

**Climate Change –
How Real Is It, and
Will CO₂ Reduction Work?**

March 2, 2009

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Overview of Presentation

- What is Climate and what impacts it?
- How big is the problem?
- Greenhouse gases and CO₂
- Temperature data
- Solar variation
- Ice core data
- Rising sea levels
- Climate change outcomes
- A summary of CO₂ and other impacts
- Technologies
- Economics
- Politics and regulations
- Proposed policy
- Final summary

What is Climate, and what influences it?

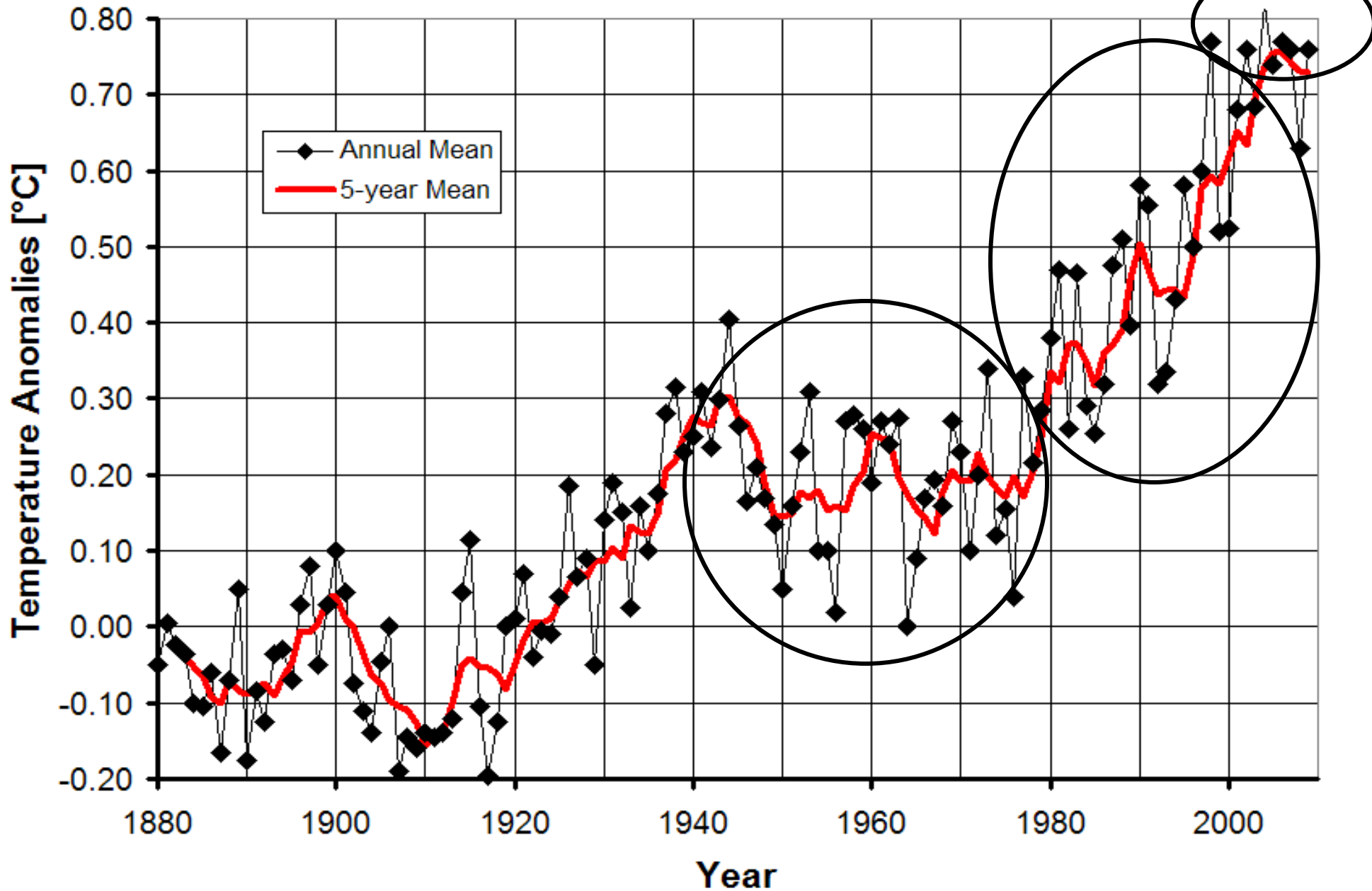
- Climate is simply the average weather over a specified period of time, usually a few decades in length.
- Regional climate is sometimes referred.
- Global climate is often referred.

- Climate is influenced by solar output, reflected solar energy (albedo), orbital variations of earth, greenhouse gases, volcanic eruptions, ocean currents, feedback mechanisms, and more.

How big Is the Problem?

- The main question revolves around whether the problem of human-caused climate change is a crisis, and how much we should try to solve it.
- Some assume the problem is a crisis and that we should do anything and everything to avoid the crisis—even if it risks modern civilization.
- But, this stance fails to address whether the problem is really a crisis, or how much we should try to remedy the problem.
- I intend to show that the science actually indicates the probable impact of human-caused global warming is less than the full observed warming of the last century.

