

# CLIMATE CHANGE

What does it mean for  
the insurance industry?

**KATHARINE HAYHOE**

Texas Tech University

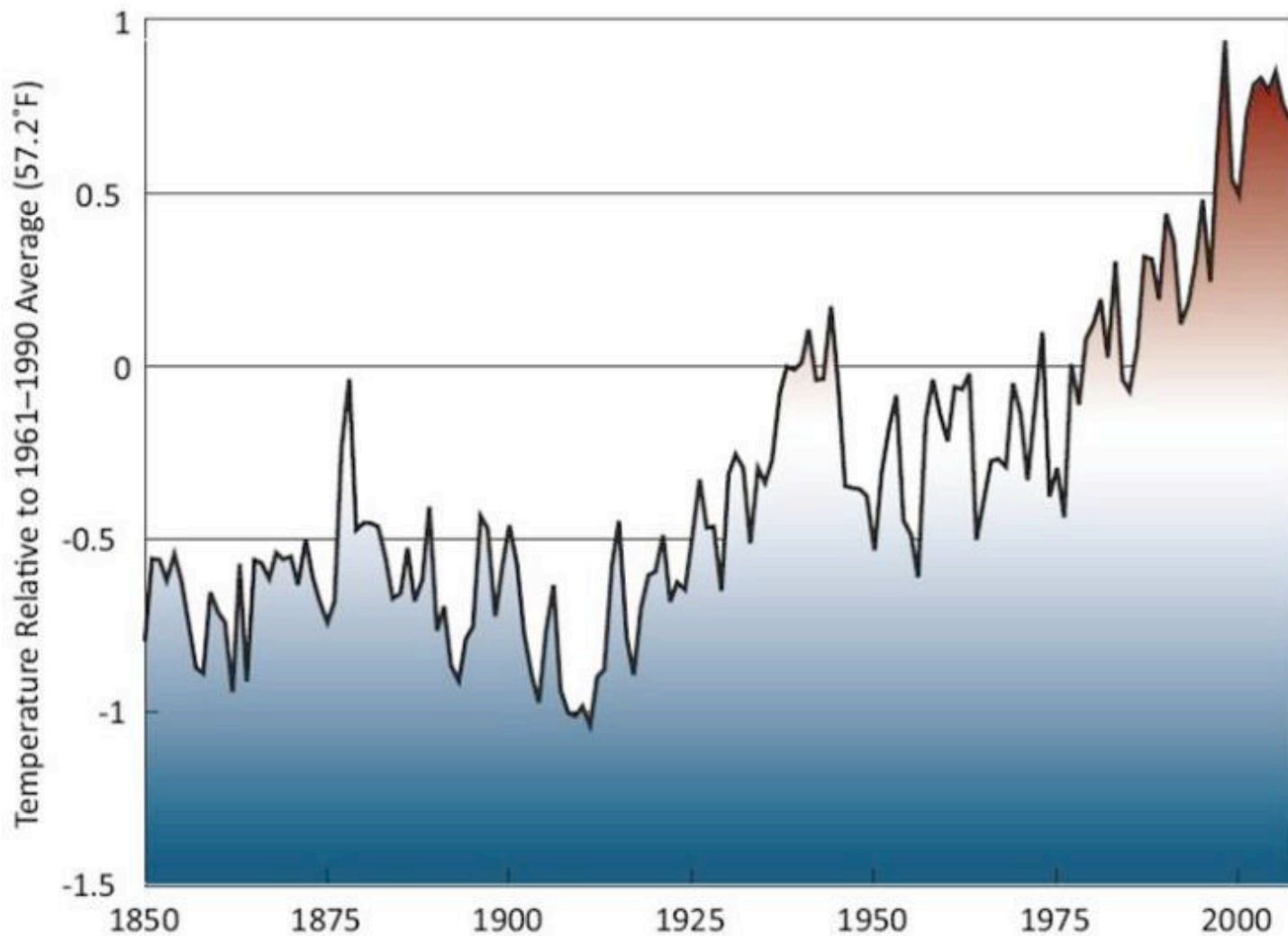
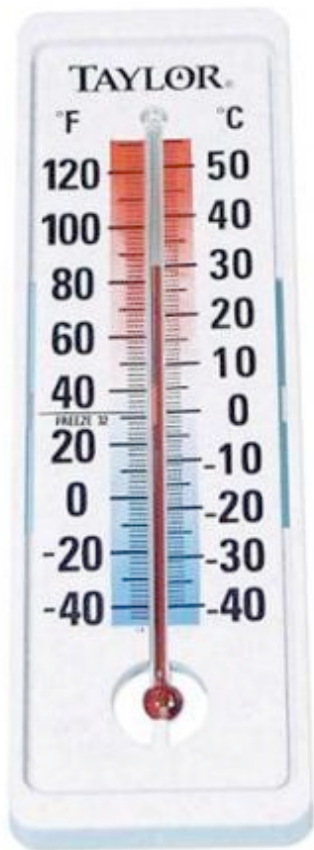
ATMOS Research

# Why consider climate change?



PART ONE

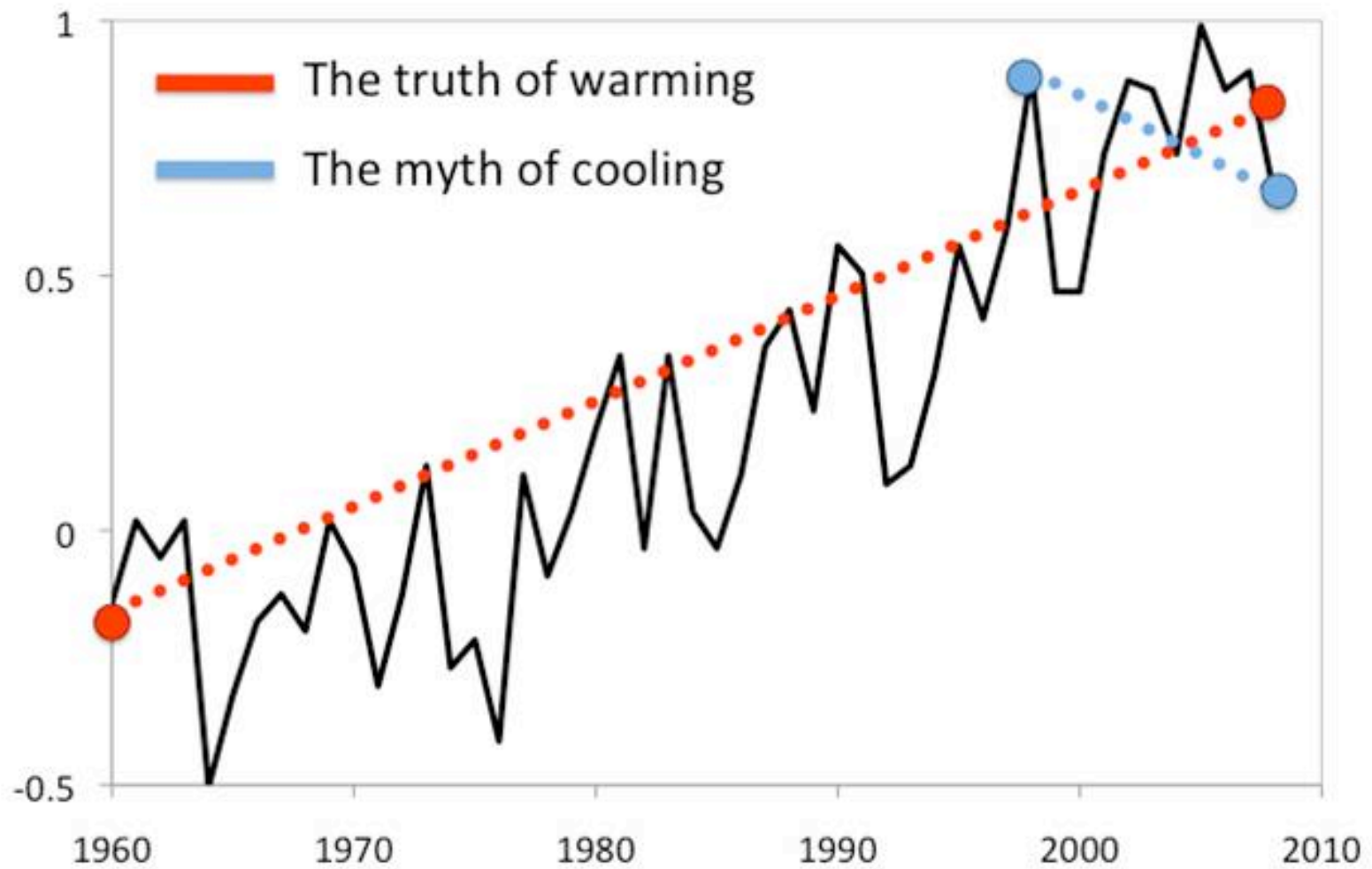
# The Earth is getting warmer ...



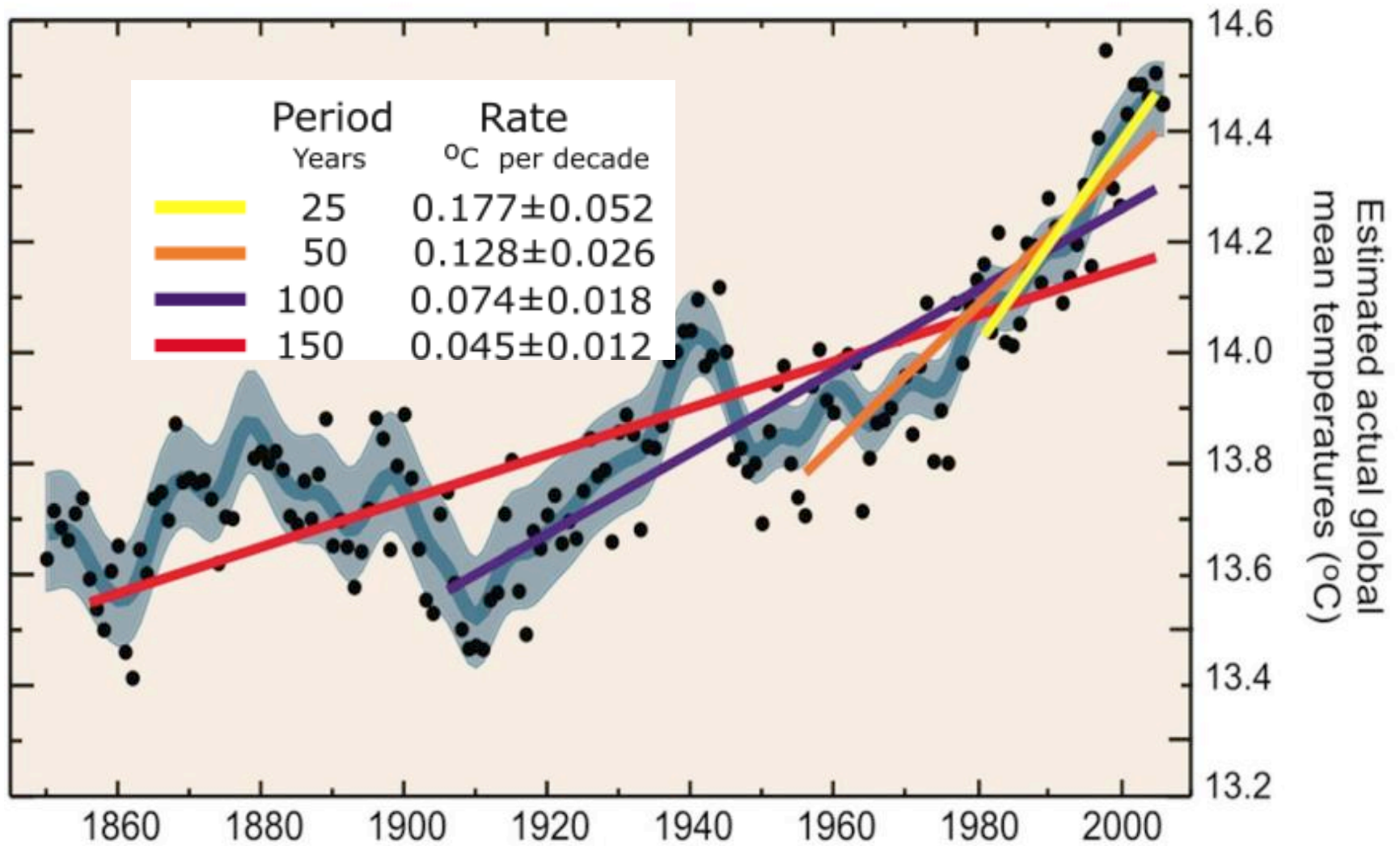
11 out of the last 12 years have been the warmest on record.

# ... despite recent claims of “cooling”

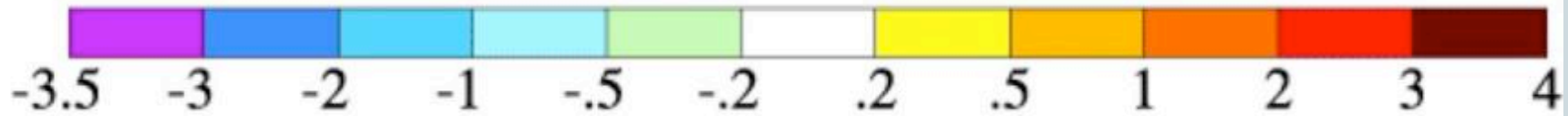
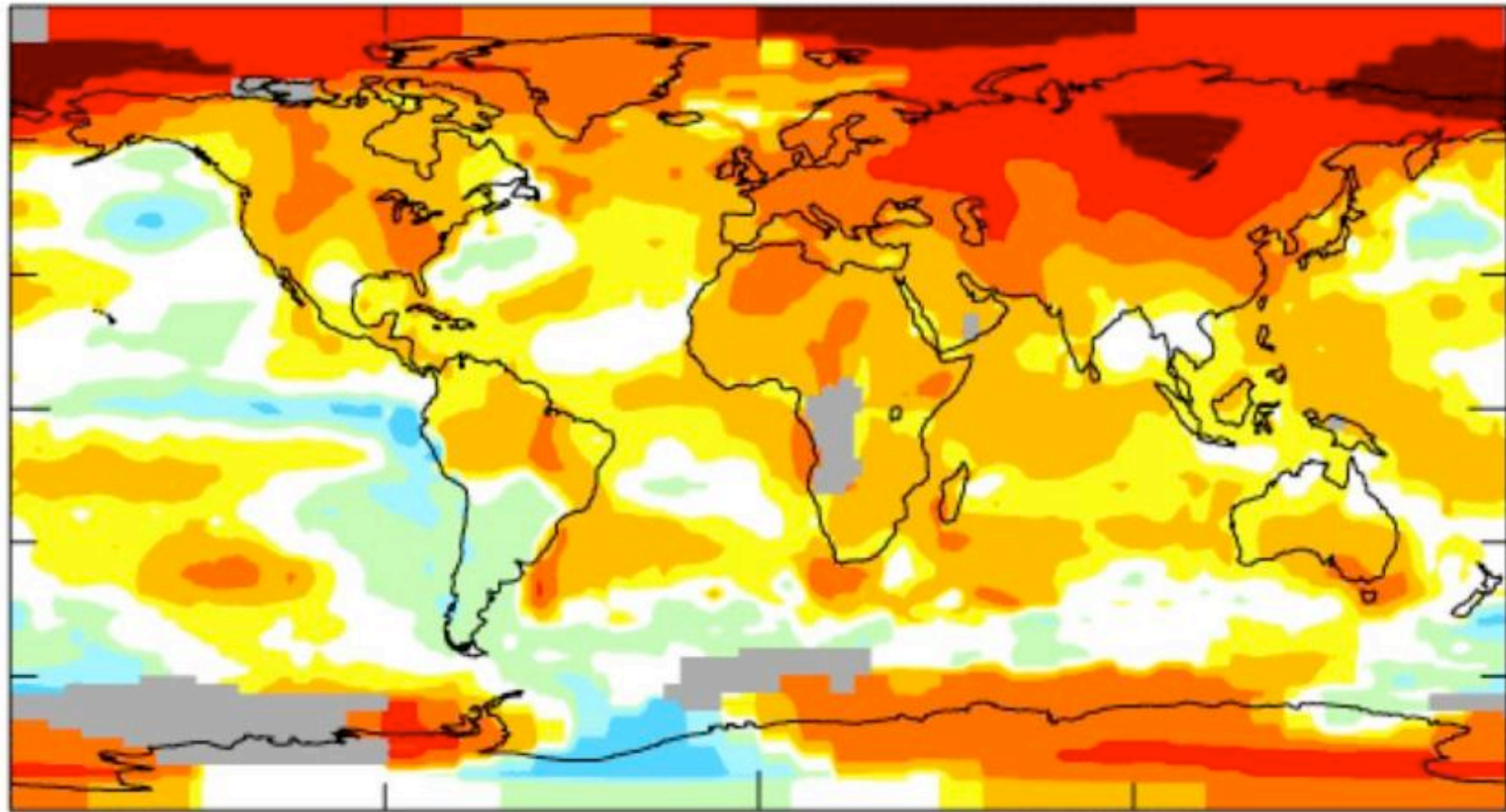
Temperature relative to 1961-1990 average (57.2°F)



