

# **Human Response to the subject of global warming**

**Ronald Sass**

**Shell Center for Sustainability**

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# Four Levels of Climate Change

- 1. Detecting a Directional Change in the Global Climate.
- 2. Attributing Climate Change to Anthropogenic or Natural Causes.
- 3. Modeling Future Climate to Determine the Degree of Changes.
- 4. Responding to Climate Change Predictions.

# 1. Detecting a Directional Change in the Global Climate

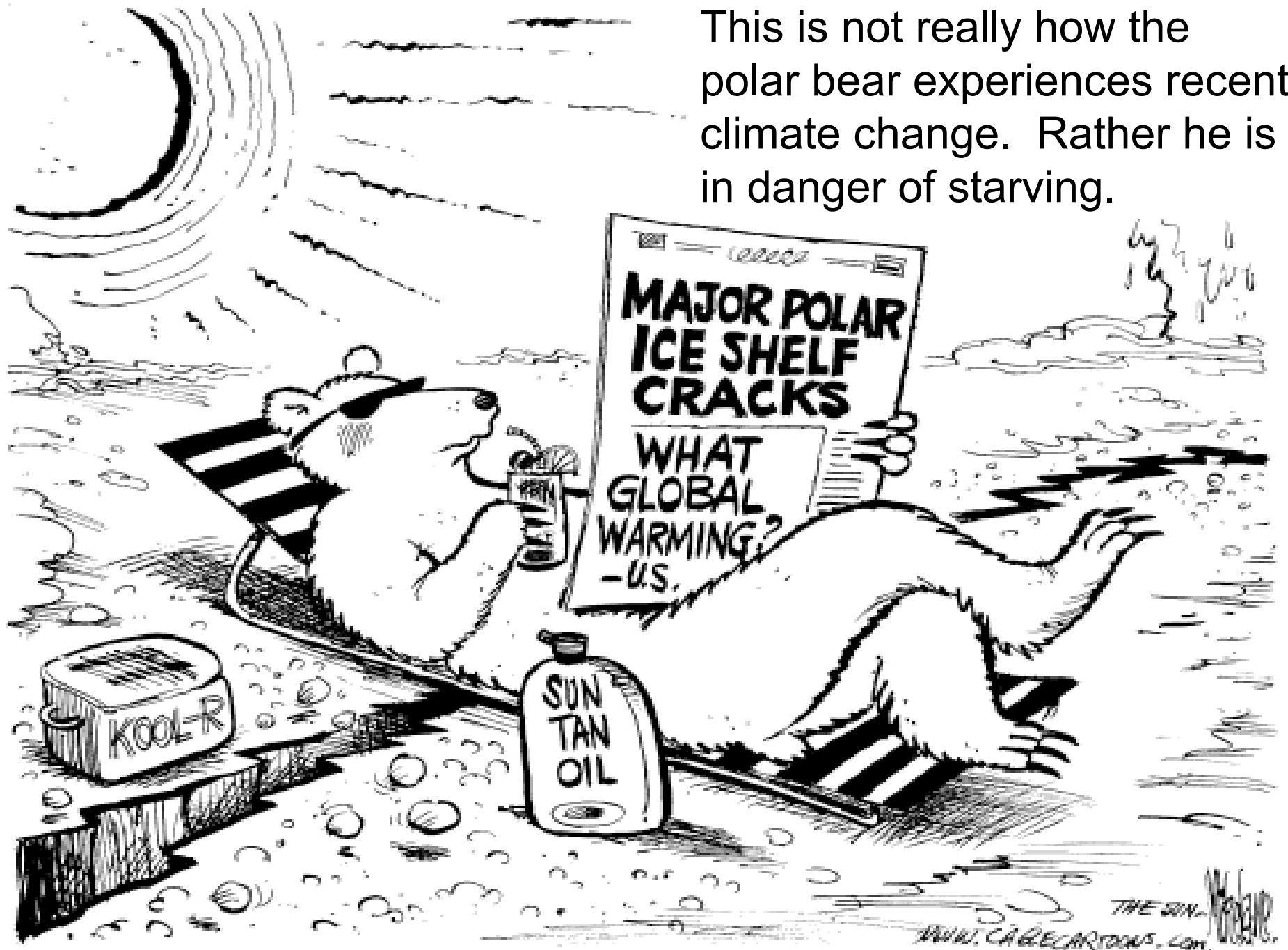
- **Scientific Certainty--Uncertainty**

- Global warming in 20th century was  $0.6 \pm 0.2^{\circ}\text{C}$  at the 95% confidence level. IPCC, 2001.

