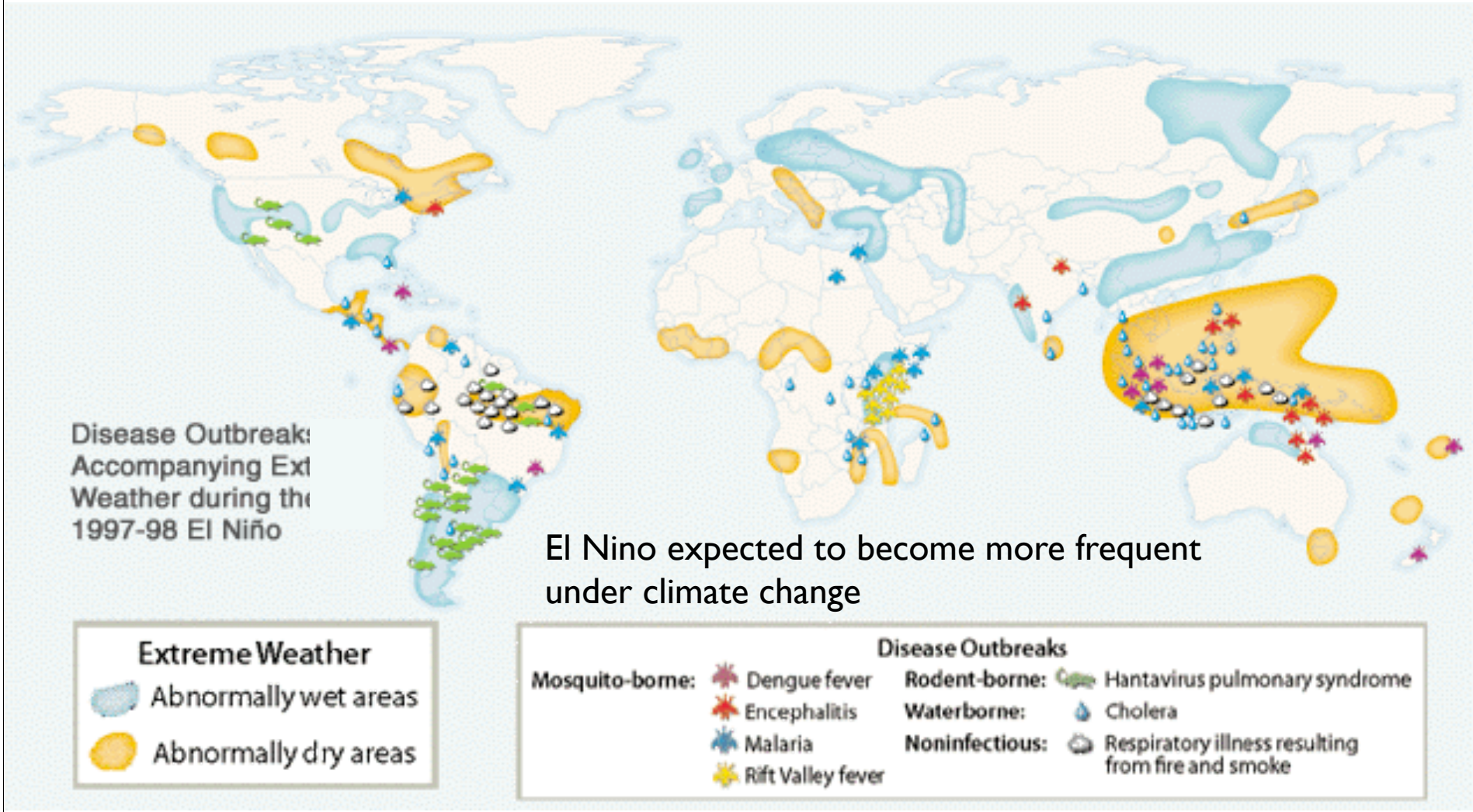


Region	Total DALYs (1000s)	DALYs / million population
Africa region	1894	3071.5
Eastern Mediterranean region	768	1586.5
Latin America and Caribbean region	92	188.5
South-East Asian region	2572	1703.5
Western Pacific region*	169	111.4
Developed countries**	8	8.9
WORLD	5517	920.3

* without developed countries; ** and Cuba

World Health Organization, *Climate Change and Human Health - Risks and Responses*, 2003.