# It's happening faster and faster



...and is greatest over land & at higher latitudes



# Are these conditions unusual?

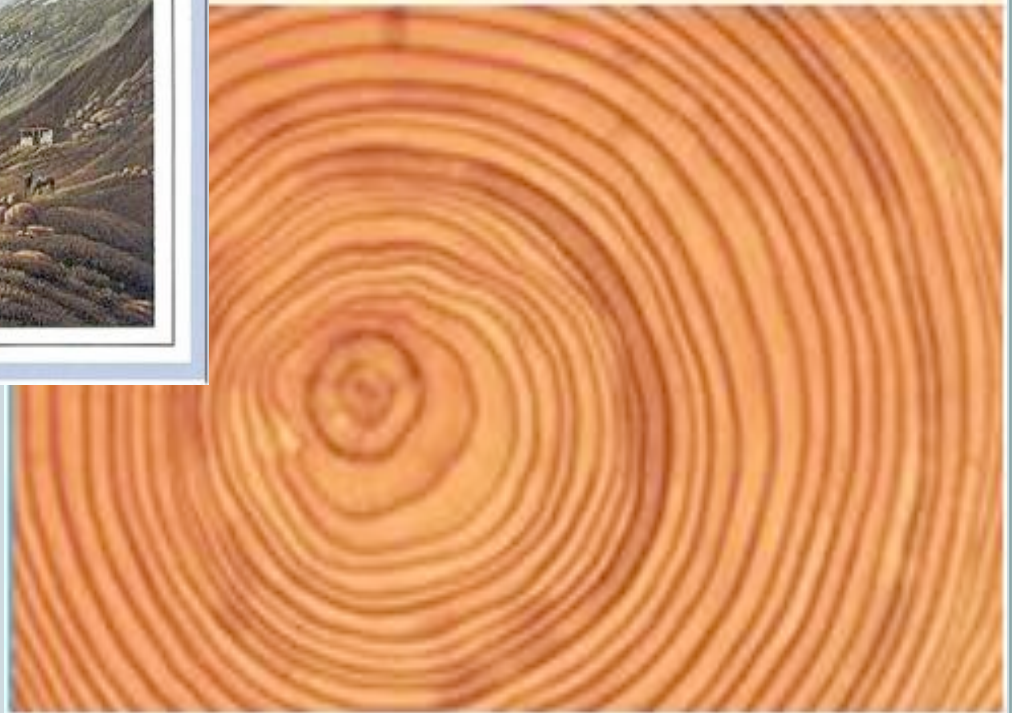


PART TWO

# “Natural thermometers”

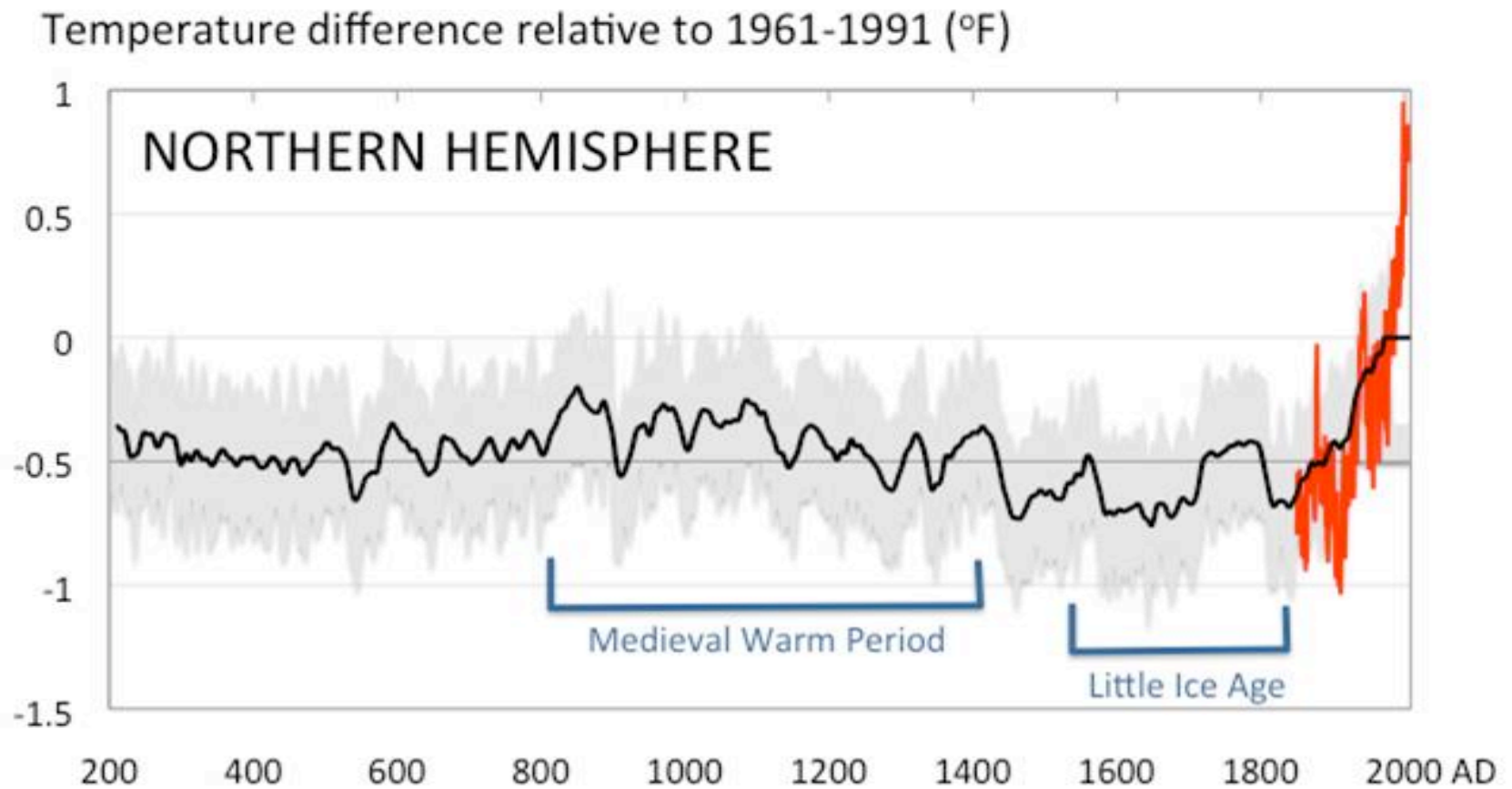


MER DE GLACE VUE DU MONTANVRE PAR HERMANS

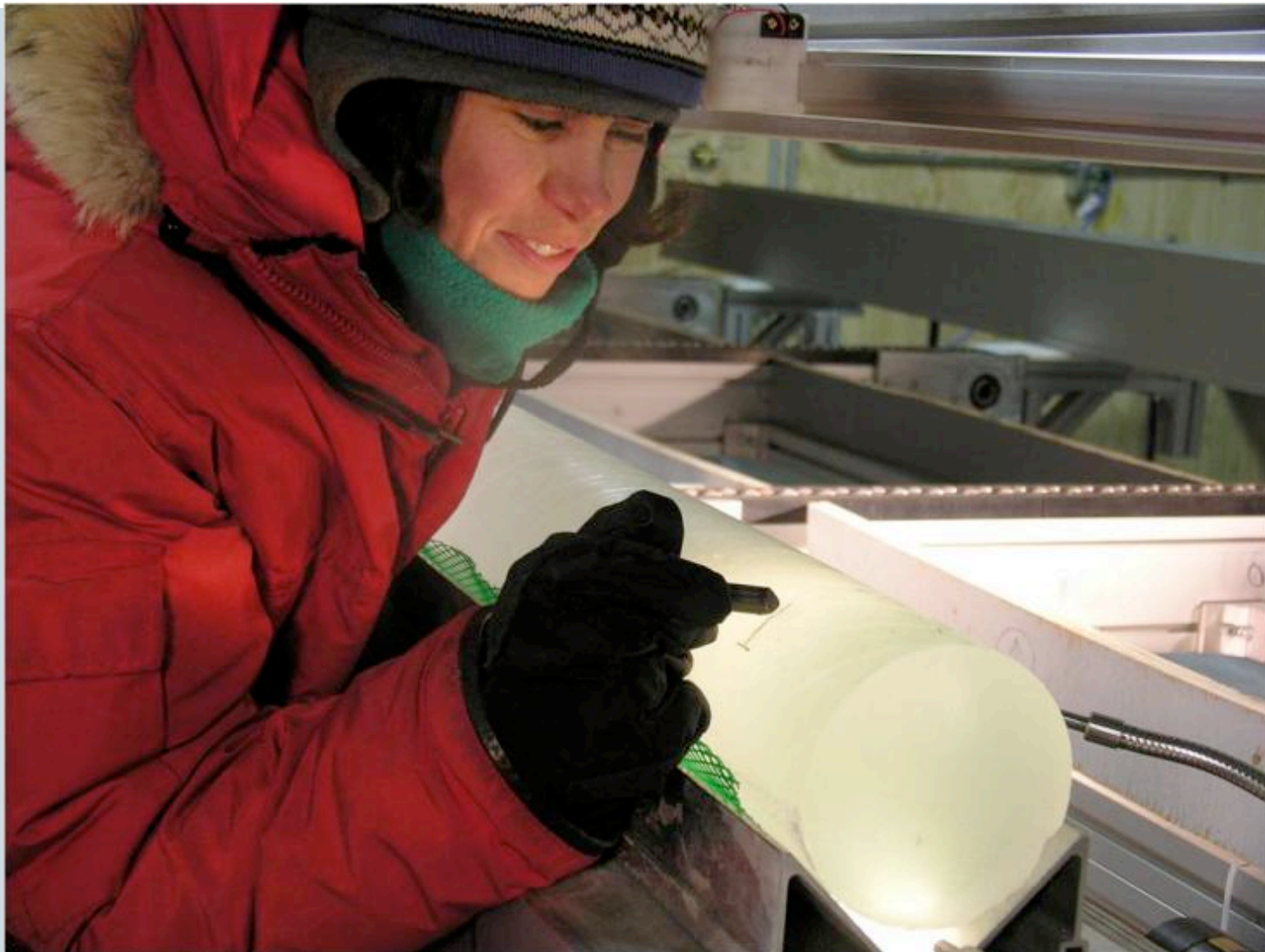




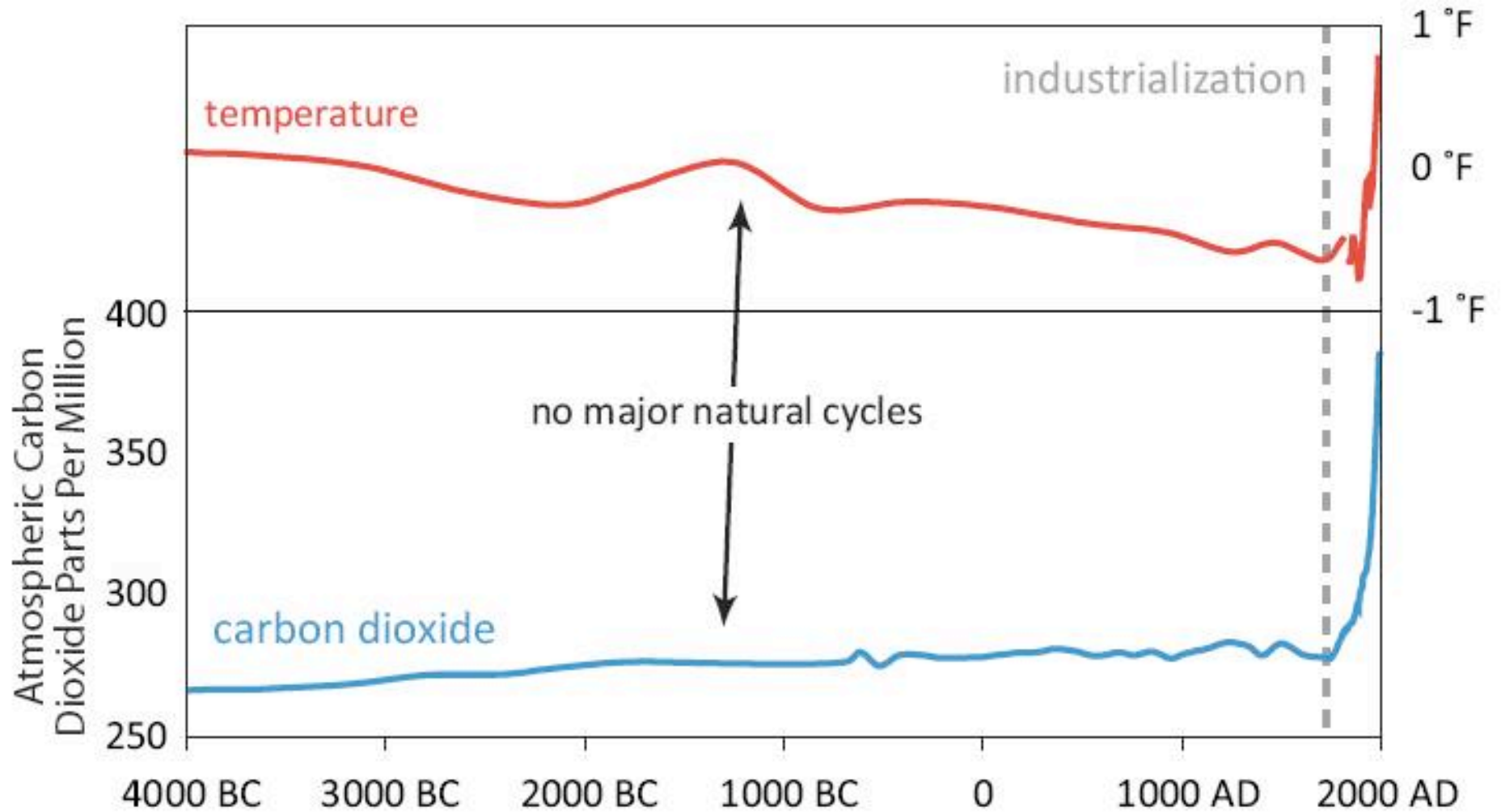
# Conditions today are unusual in the context of the last 2,000 years ...



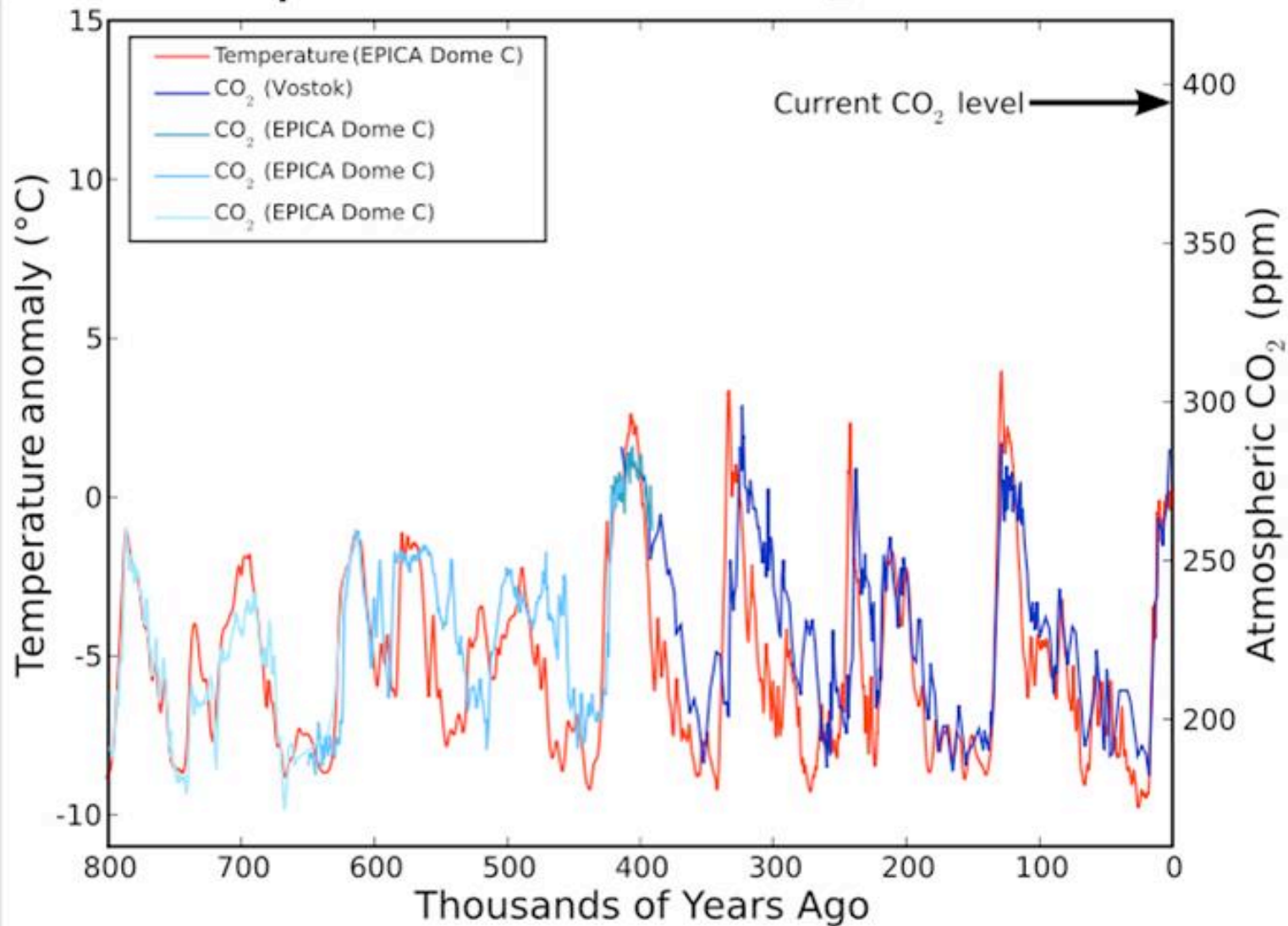
# “Natural thermometers”



# ... the last 6,000 years



... and even the last 800,000 years.



# What is causing the warming?



PART THREE

# Why is this happening?

THE NATURAL  
GREENHOUSE EFFECT  
naturally increases  
Earth's temperature by  
70°F



# Why is this happening?

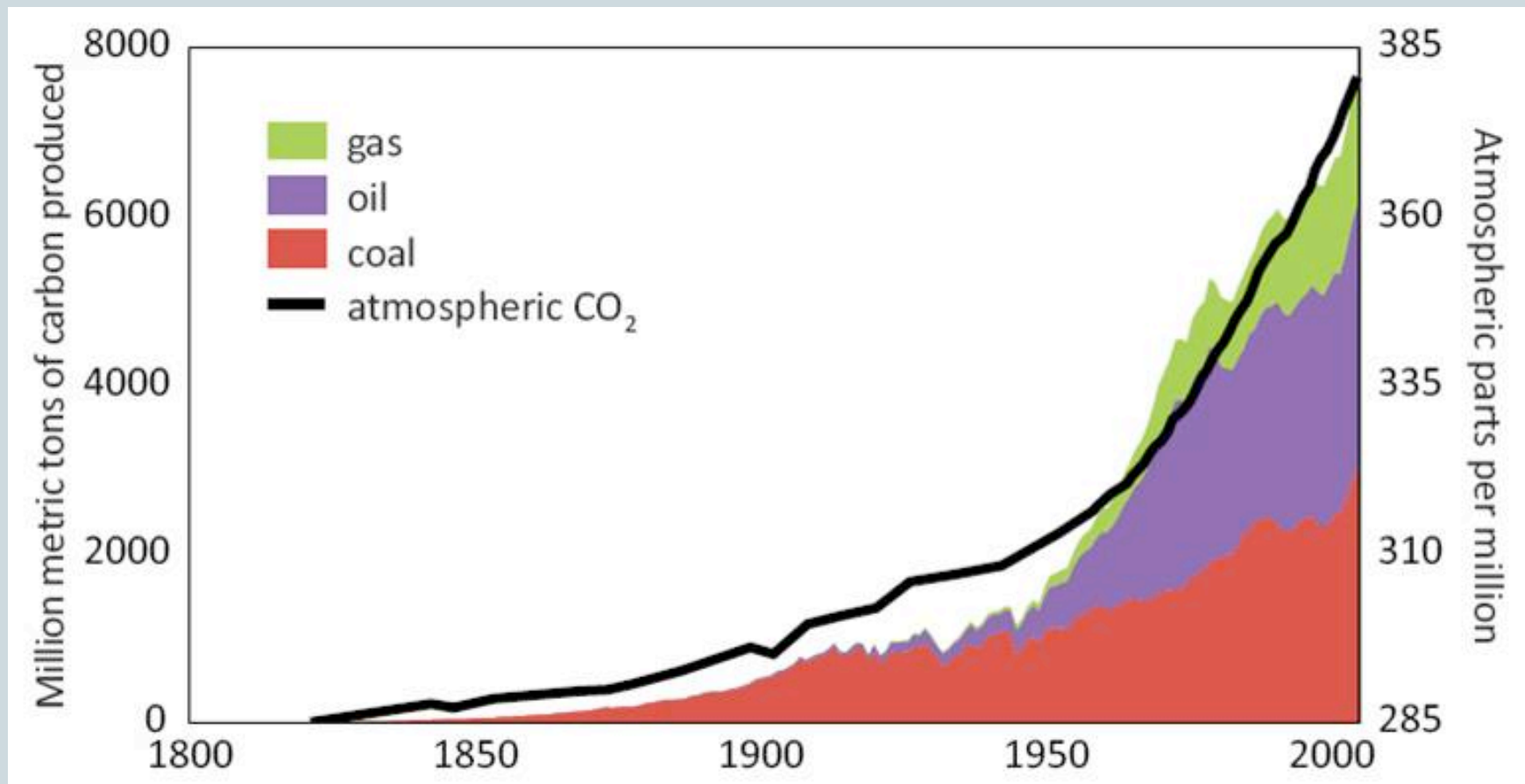
THE NATURAL  
GREENHOUSE EFFECT  
naturally increases  
Earth's temperature by  
70°F



THE ENHANCED  
GREENHOUSE EFFECT  
has artificially increased  
Earth's temperature by  
1.4°F



# Human production of heat-trapping gases

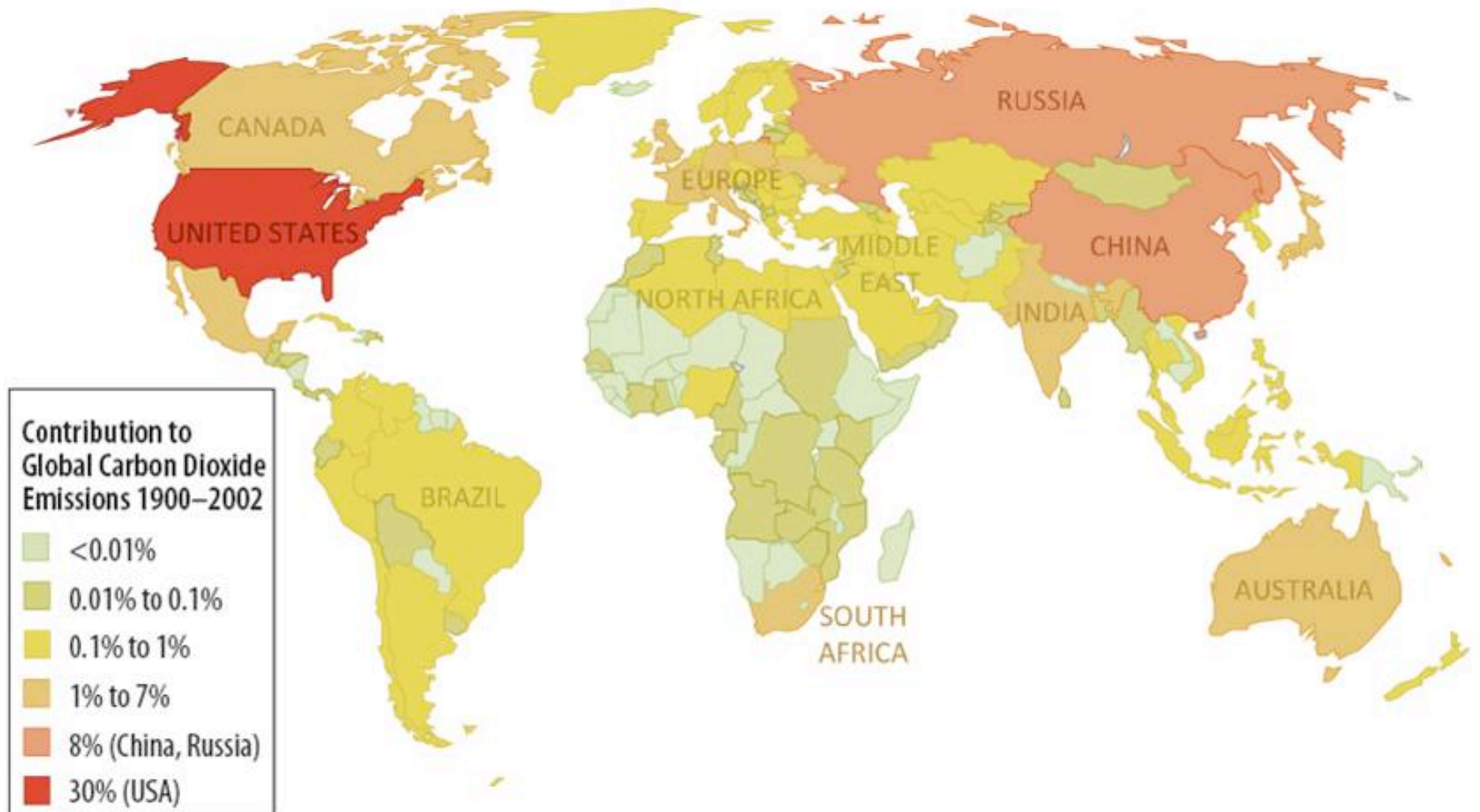




# Where do these gases come from?



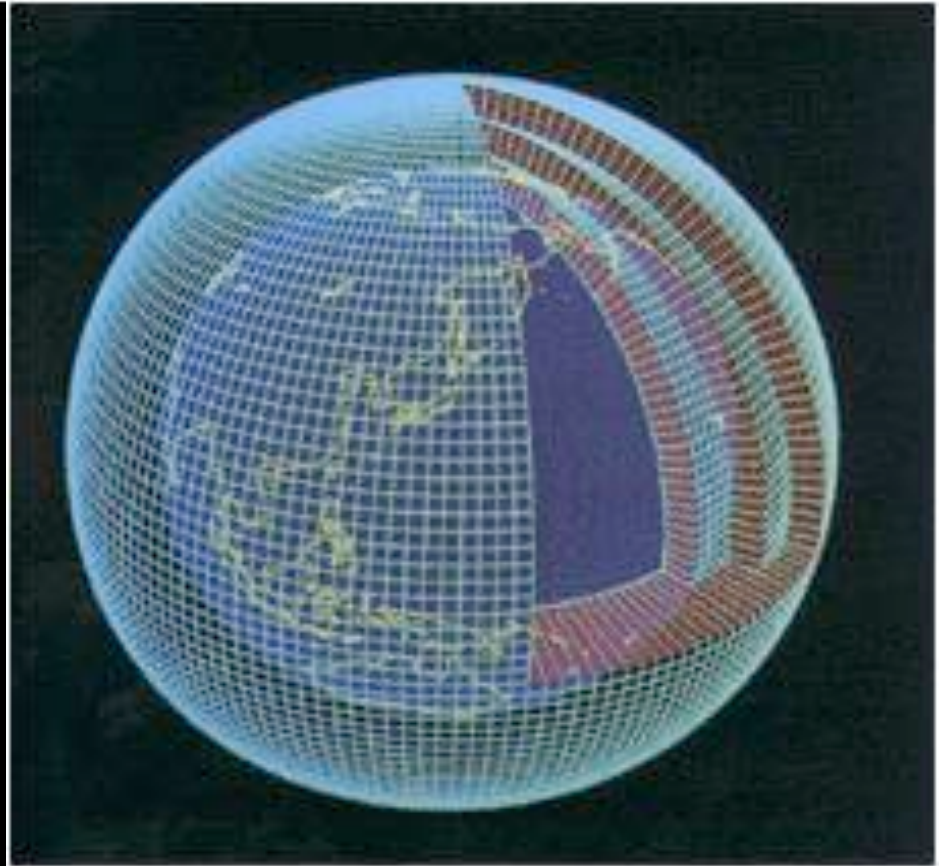
# Who is responsible?



