


Perspectives on Global Climate Change

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Climate Change

1. Definitions: What is Climate Change?
 2. The Physical Science
 3. Social-Environmental Impacts
 4. The Search for Practical Solutions
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1. What is Climate Change?

Scientific “Consensus”

- Climate change is not a “belief”
- Most climate scientists agree that:
 - Average global temperature is rising
 - Climate changes cannot be explained by natural variability alone
 - Human-caused emissions of greenhouse gases contribute to the observed changes

The IPCC

- Intergovernmental Panel on Climate Change (IPCC)
- Created in 1988 by World Meteorological Organization and United Nations Environment Program
- 130 countries participate
 - More than 2500 scientific expert reviewers
 - More than 800 contributing authors
 - More than 450 lead authors

COP 18

November 26 to December 7, 2012

Conference of the Parties (COP) to the 1992 United Nations Framework Convention on Climate Change (UNFCCC) and the 8th session of the Meeting of the Parties (CMP) to the 1997 Kyoto Protocol

- Goal: International treaty to be adopted in 2015 and take effect five years later
- However, US policies won't be enough to meet its stated goal of reducing emissions by 17 percent by 2020, compared to 2005 levels

'Climate Change' vs. 'Global Warming'

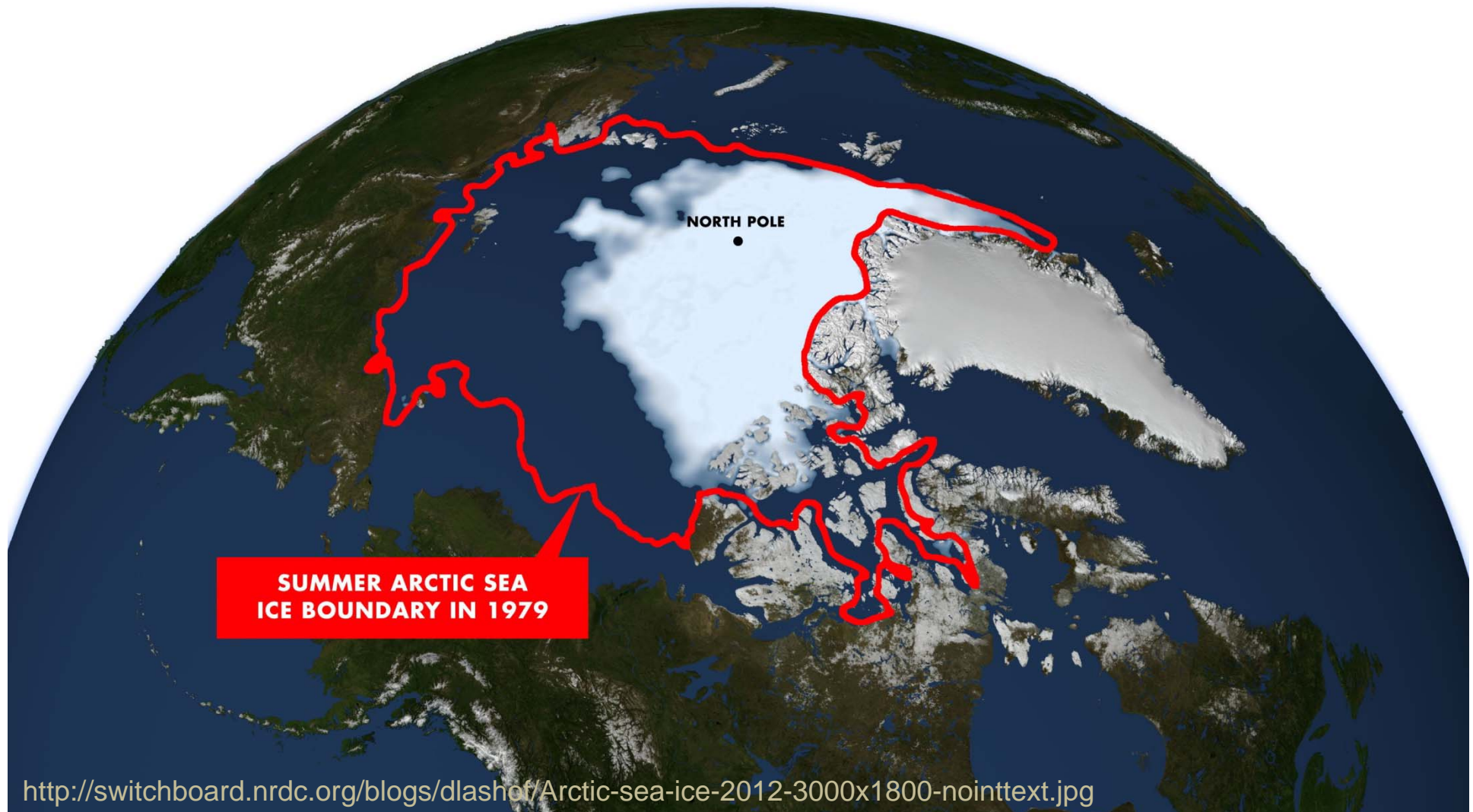
- **1975:** the first reference to the term "global warming"
- **1988:** "global warming" is popularized by NASA scientist Dr. James Hansen

Today most scientists use the term "global warming" when referring to surface temperature increases, while "climate change" refers to increases in greenhouse gas emissions and all other effects