Global Temperature Land-Ocean Index



Source: NASA, GISS December 2009

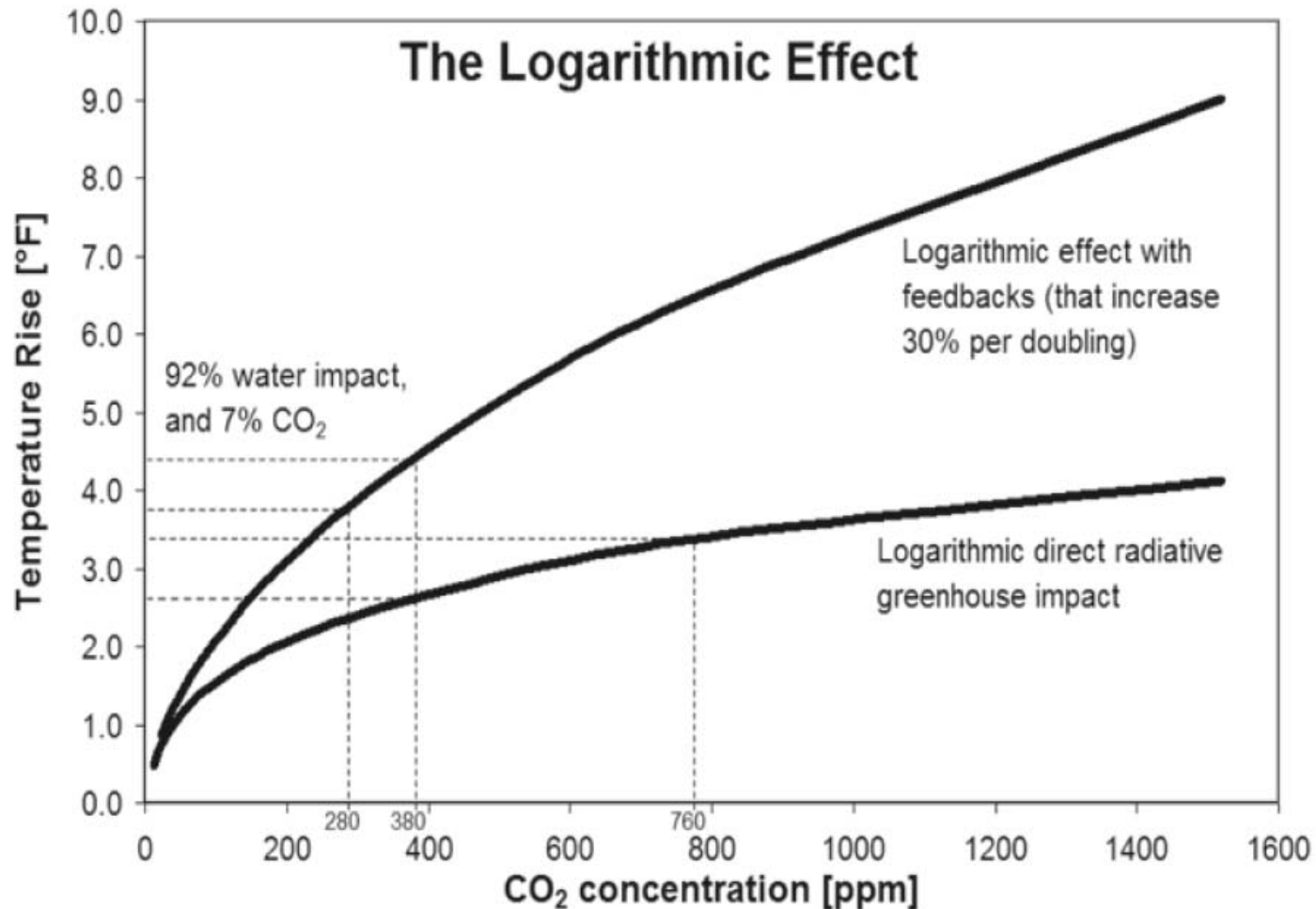
What are Greenhouse Gases?

- Triatomic and higher atomic molecules absorb electromagnetic radiation in the near infrared spectrum (0.7 to 30 μm).
- The concern surrounding greenhouse gases in the earth's atmosphere is not the existence of the greenhouse gases, but the concentration (i.e. quantity) of the greenhouse gases in the atmosphere.
- Greenhouse gases and their feedbacks elevate the average temperature of our earth by at most about 33°C (60°F).

Water Vapor Impact

- **92%–95%**—based on molecular structure the physics of absorption bands, and the relative atmospheric concentrations of CO₂ and H₂O
- **65%–70%**—inferred from climate models, and 2007 IPCC Fourth Assessment Report (AR4), Working Group I, Summary for Policymakers, p.12

The Logarithmic Effect



Climate Models (AOGCMs)

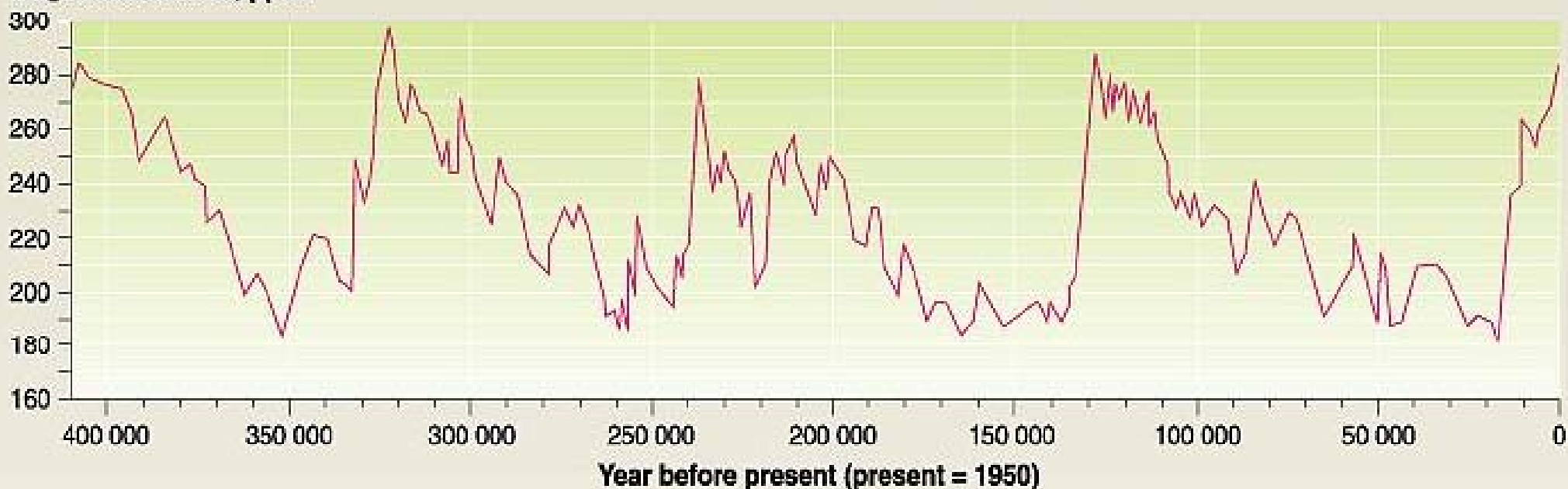
- Complex mathematical models used to forecast climate.
- Notoriously unstable.
- 19 climate models were used in the 2007 IPCC studies.
- 1°-3° grid boxes and ~20 vertical layers used.
- Commonly increments time by 30 minute intervals.
- Models indicate a doubling of CO₂ concentration might increase the surface temperature by about 5.7°F (varying between 3.7°F to 7.9°F).

HOWEVER:

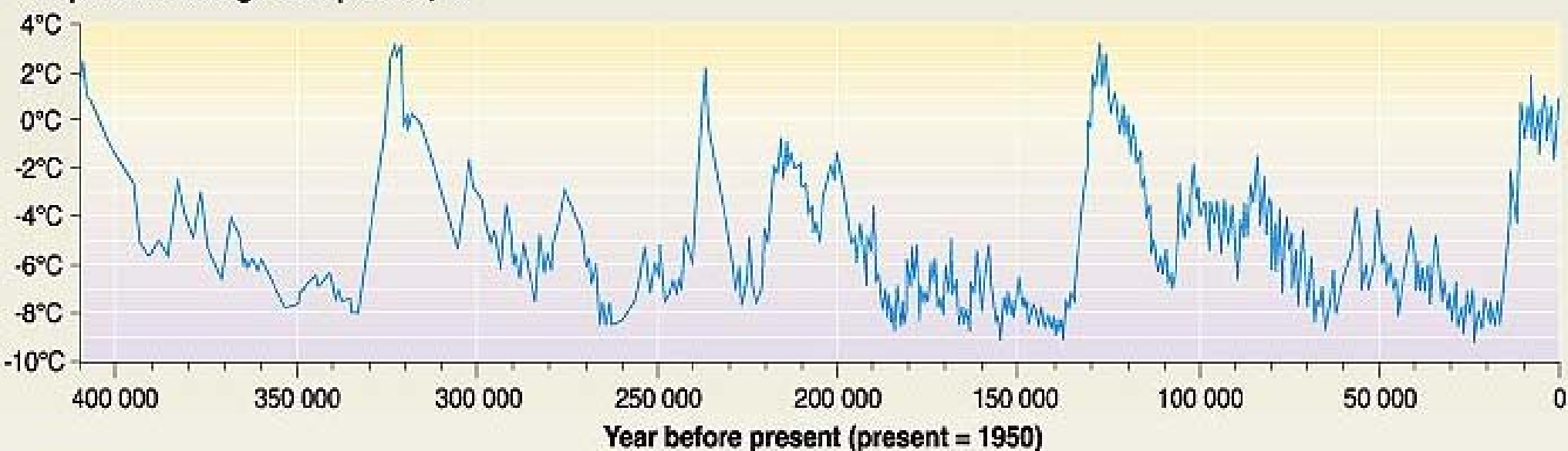
- Models don't correlate with the physics of molecular structure
- They are based on scientific determinism.
- Based partially on parametric factors that are not founded on physics, thermodynamics, or conservation of momentum.
- A common set of algorithms are used by most models ("group think").
- Models purposefully minimize solar variability.
- Models under predict diurnal temperature swings by 50%.
- Climate models don't consider known CO₂ gradients.
- Weather patterns are poorly modeled (e.g. ENSO, MJO, QBO, AMDV).
- Cooling trend since 1998 is huge unexplained problem for modelers

Temperature and CO₂ concentration in the atmosphere over the past 400 000 years (from the Vostok ice core)

CO₂ concentration, ppmv



Temperature change from present, °C



Temperatures are determined by oxygen isotope ratios using Paleothermometry.

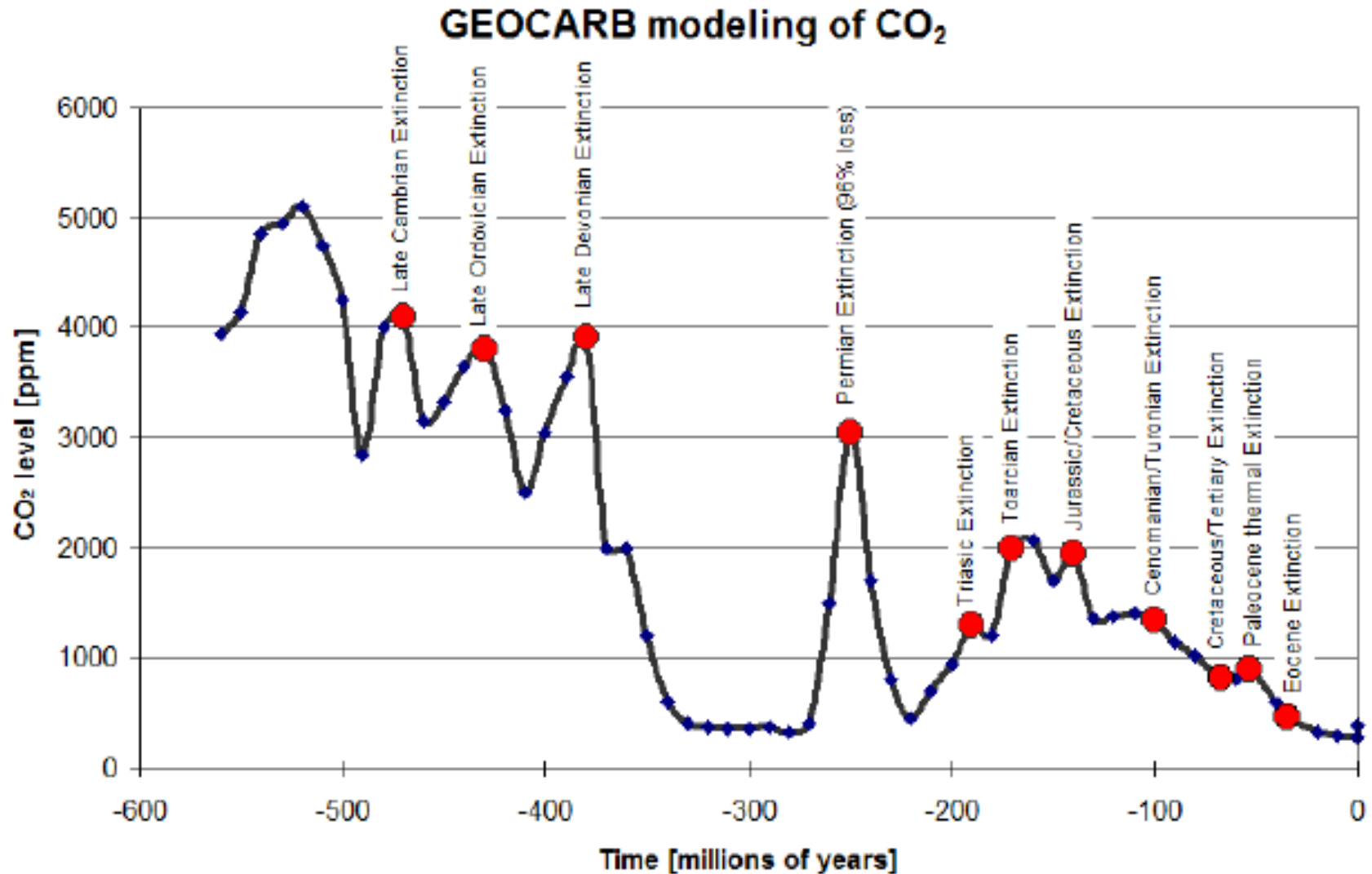
Ice Core Analysis

- Vostok ice core data goes back ~420,000 years
- EPICA Dome C data goes back ~740,000 years (current ice core limit)
- There have been many ice ages in our past, spaced ~100,000 years apart
 - Cooling for ~90,000 years
 - Then warming for ~10,000 years
- The climate in the past has been much more erratic than we had previously thought.
 - 20 abrupt temperature changes in the last glacial period.
- 11,500 years ago earth's climate changed to the Holocene (with the Younger Dryas at 10,500 years ago).
- Other climate shocks occurred at 6400 B.C., 3000 B.C. and 2200 B.C.
- The Medieval Warm Period was about 2.7°F higher in temperature than today per ice core paleothermometry.
- The Little Ice Age had about 1.8°F lower temperature than today per ice core paleothermometry.