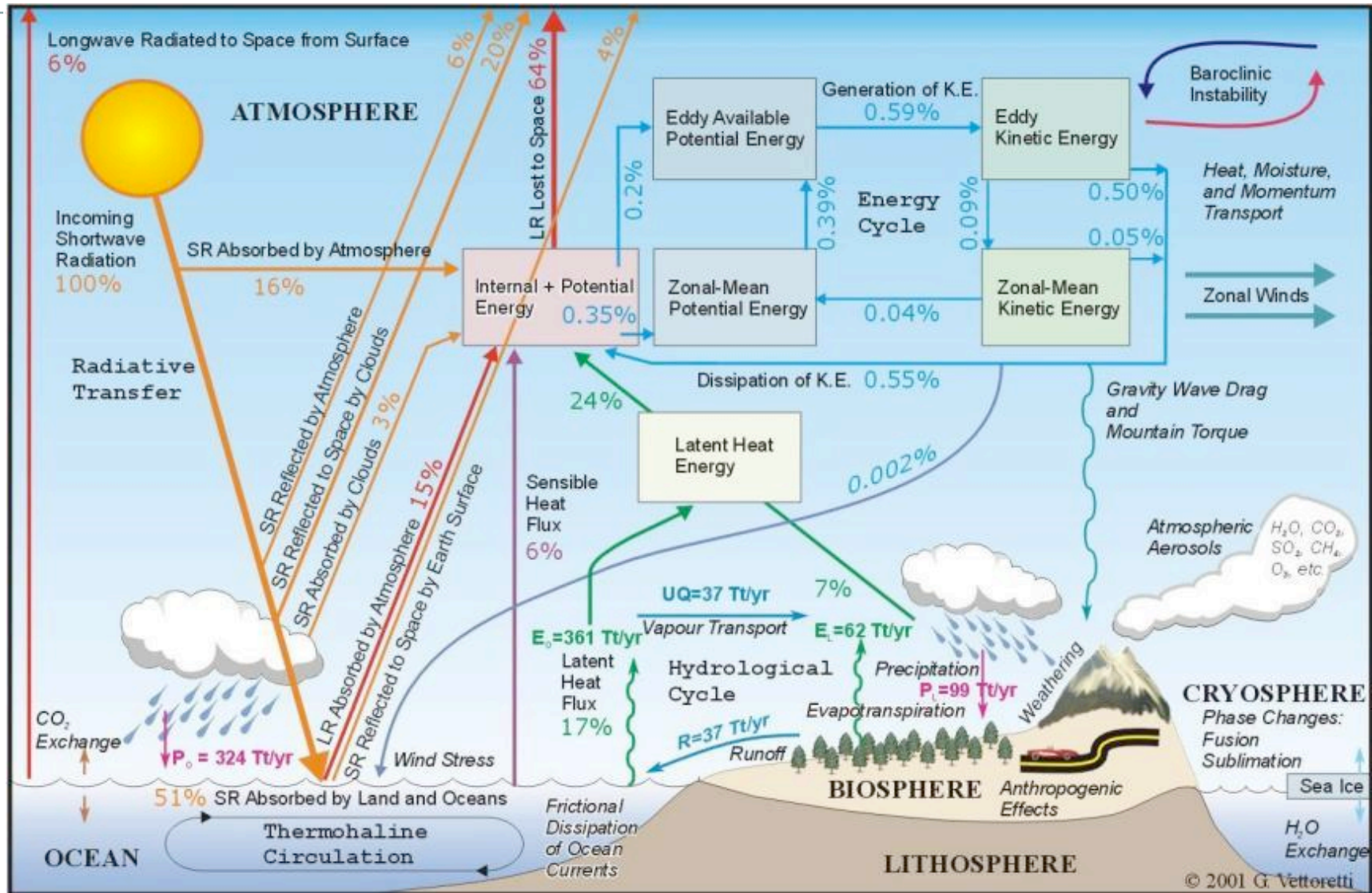
# How do we know these gases are causing the warming?



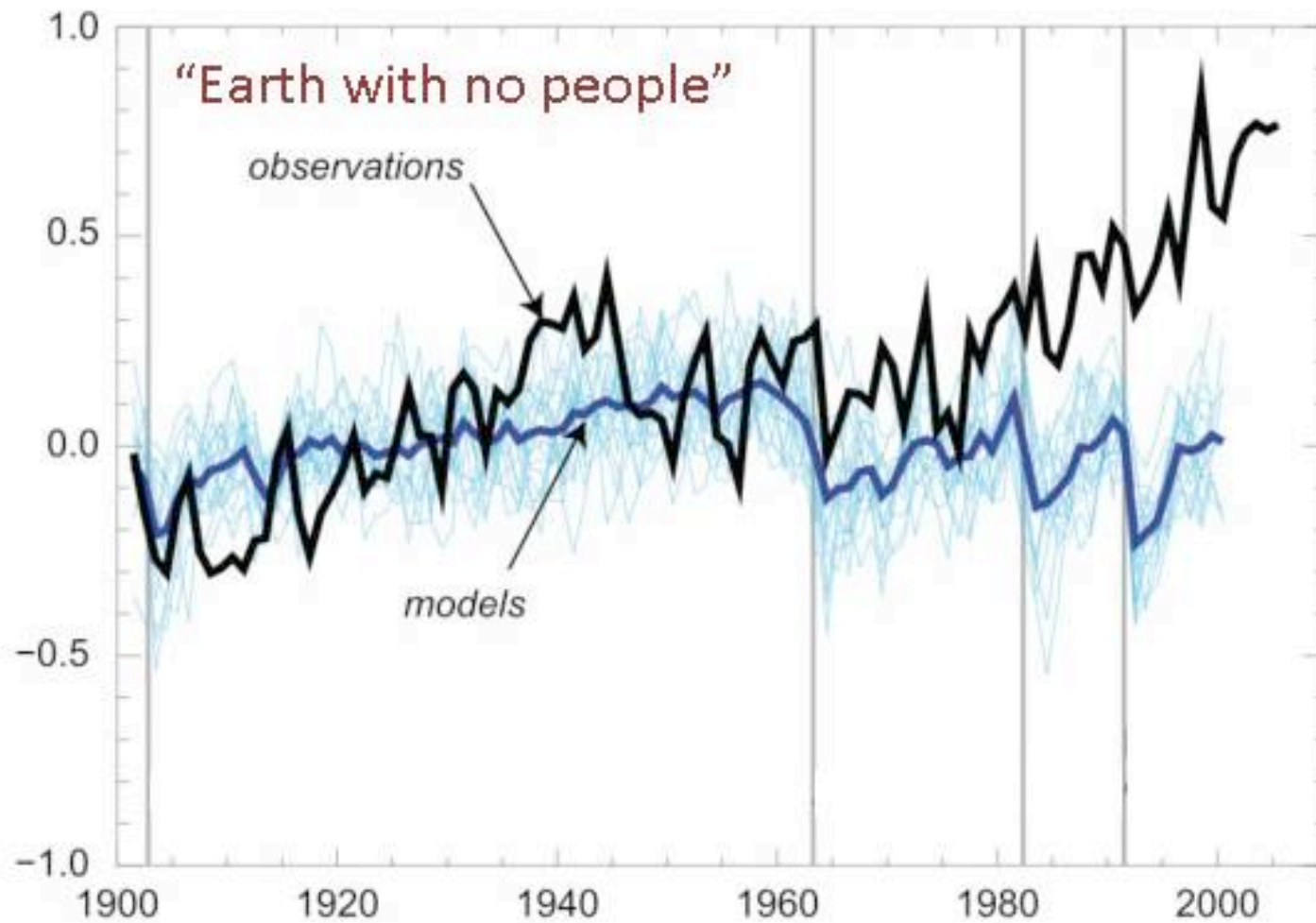
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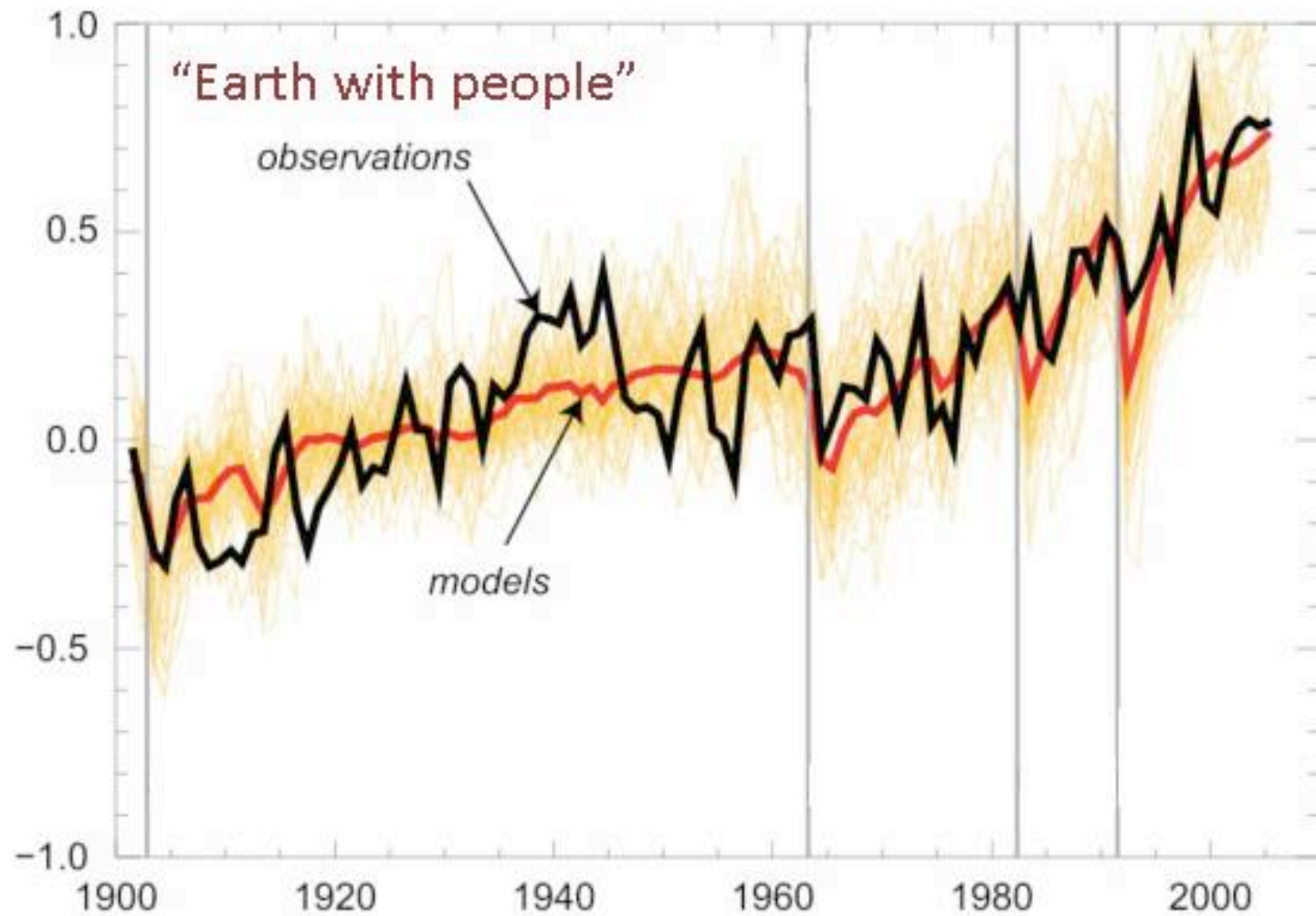
# Modeling the climate system



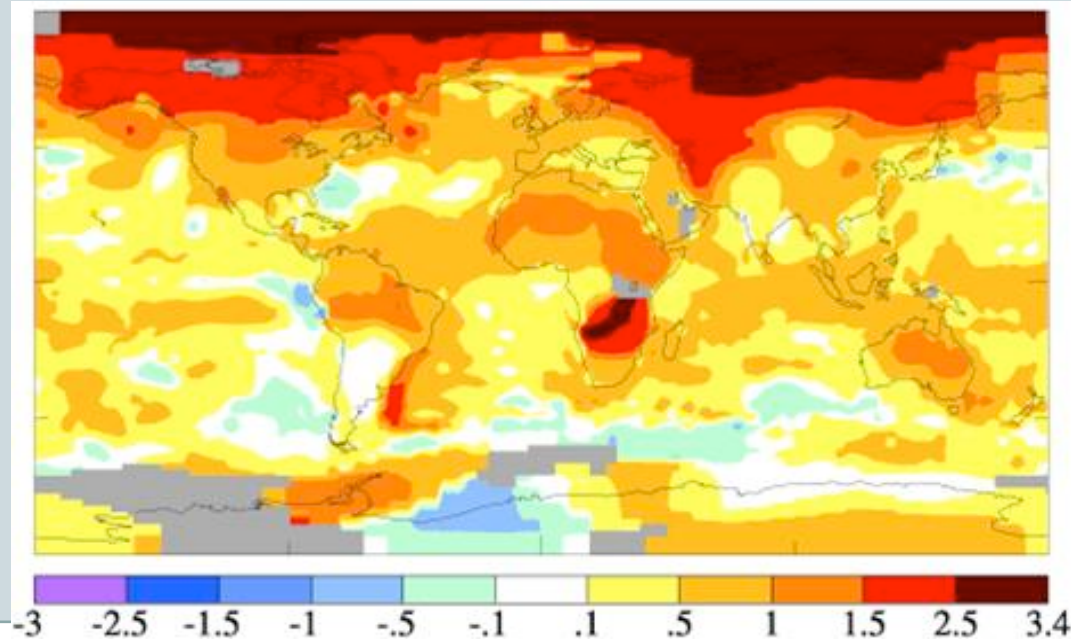
# Quantifying the human influence



# Quantifying the human influence

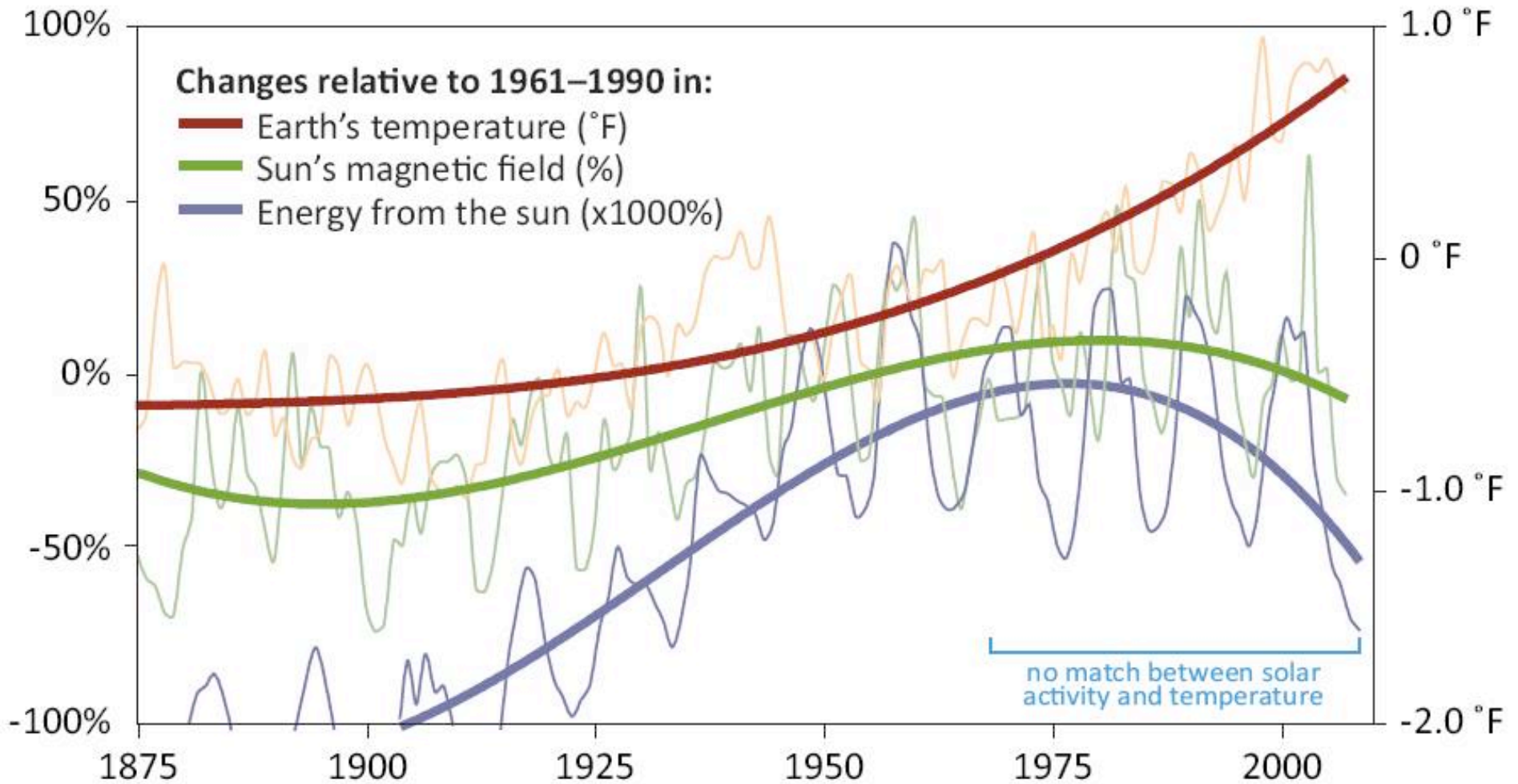


# Isn't it just the urban heat island effect?





# How do we know it's not the sun?



# What about the record cold weather they've been having in Walla Walla?



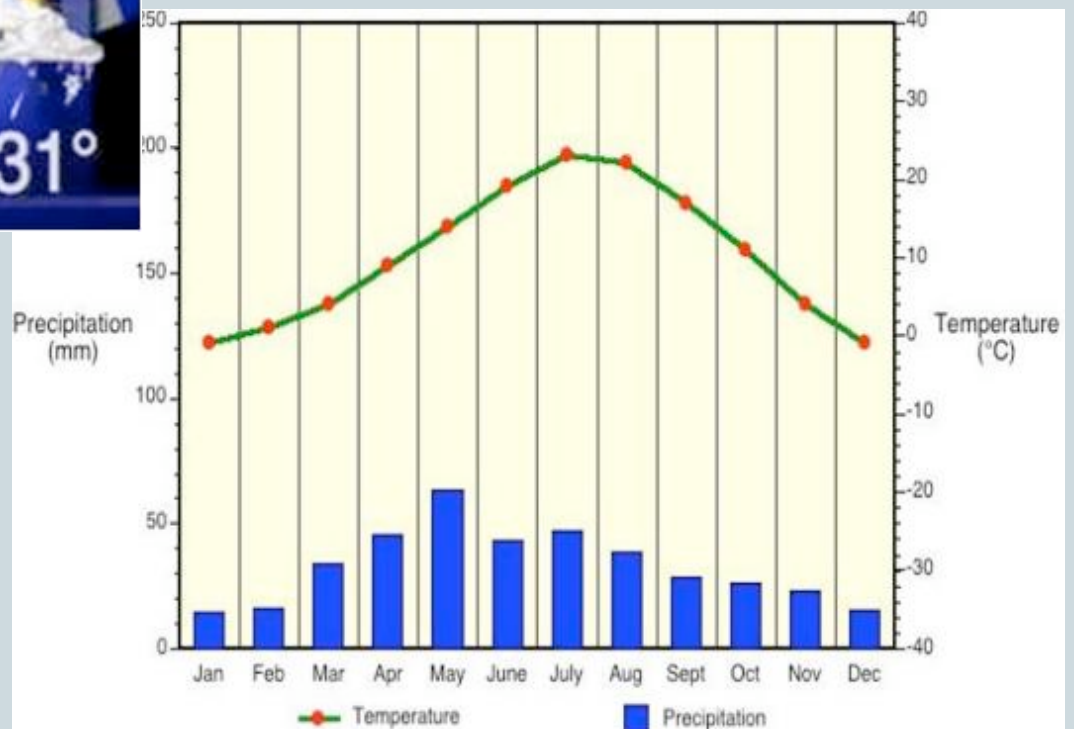
WEATHER: How conditions change from day to day or even year to year

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WEATHER: How conditions change from day to day or even year to year

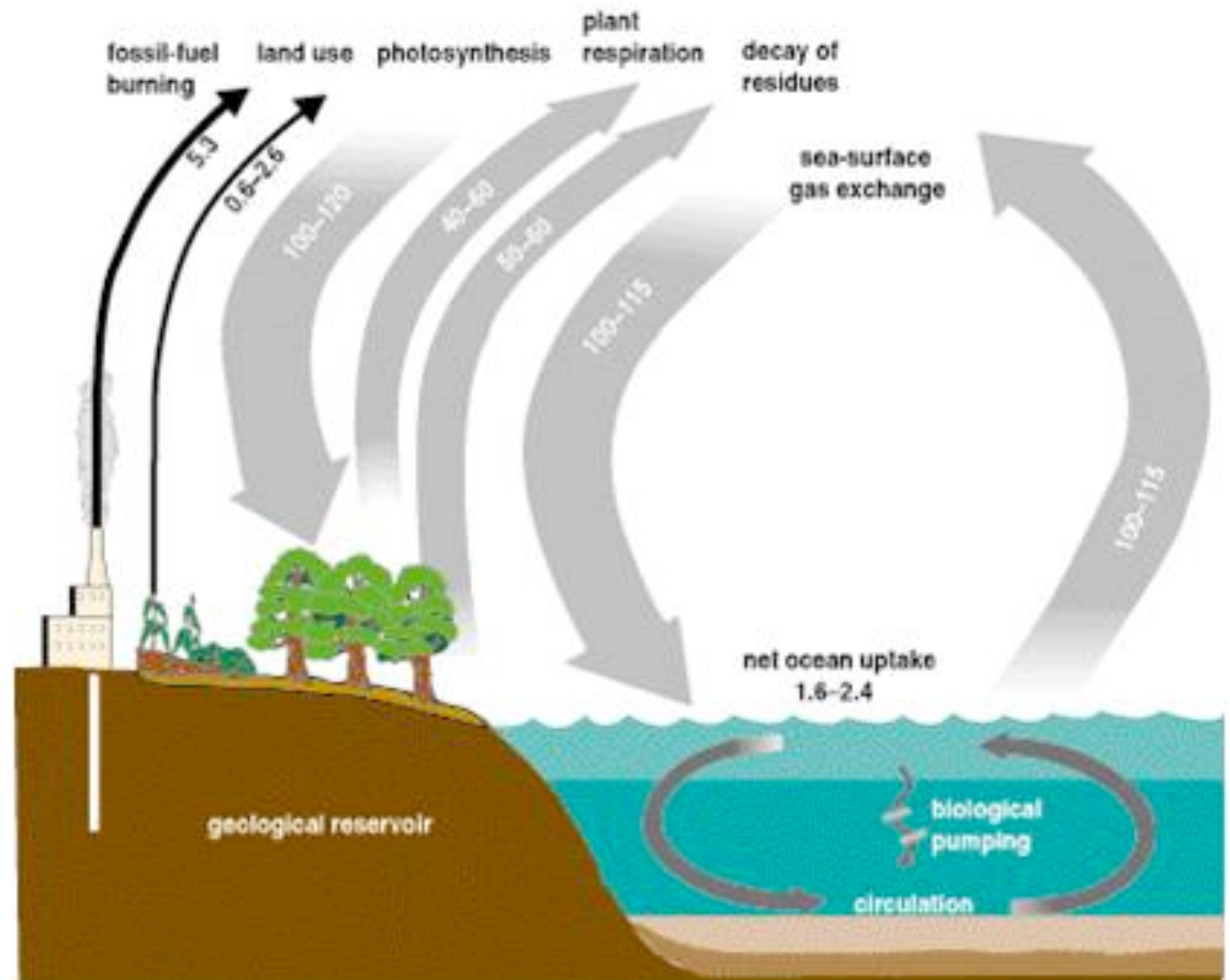
CLIMATE: The long-term average of weather over decades



# Aren't plants to "blame" more than us?

Natural carbon sources take up as much or more than they produce.

Human carbon sources absorb *nothing*.



# Aren't scientists always disagreeing?

Warming of the climate system is now evident from observations. Most of the increase is very likely (>90%) due to the observed increase in heat-trapping gas concentrations due to human activities [including burning fossil fuels].

Climatic change is being brought about by human-induced increases in the concentration of atmospheric carbon dioxide, primarily through the processes of combustion [burning] of fossil fuels.