Correlation of Disease Clusters with the 1997-1998 El Nino Extremes

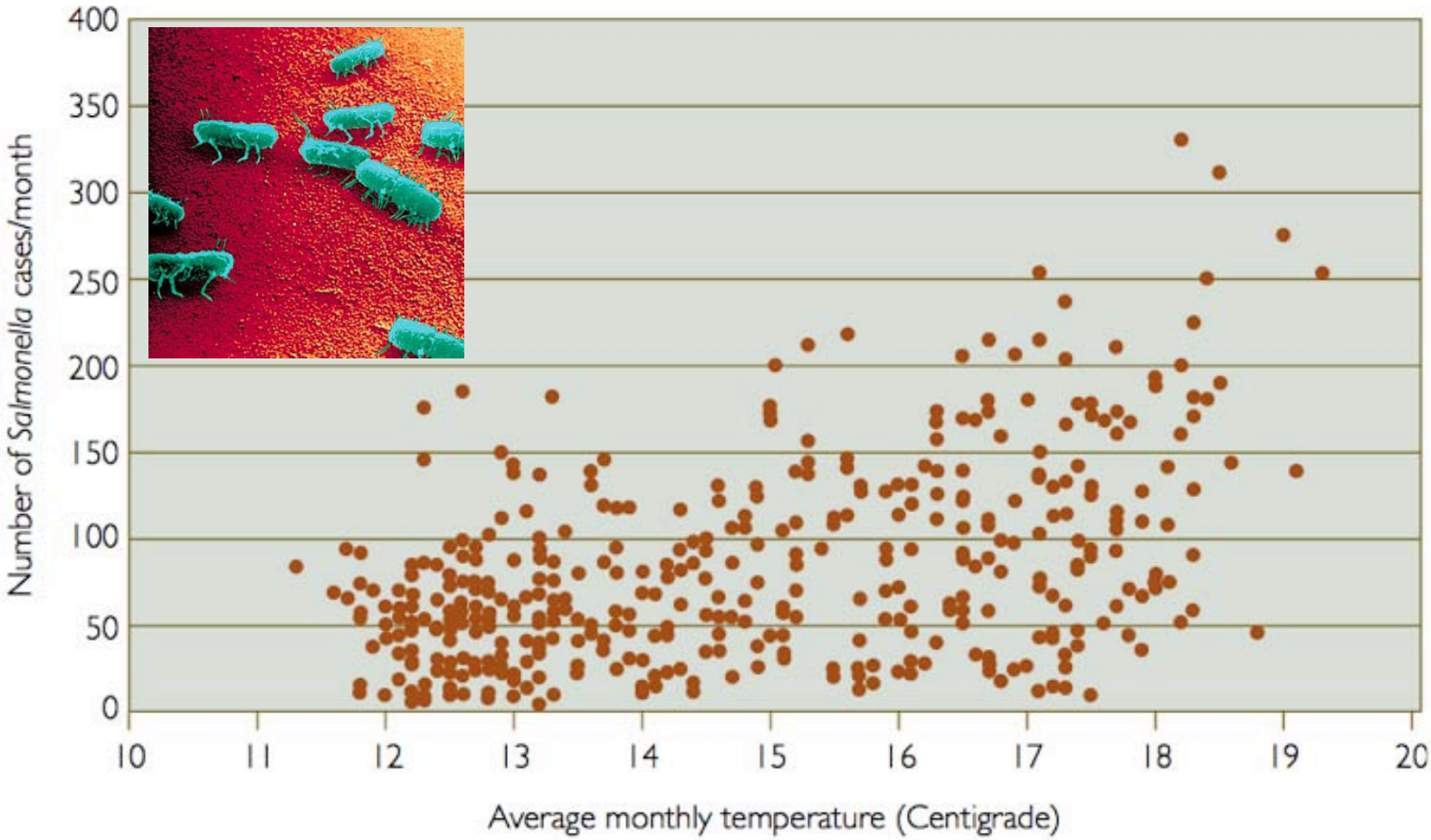


El Nino expected to become more frequent under climate change

Source: P. Epstein, Harvard Medical School, *Science*

Salmonella

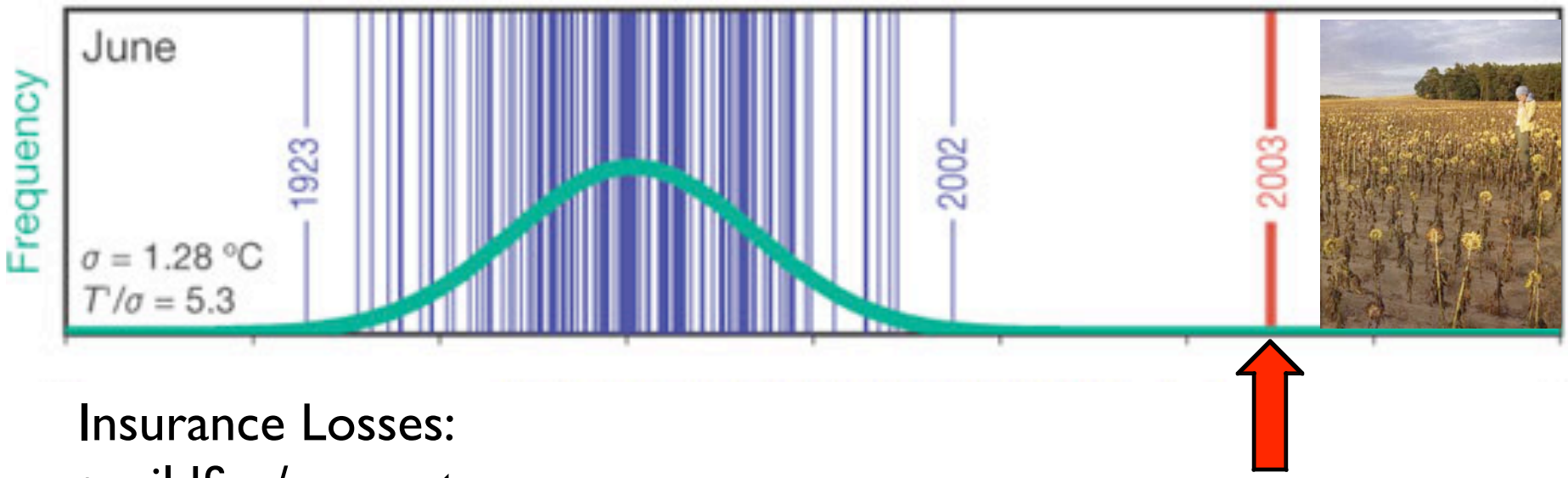
Figure 4.2 Relationship between mean temperature and monthly reports of Salmonella cases in New Zealand 1965 - 2000



World Health Organization, *Climate Change and Human Health - Risks and Responses*, 2003.

Rare Extremes Cause Most of the Damages & Insured Losses

The European heat wave of Summer 2003



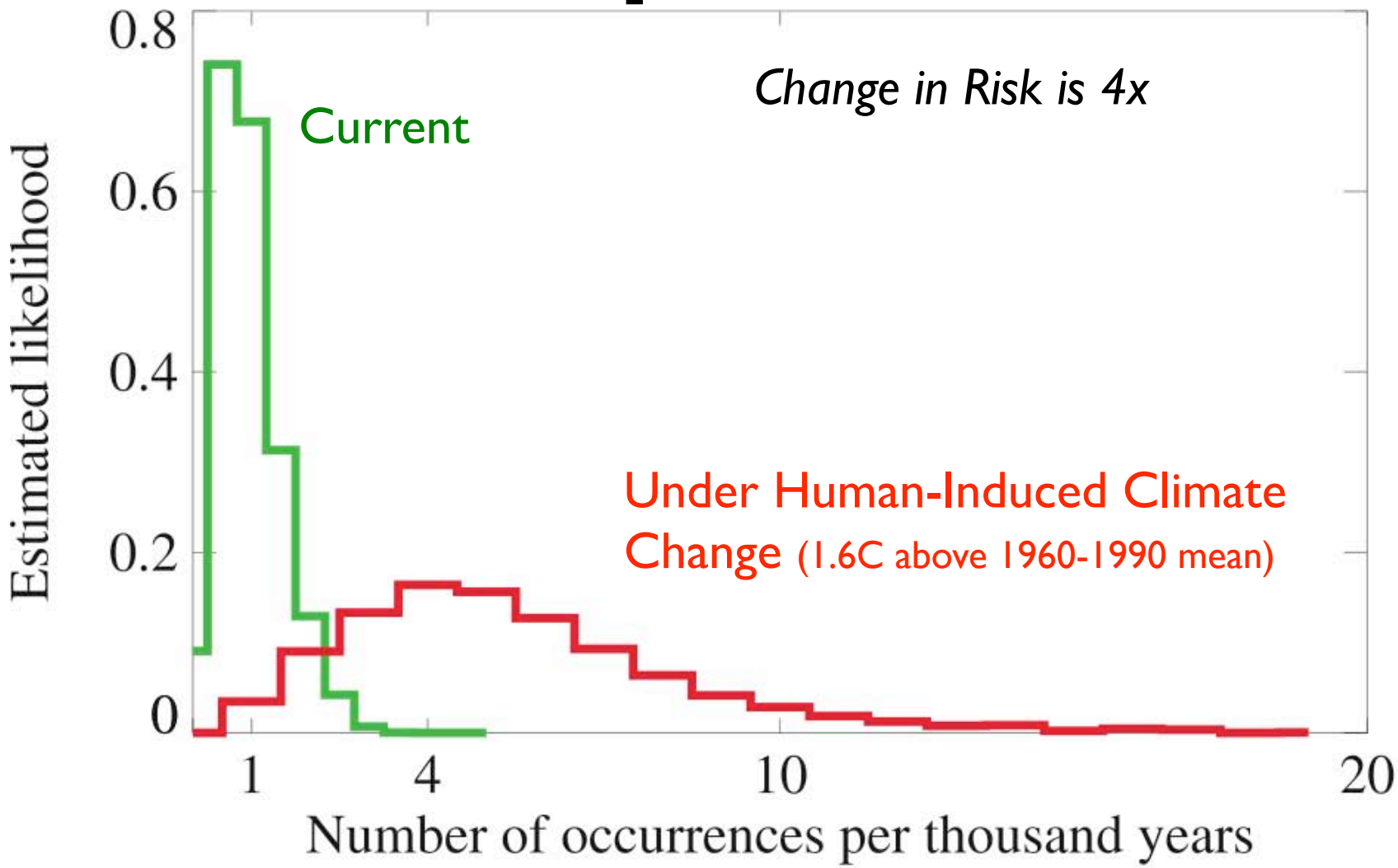
Insurance Losses:

- wildfire/property
- crop
- power sales
- health/mortality

Event was "six-sigmas" outside of norm.
16ºF above average in France and Germany
was a 1-in-10,000 event to 1-in-46,000 event