- **Public Understanding-Misunderstanding**

- “I don’t think the weather has changed. Some of my students were at a conference where they had a debate. And they learned that there is scientific evidence to show that the earth is not warming. In fact it is cooling. We go through cycles, but sometimes people have short memories”--a high school principal to John Immerwahr.

This is not really how the polar bear experiences recent climate change. Rather he is in danger of starving.



## **What's In a Name?**

**Regardless of the causes, the world's climate is changing and is doing so at an alarming rate. The current response to this change by the public and many in charge of our well being is that they are not convinced that attendant changes will adversely impact us and consequently do little if anything to respond to them.**

**Perhaps we should not refer to this phenomenon as GLOBAL WARMING, which is rather neutral or even soothing.**

**A more accurate term is now used by those studying the subject, namely GLOBAL CLIMATE CHANGE.**

**An even more accurate describer would be GLOBAL CRISIS and soon may be GLOBAL CATASTROPHY.**

## 2. Attributing Climate Change to Anthropogenic or Natural Causes

- **Scientific Certainty--Uncertainty**
  - “the balance of evidence suggests that there is a discernible human influence on global climate” IPCC, 1995
  - “most observed warming over the last 50 years is likely [66% to 90% chance] to have been due to the increase in greenhouse gas concentrations” IPCC, 2001
- **Public Understanding-Misunderstanding**
  - “Not only are Americans more or less equally misinformed as people elsewhere about the causes of global warming, but they also are among the most misinformed of the nations surveyed” Press release, Steven Brechin, University of Illinois.
  - “Only 15 percent of the U.S. citizens surveyed correctly identified burning fossil fuels as a primary cause of global warming.” Gallop Pole, 2001.

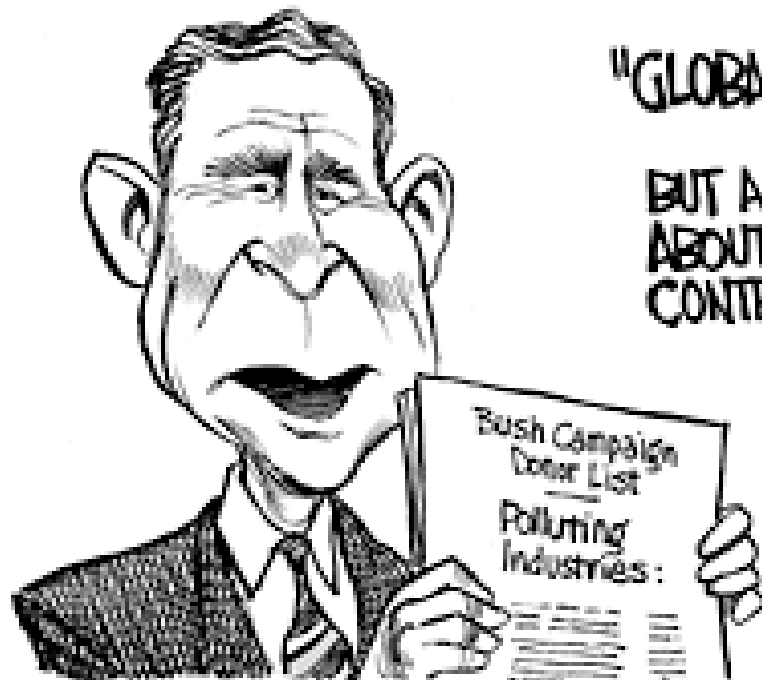
**SCIENCE:**



"GLOBAL WARMING IS REAL!

FAILURE TO DO SOMETHING ABOUT IT  
COULD CAUSE WATER SUPPLIES TO  
DRY UP IN THE WEST  
AND LEAD TO  
CATASTROPHIC STORMS  
ON THE EAST COAST!"