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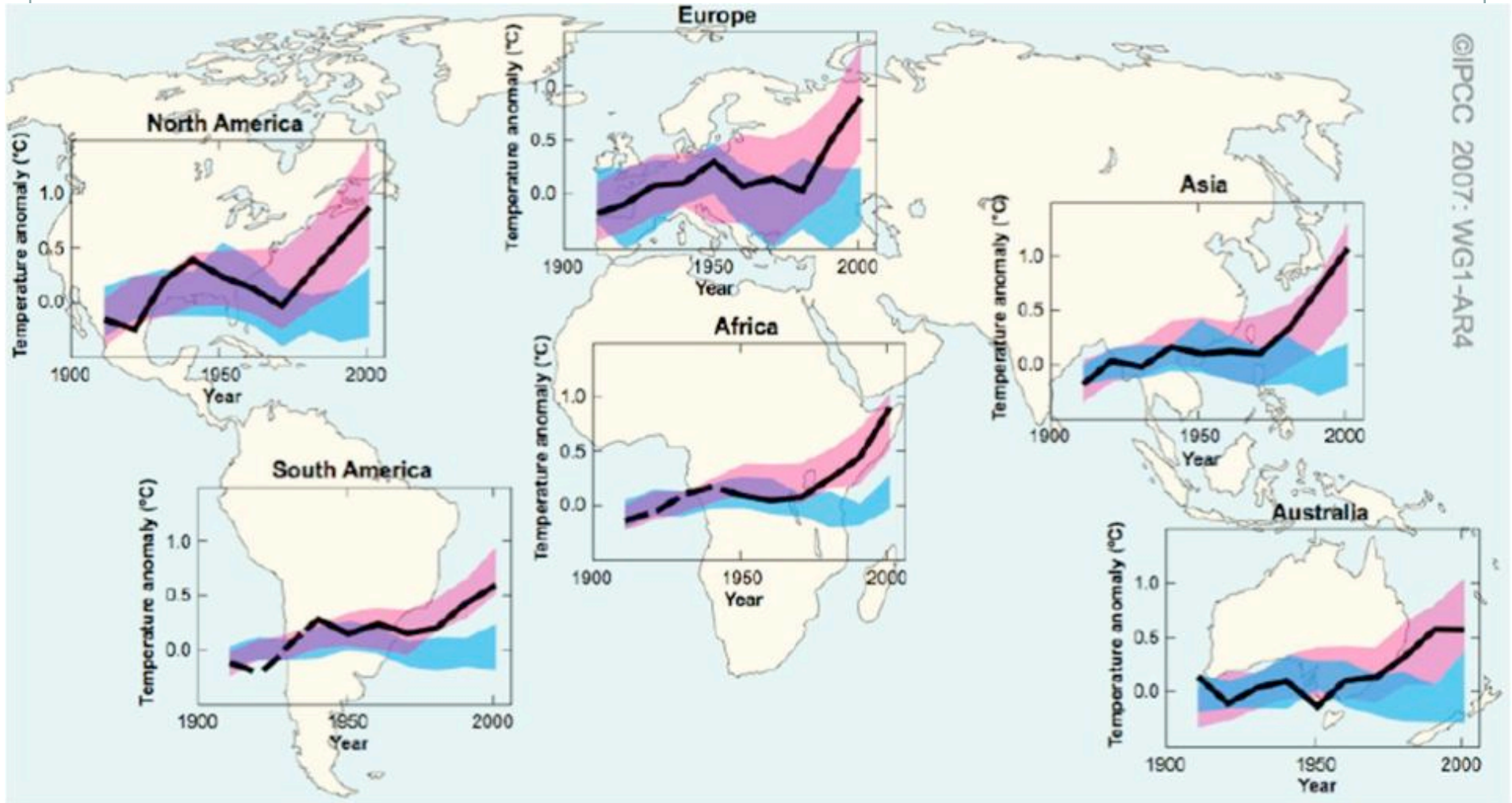
## **The United Nations Intergovernmental Panel on Climate Change, 2007**

Climatic change is being brought about by human-induced increases in the concentration of atmospheric carbon dioxide, primarily through the processes of combustion [burning] of fossil fuels.

## **"The Artificial Production of Carbon Dioxide and Its Influence on Temperature"**

**Guy Callendar, 1938**

# Humans are the only explanation.



# How is this warming already affecting our planet?



PART FOUR



# Glaciers are melting



Blomstrandbrennen Glacier in Norway

# Glaciers are melting



Blomstrandbrennen Glacier in Norway

# Glaciers are melting



Franz Josef Glacier, New Zealand

# Glaciers are melting



Franz Josef Glacier, New Zealand

# Glaciers are melting



Orubare Glacier, Uganda

# Glaciers are melting



Orubare Glacier, Uganda

**By 2030, the snows of Kilimanjaro will be gone.**

# Glaciers are melting



The Rhone glacier in the Bernese Oberland, Switzerland

# Glaciers are melting



The Rhone glacier in the Bernese Oberland, Switzerland



# Glaciers are melting



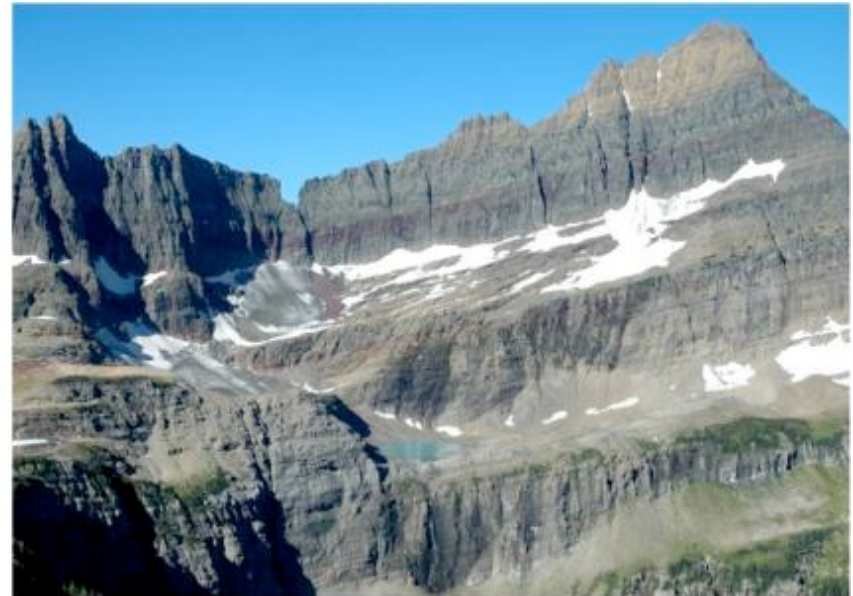
**1913**

Shepard Glacier, Glacier National Park, USA

# Glaciers are melting



1913



2005

Shepard Glacier, Glacier National Park, USA

**By 2030, Glacier National Park could be glacier-free.**

# Why do we care:



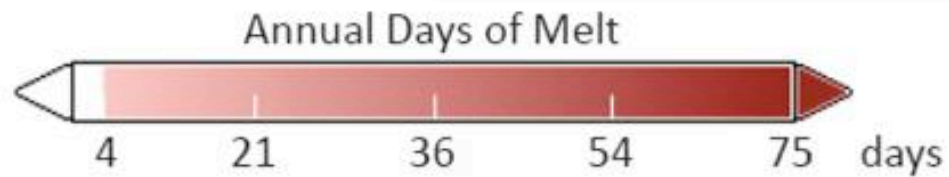
1 billion depend on glacier melt for water supply

# Lima's water supply is disappearing

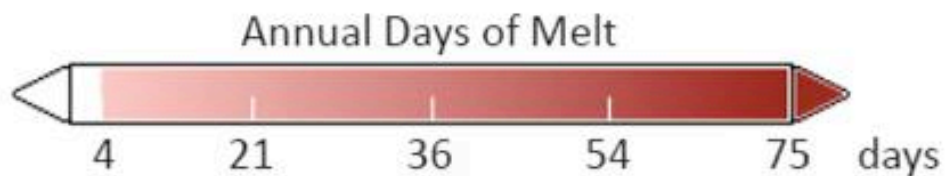


1 billion depend on glacier melt for water supply

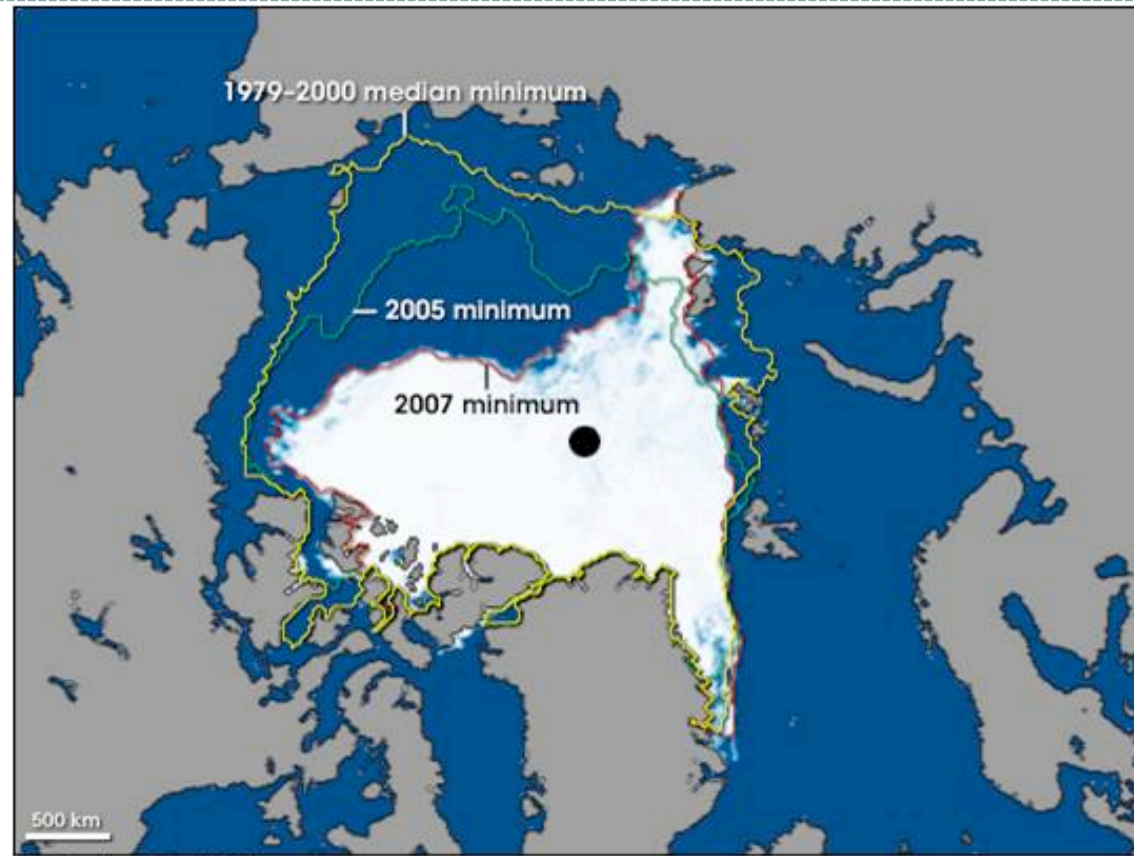
# Ice sheets are melting



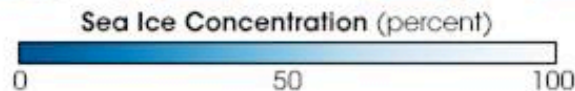
# Ice sheets are melting



# Arctic sea ice is shrinking



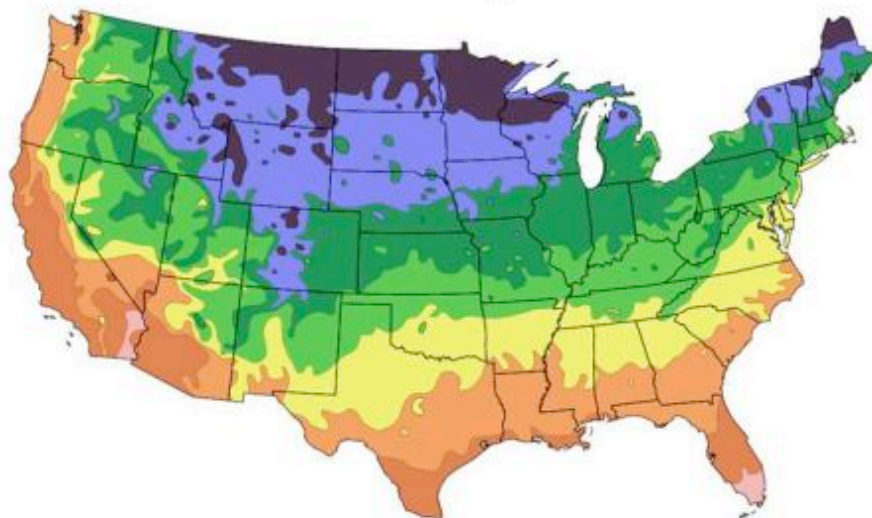
September 16, 2007



- Summer sea ice extent decreased 15-20% over last 40 yrs
- Ice-free summers likely within a few years

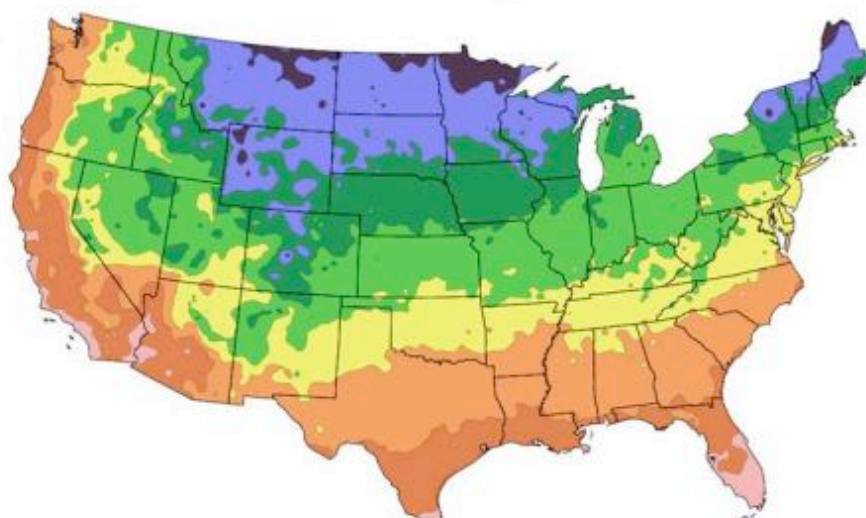
# Plant hardiness zones moving north

1990 Map



After USDA Plant Hardiness Zone Map, USDA Miscellaneous  
Publication No. 1475, Issued January 1990

2006 Map



National Arbor Day Foundation Plant Hardiness Zone Map  
published in 2006.

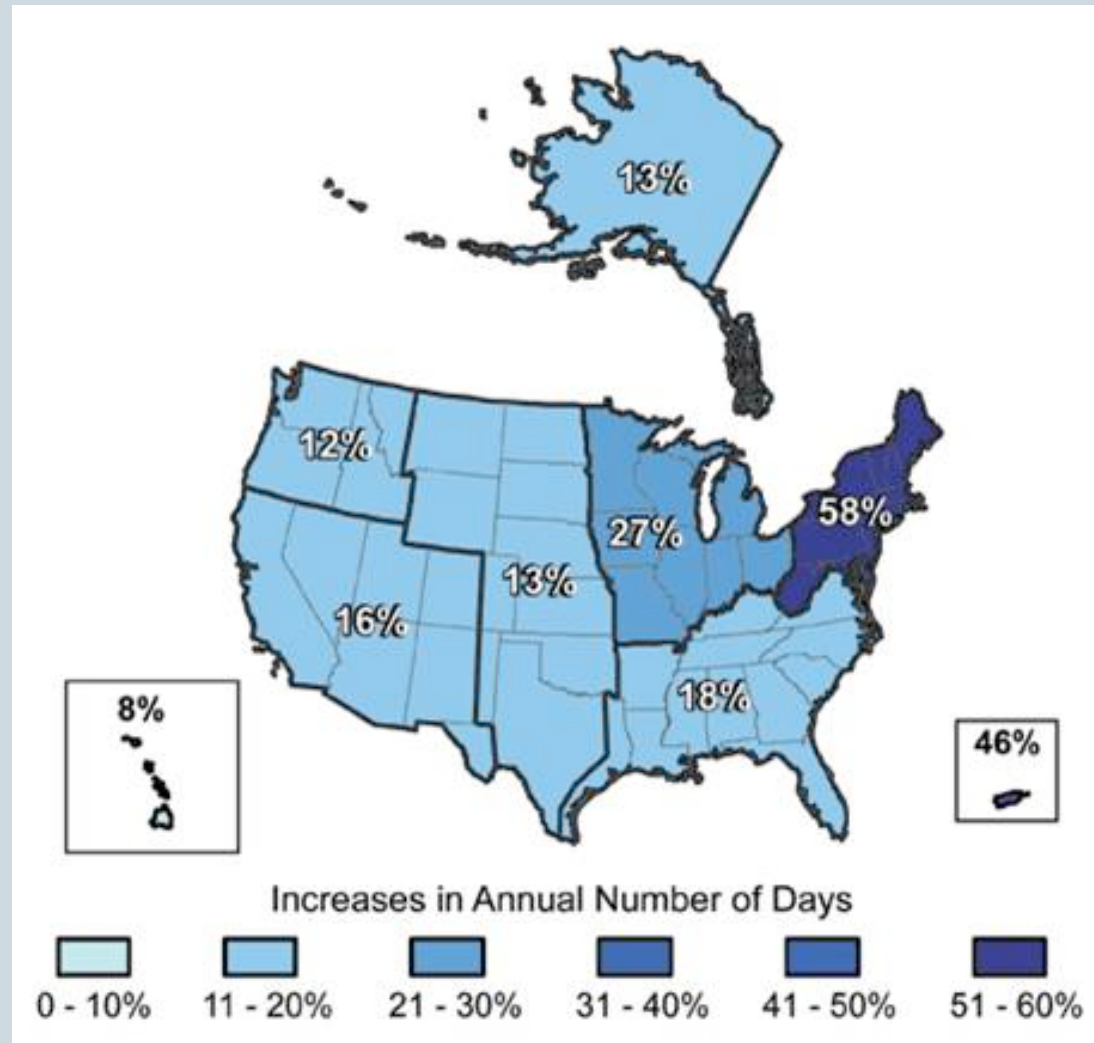
Zone



Most locations in US now feel like it used to  
about 200 miles south—just 20 yrs ago.

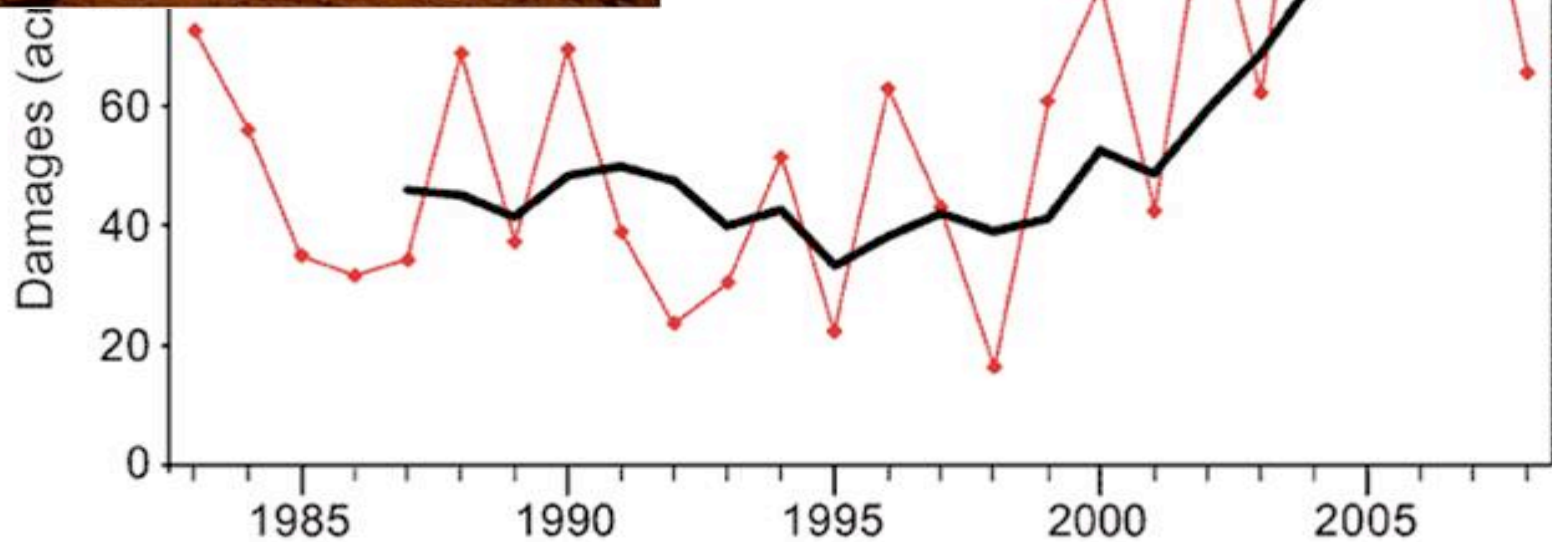


# Extreme rainfall more frequent

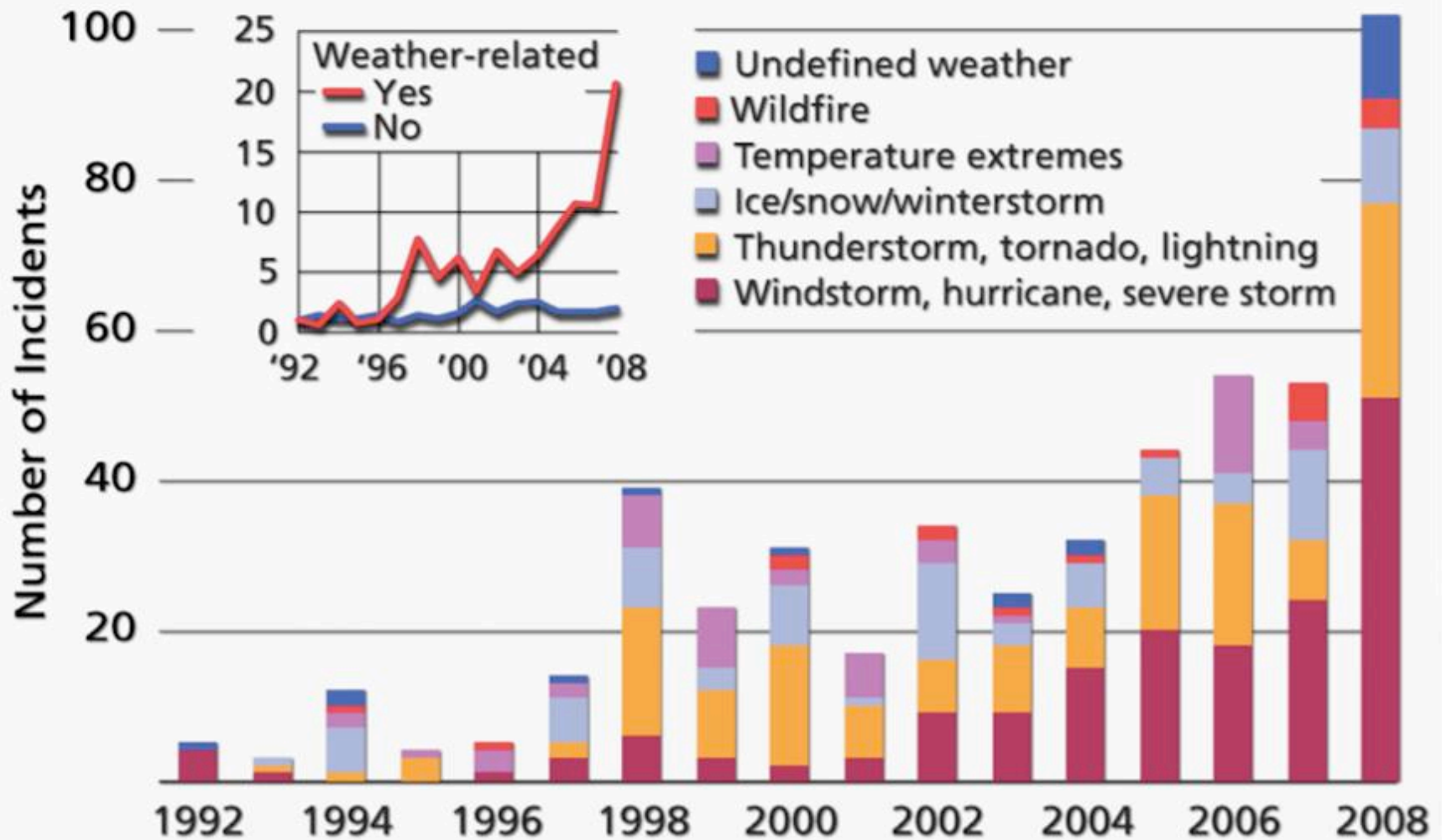


Increases in average number of days with very heavy precipitation (1958 to 2007)

# Larger & more damaging fires in the West



# More frequent weather-related electricity outages



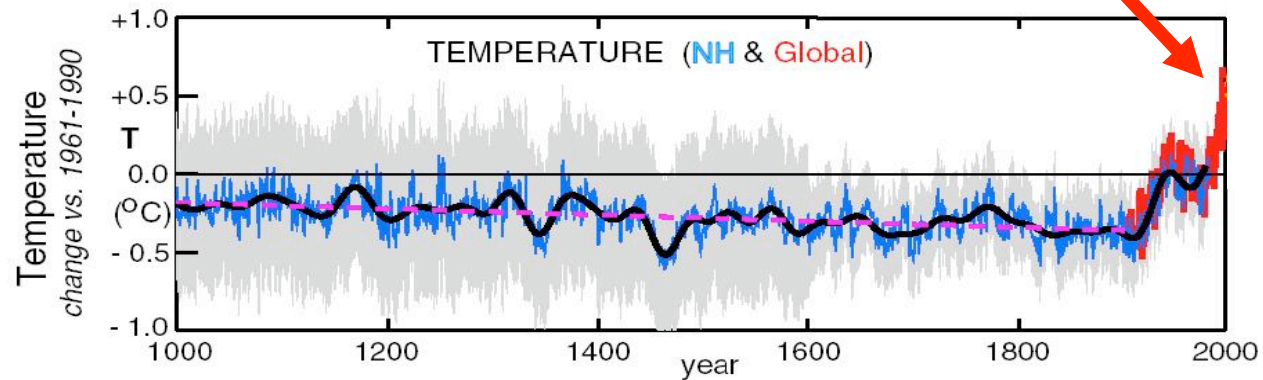
# What might the future hold?