2. The Physical Science

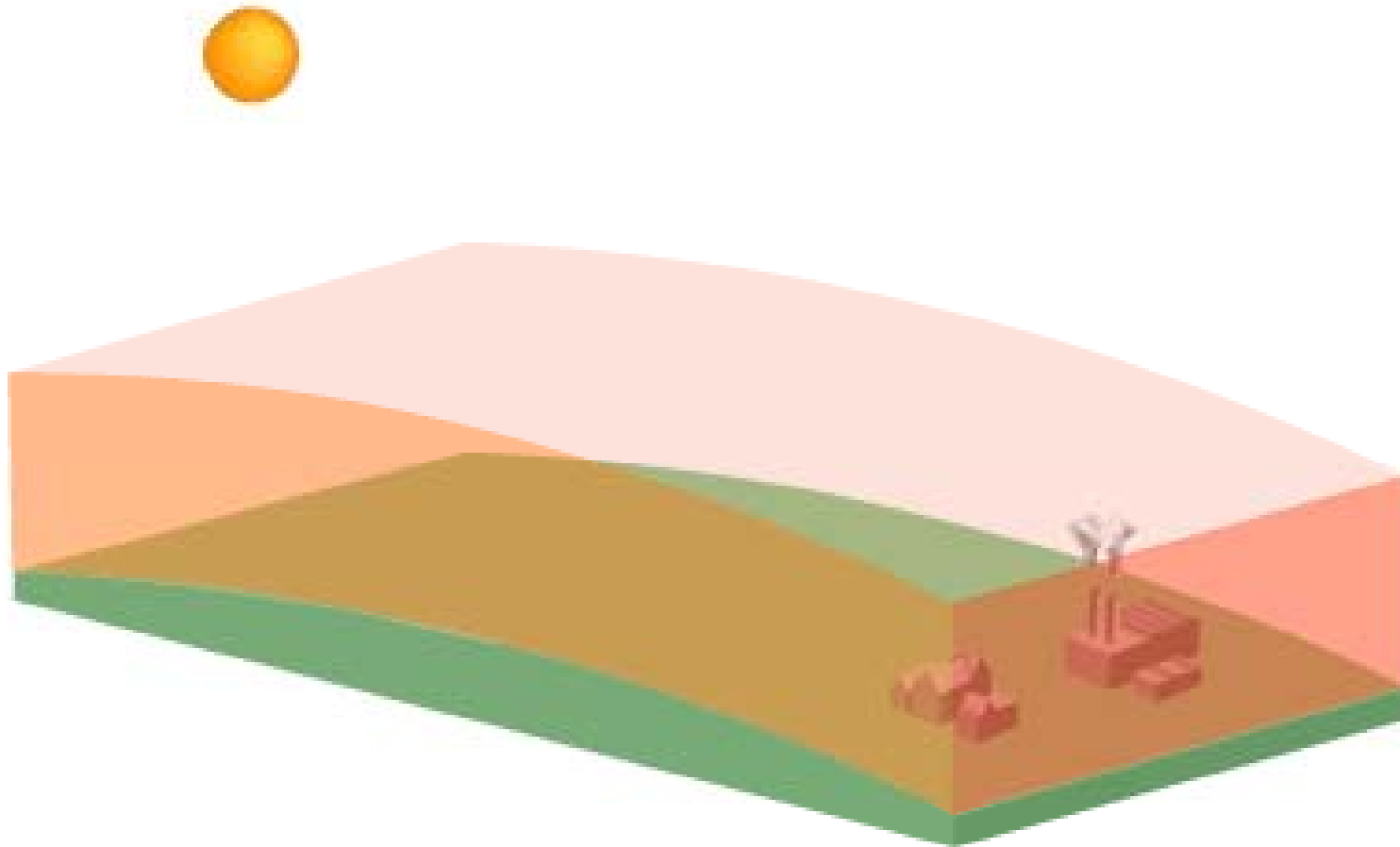


September 16, 2012



The Greenhouse Effect

As the greenhouse gases increase in the atmosphere, they work to increase temperatures at the surface