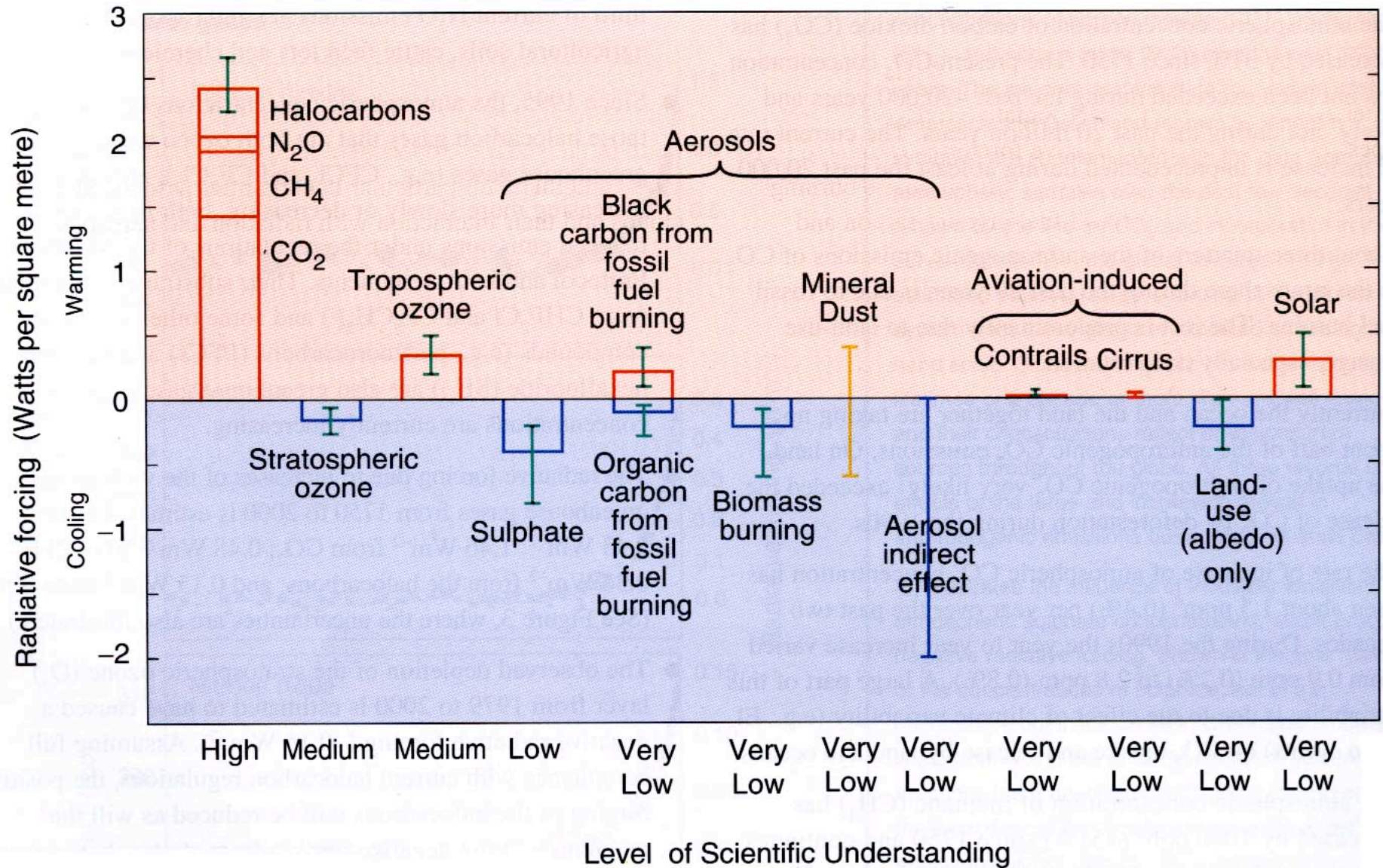
**POLITICAL  
SCIENCE:**



"GLOBAL WARMING IS REAL!

BUT ACTUALLY DOING SOMETHING  
ABOUT IT COULD CAUSE CORPORATE  
CONTRIBUTIONS TO DRY UP AND  
LEAD TO CATASTROPHIC  
RESULTS FOR MY RE-ELECTION  
CAMPAIGN!"