CO₂ Temperature Correlation

- CO₂ concentration is recorded by the gases trapped in ice crystals of the ice core layers
- Temperature is determined by the Paleothermometry of ice core layers
- The statistical comparison suggests CO₂ lags temperature by 200 years to 800 years
- It is much more likely that temperature increases have caused CO₂ concentration increases rather than the other way around
- Therefore, CO₂ as a primary cause of increased atmospheric temperature seems unlikely based on ice core data

GEOCARB Model Data

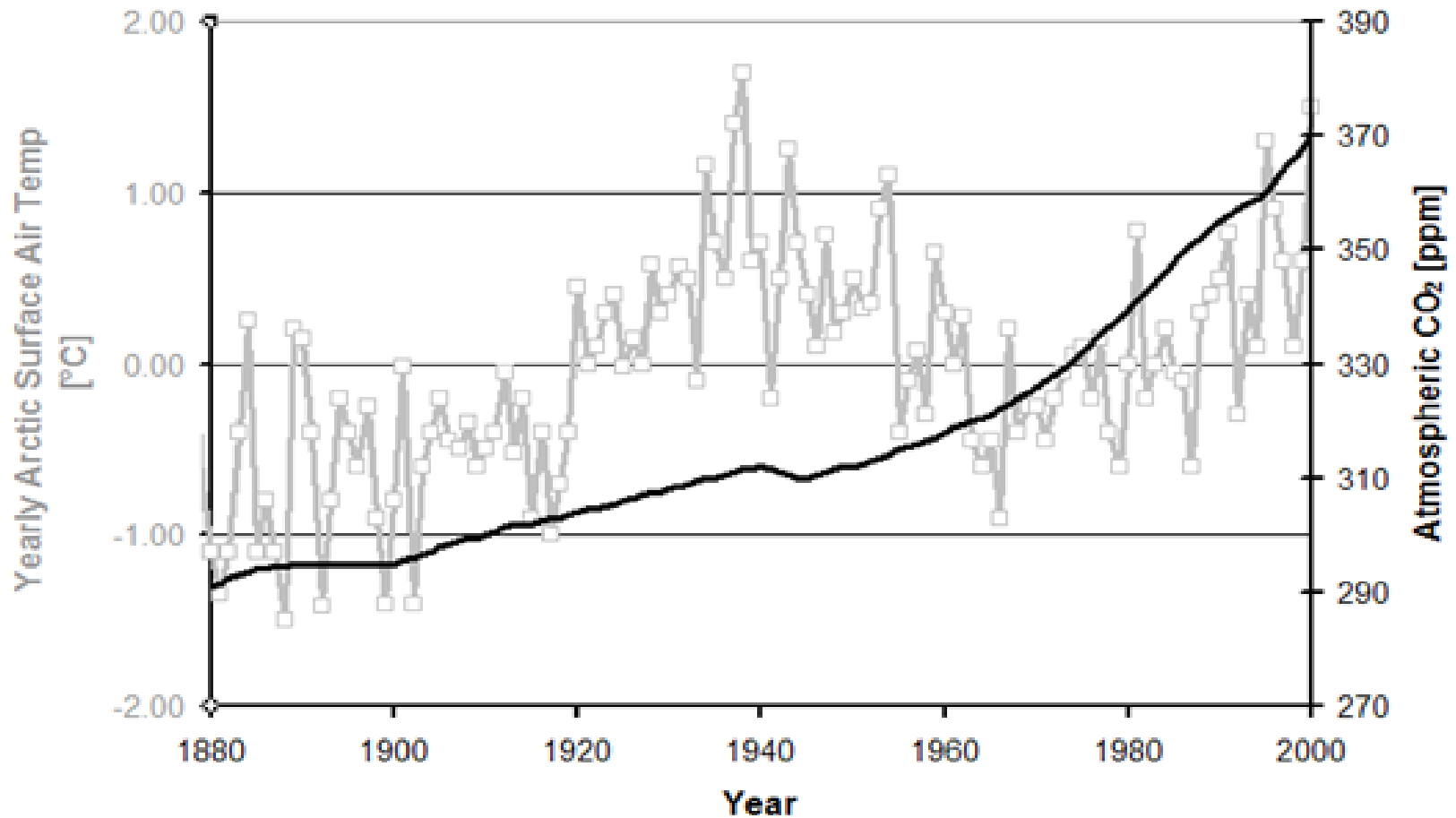


Solar Variability

- The “solar constant” is about 1370 W/m^2 at the top of the atmosphere.
- The average incoming solar irradiation is about 342 W/m^2 at the top of the atmosphere.
- The Hoyt-Schatten Total Solar Irradiance (TSI) has actually varied about 0.2% over the last century.
- Ultraviolet irradiation has varied even when TSI was constant.
- The sun’s magnetic field has increased 2.3 times since 1900. The sun’s magnetic field bends deep space cosmic rays away from the earth. Experiments correlate cosmic rays to low elevation cloud formation.
- About 50% of global warming prior to 1970 has been attributed to solar variability.
- About 30% of global warming after 1970 has been attributed to solar variability.

CO₂ Correlation to Temperature

Arctic-Wide Surface Air Temp. vs. CO₂



Reasonable Impacts

Table 6.9 With Consideration for Cosmic Ray Effects:

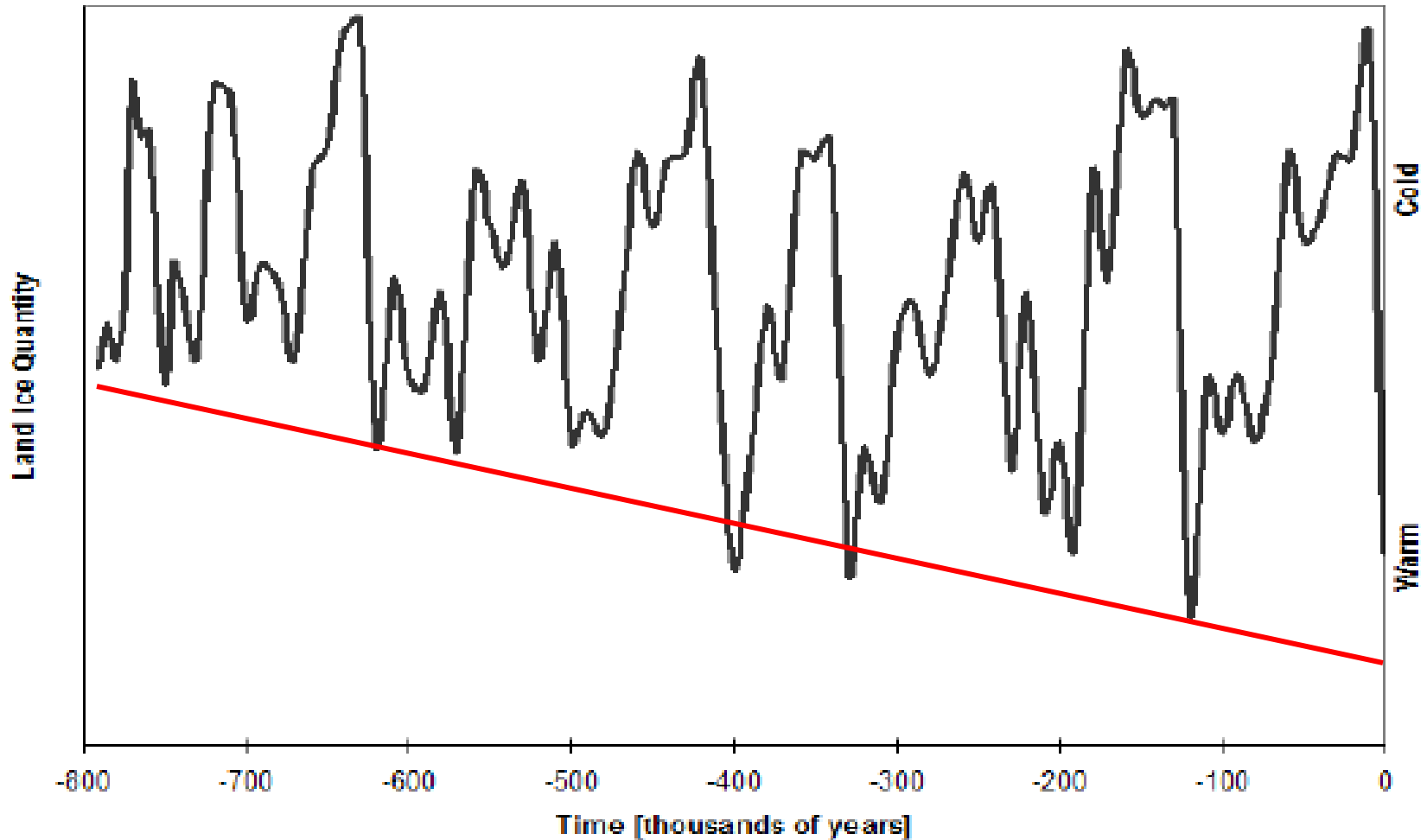
<u>Aspect</u>	<u>Temp Rise</u>	<u>Forcing Factor</u>	<u>Percent</u>
Anthropogenic CO ₂ (+100 ppm)	≤0.6°F	1.4 W/m ²	45% or less
Anthropogenic Other GHGs	≤0.1°F	0.2 W/m ²	7% or less
Anthropogenic Total	≤0.7°F	1.6 W/m ²	52% or less
100yr Solar Impact (+ cosmic rays)	≥0.6°F	≥1.4 W/m ²	48% or more
Natural Water Vapor Response	???	unquantified	unknown
Overall 20 th Century Observed	~1.3°F		100%
Direct Doubling of CO ₂	~1–1.5°F	1.5–2.8 W/m ²	
Doubling of CO ₂ with Feedbacks	~1.5–3°F	2.8–5.6 W/m ²	
Overall CO ₂ (380 ppm)	3°–7°F		
Water Vapor Impact	54°–59°F		
Total Greenhouse Effect	60°–63°F		
Dense Cloud Albedo		50–75 W/m ²	
Annual ~47° Sun Azimuth Swing	~35°F–50°F	~100–150 W/m ²	
Total Incoming Solar (average)		342 W/m ²	

Climate Change Outcomes

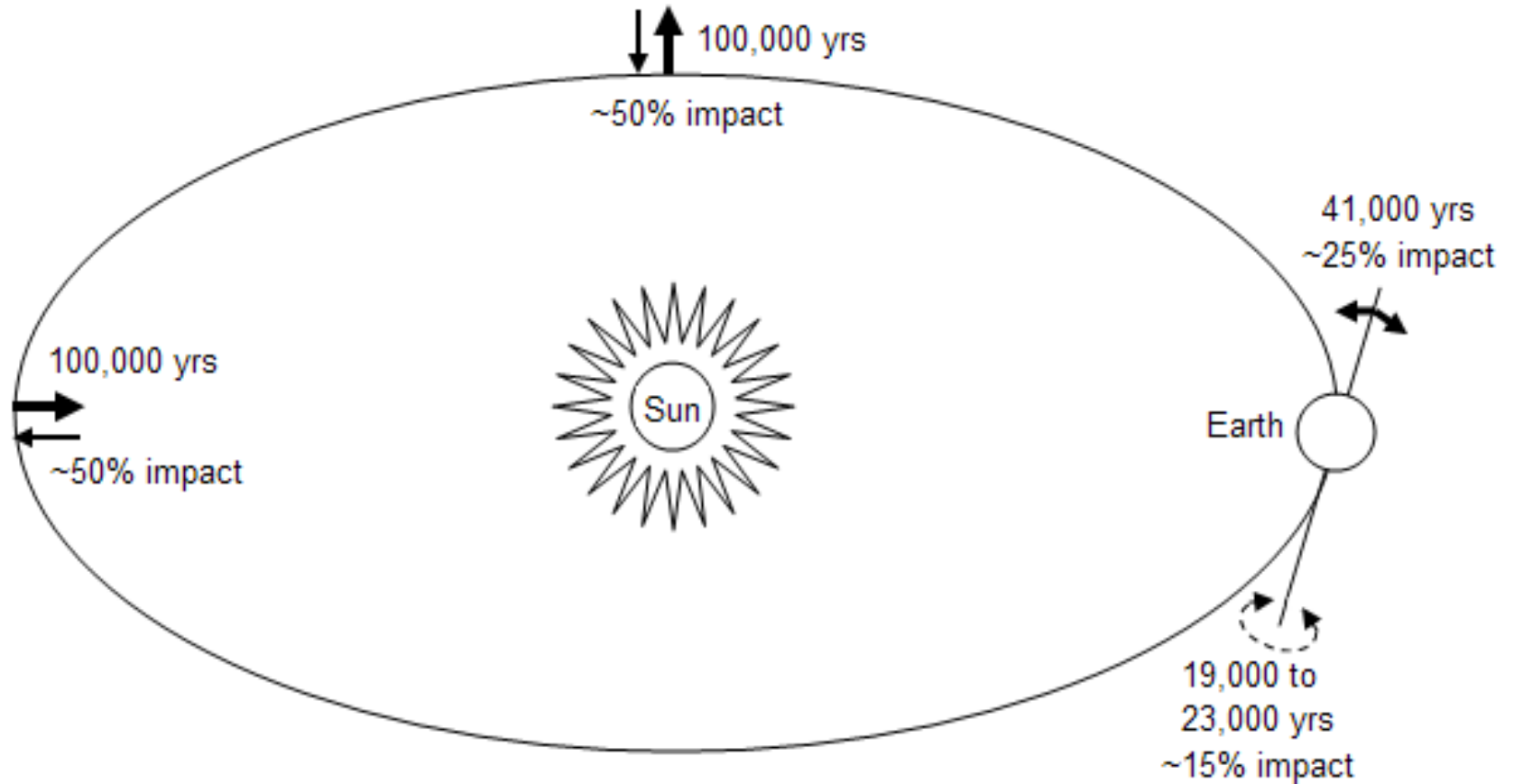
- Food shortages
- Water shortages
- Ecosystem stress and species extinctions
- Weather variability
- Increased severe weather
- Melting glaciers and melting ice caps
- Sea level rise

Global Ice Volume History

Land Ice On Earth



Milankovitch Cycles



Milankovitch orbital oscillations and their impact on ice ages.