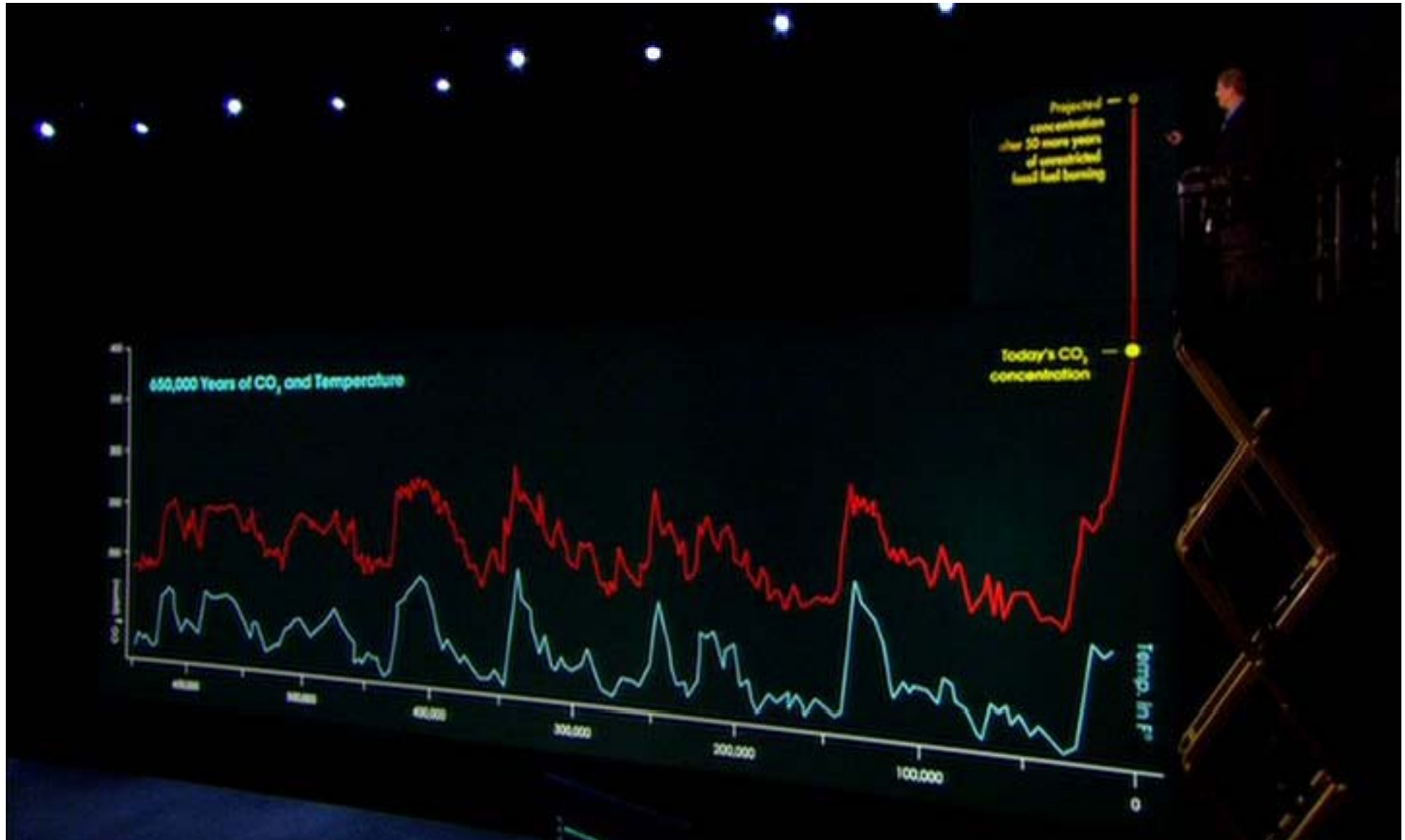


Feedback Processes

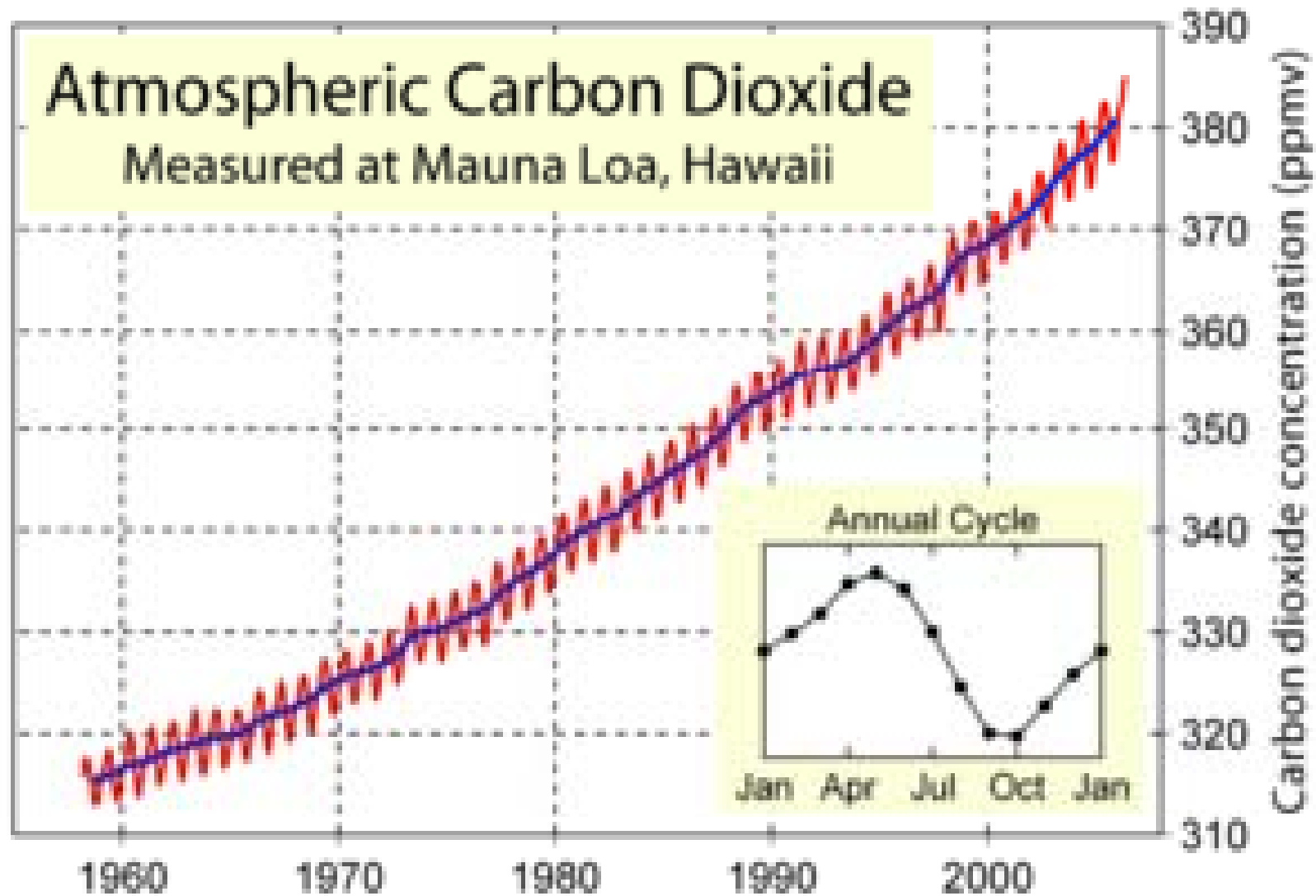
- Permafrost melting
- Release of methane from oceans
- Albedo effect
- More forest fires
- Ocean acidification
- Possible increased plant growth