# The global mean radiative forcing of the climate system for the year 2000, relative to 1750

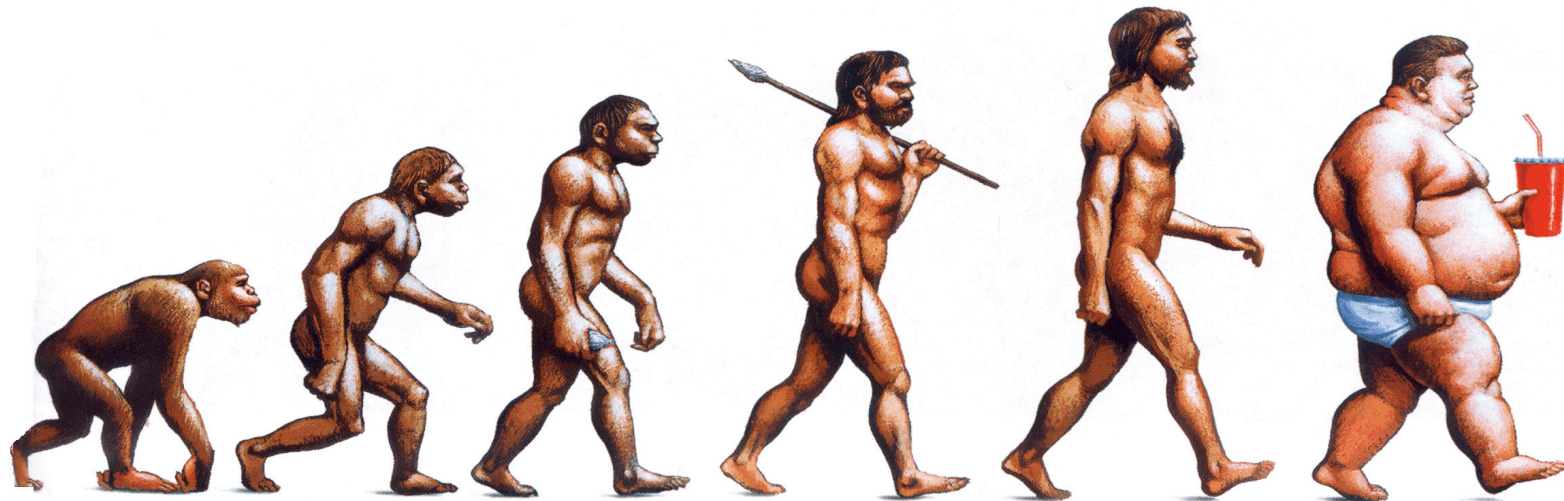


Many external factors force climate change.

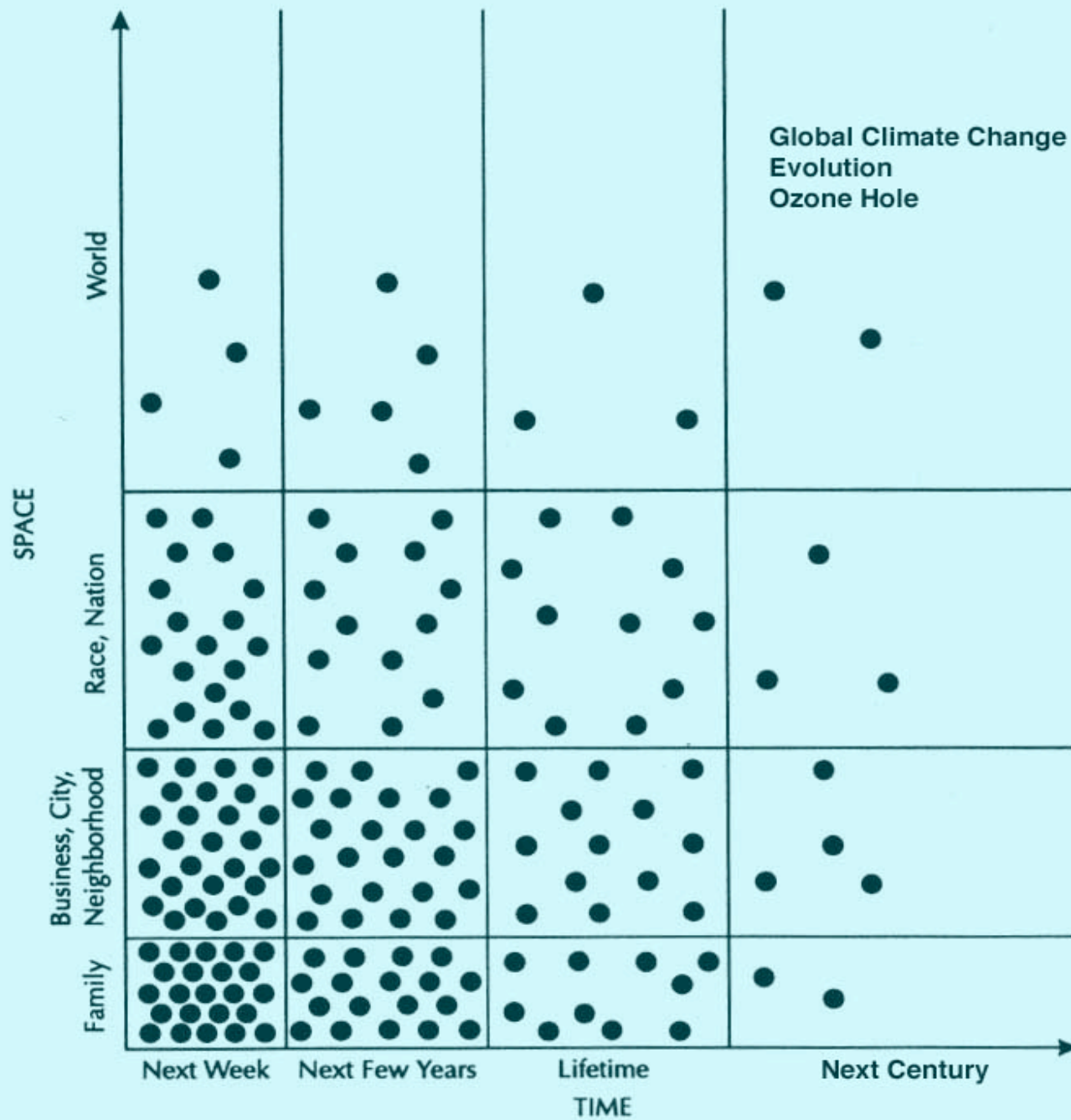
IPCC, Climate Change 2001, The Scientific Basis