Sea Level Changes Correlate With Ice Volumes

- Sea levels have naturally risen and fallen 410 feet to 470 feet between glacial minimums and interglacial maximums.
- Sea levels in the present interglacial have only risen 400 feet so far. (this was determined in 1988 by Richard Fairbanks by boring and radiocarbon dating Barbados coral, *Acapora Palmata*)
- Therefore, sea levels during the last inter-glacials were 10 to 70 feet higher than today.
- Sea levels are expected to rise naturally over the next few centuries due to the Milankovitch cycling.

Added Perspective

- ~18% of global CO₂-equiv. emissions are due to agriculture (mostly as methane) (per UN Food and Agriculture Org)
- ~7% of global CO₂ emissions are due to human respiration
- Therefore, ~25% of global CO₂-eq emissions are currently due to animal bodily functions
- Human caused forest fires and military activity also emit significant CO₂
- It will be hard for cap-and-trade regulations to address these
- In order for cap-and-trade legislation to reduce CO₂-eq emissions even approaching 75% (as current cap-and-trade legislation promotes)—global GHG emissions from industry, automobiles, airlines, railroads, utilities, homes, cooking, and all other buildings would need to be reduced to **zero**!
- This would obviously be extreme, and would severely impact human life on this planet . . . Does this really make sense?

Politics and Regulations

- Kyoto Protocol
 - Ineffective even with 100% ratification and compliance
- California Low Carbon Fuel Standard (LCFS)
 - To reduce well-to-wheels carbon footprint for transportation fuels
- Cap-and-trade legislation
 - Lieberman-Warner bill (2008)—63%-71% reduction in GHGs by 2050
 - Obama direction (2009)— proposed 80% reduction in GHGs by 2050
 - Waxman-Markey bill (June 2009) — 80% reduction in GHGs by 2050
 - Kerry-Boxer bill (before Senate) — 83% reduction in GHGs by 2050
 - Cap-and-trade encourages manipulation and fraud on a global scale
- EPA given power to regulate CO₂ emissions (April 2009)
 - Potential to use a big hammer if congress doesn't act
 - EPA declares GHGs endanger public health and welfare (Dec-2009)
 - Probable decimation of U.S. industry if acted upon
 - Likely to be in courts for years

Technologies to Reduce CO₂

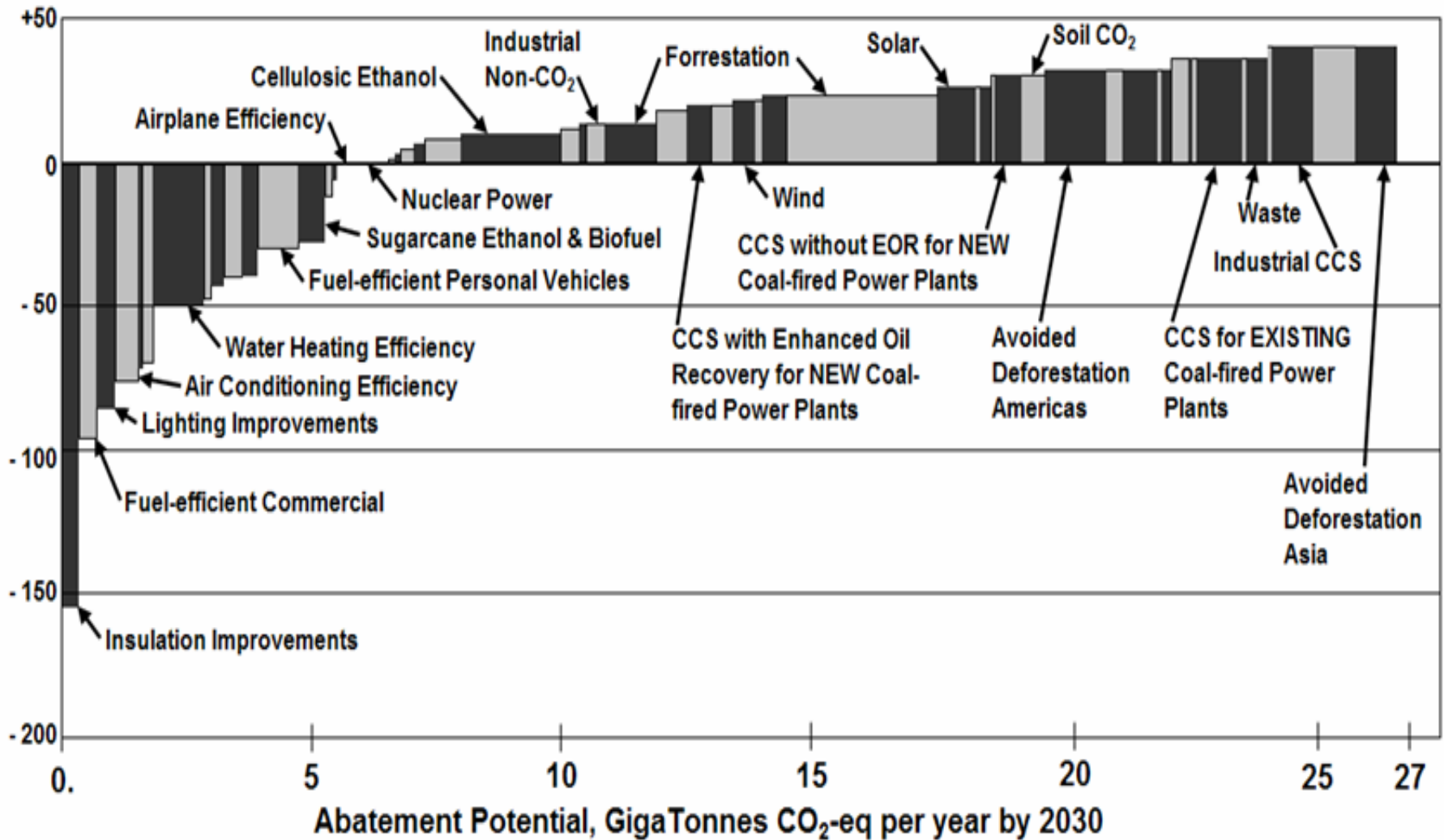
- Energy efficiency measures
- Improved engine technologies
- Hybrid vehicles and electric vehicles
- Corn-based ethanol, sugarcane ethanol, and cellulosic ethanol
- Bio-diesel, Jatropha oil, algae, bio-butanol
- Gen IV nuclear energy
- Hydrogen fuel and fuel cells
- Cogeneration (CHP) for electricity and steam
- Geothermal heat pumps for heating and cooling
- Carbon capture and storage (CCS)
- Wind, solar, and waves

The Economic Cost

- There are ~35 giga tonnes per year of CO₂-eq emissions globally.
- 20% of these CO₂-eq emissions can be reduced by known action measures that are *positively* economic.
- Another 20% of these CO₂-eq emissions can be reduced by known action measures that are *marginally* economic.
- A remaining 35% of our CO₂-eq emissions have known action measures but they are *NOT* economic.
- That leaves about 25% of emissions that do not have known reduction mechanisms.