Historic GHG Concentrations



Recent GHG Concentrations



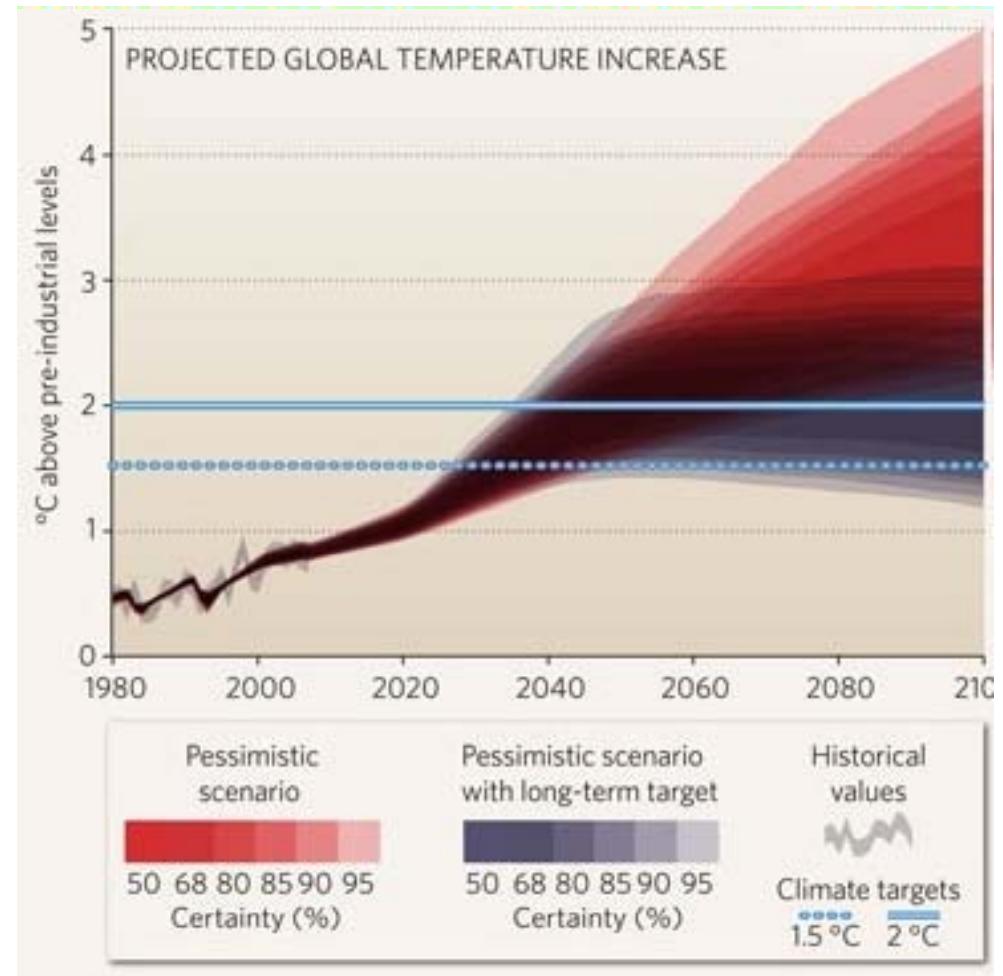
Source: http://blogs.nature.com/climatefeedback/categories/topics/climate_science/ghg_emissions/

Predicting Risk

**Predicted temperature increase by 2100:
1.4 - 5.8°C**

GHG concentrations:

- Premodern: 275 ppm
- Current: 392 ppm, growing by 2ppm annually
- Target to minimize risk of 2°C change: 350



Analysis from McKibben

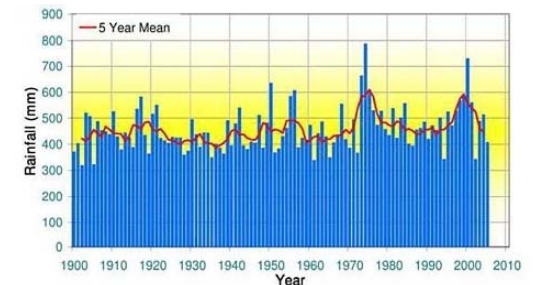
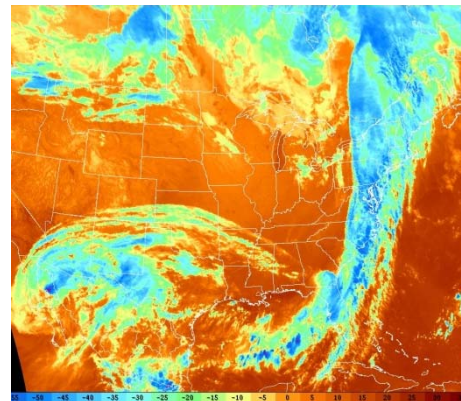
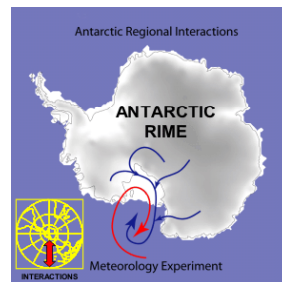
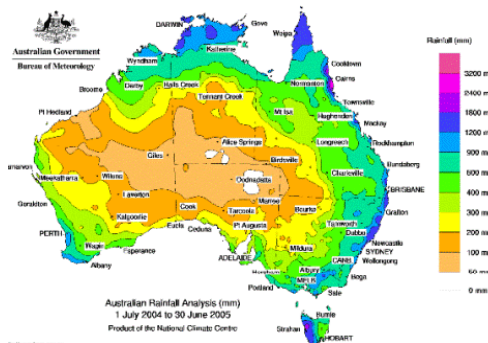
“If we want a 50-50 chance of staying below two degrees, we have to leave 2/3 of the known reserves of coal and oil and gas underground; if we want an 80% chance, we have to leave 80% of those reserves untouched. That's not ‘environmentalist math’ or some radical interpretation – that’s from the report of the International Energy Agency ...

“It means that – without dramatic global action to change our path – the end of the climate story is already written.”

Scientific Debate About CC

There is disagreement among climate scientists about:

- How to predict future change and impacts
- The best policies to deal with these problems



Positive proof of global warming.



***18th
Century***

1900

1950

1970

1980

1990

Why Does the Public Misperceive the Scientific Consensus?