PART FIVE

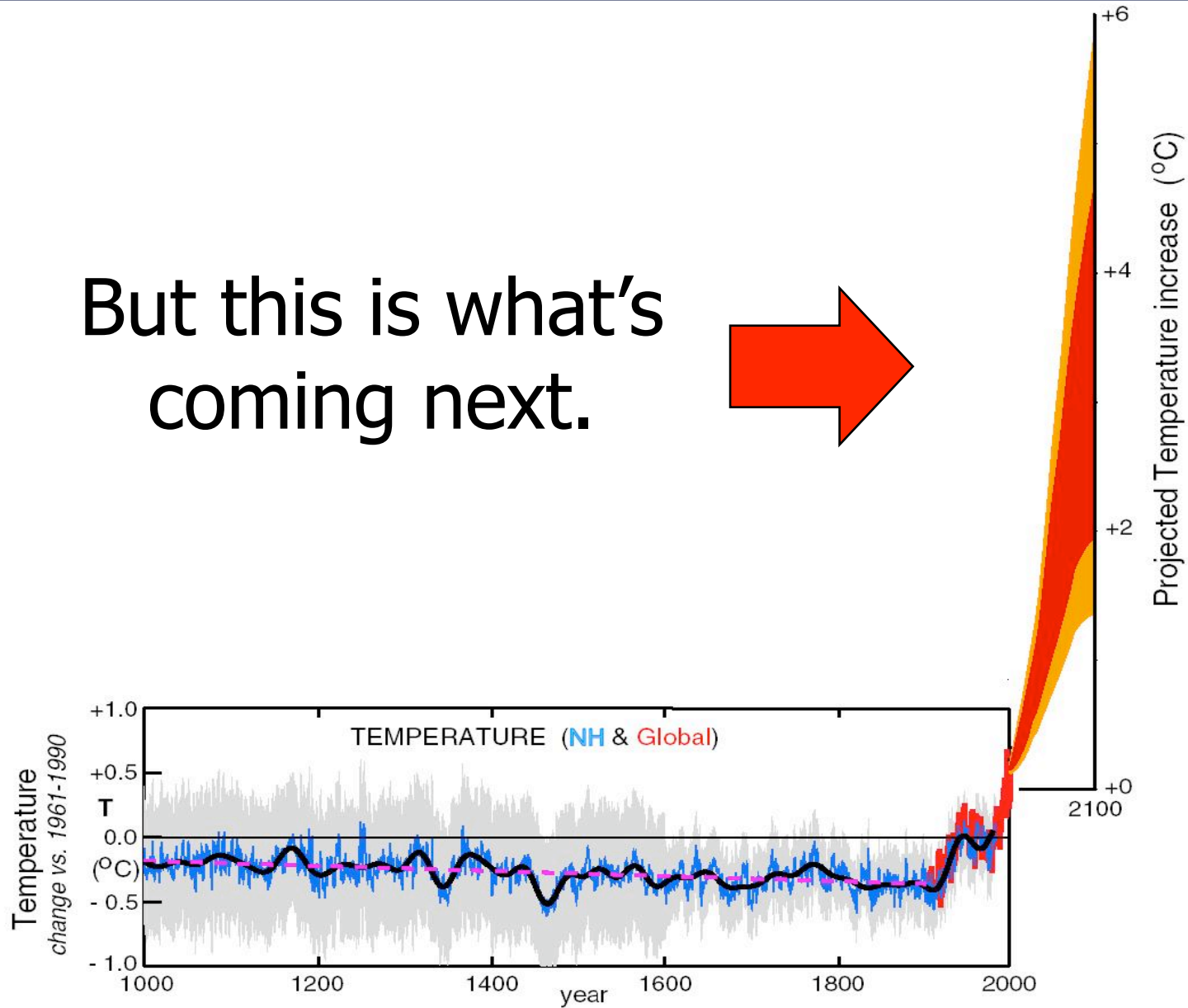
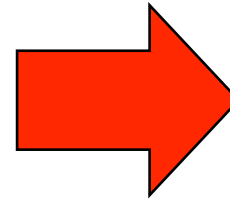
# What can we expect in the future?

We're already  
concerned about this

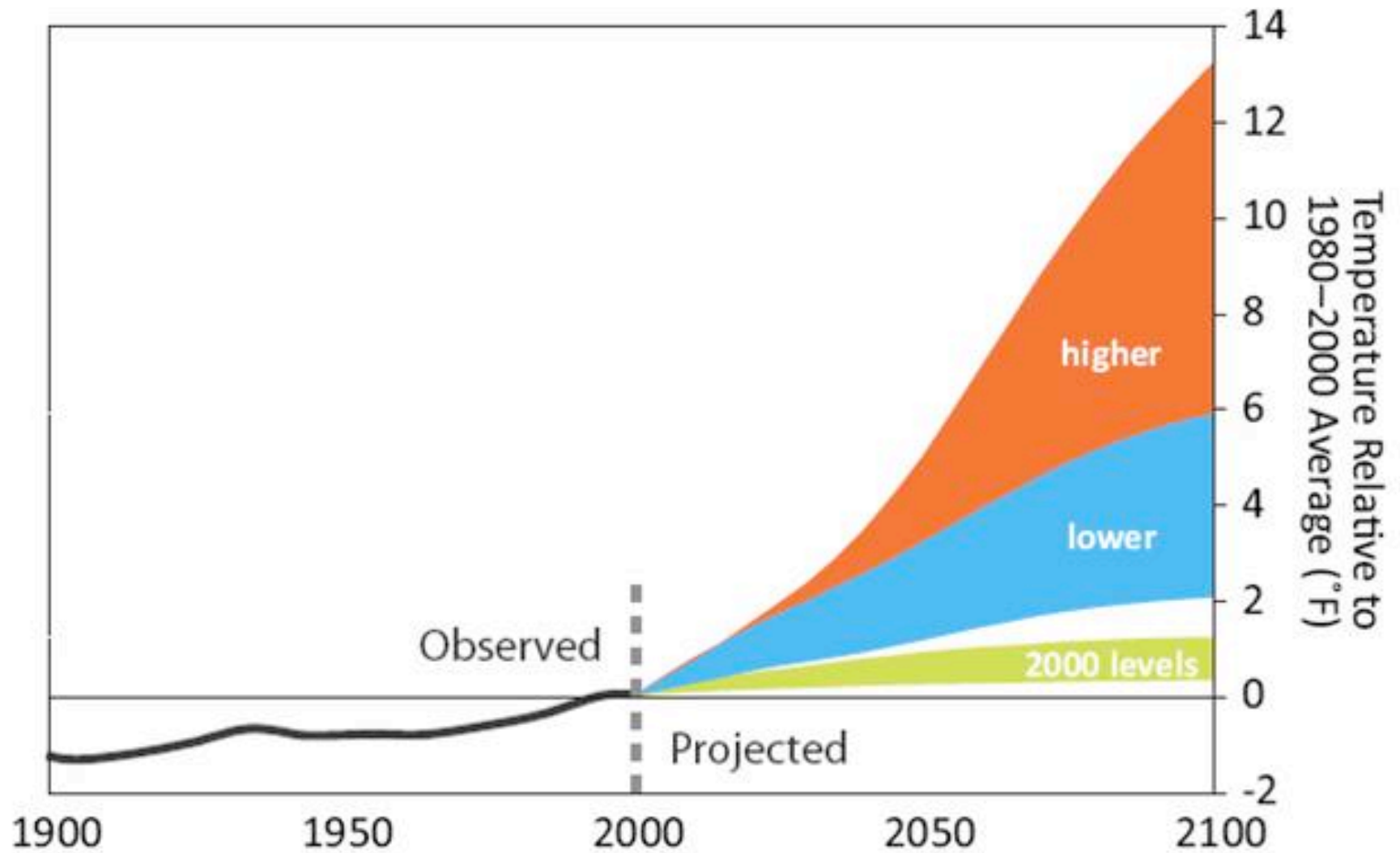


# What can we expect in the future?

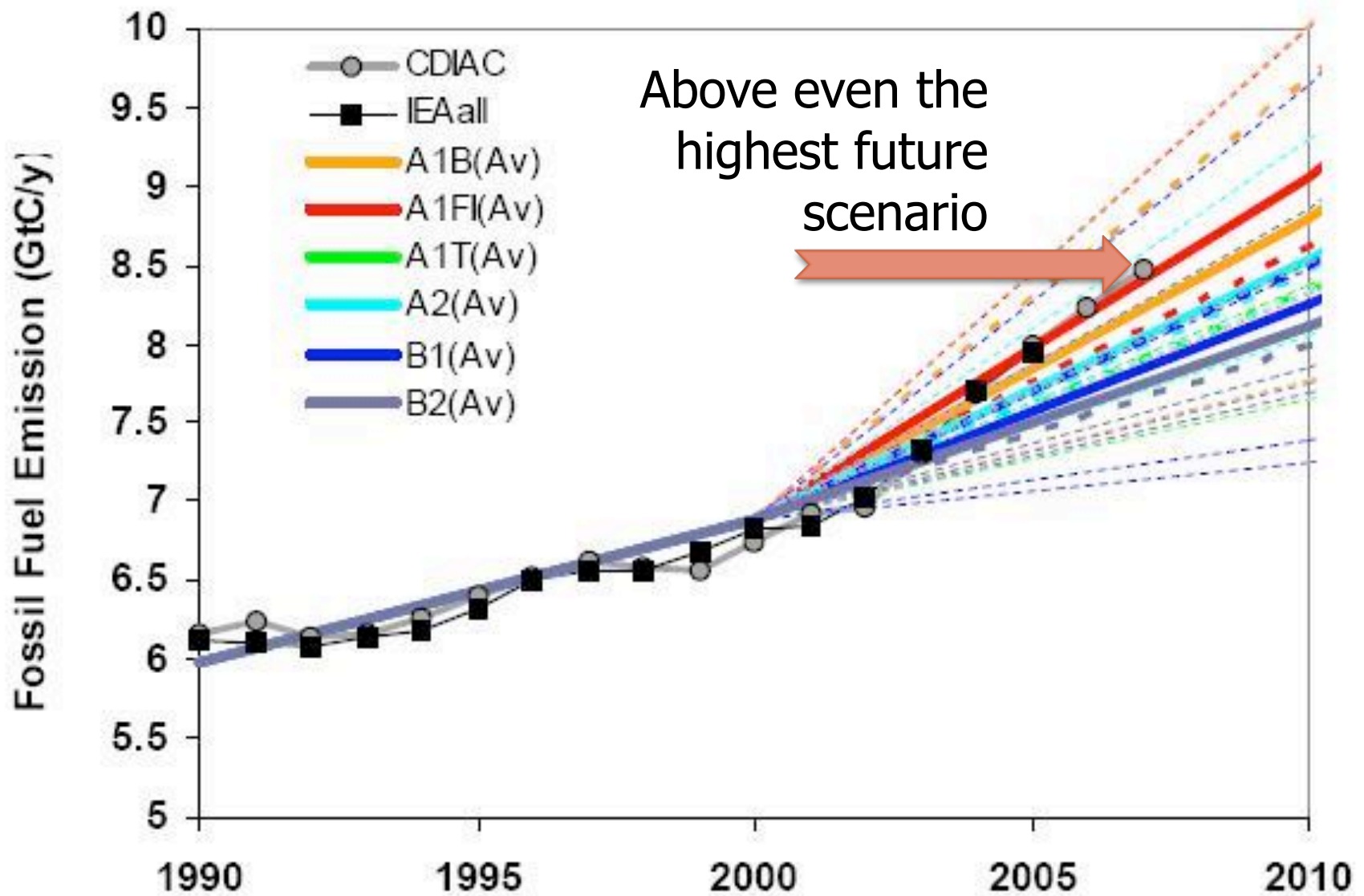
But this is what's coming next.