Various CO₂-eq Abatement Measures and Their Costs

Marginal cost of abatement in Euros/Tonne of CO₂-eq



Adapted from: Vattenfall; *The Economist*, June 2, 2007; and McKinsey

Proposed Policy

- Energy security, economic stability, trade deficits, and fighting poverty should all be considered in concert when considering reducing GHG emissions.
- It will take decades to develop alternative fuels that will reduce GHG emissions at scale.
- Increased domestic crude production would help trade deficits and provide jobs and energy while alternative fuels are being developed.
- We should promote natural gas usage, which has the lowest GHG emissions per BTU.
- We should aggressively promote energy conservation and energy efficiency measures as they are already cost effective.
- We should provide a framework to help industry pursue marginally economic measures, but only with full cooperation from China and India.
- We should not pass laws today that promote the most aggressive action measures unless and until breakthroughs in technologies occur.

Summary

- Mankind has had a discernable impact on the climate, but natural causes of global temperature have also had an impact.
- Human-caused global warming in the 20th century could be about half of the observed 1.3°F temperature rise.
- The outcomes of human-caused global warming and climate change are less severe than is often promoted, and many outcomes should be expected to occur naturally anyway.
- There are always trade-offs to consider, and net benefits must be calculated with every action measure.
- To be the most responsible to future generations, resources should not be wasted (including human resources).
- Pursuing economic action measures, and soon-to-be economic measures, are proposed. Those alone would take proposed cap-and-trade mechanisms about two decades to achieve.
- In two decades we could have better climate data and technology breakthroughs to determine if (or how much) we should go further.
- We do not need to gamble with our country, our future, and the planet by pursuing (today) the most aggressive action measures.

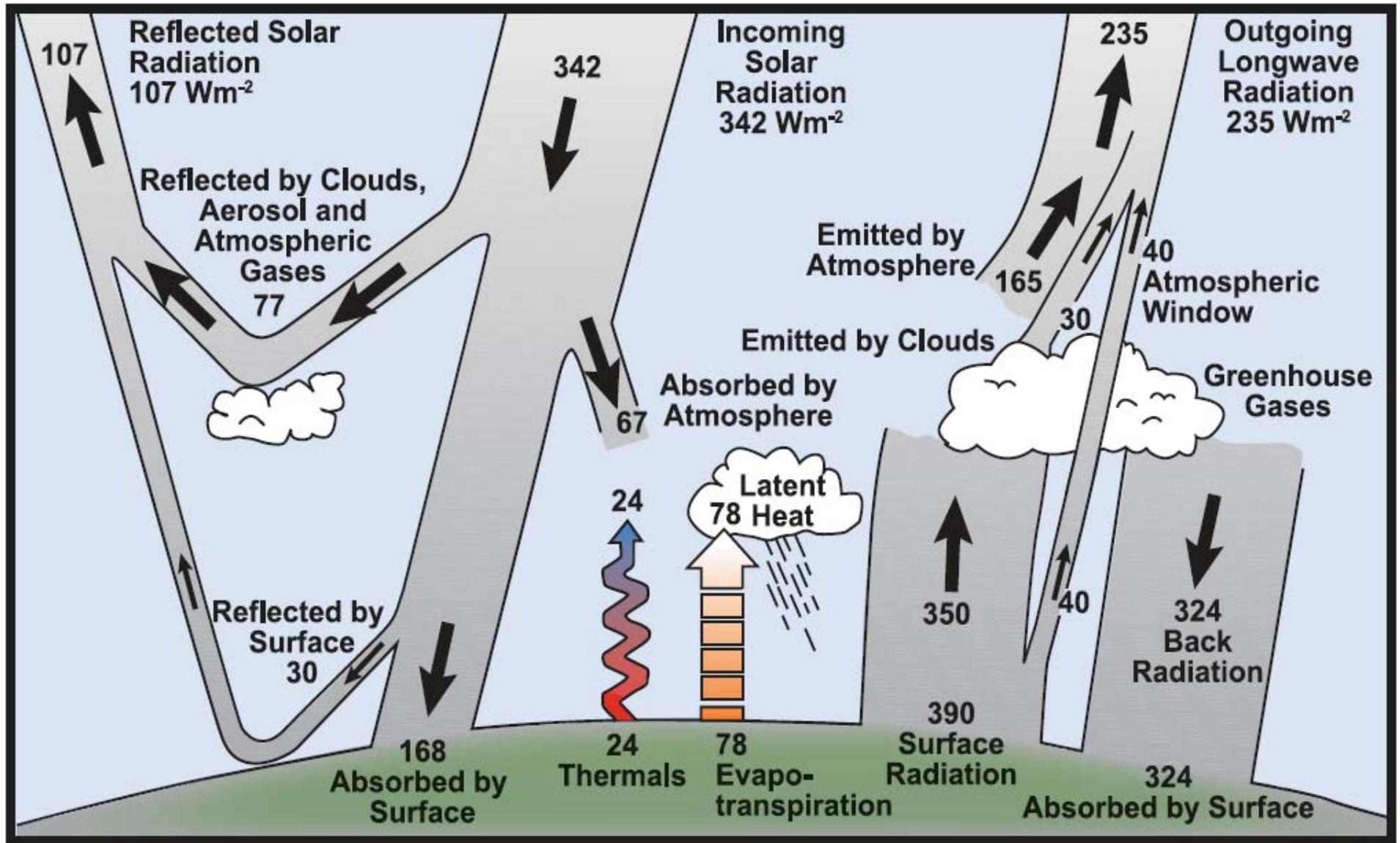
Thank You !