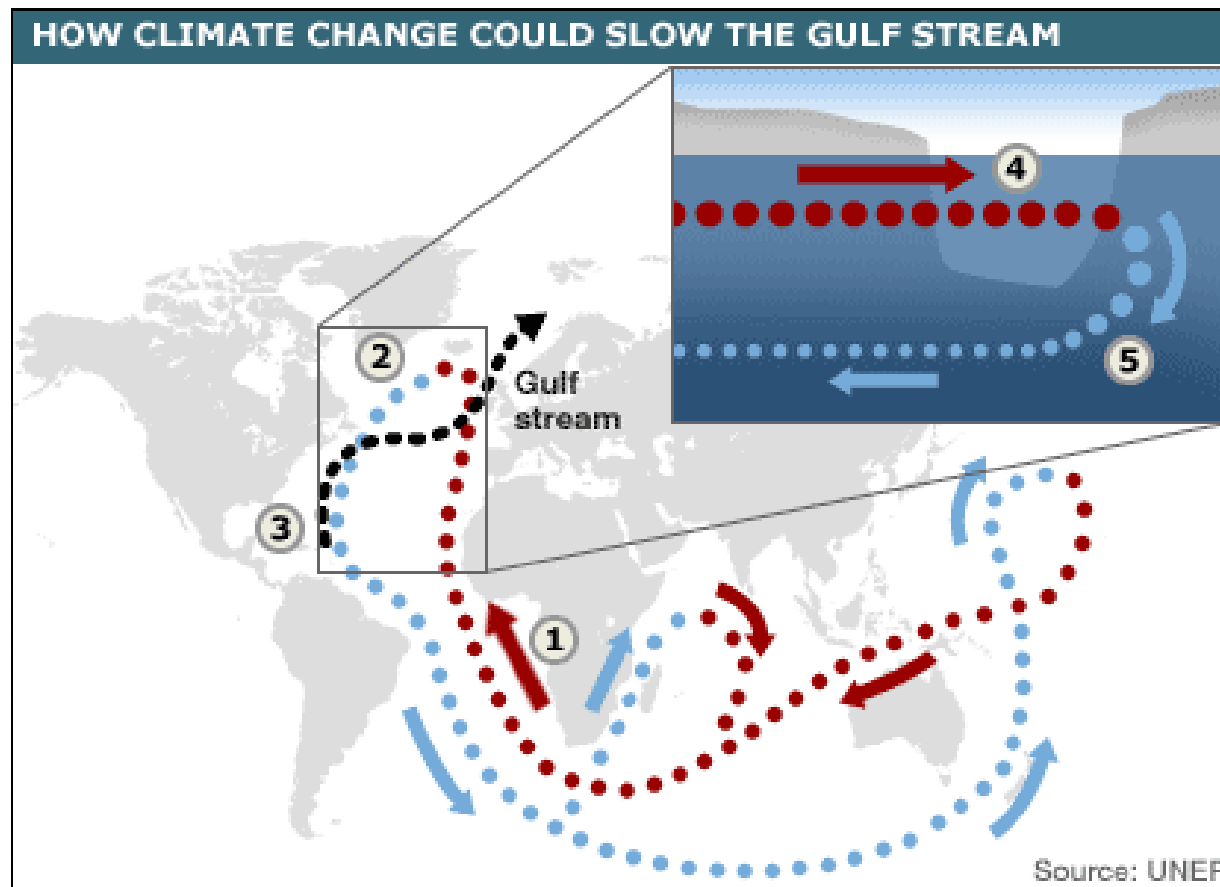
- Confusion over scientific vs. political uncertainty
 - Science says CC is happening, but not exactly how to deal with it
- Prediction of the future is uncertain
- It's difficult for scientists to communicate effectively to media
- It's difficult for the media to communicate science to the public
- The Giddens Paradox: People will not act on climate change until it is visible to them, by which time it will be too late

3. Social-Environmental Impacts

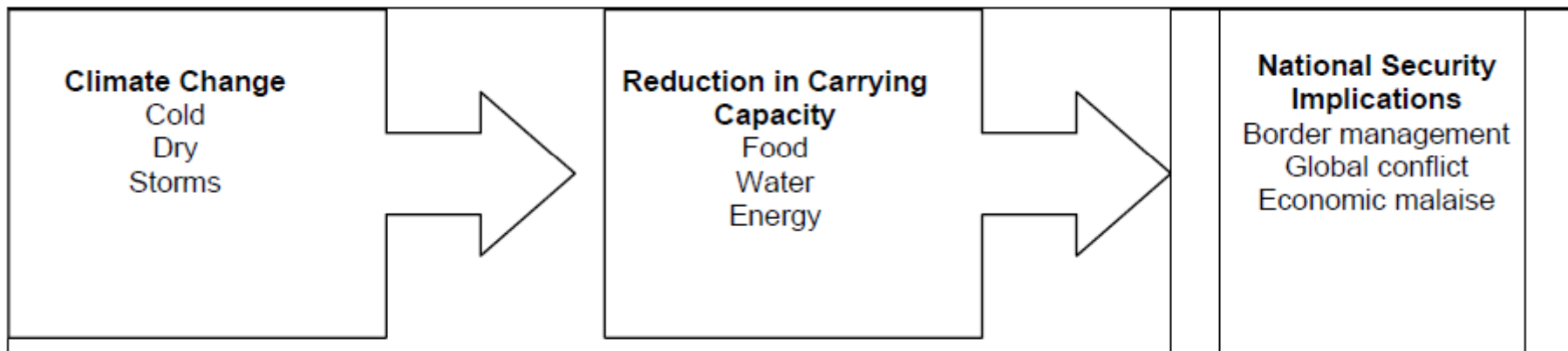
- Rising sea levels
- More extreme weather events
- Spreading of disease and pests
- Loss of ecosystem services (habitat loss, extinction)
- Agricultural problems
- Shifting vegetation zones
- Mass migration of human populations
- Energy system disruptions (e.g., nuclear)
- Negative economic impacts
- Social conflict and war

US Department of Defense

“An Abrupt Climate Change Scenario and Its Implications for United States National Security” (2003)



US DoD and Climate Change



The main threats to US national security:

1. Food shortages due to decreases in agricultural production
2. Decreased availability and quality of fresh water due to flooding and droughts
3. Disrupted access to strategic minerals due to ice and storms

Insurance Companies and Business

UK Government's *Stern Review on the Economics of Climate Change* (2006)

- It is more costly to deal with climate change than prevent it
- Cost of mitigation: ~1% of global annual GDP
- Losses from climate change: 5-20% of global GDP every year
- US National Association of Insurance Commissioners studying impacts of CC on their industry

Climate Ethics

- Most historic emissions have been from developed nations (e.g., USA, Europe, Japan)
- Poor regions will suffer most from climate change
- Solution: Develop a system of per capita carbon rations?