# The magnitude of future change depends on our near-term choices

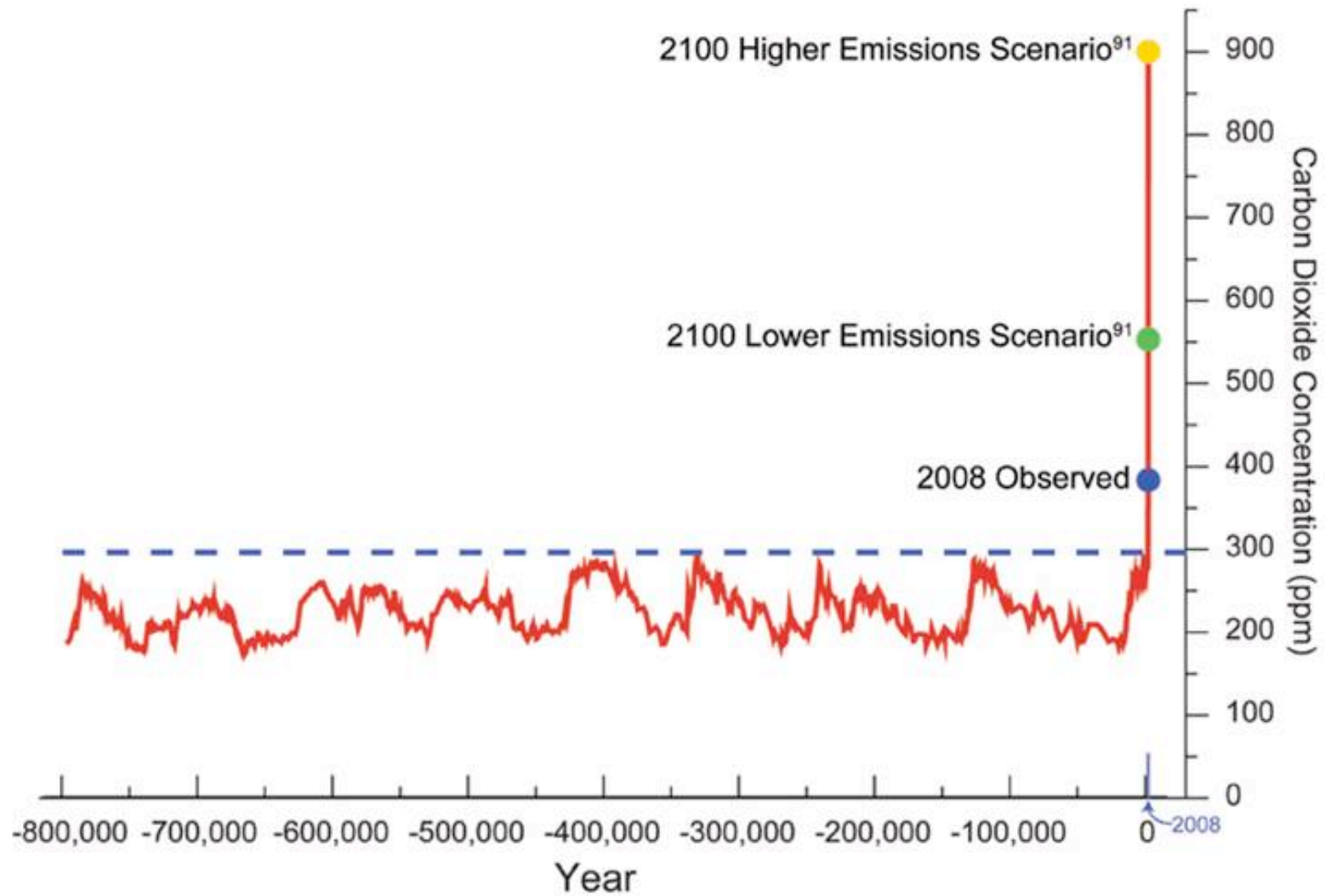


# Reality check: where are we now?



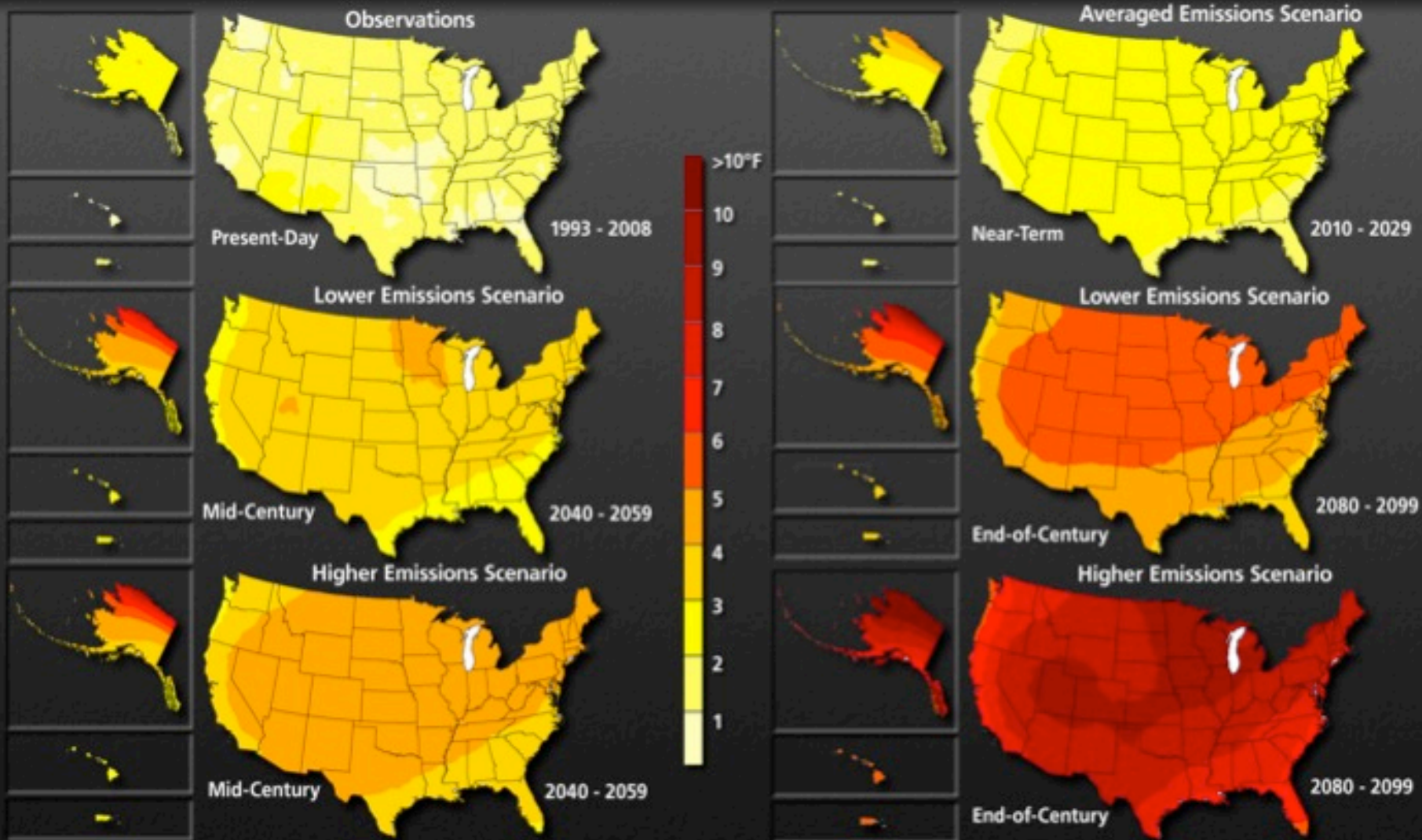


# ... and in context of the last 800,000 yrs

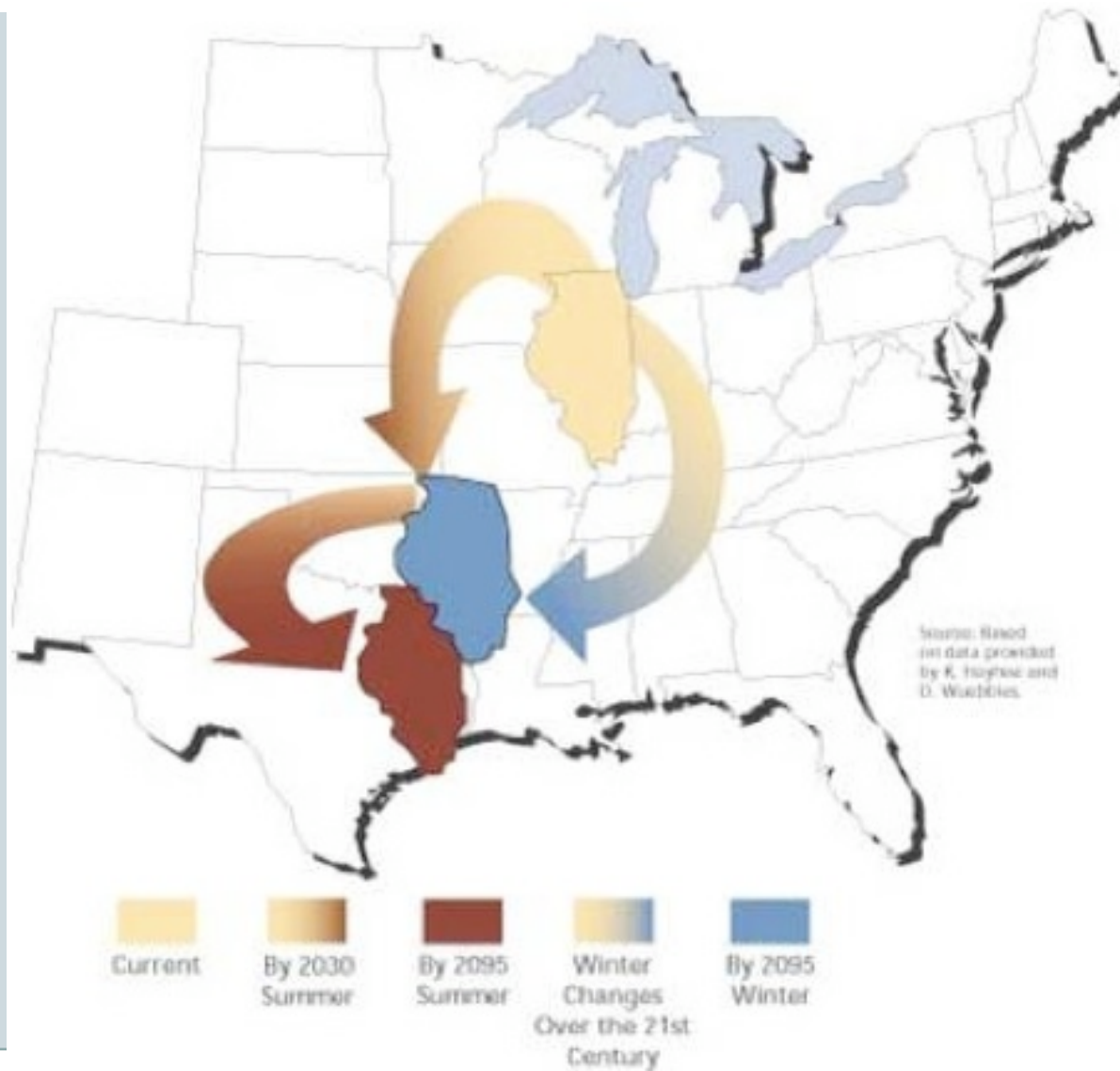


# Observed and Projected Average Change °F

from 1961 - 1979 Baseline



# “Migrating states”



# Focus on Chicago

**What will a typical Chicago summer feel like in the future?**

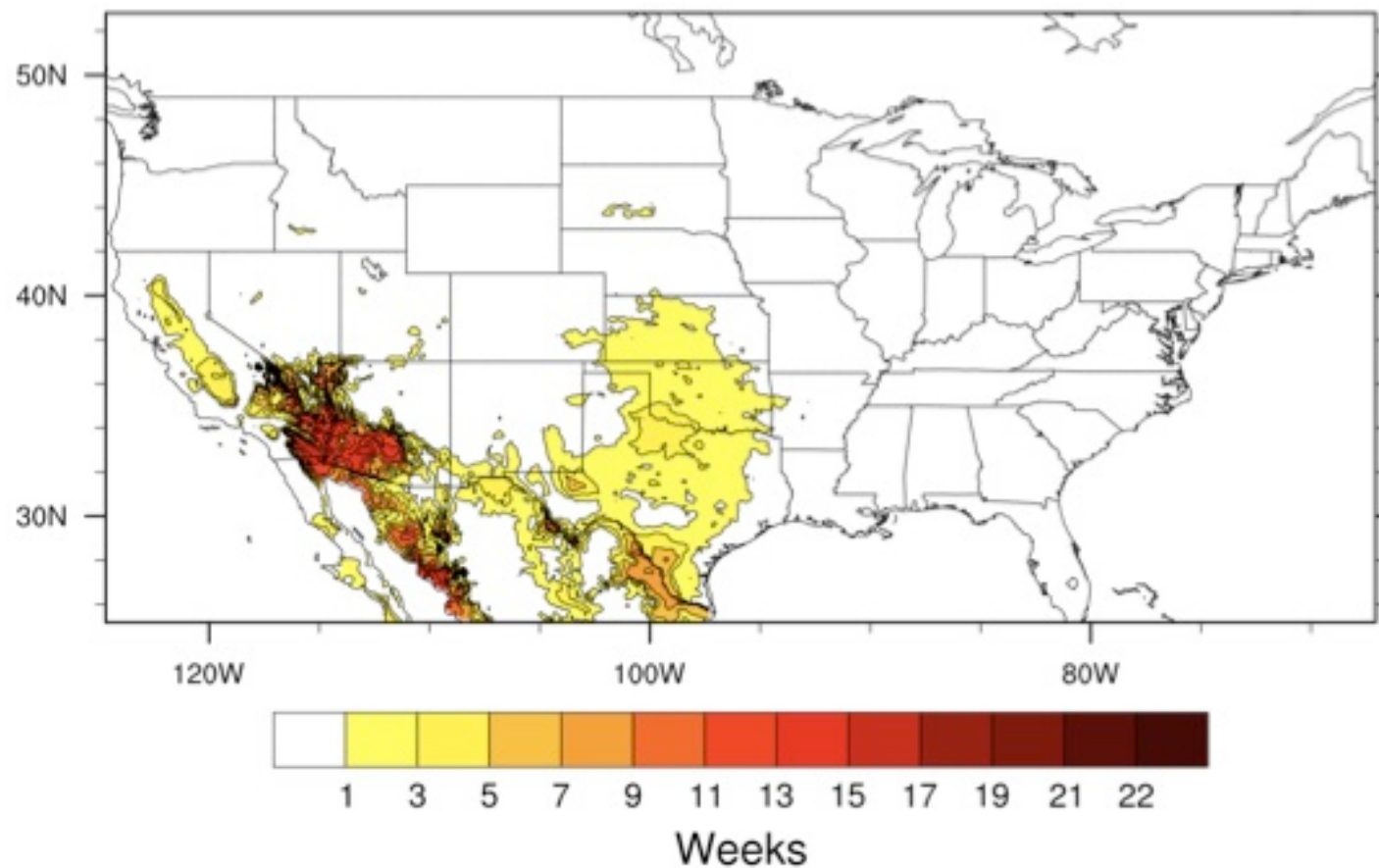
 **under higher emissions**

 **under lower emissions**



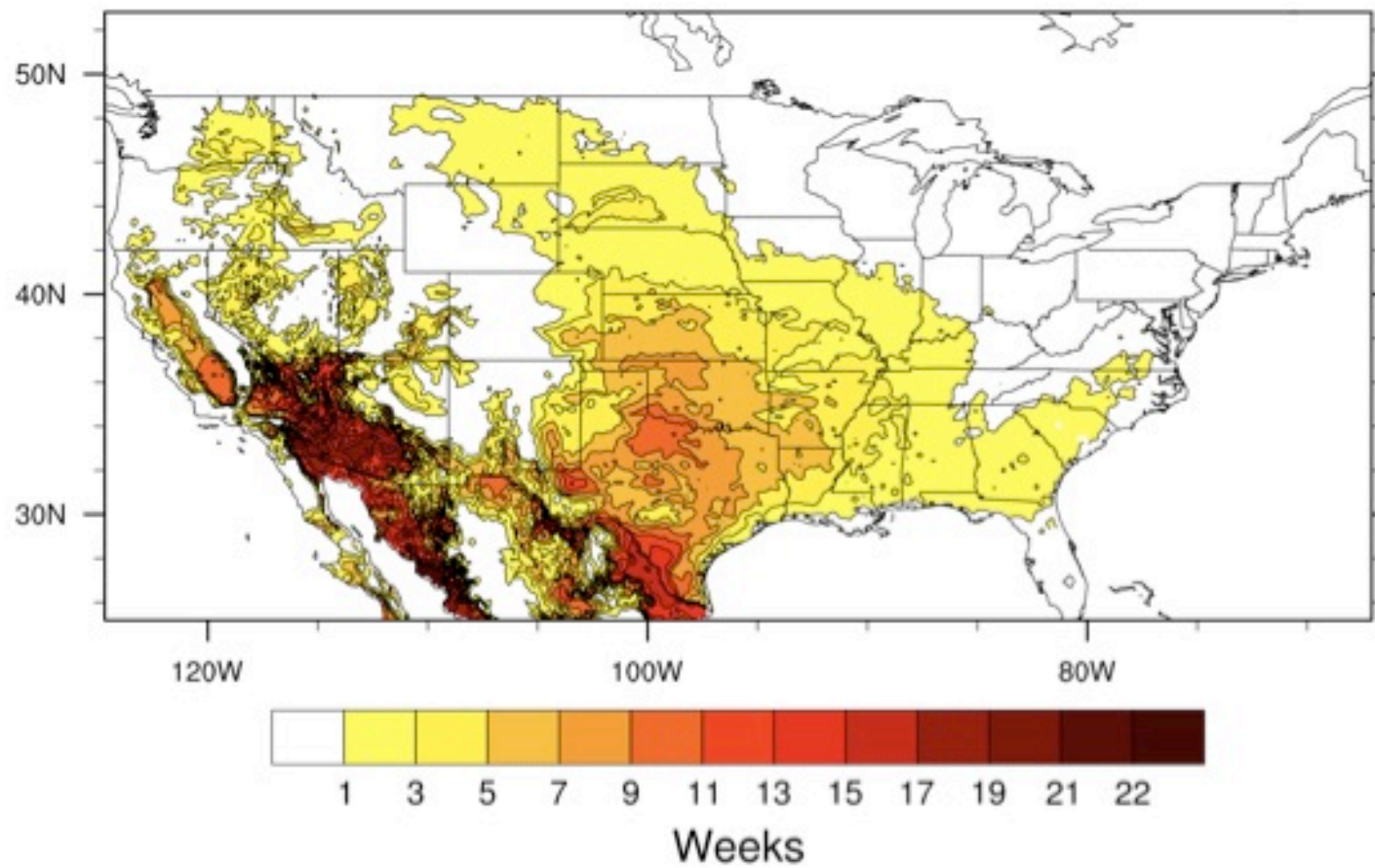
# Extreme Heat: Days > 100oF

1961-1979



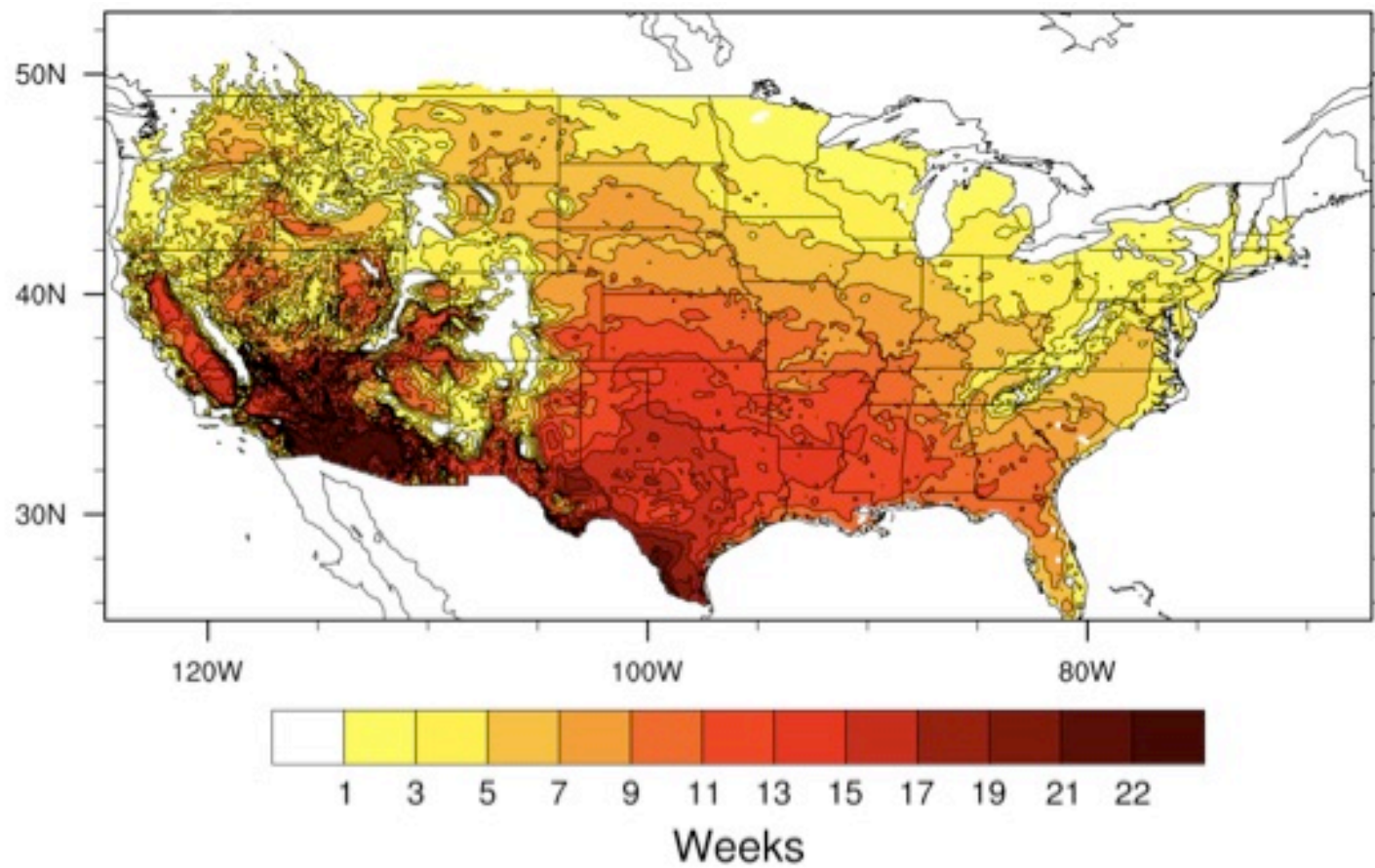
# Extreme Heat: Days > 100oF

## Lower Emissions: 2070-2099

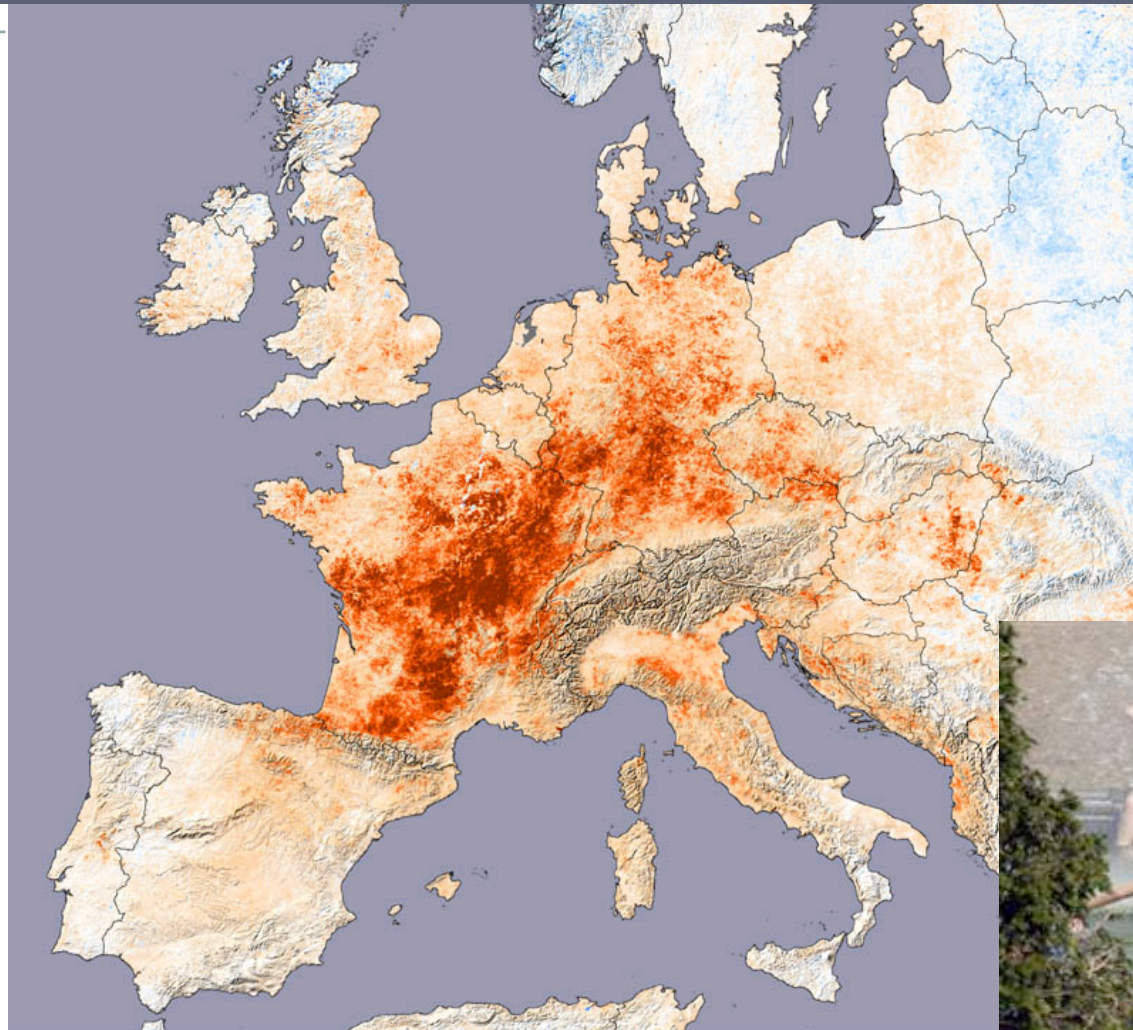


# Extreme Heat: Days > 100oF

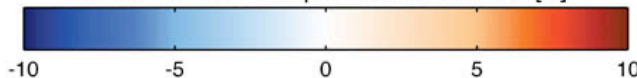
## Higher Emissions: 2070-2099



# More frequent & severe heat waves



Land Surface Temperature difference [K]



**2003 European  
Heat Wave  
>70,000 deaths**

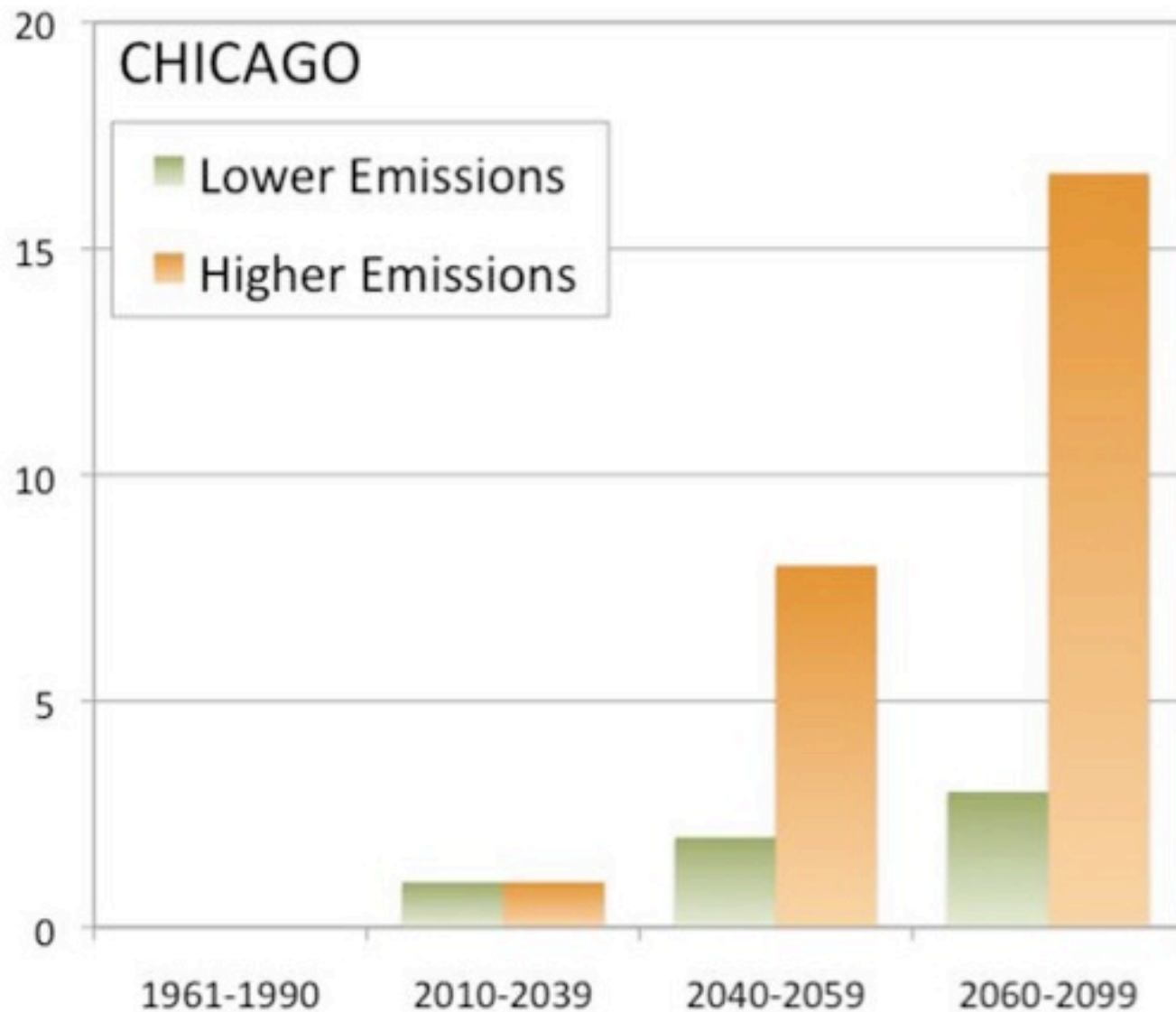
15% of Portugal's forests  
destroyed by fire (+18  
deaths)