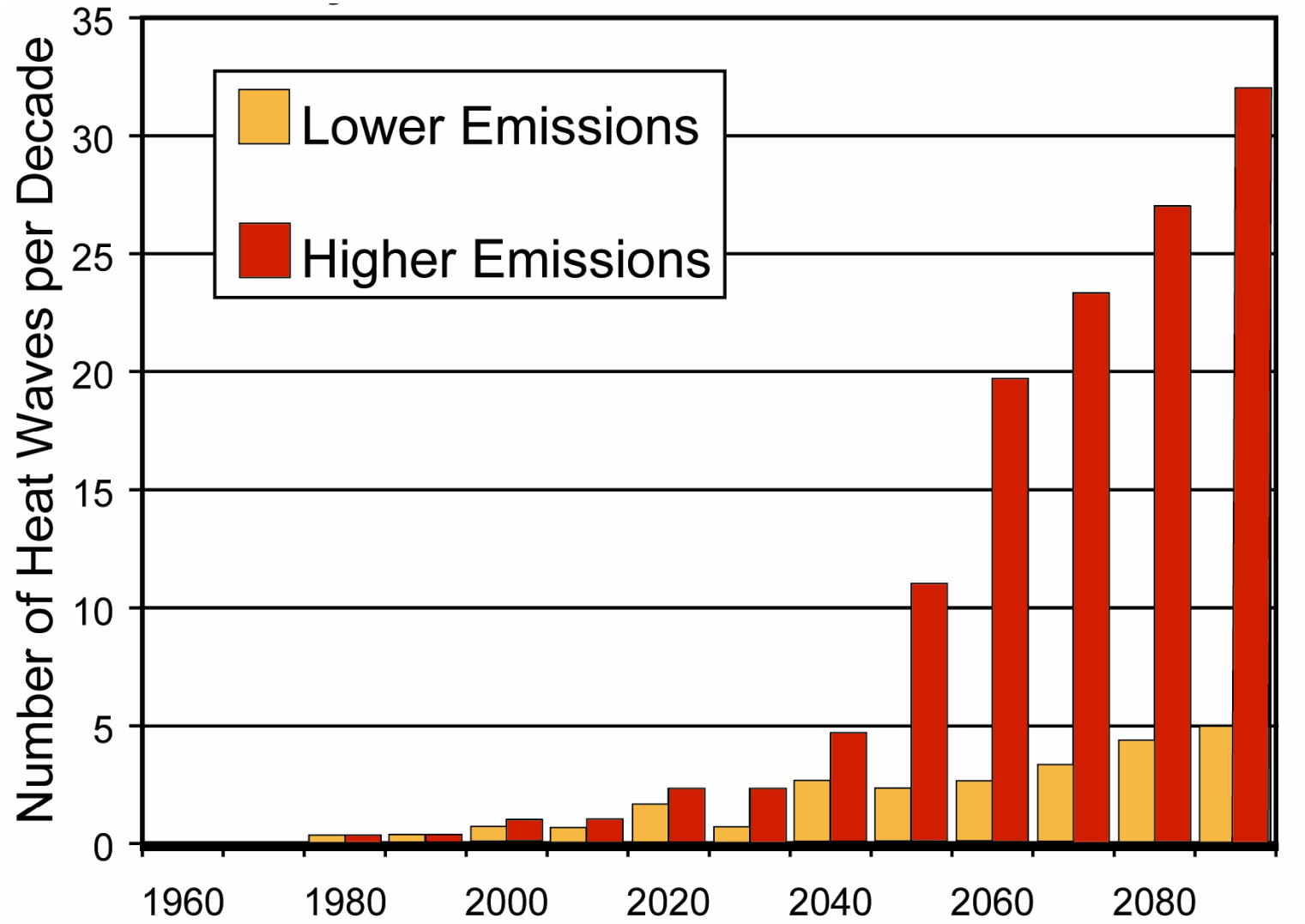
Source: Schar et al, Nature, v. 427, 2004.

Change in Frequency of Extreme European Heat Waves



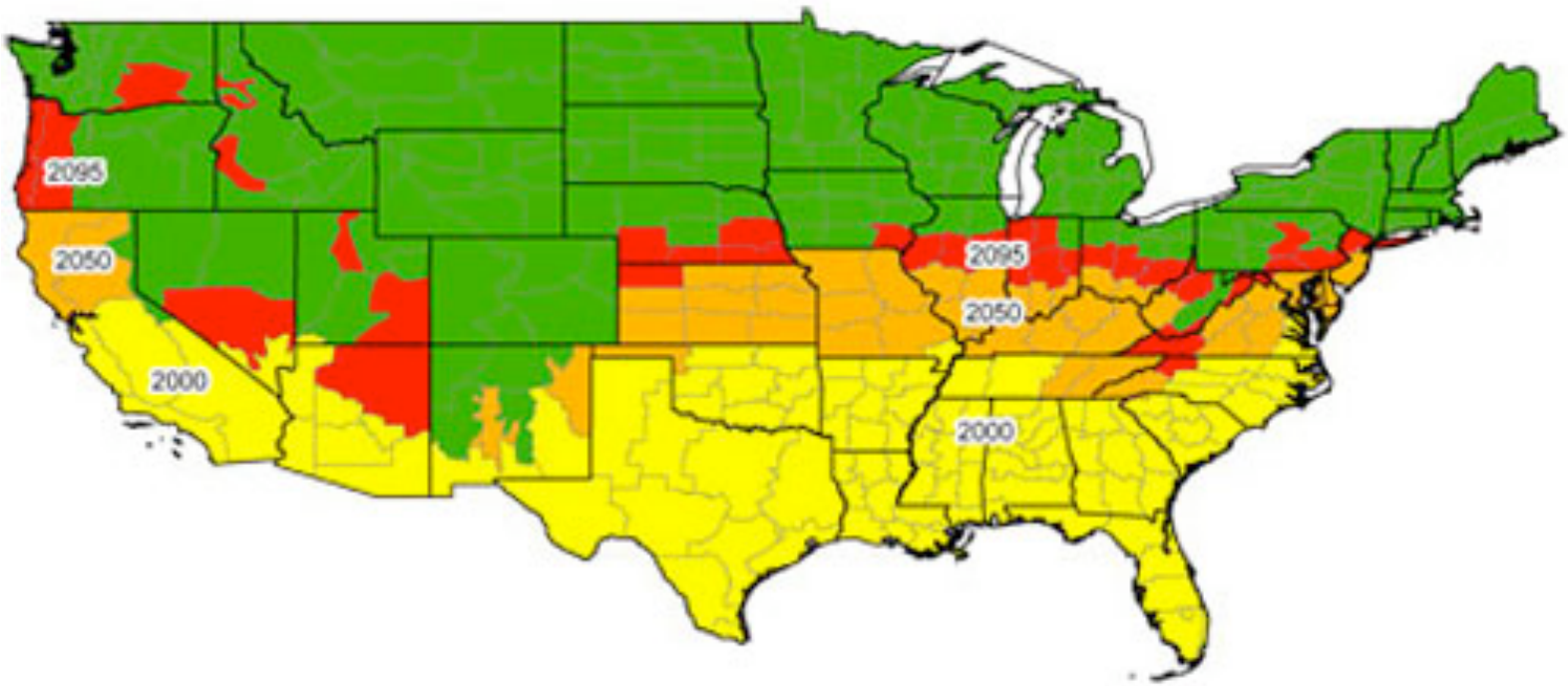
Source: IPCC AR4, Corresponds to 1.6C change in mean

Changes in Severe US Heatwaves



Northward Expansion of Kidney-stone "Belt": 2000-2095

Population grows from 40% to 56% by 2050; 70% by 2095 - increase of 1.6-2.2 million cases, at cost of ~$1 billion per year.