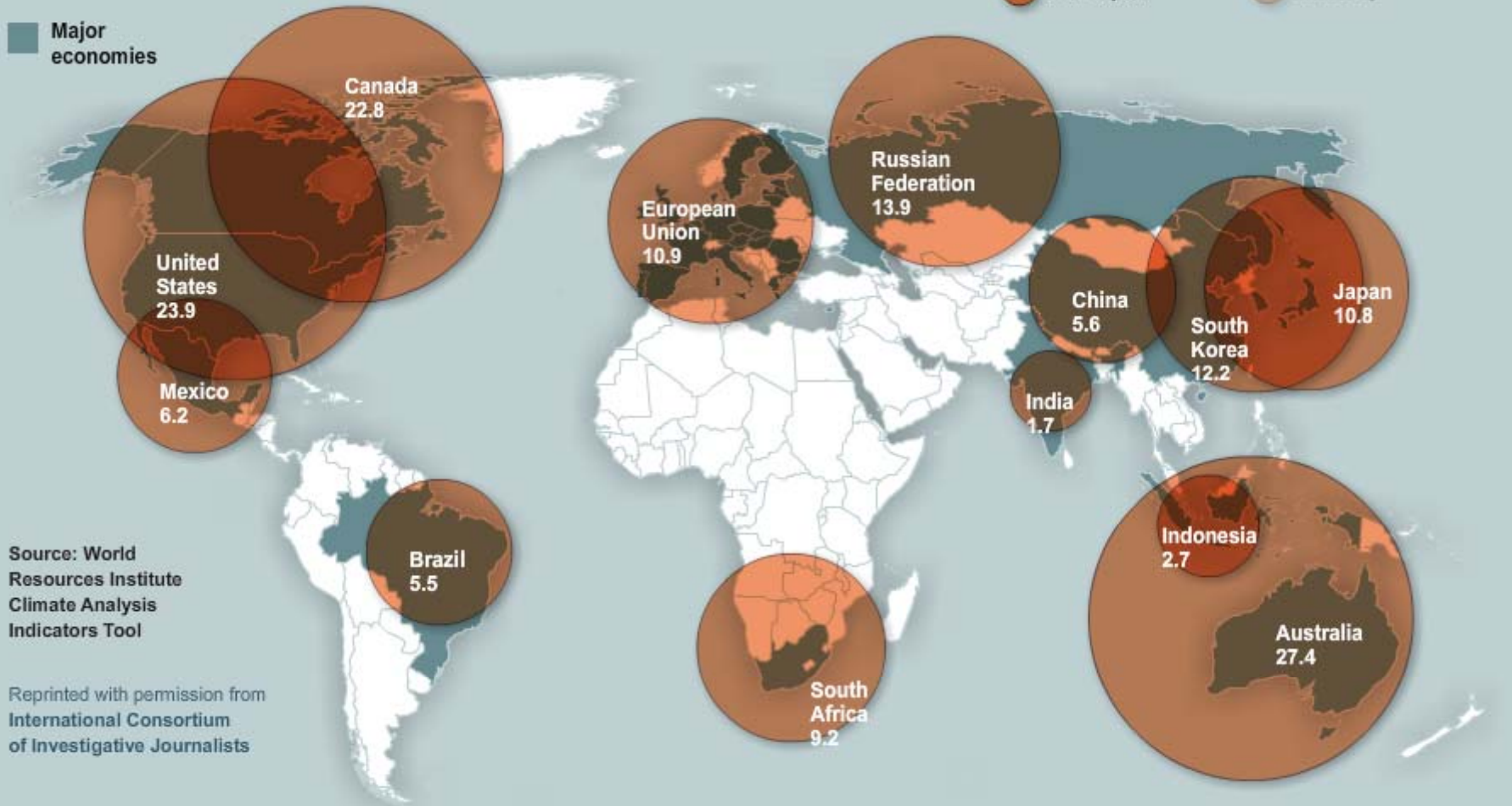
Four Ways to Look at Global Carbon Footprints

More than 80 percent of world greenhouse gas emissions come from these 12 nations and Europe.

Compared to more developed nations, developing countries contribute relatively little to greenhouse gas emissions on a per-person basis.

Per Capita (tons per person)

Major economies



Source: World Resources Institute Climate Analysis Indicators Tool

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Note: Emissions data are from 2005. Includes carbon dioxide and five other greenhouse gases.

Each of the four charts is scaled independently.
Graphic by Stephen Rountree

Four Ways to Look at Global Carbon Footprints

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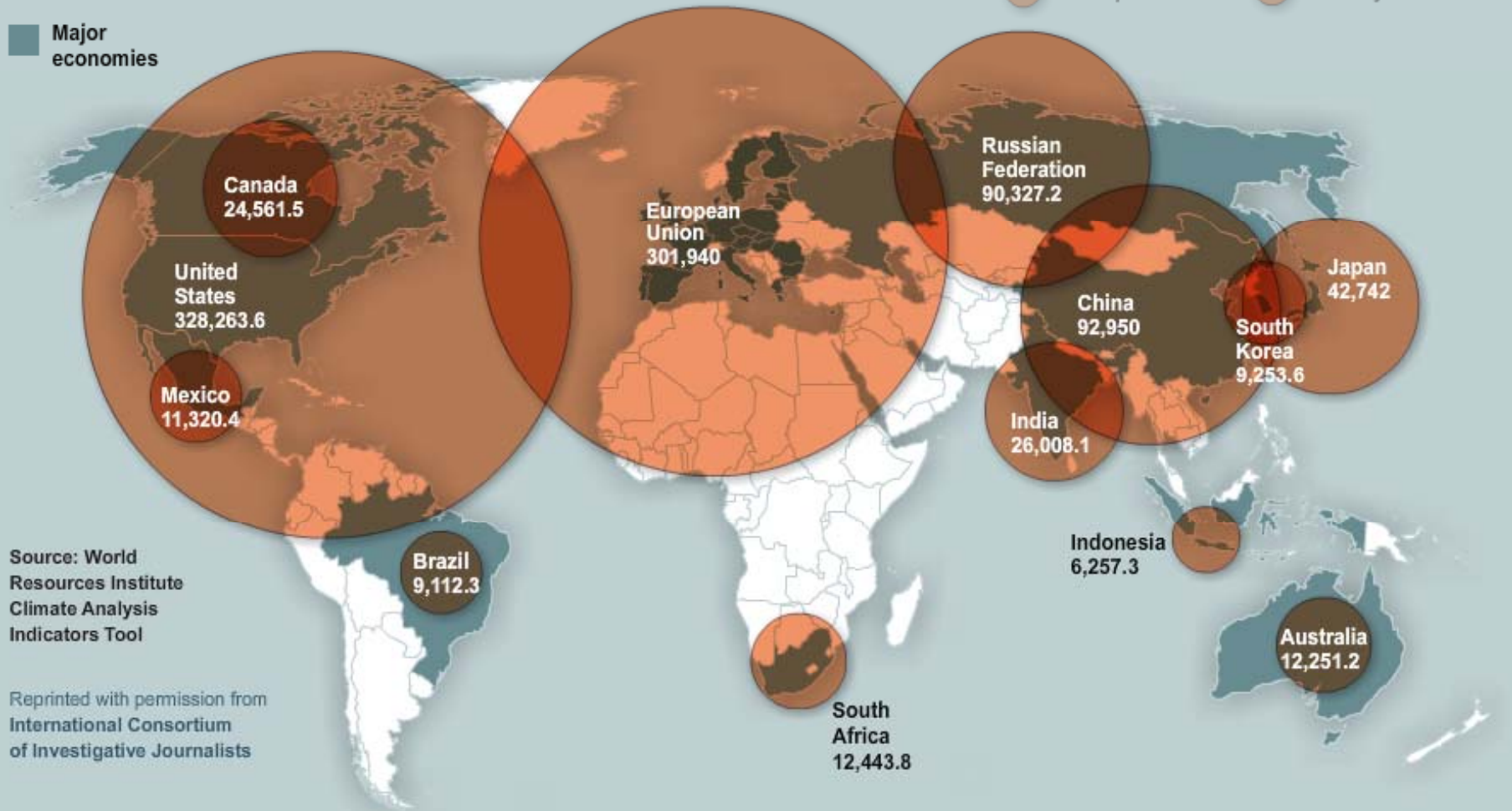
Measured from the mid-19th century, emissions from the United States and the European Union far surpass the rest of the world in their contribution to global warming.