Flash floods in the Alps  
from melting glaciers

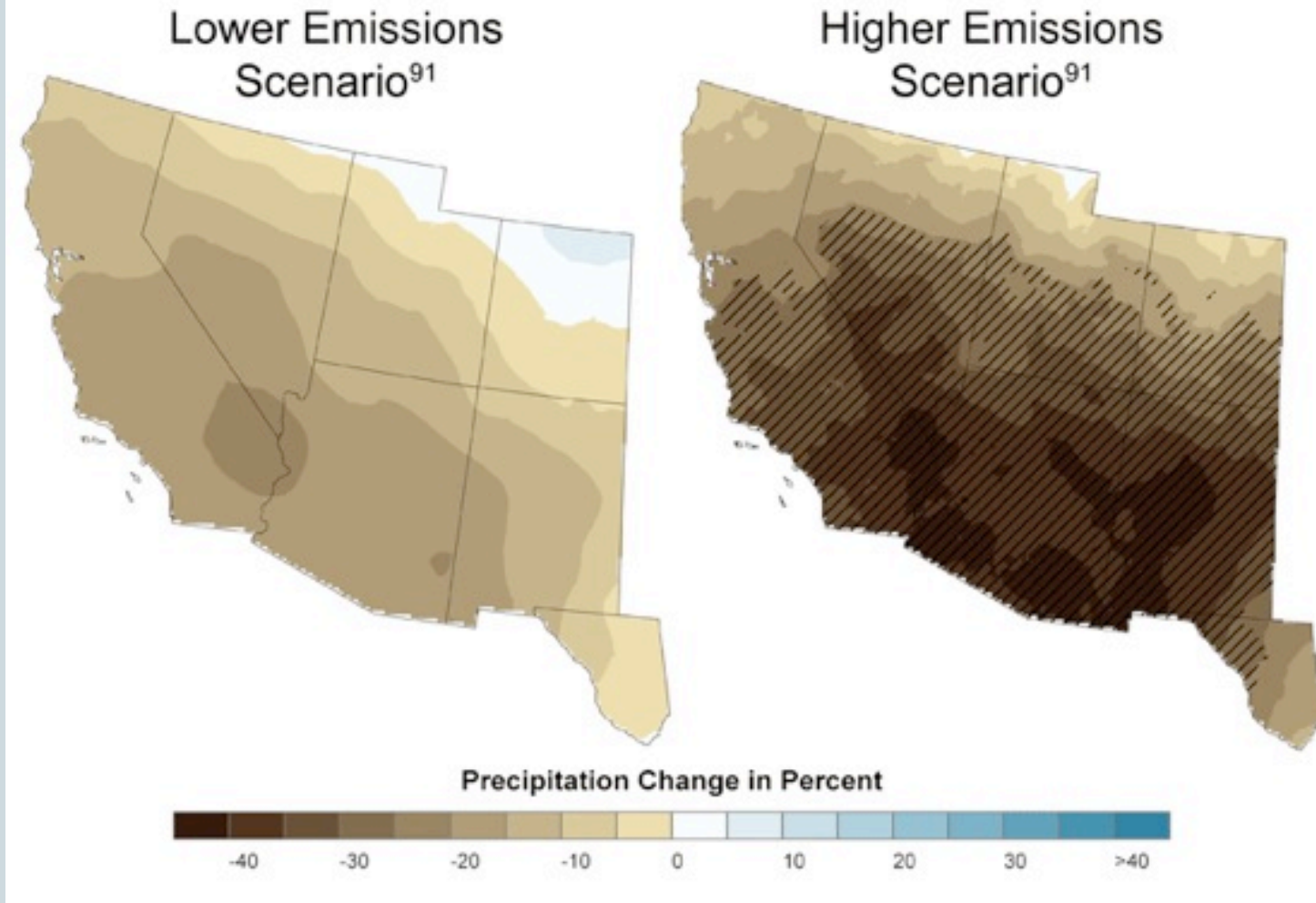




# What are the chances of a Europe 2003 heat wave in Chicago?

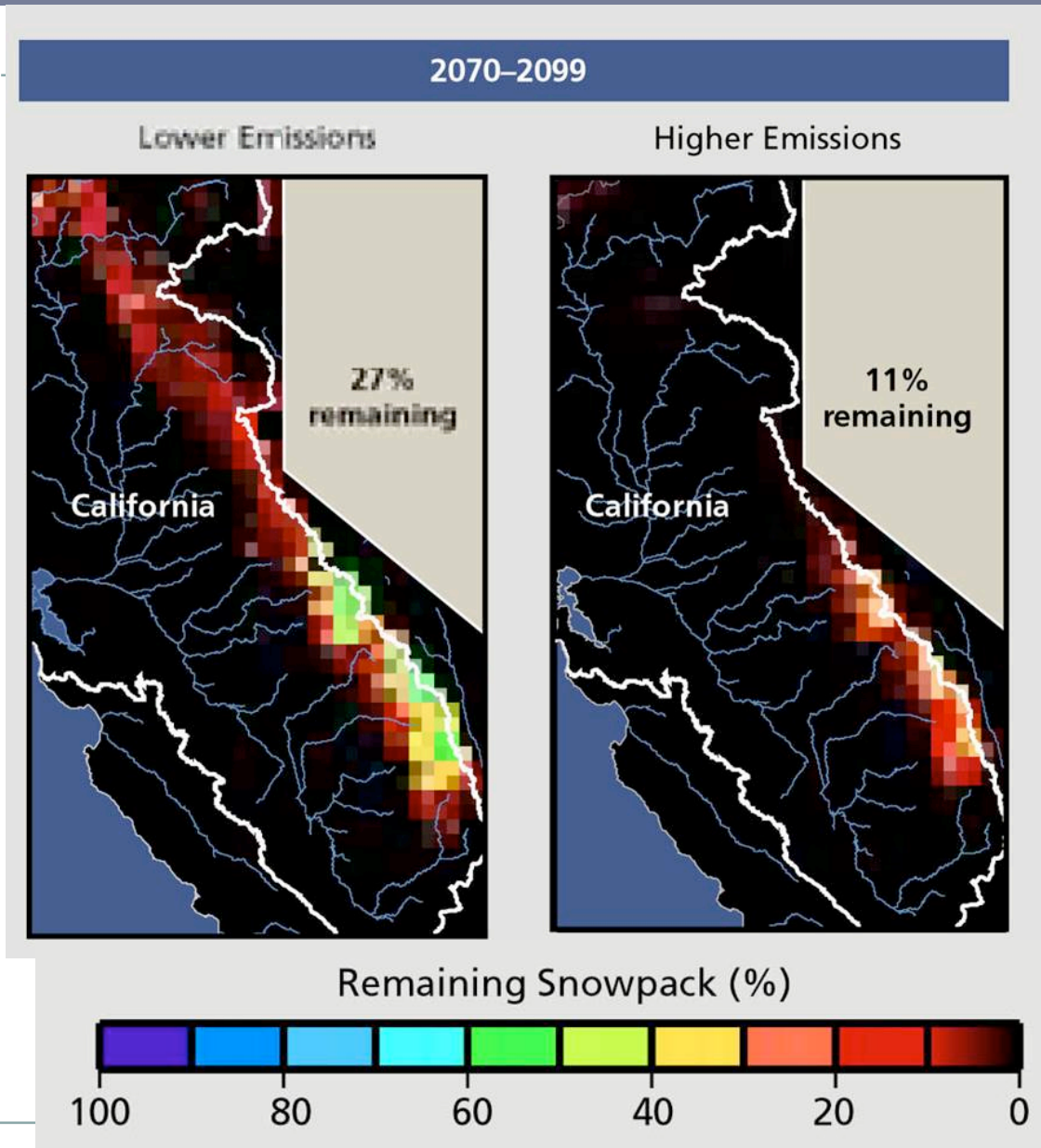


# Increasing risk of drought

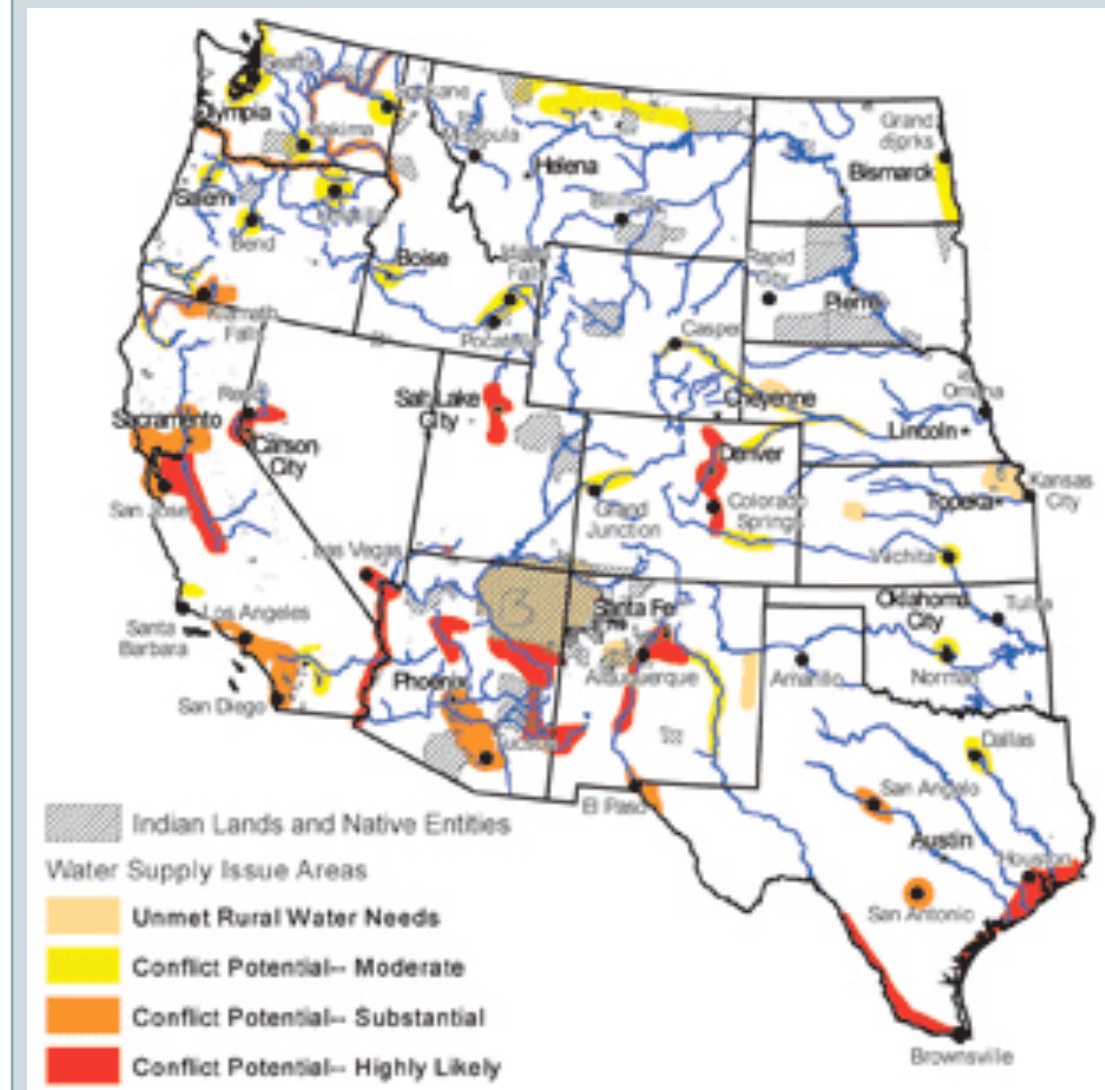


Change in March-April-May precipitation for 2080-2099 compared to 1961-1979

# Shrinking snowpack and water resources

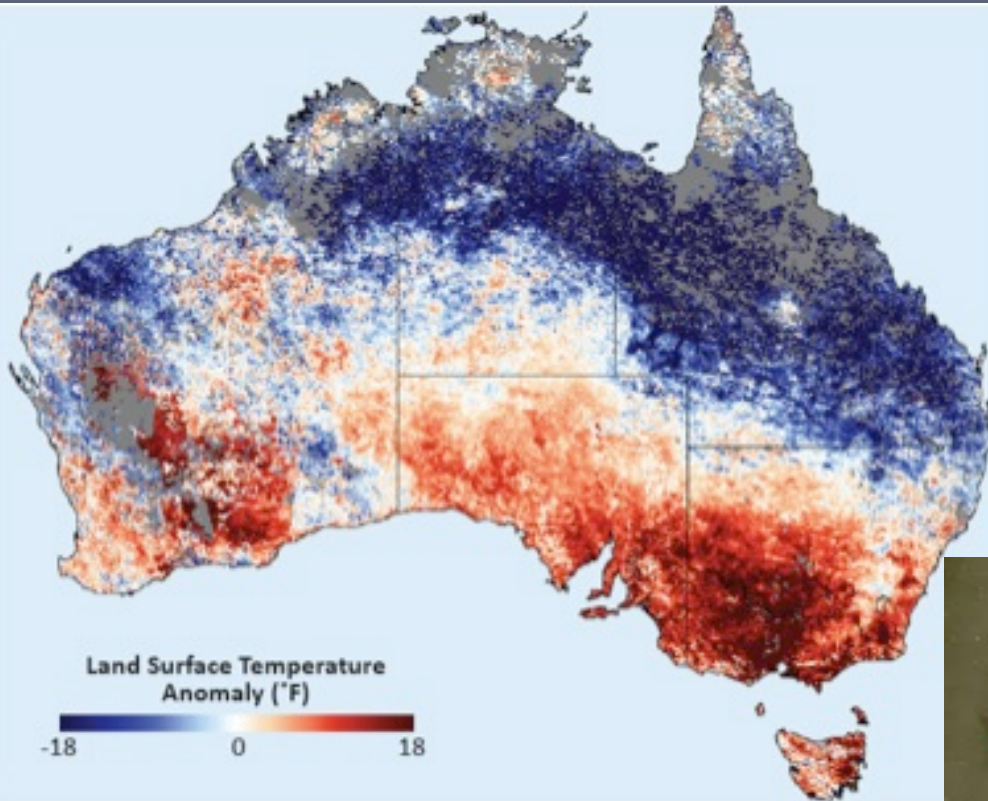


# Increasing potential for water supply conflicts



- regions where water supply conflicts are likely to occur by 2025
- based on population trends & potential endangered species
- *analysis does not factor in climate change*

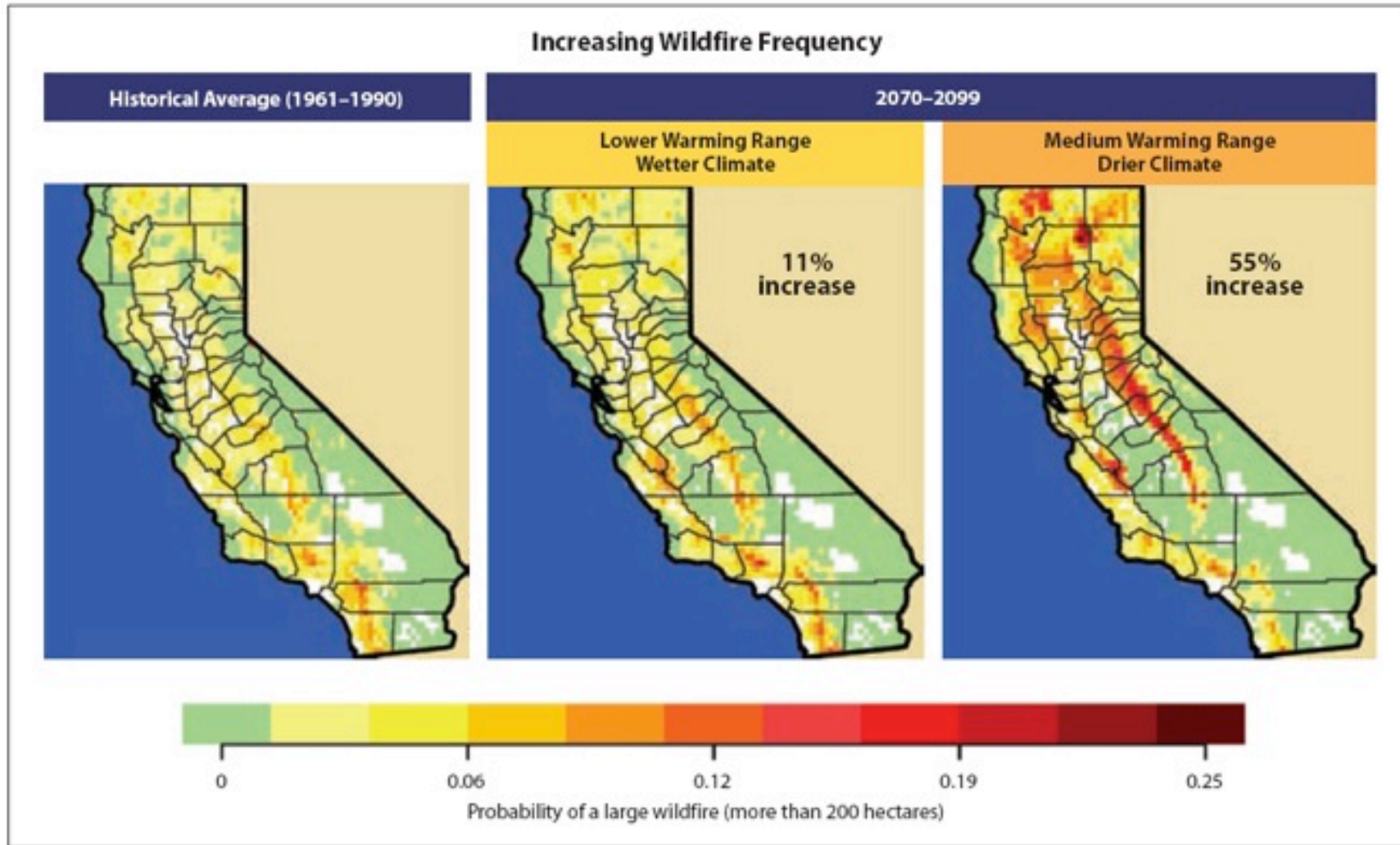
# More frequent heat, drought, and fire

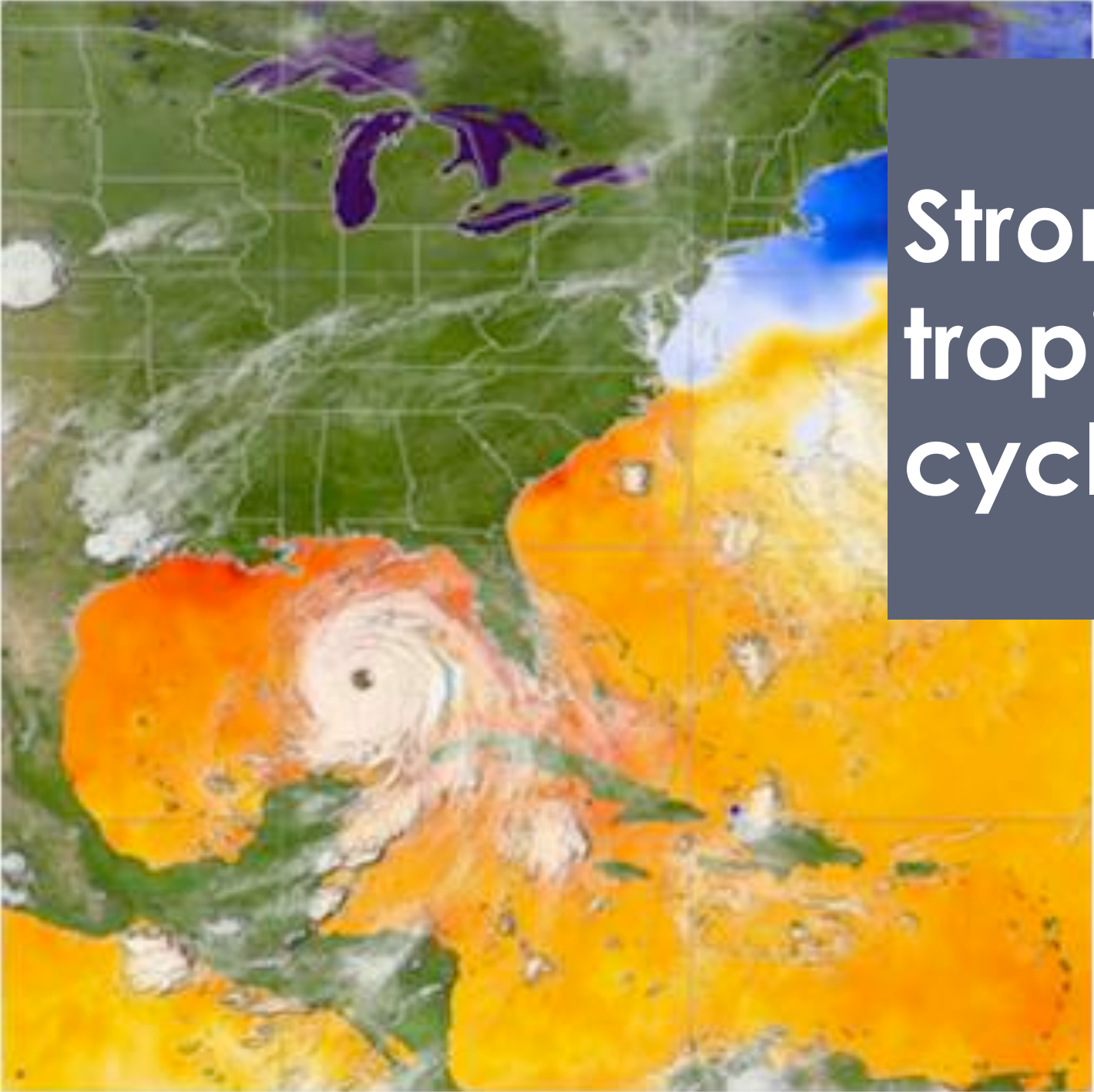


**AUSTRALIA**  
Jan-Feb 2009



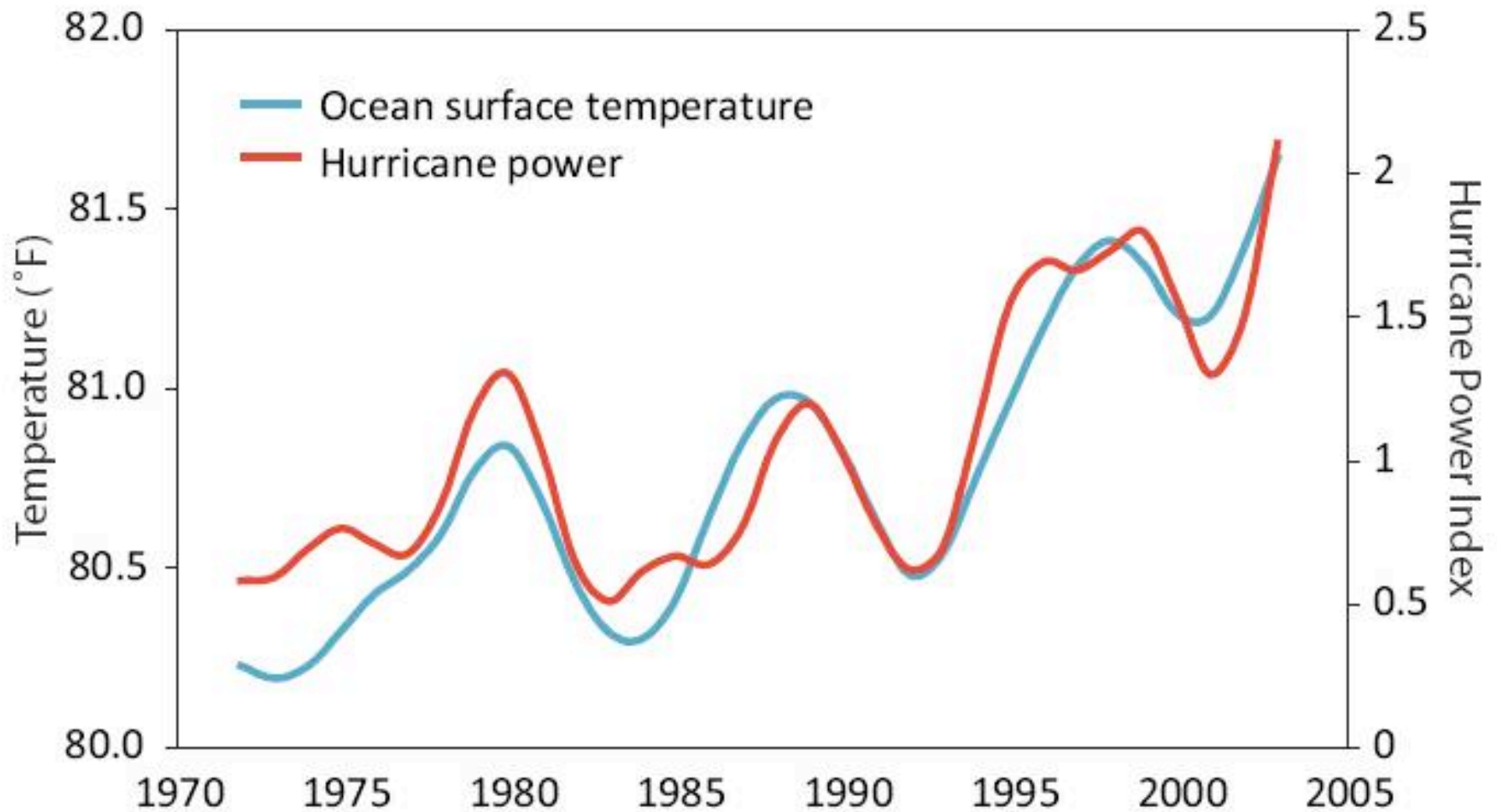
# Wildfire frequency in California



A satellite image showing several tropical cyclones over the Atlantic and Caribbean regions. The cyclones are depicted as swirling cloud patterns with distinct eyes, colored in shades of orange, red, and yellow. The surrounding ocean is shown in green and blue. A dark grey rectangular box is overlaid on the right side of the image, containing the text 'Stronger tropical cyclones' in white. The box is positioned over the Atlantic Ocean, partially overlapping the satellite image and the white background of the slide.