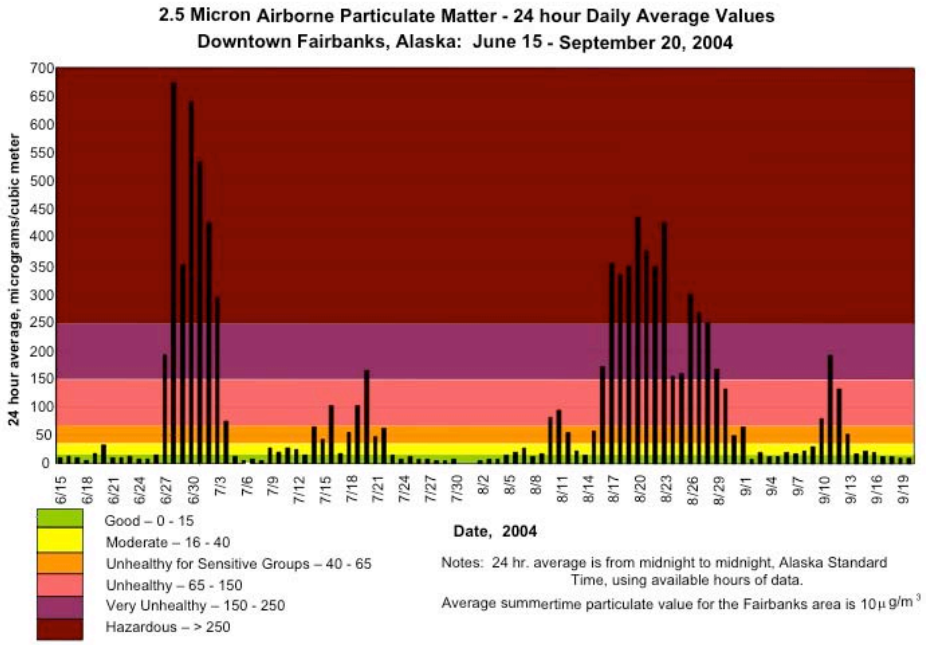


Brinkowski, et al. 2008. "Climate-related increase in the prevalence of urolithiasis in the United States" Proceedings of the National Academy of Sciences, vol 105, No 28: 9841-9846.

Human Health Impacts

Respiratory Disease

- Pollen
- Mold
- Smoke and particulates
- Photo-chemical air pollution



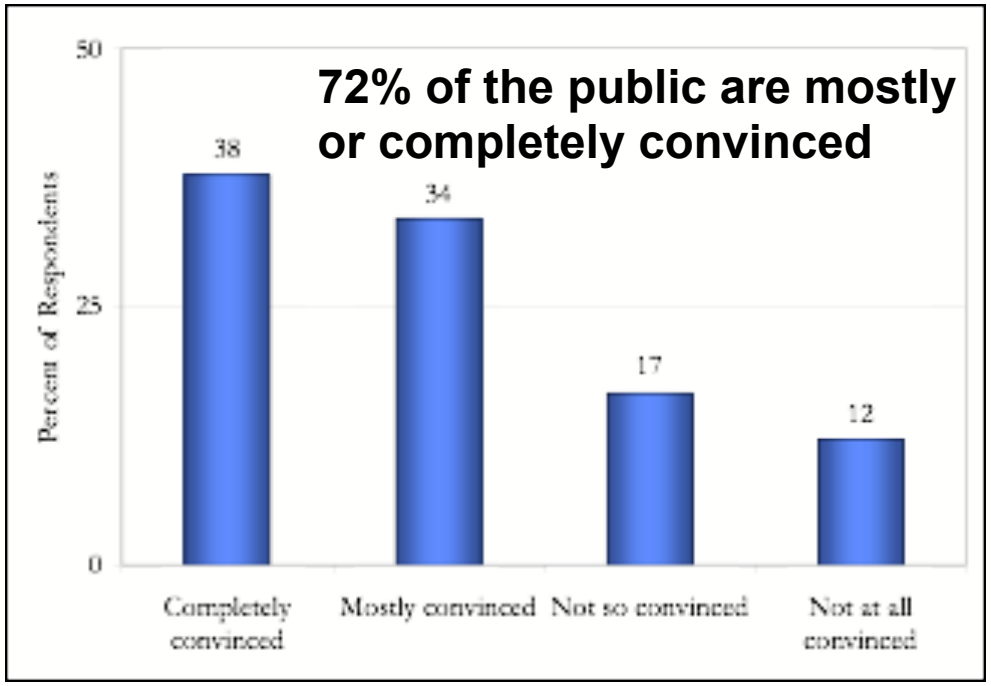
Fairbanks June 28, 2004

July 6, 2004

Temperature of Public Opinion

- In 2007, twice as many people believed climate change is here than did in 2004

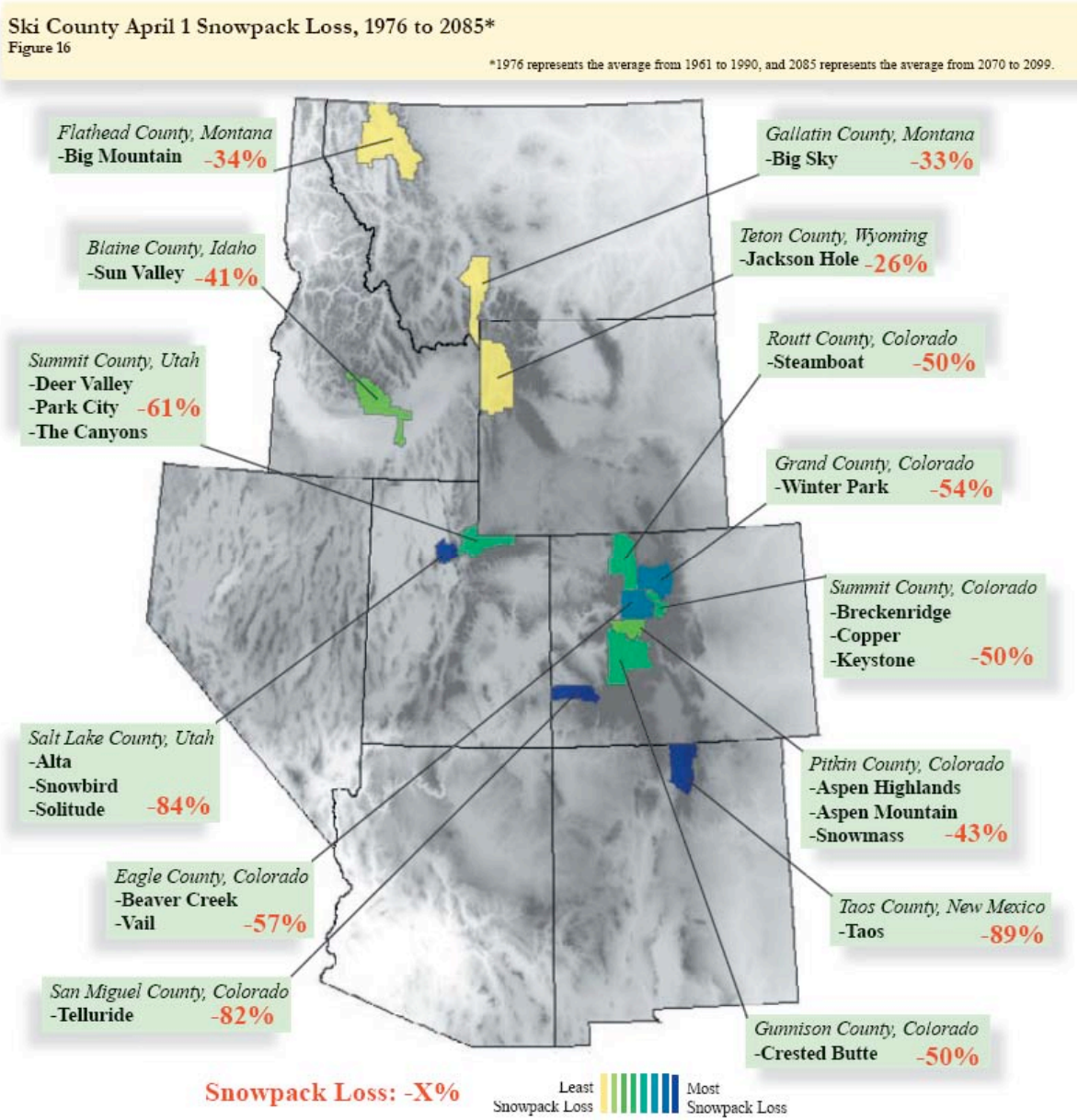
- But public opinion lags scientific certainty by a *significant* margin