1. Humans react most decisively to an immediate real or perceived external or alien threat.
  - a. We have a need to identify the enemy--another human, animal, an evil axis, aggressor country.
  - b. Global climate change is largely a product of our own actions and thus is not recognized as an enemy.
2. In addition we tend to react less as perceived dangers become more remote in time and space. Bad things happen only to other people in distant places.



Evolution in action



“Density”  
of Human  
Concerns  
Scaled in  
Space and  
Time

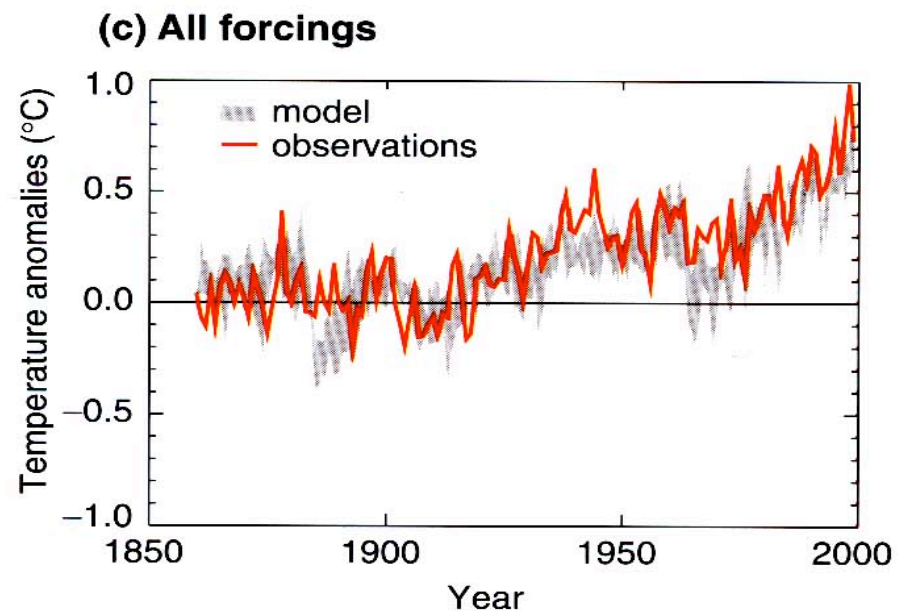
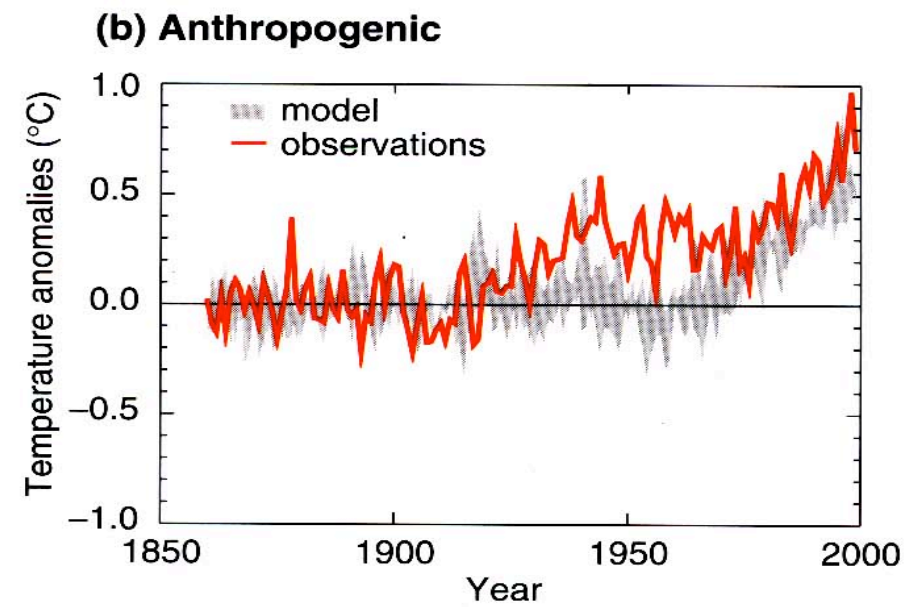
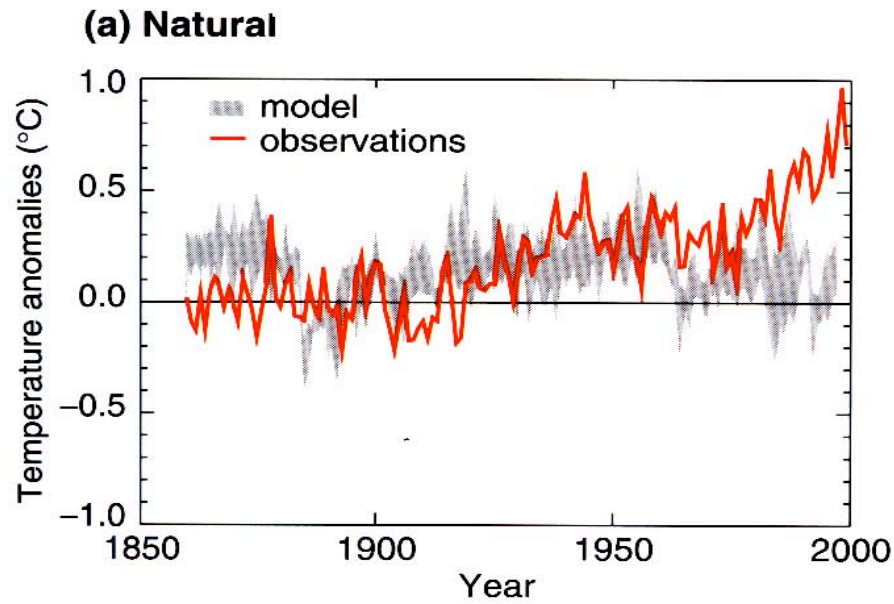
### 3. Modeling Future Climate to Determine the Degree of Changes

- **Scientific Certainty--Uncertainty**
  - “I don’t know that they [models] reproduce climate any better than they did 5 years ago” Tim Barnett, Scripps Inst.
  - “The uncertainties are large, as large as they were 20 years ago” Gerald North, Texas A&M
- **Public Understanding-Misunderstanding**
  - “Natural fluctuations in the Earth’s temperature, not Man, is the likely explanation for any recent warming” John Carlisle, National Center for Public Policy Research

## Models are seen as flawed representations in virtual reality

- No one has ever seen the ozone hole. However real the problem may be, our knowledge of it cannot help being virtual. The same is true of global warming.
- In a very real sense, global warming is the ultimate example of a virtual crisis in virtual nature, which is far from saying that it is unreal. Instead, it is proof that the virtual and the natural can converge in surprising ways.
- Can we learn to trust in a virtual understanding of the future world?