▼ Roll over to view data

- Current Emissions
- Cumulative Emissions
- Per Capita
- Intensity

Cumulative Emissions (millions of tons)

■ Major economies



Source: World Resources Institute Climate Analysis Indicators Tool

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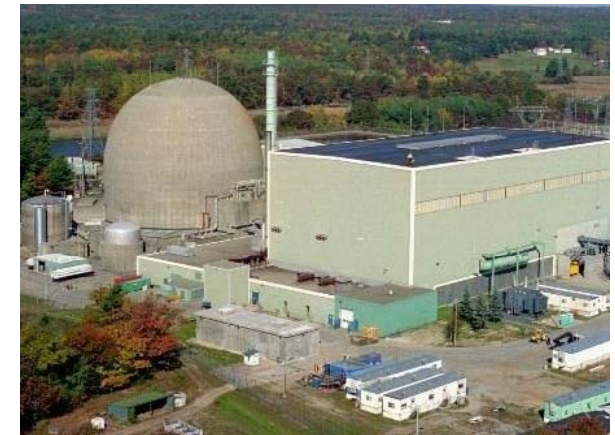
Note: Emissions data are from 1850 to 2005. Includes carbon dioxide and five other greenhouse gases.

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4. The Search for Practical Solutions

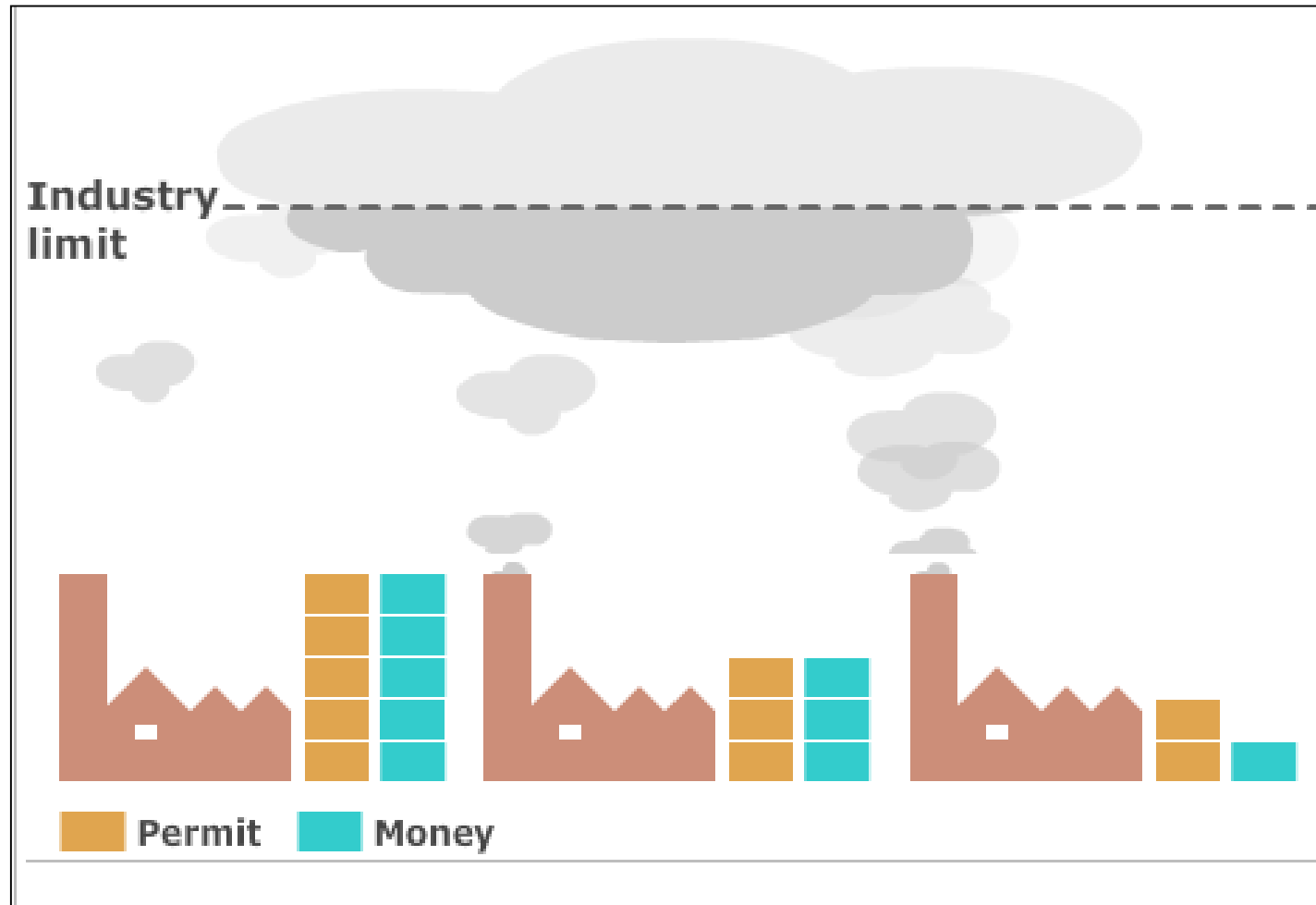
Technical Fixes

- Electric vehicles
- Nuclear and renewable energy
- Carbon sequestration
- Lighter & more efficient aircraft



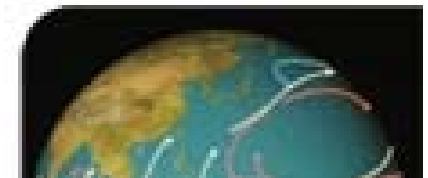
Emissions Trading

“Cap and Trade”



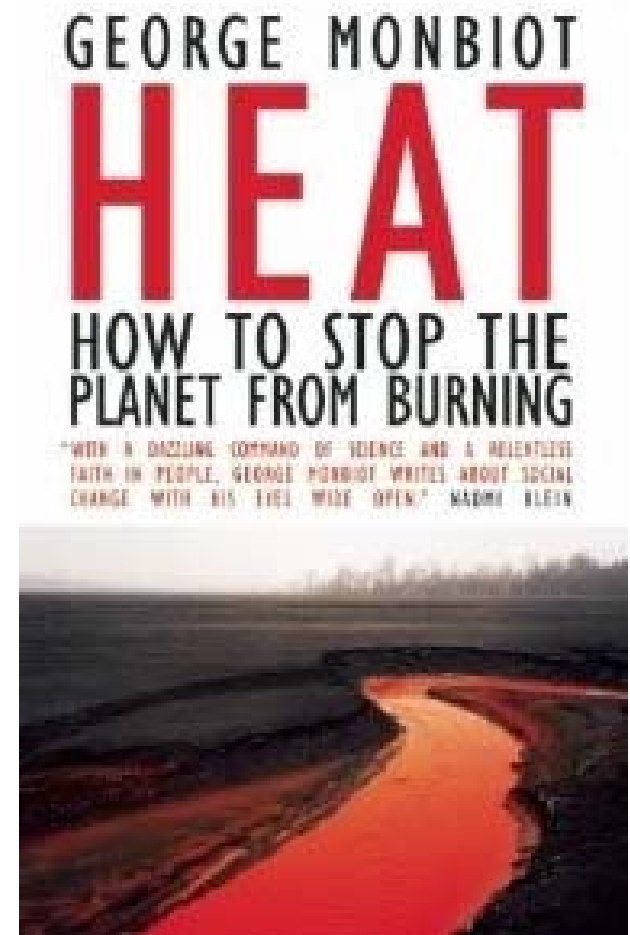
Solutions from Al Gore

- 1. Replace regular lightbulbs with compact fluorescent ones.** 150 pounds of carbon dioxide (CO²) saved a year.
- 2. Drive less.** 1 pound of CO² for every mile you don't drive!
- 3. Recycle more.** 2400 pounds of CO² saved every year if half your household waste is recycled.
- 4. Keep your tyres properly inflated.** Improves gas mileage by more than 3%. Every gallon saved means 20 pounds of CO² kept out of the atmosphere!
- 5. Use less hot water.** Install a low flow showerhead (350 pounds of CO² saved per year); wash clothes in cold or warm water (500 pounds saved per year).
- 6. Avoid products with a lot of packaging.** 1,200 pounds of CO² saved per year if you reduce rubbish by 10%.
- 7. Reduce your heating and air-conditioning usage.** Save 2000 pounds of CO² a year by turning heating down by 2° in winter and air-conditioning by 2° in summer.
- 8. Plant a tree.** Just one tree absorbs a ton of CO² in its lifetime.