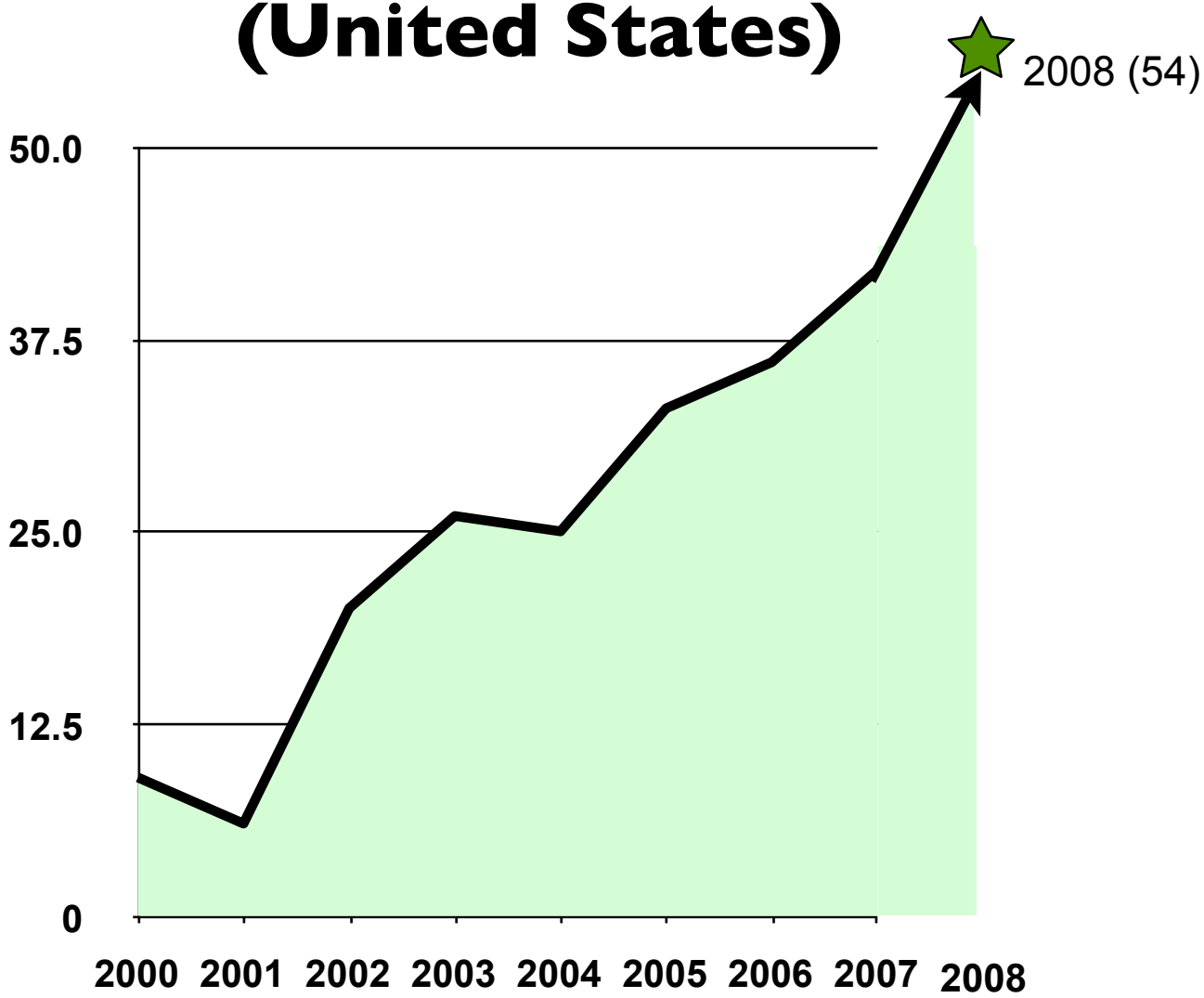
And.... diminishing differences by political party affiliation

Source: Yale-Gallup Poll (July 2007): http://environment.yale.edu/news/Research/5317/americans-consider-global-warming-an-urgent-threat/

Insurance Customers Impacted



Shareholder Climate Resolutions
(United States)



Sources: 2000-2006 Data: ISS 2007; 2007 Data (as of 02.06.07): Ceres 2007 & 2008

Carbon Disclosure Project

Annual questionnaire on business risks and opportunities presented by climate change and greenhouse-gas emissions data from the world's largest companies

Run by Institutional Investors:
$57 *Trillion* under management
(major holdings in insurance)

Started in 2000, the CDP now has 385 signatory investors, including Merrill Lynch, Goldman Sachs, Morgan Stanley, AIG Investments, Barclays and HSBC are among current signatories.

Currently polling 3800 companies

Source: http://www.cdproject.net/

Insurance Regulators Recognize the Problem

"Global warming is upon us, and it poses unprecedented new threats to the insurance industry and vast segments of society that rely on insurance for peace of mind and financial security."

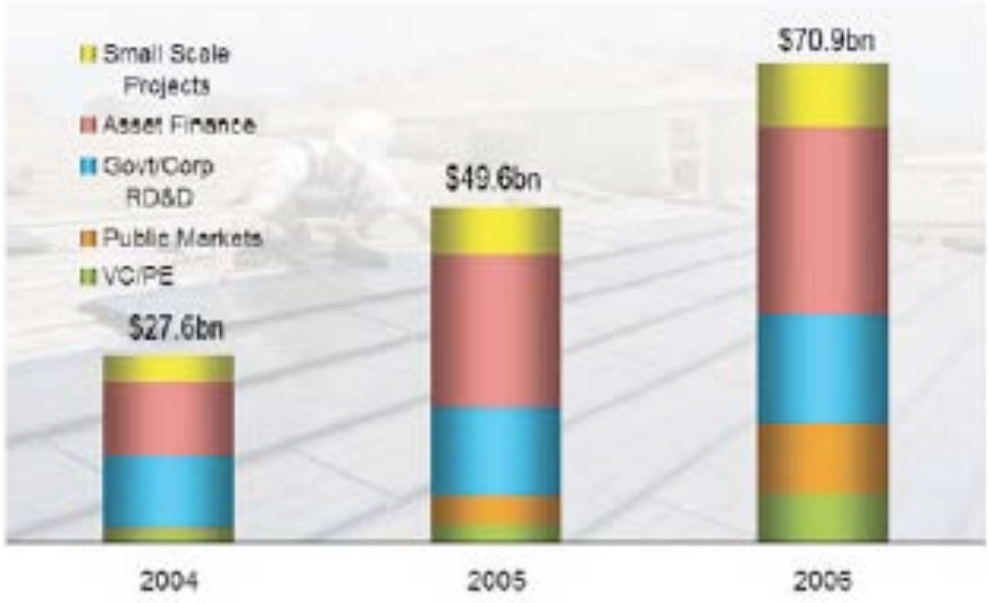
Michael Kreidler
Washington Insurance Commissioner

Tim Wagner (deceased)
Nebraska Insurance Commissioner

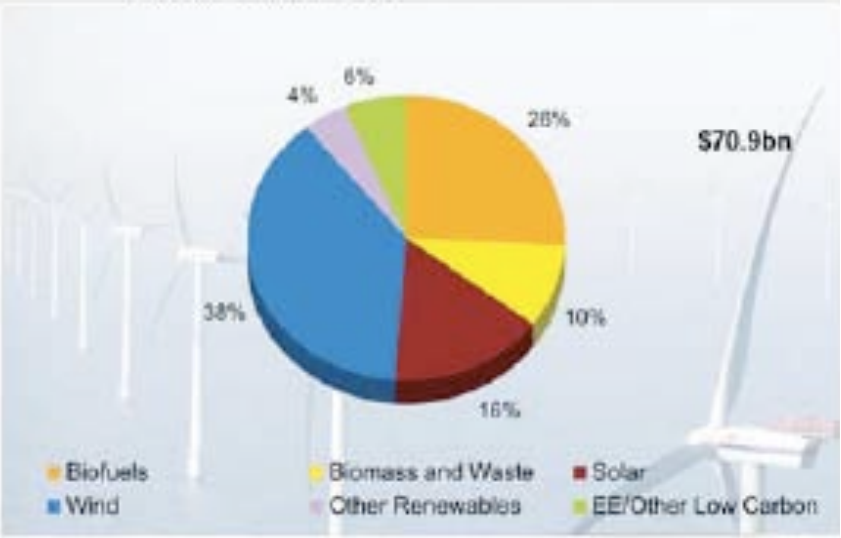
The Business Climate is Also Changing

Global Direct Investment in Sustainable Energy: 2004-2006

Investment by Type



Investment by Technology



* Sylvie Lemmet, Division of Technology, Industry and Economics, UNEP. "Back to the Future: Investing in Clean Energy, Climate Action, p. 138 (2007)