Adapted from William Cronon, In **Search of Nature**

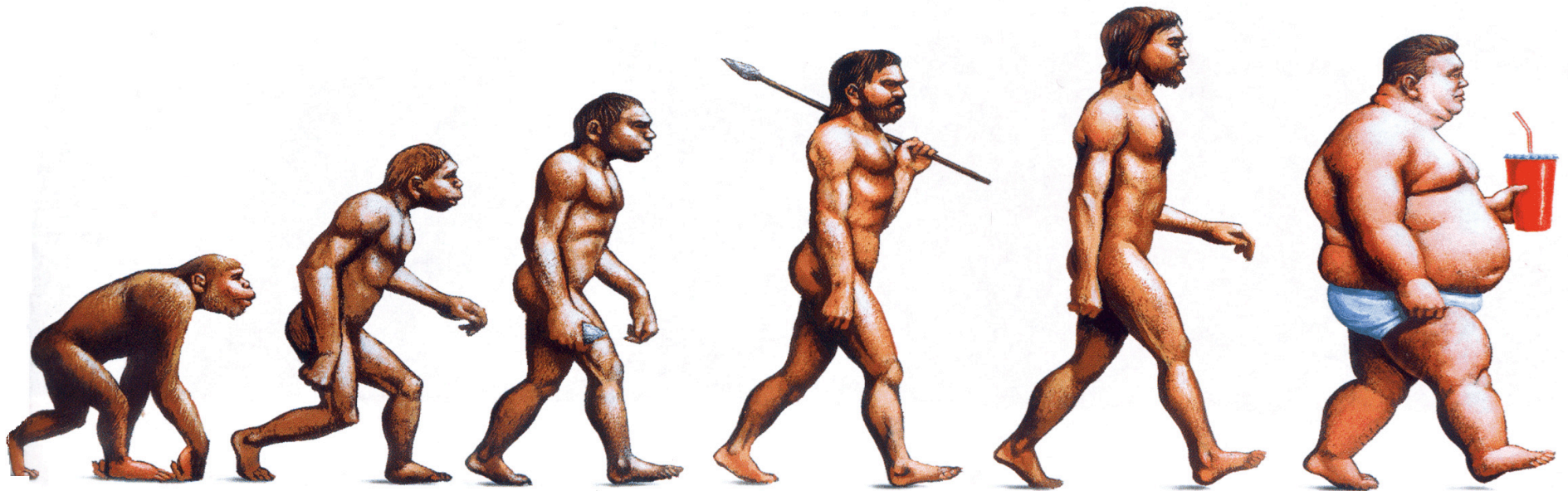


Simulating the Earth's temperature variations, and comparing the results to measured changes, can provide insight into the underlying causes of the major changes.

# We are the product of our past???

3. Humans do not respond decisively to virtual or abstract representations of reality. Models are seen as flawed representations in virtual reality.

4. We view the future as a continuation of the past—one that is familiar and one that we are used to dealing with.



Evolution in action

## 4. Responding to Climate Change Predictions

- **Scientific Certainty--Uncertainty**

“A number of uncertainties are still with us, but no matter what model you look at, all are producing significant warming beyond anything we’ve seen for 1000 years.”  
Jeffrey Kiehl, NCAR