# Stronger tropical cyclones

# Hurricane power and ocean temperature

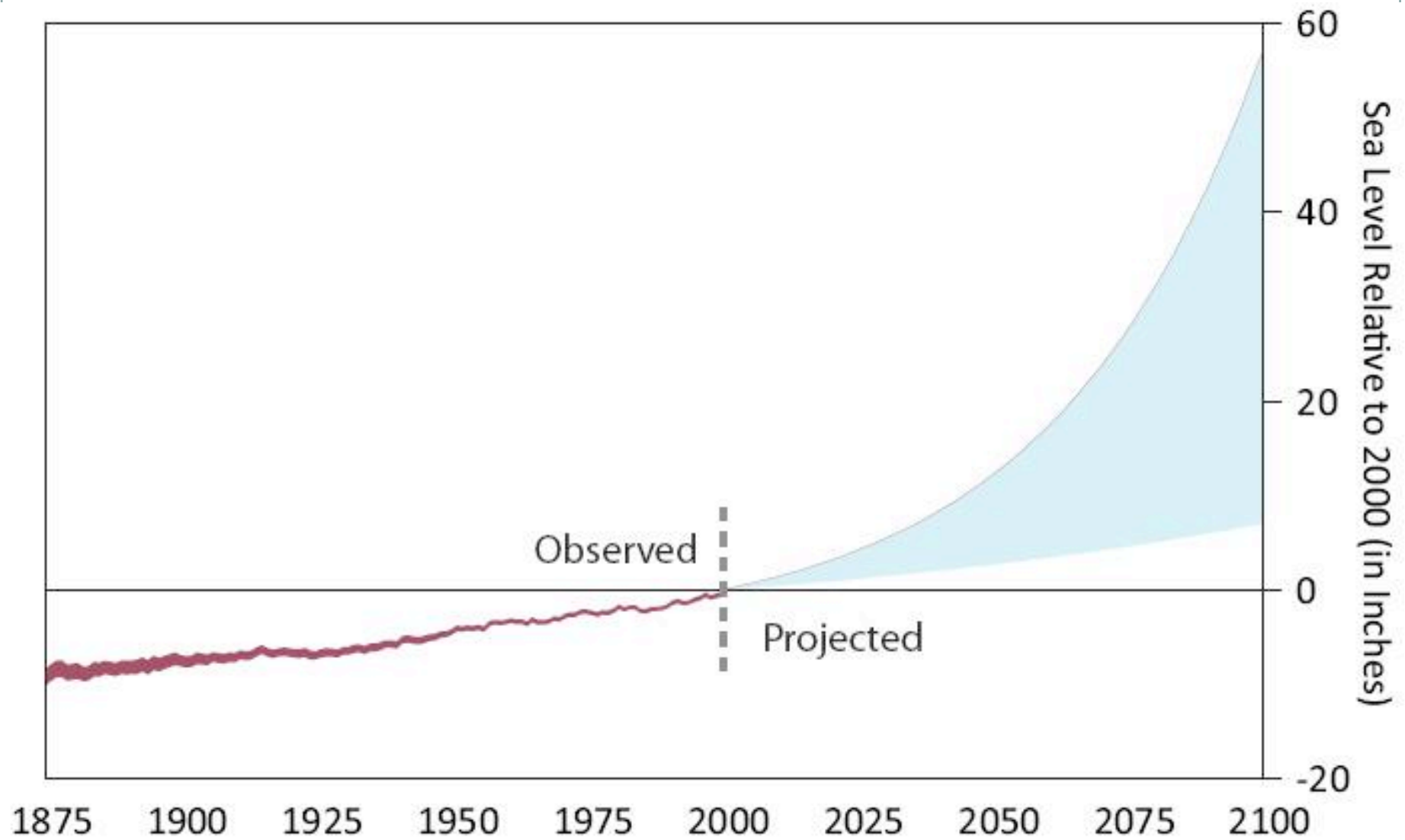




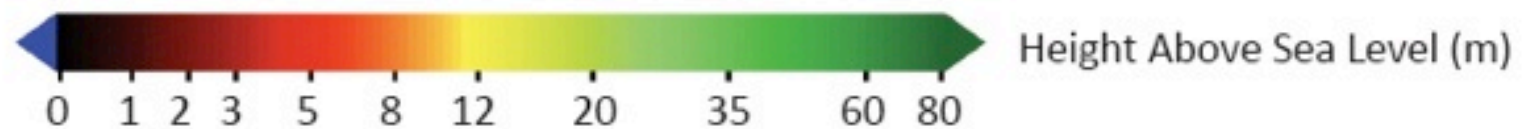
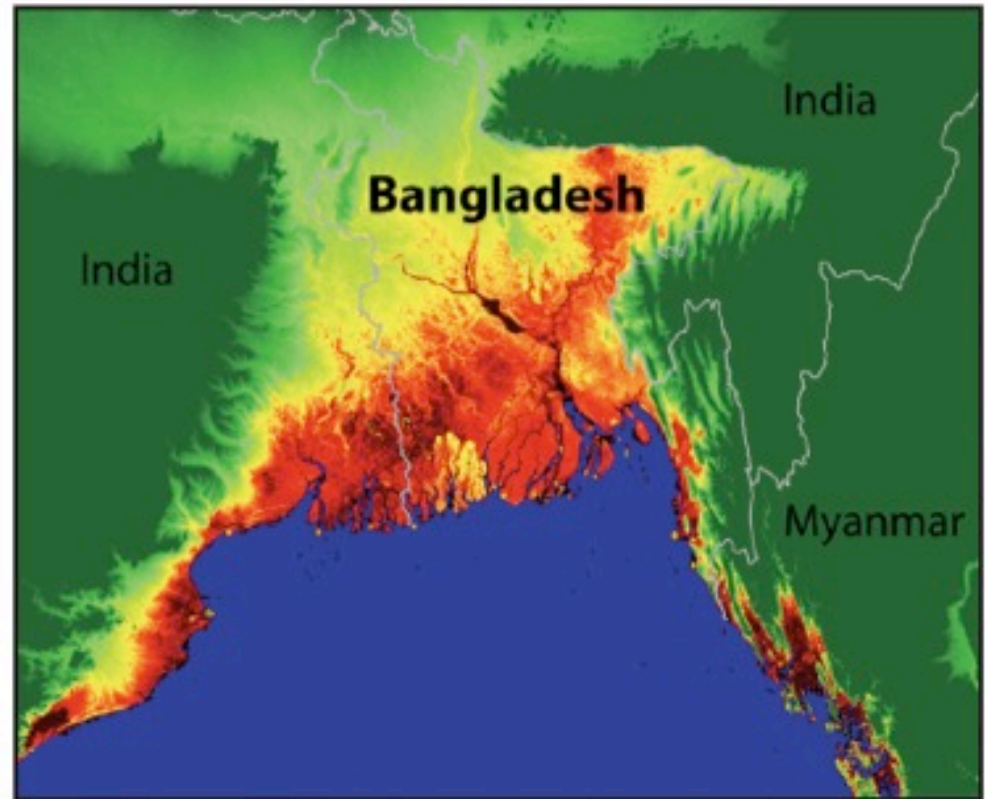
# It's not so simple

Mechanism	Likely change	Result
Ocean surface temperatures	Getting warmer	Longer season More powerful storms Greater number of storms
El Niño	More frequent	Suppresses hurricane formation
Atlantic Meridional Mode	Unsure	Alters location of hurricane formation; affects landfall frequency
Vertical wind shear	Decreasing	Conditions suitable for hurricane formation
Latent heat (condensation)	Increasing with warmer Ts	More rainfall associated with any hurricane

# Rising sea level



# Area at risk from sea level rise



# How can we respond?



PART SIX

# Small things matter



stop using this



start using this

# Ultimately we need a fundamental change



stop using this

start using this

# What can we do about it?

“We basically have three choices: mitigation, adaptation, and suffering. We’re going to do some of each. The question is what the mix is going to be. The more mitigation we do, the less adaptation will be required and the less suffering there will be.”

**John Holdren**

President of the American Association for the  
Advancement of Science; Harvard University

# Business climate is changing ...

## Global Renewable Energy Investments: \$85 Billion in 2007



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# Risk profiles are changing



The world is changing. We're changing how we insure it.

Real estate challenges are changing the world. That's why we created our Upgrade to Green™ coverage and Historic Rehabilitation Tax Credit insurance for commercial risks. These landmark coverages set a new standard and are just two of the 70 products we've developed since 2002 and 15 in 2007 alone. Because when a world changes this fast, you need an insurance company who can change right along with it.

Market Leadership Powered by the Spirit of Innovation

**Lexington Insurance Company**  
An AIG Company

# Sources of risk are changing

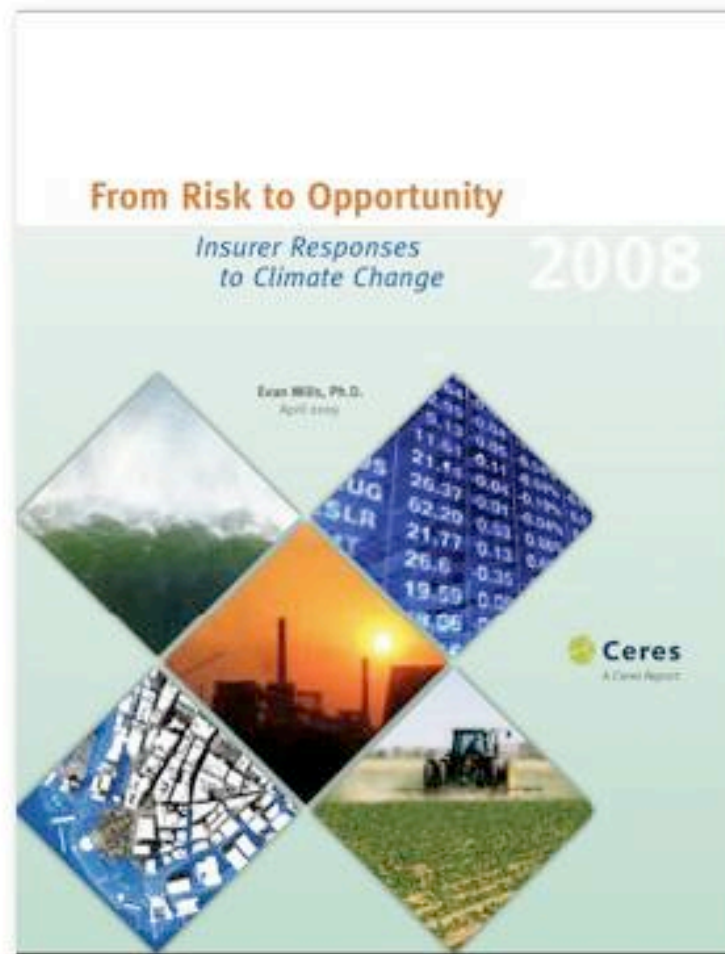
## **Climate Change is #1 Risk, According to >70 Insurance Industry Analysts** (Ernst & Young Survey, March 2008)

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

# It's time to move *from risk to opportunity*

**34 strategies; 643 examples**  
**278 entities; 29 countries ... and counting**



# Opportunities: new markets

- **Insurance Australia Group:** offering on-line automobile carbon-offset service for customers



Climate Help

Climate change

Going carbon neutral

What we're doing

How you can help

FAQ

Contact

NRMA INSURANCE

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NRMA Climate Help Pay for your emissions

Back to Climate Help

Paying for your emissions is one of the simplest things you can do to help the environment. And we've tried to make it even simpler by allowing you to pay online with your credit card. It's great to know you're doing the right thing, so we can also send you a certificate confirming that your car emissions will be offset. Just check the box on the next page and we'll email it to you in PDF format.

Calculate your CO<sub>2</sub>

Choose your car's make/model/year

Model

How far do you drive each year?

Your car emits 3.1 tonnes of CO<sub>2</sub> emissions annually

To offset your emissions for 12 months you need to pay \$32.93\*

\*It costs \$15.48 to offset one tonne of CO<sub>2</sub>

Pay for your emissions

Title  First name  Surname

MR  Email  Age

Are you an NRMA Insurance customer?  Yes  No Are you an IAG staff member?  Yes  No

Name on credit card  Credit card number  Expiry date  Credit Card Type

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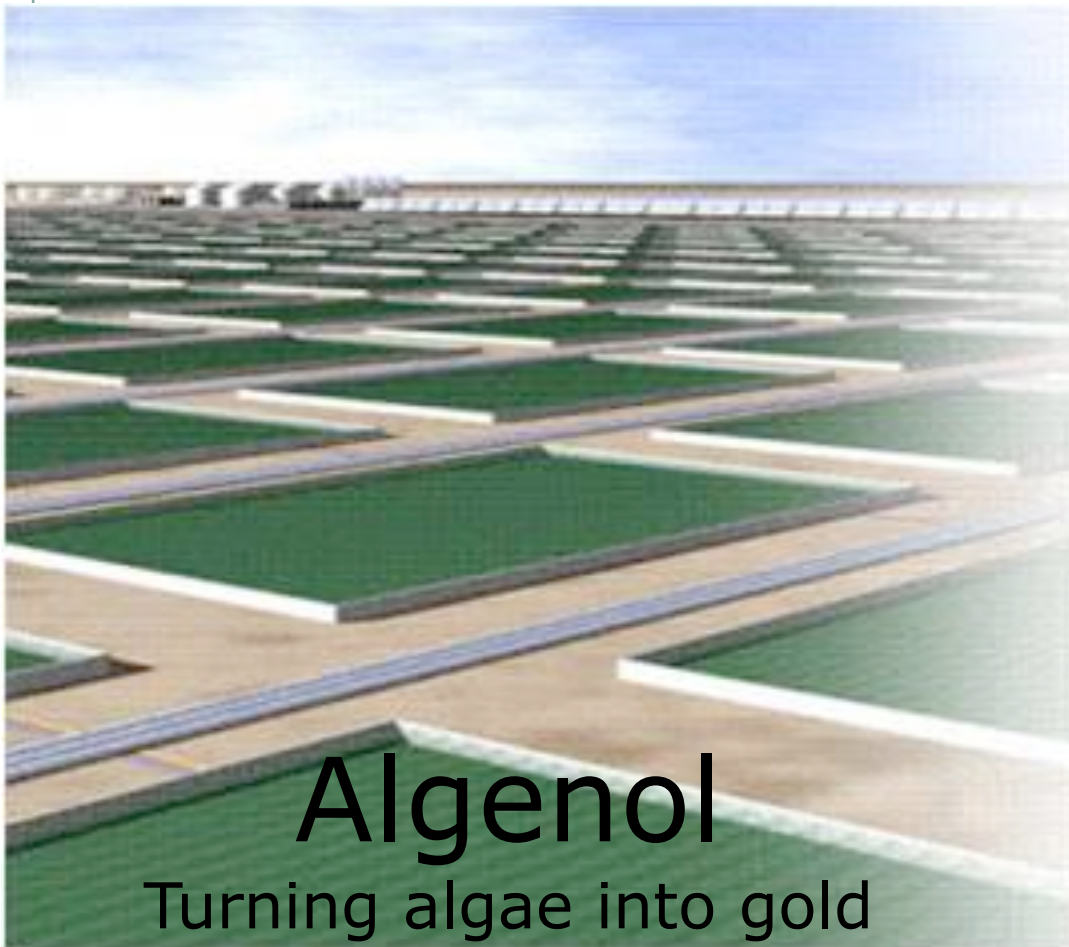
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Source: <http://www.climatehelp.com.au/>

Opportunities: new products

# Applied Marine Technologies

Constructing artificial reefs



## Algenol

Turning algae into gold



# Opportunities: new incentives



# Resource 1

## Global Climate Change Impacts in the United States

What climate change means for the places we care about ...

PDF & educational materials free online at:

[www.globalchange.gov/usimpacts](http://www.globalchange.gov/usimpacts)

## Global Climate Change Impacts in the United States

U.S. Global Change Research Program

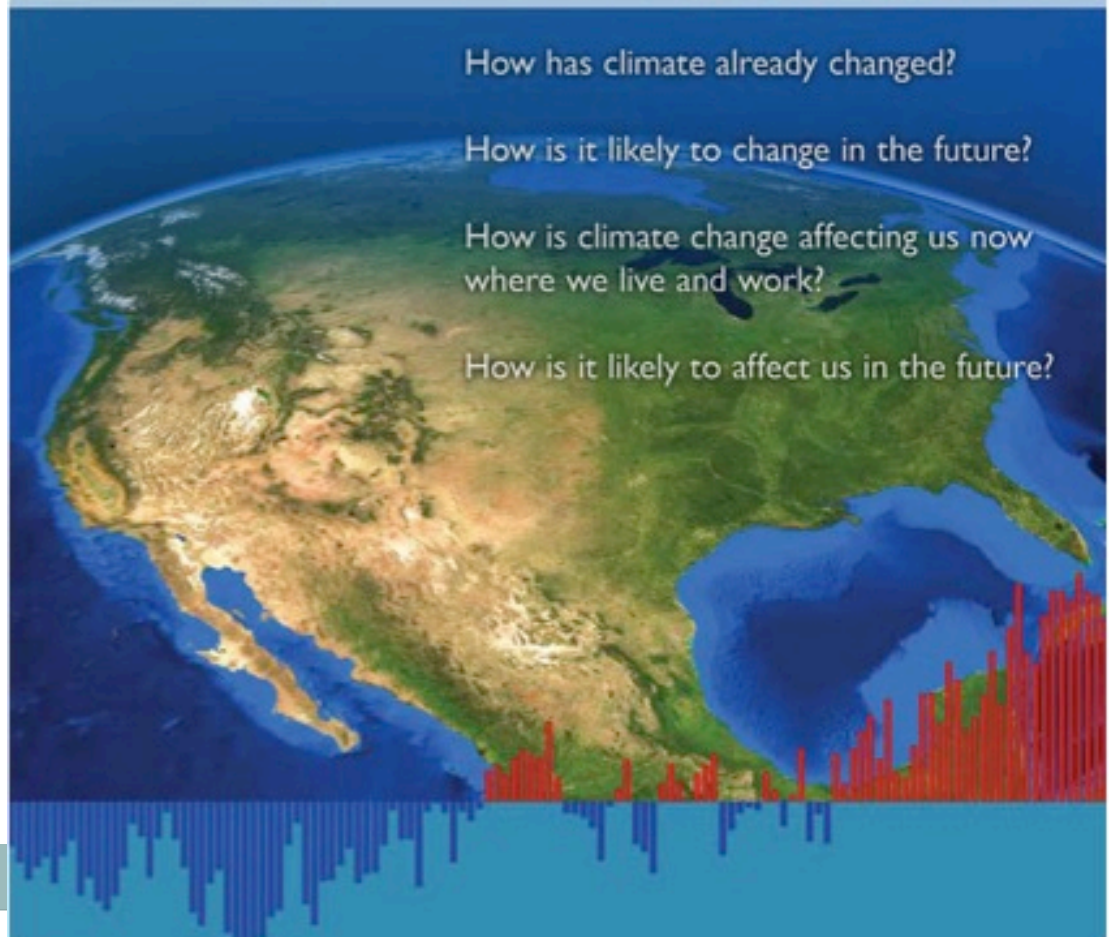
### HIGHLIGHTS

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?



# Resource 2

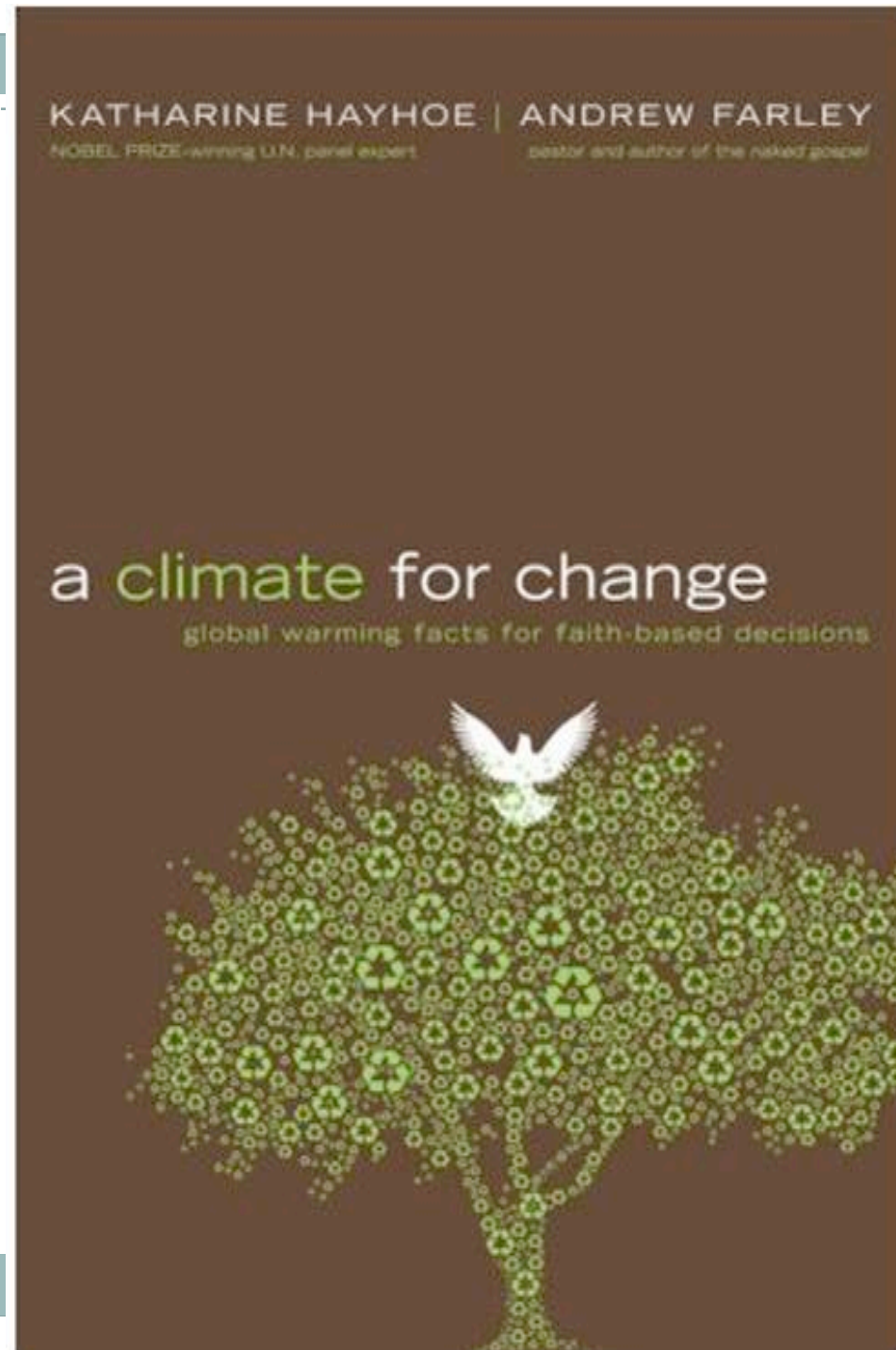
## A Climate for Change

### Global Warming Facts for Faith-Based Decisions

Why climate change is happening, and how it is affecting our world ...

Free preview at:

[www.katharinehayhoe.com](http://www.katharinehayhoe.com)





# THE END



FOR MORE INFORMATION

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