Top Concerns: Survey of 139 Insurance Executives in 21 Countries

1	Too much regulation	12	Managing technology	23	Corporate governance
2	Natural catastrophes	13	Equity markets	24	Demographic trends
3	Management quality	14	Risk-management techniques	25	Contract wording
4	Climate change	15	Back office	26	Capital availability
5	Managing the cycle	16	Political shocks and pressures	27	Security of reinsurance
6	Distribution channels	17	Pricing new risks	28	Availability of reinsurance
7	Long-tail liabilities	18	Terrorism	29	Business continuation
8	Actuarial assumptions	19	Complex instruments	30	Fraud
9	Longevity assumptions	20	Retail-sales practices	31	Merger mania
10	New types of competitors	21	Pollution	32	Too little regulation
11	Investment performance	22	Interest rates	33	Asbestos

Source: Centre for the Study of Financial Information and PricewaterhouseCoopers survey: 2007

Climate Change is #1 Risk, According to >70 Insurance Industry Analysts

(Ernst & Young Survey, March 2008)

1. ***Climate change***
2. **Demographic shifts in core markets***
3. **Catastrophic events***
4. **Emerging markets***
5. **Regulatory intervention***
6. **Channel distribution**
7. **Integration of technology with operations & strategy**
8. **Securities markets***
9. **Legal risk***
10. **Geopolitical or macro-economic shocks***

* Also influenced by climate change

Challenges for insurers

- Rising magnitude of losses; shorter return periods
- Increased variability
- Non-linear/abrupt change
- Changing geography of losses
- More correlation among losses
- Population moving into harm's way
- Data and CAT-model blind spots
- Risks and opportunities in asset management

A future unlike the past

Erosion of insurability

Insurability

"Radical changes in natural catastrophe frequency and/or severity could eliminate certain of our markets through physical damage, price escalation, or regulatory activity... unpredictability could negate the use of actuarial techniques and undermine our ability to price and risk-manage product offerings."

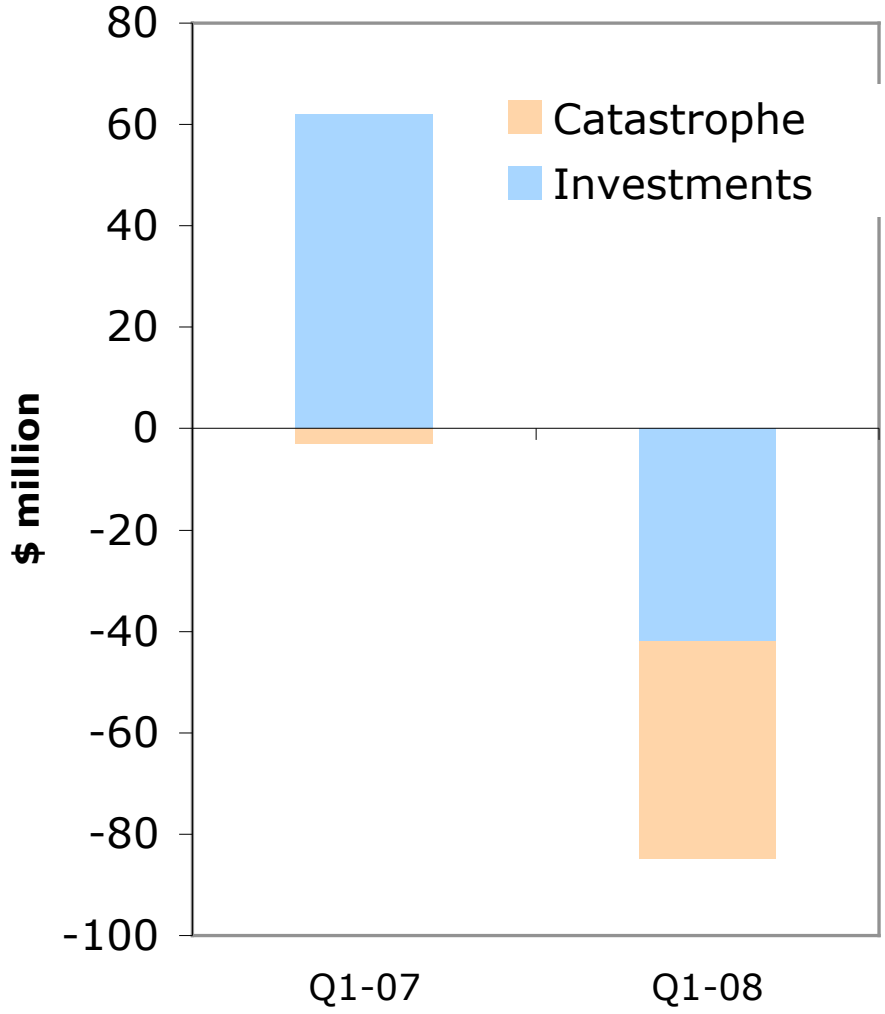
ACE Limited response to the fifth annual Carbon Disclosure Project questionnaire

Climate Change is Integral to Mainstream Insurance Issues

- Customer retention
- Corporate governance, investor relations, & disclosure
- Balance sheet strength & solvency
- Competitiveness
- Emerging markets
- Reputation & trust
- Modeling weaknesses: Past *vs* future
- Regulation
- Government entry into risk markets
- Macro-economic trends; security
- *Insurability*: availability & affordability

Climate Change is a "textbook" issue for **Enterprise Risk Management**

PERFECT STORM
Cincinatti Financial
Results: Q1 - 2007 and



Source. J. Greenwald. 2008. "Investment, Catastrophe Losses Hit Cincinnati Financial," Business Insurance, July 14, p. 4.

Double-Whammy of troubled economy and high energy

fewer boat purchases
+ more repossessions
+ more time laid up

= Falling premiums and fewer customers

... but also fewer losses

E&S/SPECIALTY MARKET REPORT: SPORTS & RECREATION

ALL ASHORE?

Soaring Gas Prices, Sinking Economy Combine To Leave Boat Insurers At Sea

For all but the biggest yachts, agents and carriers see market stuck in rough waters

BY DANIEL HAYS

BATTERED BY RISING GASOLINE prices and a sinking economy, the insurance market for small recreational boats is facing rough waters, while smooth sailing continues for the mega-yacht sector, both brokers and insurers in various sectors of this specialty market report.

"Increased gas prices are killing the boat industry," according to Mike Cracco, president of Completely Covered Insurance Agency, a Long Island firm based in Massapequa, N.Y.

Mr. Cracco said he has been receiving requests from boat policyholders who want to increase the time their boats are laid up on shore without coverage, which his agency cannot accommodate.

Some owners, he said, are increasing their deductible and adopting the attitude: "God forbid it goes on fire. I'll take that chance." Boats, he added, are being repossessed "like crazy," and are being auctioned by banks.

He reported a tremendous softening in insurance prices, with double-digit decreases in some cases.

In the case of a 39-foot boat that he handles, Mr. Cracco said, "This year it's a 20 percent decrease for the same exact boat."

The economic problems are impacting his marina business as well. He sees them going out of business or cutting back on insurance as their repair business plummets, as more boaters cut back on usage, and less of them need to be towed in.

Steve Ruchman, a past president of the National Association of Professional Insurance Agents and president of Ruchman Associates Inc. in Rockville Center, N.Y., said he does not see rates decreasing by 20 percent, but acknowledged that insurers are now very competitive for boaters' business.

Insureds who shop can easily steer their way to a good deal, he said, adding that competing companies may not be advertising lower rates, but they "do whatever [it takes] to get the price down" and are very creative in offering deals.