- **Public Understanding-Misunderstanding**

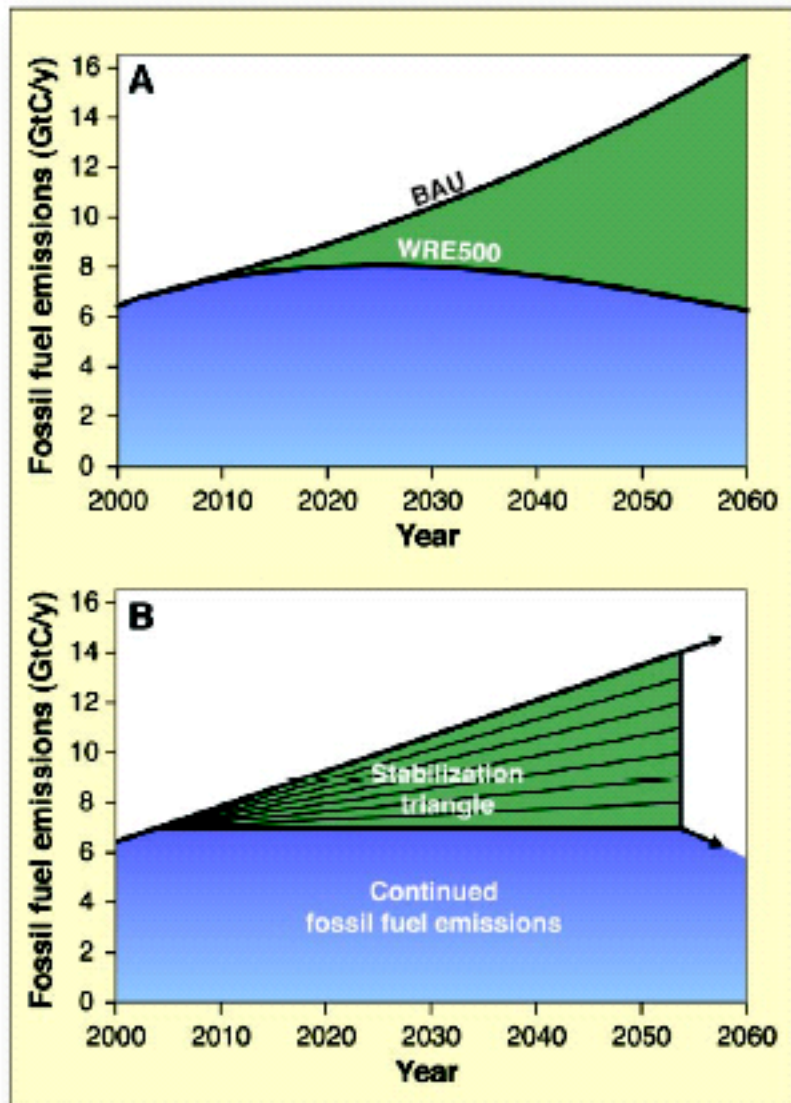
“I’ve asked my advisors to consider approaches to reduce greenhouse gas emissions, including those that tap the power of markets...We must always act to ensure continued economic growth and prosperity for our citizens...” George W. Bush, 6/11/01.

# Responding to Climate Change Predictions

- Humans will either mitigate the problem by reduction of greenhouse gas emissions or adapt by changing their life style.
- Other species will not have a choice. They cannot mitigate the problem and they cannot easily change their life style.
- It may be that the ultimate losers in the climate debate will not be us but rather all of our fellow travelers.



# Carbon Mitigation Model



(A) The top curve is a representative BAU emissions path for global carbon emissions as CO<sub>2</sub> from fossil fuel combustion and cement manufacture: 1.5% per year growth starting from 7.0 GtC/year in 2004. The bottom curve is a CO<sub>2</sub> emissions path consistent with atmospheric CO<sub>2</sub> stabilization at 500 ppm by 2125.

(B) Idealization of (A): A stabilization triangle of avoided emissions (green) and allowed emissions (blue). The allowed emissions are fixed at 7 GtC/year beginning in 2004. The stabilization triangle is divided into seven wedges, each of which reaches 1 GtC/year in 2054. With linear growth, the total avoided emissions per wedge is 25 GtC, and the total area of the stabilization triangle is 175 GtC.

(C) This model requires that 175 GtC be removed from the atmosphere in 50 years or at a rate of 3.5 GtC/year.

(D) Remember that this requirement does not provide for the removal of carbon being emitted at the 1990 level. This must also be reduced eventually because it itself will cause the CO<sub>2</sub> to be higher than 500 ppm.

# Model for Mitigation of and Adaptation to Increased Atmospheric Carbon

## Mitigation

- **Suppose cap and trade legislation is established for carbon.**
- **The amount of carbon that needs to be reduced world wide is 3.5 Gt/year of carbon.**
- **A cap and trade process operating through the free market will establish a price for carbon reduction.**
- **This price will probably ranging from \$5 to \$100 depending on the introduction of new technology and the refinement of existing methods. The US DoE currently estimates a target value of \$37/tonC.**
- **These figures would predict a total world price for mitigation of 3.5 GtC at from 17.5 to 350 billion dollars per year and most probably 130 billion dollars per year.**

## Adaptation

- **The cost of adaptation depends on the costs of increased draught, flooding of coastal cities, effects on agriculture, increased numbers of severe weather events, and other such factors as well as the cost of personal comfort with changing temperatures.**
- **The financial impact of this, according to Munich Re, the world's largest reinsurer, will run at more than \$300bn a year by 2050, while the IPCC estimates that the cost to Europe of climate change at the "moderate" end of its predictions will be an additional \$280bn a year.**
- **Thus, financially, adaptation is at least as or probably more expensive than mitigation. This conclusion does not include personal discomfort, displacement or deaths.**
- **What is your choice of action?**

# Today's Weather



COLD & CRAPPY      CRAPPY      HOT & CRAPPY