- 9. Turn off electronic devices instead of setting to standby.** Turning off TVs, DVDs, Stereos and computers saves thousands of pounds of CO² every year.
- 10. Be a part of the solution. Learn more at aninconvenienttruth.co.uk**



George Monbiot – *Heat: How to Stop the Planet From Burning* (2007)

- Must reduce CO2 concentrations to 350ppm for 90% chance of $<2^{\circ}\text{C}$
- Needed global reduction by 2030: 60%
- Developed nations like the UK must cut emissions by $\sim 90\%$ by 2030
- Per capita carbon emissions: capped at 0.33 tons/year (current UK: 2.6 tons/year)



Solutions from George Monbiot

1. Set a target for reducing greenhouse-gas emissions based on the latest science
2. Use that target to set an annual carbon cap, which declines every year
3. New building regulations
4. Ban the sale of incandescent lightbulbs and other wasteful technologies
5. Move money from military to develop new energy sources
6. Promote public transportation
7. Require petrol stations to offer car batteries
8. Stop building new roads
9. Reduce airport capacity
10. Replace suburban malls with a warehouse and delivery system

Monbiot's Conclusion (2007)

It is technically and economically feasible to cut emissions to achieve 350 ppm and minimize risk of 2°C change, if we:

- Combine reductions, efficiency, and new sources of energy
- Reduced consumption lifestyles
- Travel less

... But probably not politically feasible.

Geoengineering and “Climate Mitigation”

The Ultimate Technofix?

- Scatter sulfate particles in upper atmosphere
- Inexpensive
- Reversible

Professor Paul Crutzen, Max Planck
Institute for Chemistry:

“If sizeable reductions in greenhouse gas emissions will not happen and temperatures rise rapidly, then climatic engineering, as presented here, is the only option available to rapidly reduce temperature rises and counteract other climatic effects.”