If they are unable to lower the premium, Mr. Ruchman said carriers will negotiate on coverage terms and conditions, with areas of discussion including lay-up periods, permitted navigable waters and towing.

In addition, the more electronic navigation equipment an owner has, the more premium credits a carrier is generally willing to give, he advised.

Howard Reif, with Sullivan and Strauss Agency in New Hyde Park, N.Y.—which trades as SkiSafe—said companies that left the market after the extensive boat losses from the hurricanes of 2005 are now back in. "They have a short memory," he quipped. He said he has seen ACE, Allstate, Nationwide, Progressive and Zurich all show a greater appetite for business.

Meanwhile, Mr. Reif said the competitive challenges in the small-boat insurance market are increasing because of plunging boat sales. Purchases are down 20 percent, he said, adding: "I don't see it getting better." Making matters worse, he added, is the fact that "we are at a point with more boats for sale than I have seen in the last 15 years."

He remarked that "there has been a drastic credit crunch affecting the recreational marine market in a bad way," with loans for boat purchases hard to come by and many who took out loans to buy boats going into default.

All this translates into a smaller marketplace for the insurance industry, according to Mr. Reif.

"Generally speaking, insurers who specialize in boats are seeing a significant drop in business this year," he declared, noting that rates are particularly soft for boats located on inland lakes or rivers.

However, for big boats—those mega-yachts that measure 100 feet or longer and cost $5 million or more—it's a very different story.

Sean Blue, yacht director for the AIG Private Line Group in Seattle, said that for such maritime heavies, "there is a large demand and a high waiting list at some of the larger yacht shipyards."

The competition is limited among carriers who take on such risks, he said, because "not many can insure a $100 million yacht."

He said the AIG private line yacht sector is six years old, and retention of clients has been very good, as has growth, noting that the company is adding staff and products.

"We expanded into the European market and have offices in Dubai, Sydney, Hong Kong and London," he said.

One of the risks involved with mega-yachts is piracy—particularly in Southeast Asia, according to Mr. Blue, who said AIG checks the owners' security precautions for those waters, pointing out that some are shadowed by security boats.

Mr. Ruchman said the boating endeavors

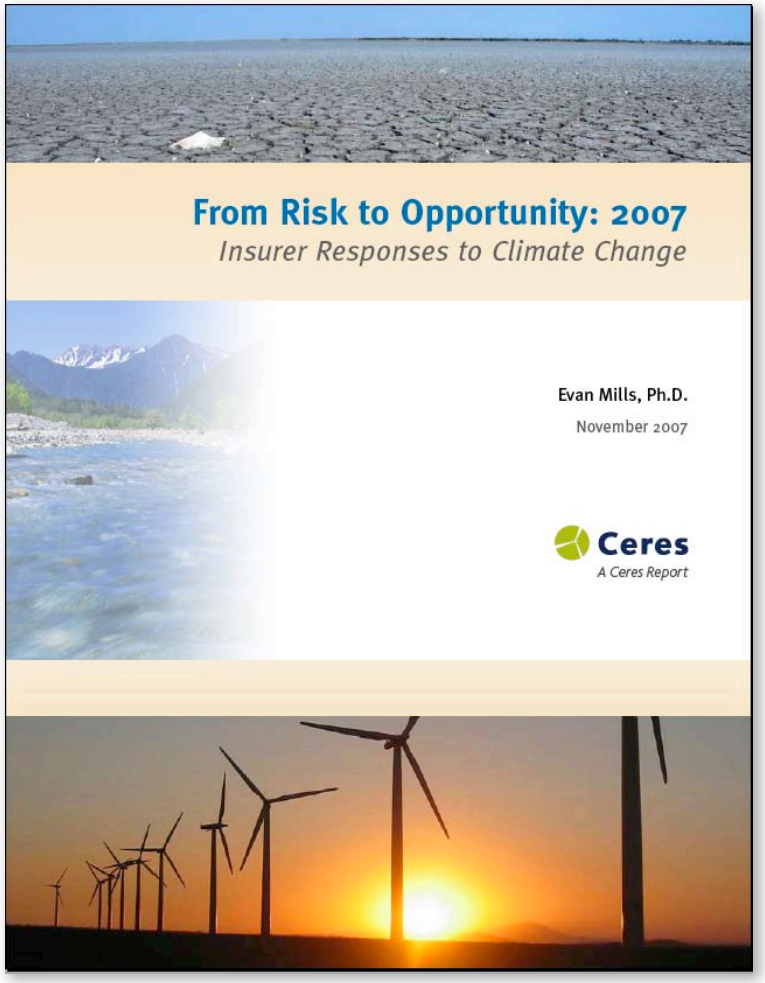
▸ continued on page 21

▶ NOT ONLY ARE BOAT INSURANCE PREMIUMS PLUMMETING, but the market is contracting as boat sales are way off, many who have boats are dry-docking them, and some who borrowed to buy boats are going into default.

Insurance Paradigm Shift

From Risk … to Opportunity

30 strategies; 422 examples
~190 parties; 26 countries … and counting



About 40% are U.S. companies...

New Insurer Business Units

AIG — "Office of Environment & Climate Change"; "Advanced Energy Solutions"

Allianz — "Climate Solutions"

AON — "Agri-Fuels Group"

CHUBB — "Green Energy Team"

TRAVELERS — "Core Business Climate Change Project"

ZURICH — "Climate Change Advisory Council"

Insurers are innovating!

STRATEGY	*EXAMPLE*
1. Understanding the Problem	*Improved data & CAT modeling*
2. Promoting loss prevention	*Protecting mangroves & wetlands*
3. Rewarding risk-reducing behavior	*Mileage-based auto insurance*
4. Crafting innovative insurance products	*Green-buildings products*
5. Carbon risk-management and reduction services	*Offsets bundled with insurance*
6. Financing improvements	*Loans for energy-efficiency upgrades*
7. Direct investment	*Development of wind farms, etc.*
8. Engaging in public policy	*Calling for deep emissions cuts*
9. Leading by example	*Going "carbon-neutral"*
10. Carbon risk disclosure	*Responding to Carbon Disclosure Project*

Aligning Terms & Conditions with Risk-reducing Behavior

- Insurance discounts of up to 40% for low mileage:
  - ***Aioi***
  - ***Axa***
  - ***GMAC***
  - ***Hollard***
  - ***Milemeter***
  - ***Norwich Union***
  - ***Polis Direct***
  - ***Progressive***
  - ***Rheinland***
  - ***Sompo***
  - ***Tokio Marine Nichido***
  - ***Unigard***
  - ***Versicherungen***

250,000 policies in Europe as of 2007; $700M revenues projected by 2010

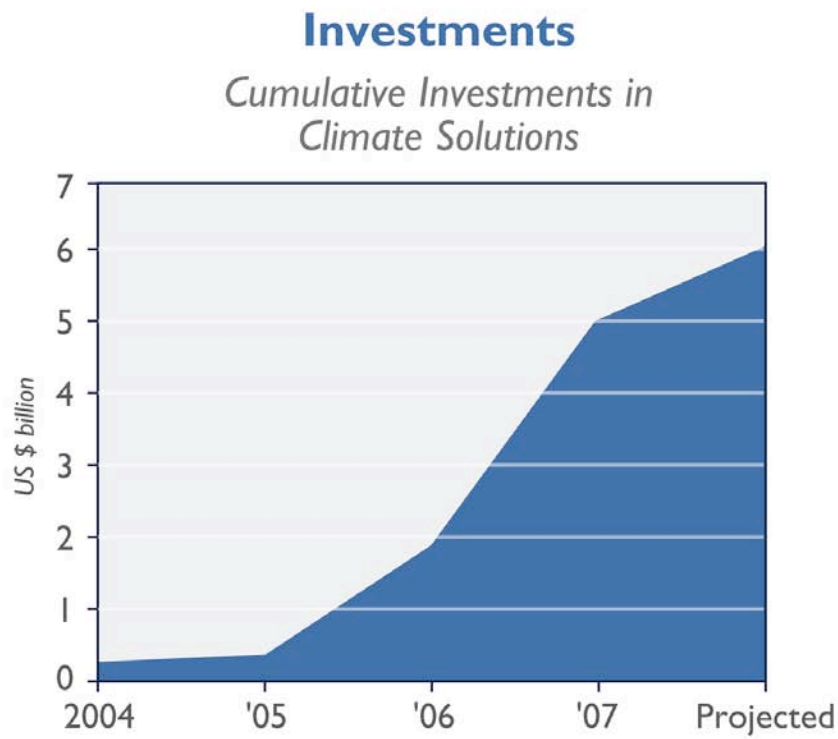
General Motors Acceptance Corporation (GMAC) PAYD discount schedule.

Miles/year	Discount offered
1 – 2,500 miles	40%
2,501 – 5,000	33%
5,001 – 7,500	28%
7,501 – 10,000	20%
10,001 – 12,500	11%
12,501 – 15,000	5%
15,001 – 99,999	0%

Some use GPS --> stolen-vehicle recovery; avoids reporting fraud

Direct Investment

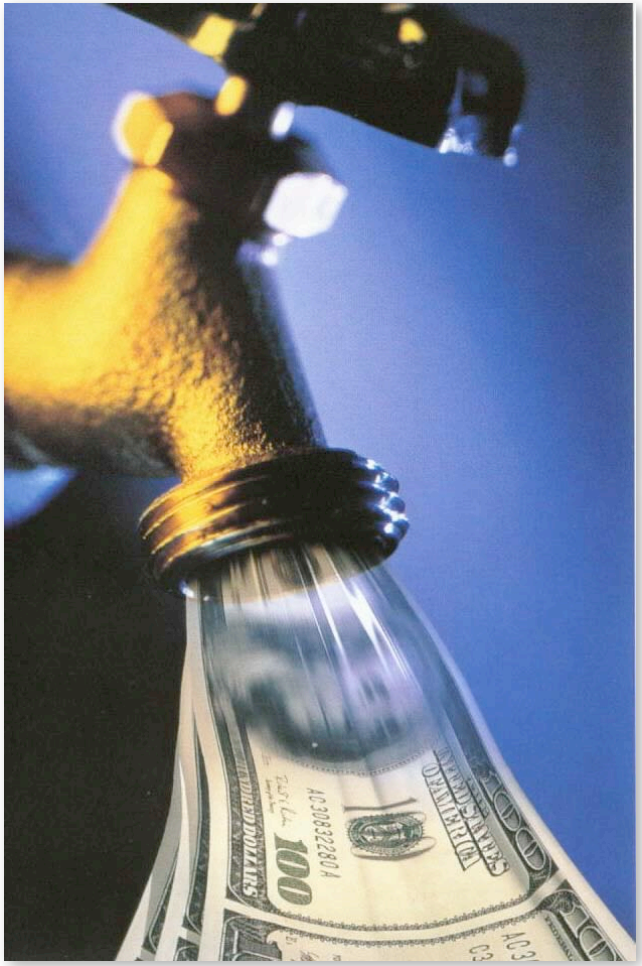
- ***Allianz:*** $15 million in the European Carbon Fund; plans to invest between $400 and $650 million in renewable energy
- ***Gerling:*** Sustainable Development Project operates a $100 million venture capital fund
- ***ING:*** Green finance - $1.16 billion
- ***Sompo Japan:*** $100 million green fund
- ***Swiss Re:*** $429 million "clean energy" venture fund; $320 million in individual investments



2008 CERA study predicts $7 trillion investment in "clean-energy technologies".

Financing Emissions-reduction Projects

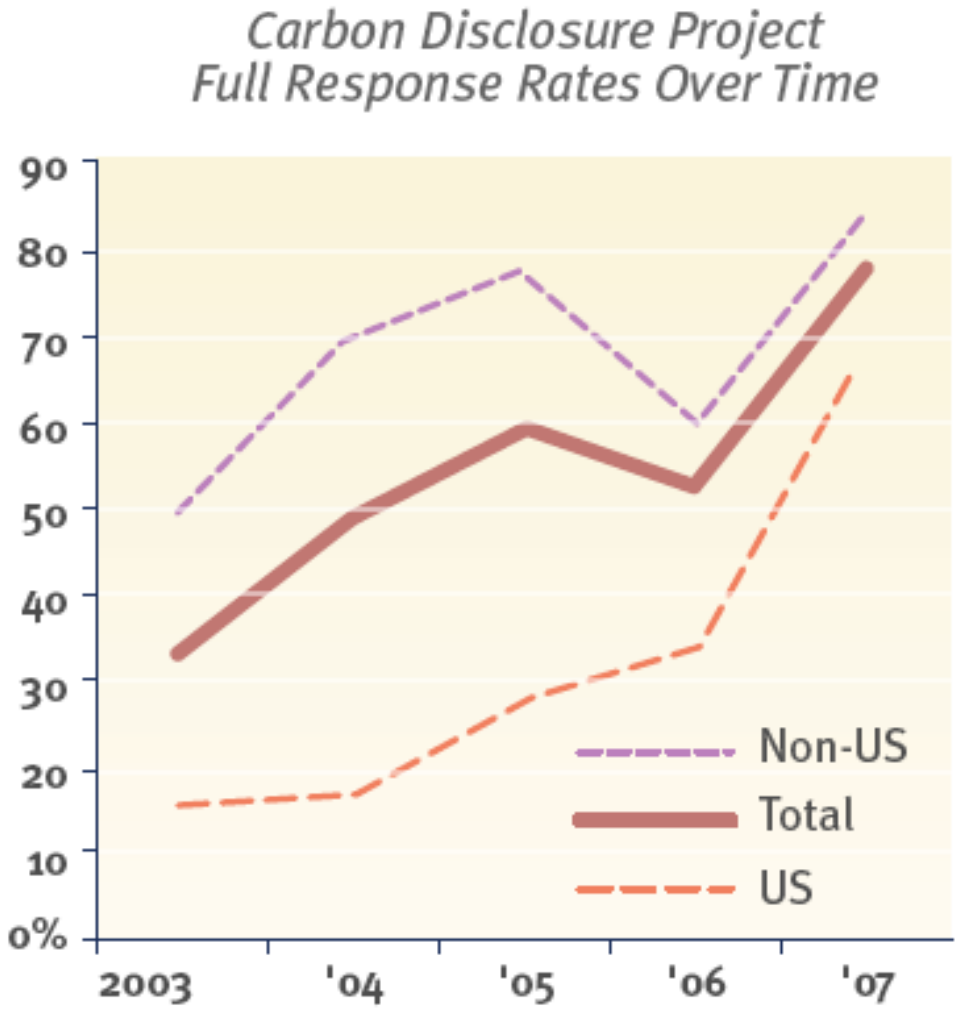
- ***AIG:*** $300 million lending facility for efficiency and clean energy
- ***Fortis:***
  - Preferential lending rate for energy-efficiency upgrades +10% premium discount
  - $106 million "Green Bank" loans
- ***HSBC:*** $45 million for wind projects in India
- ***Mitsui Sumitomo:*** Loans for building-integrated solar systems
- ***TrygVests:*** $10k financing for "climate-friendly home energy upgrades" after loss.



Carbon Risk Disclosure

Carbon Disclosure Project: Annual Global Survey by Institutional Investors ($57 Trillion under management)

113 Insurer responses: 2003-2007 - ***AIG, Allstate, Aon, Chubb, Marsh, MBIA, Safeco, St. Paul Travelers, Unum Provident, Munich Re, others...***



Source: http://www.cdproject.net/

Roles for Actuaries

1. Help your management make sense of the science, debates, and the business implications
2. Incorporate climate change effects into models & "stress-testing"
3. Understand the risk profiles of climate change *responses*
4. Participate in the development of "green" products & services
5. Assess comparative risks of "green" asset management strategies

"When the winds of change blow, some build walls ... others build windmills."

- Chinese Proverb

http://insurance.lbl.gov
emills@lbl.gov

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