Q & A

For more information visit:
<http://ClimateBalance.TatePublishing.net/>



Appendix

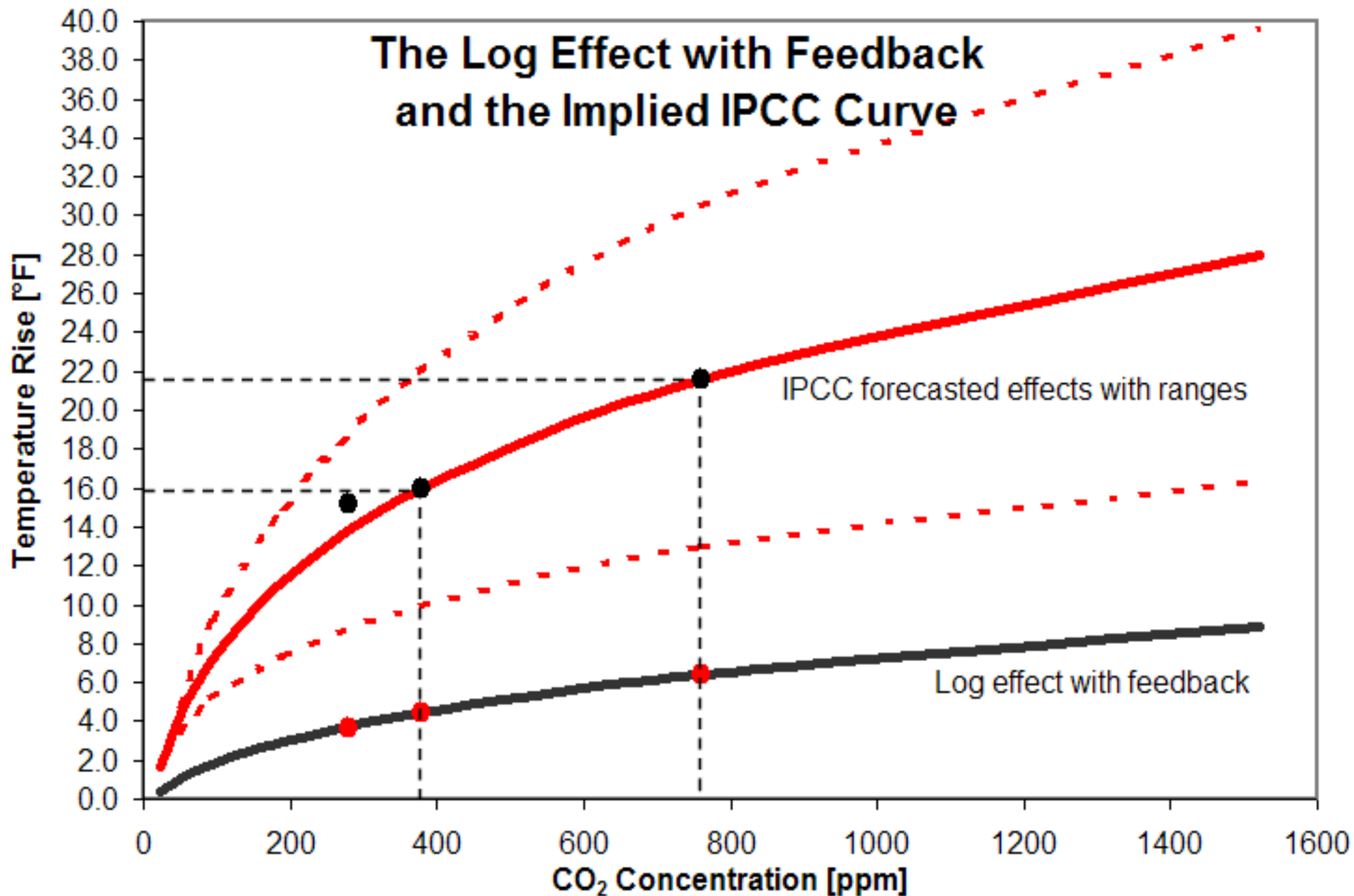


The Radiative Balance of the earth, on an annual and global mean basis.
 Source: 2007 IPCC report.

“The IPCC Report is backed by over 3000 Top Scientists”

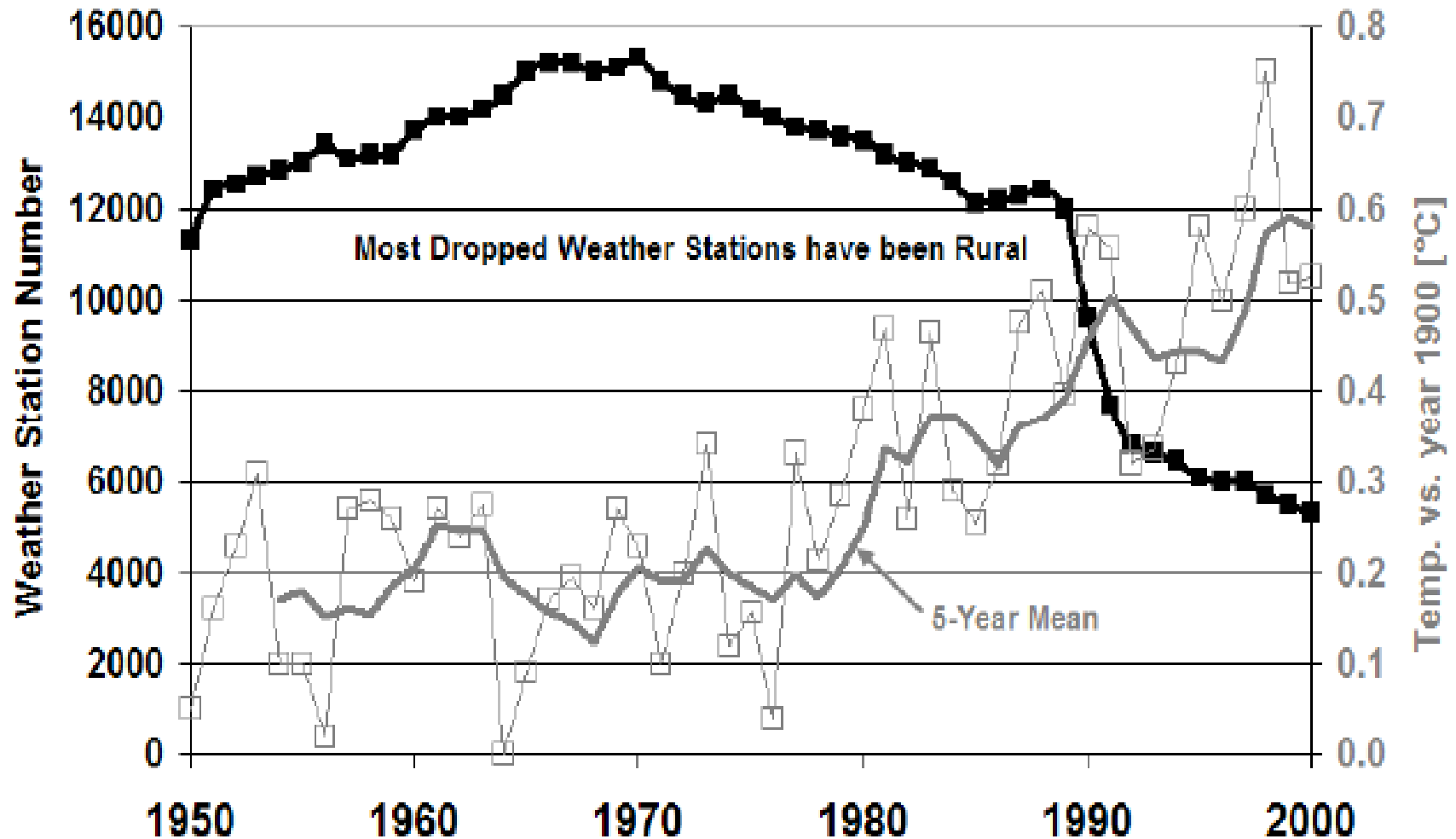
- Science is never ultimately determined by a vote of scientists.
- The listing of these contributing scientists does not signify consensus.
- The supporting scientists submitted their data and drafted their sections. But, only a small group of pre-approved “similarly-minded believers” weighed the data, changed the data, and managed the reports.
- The IPCC reports appear to slant the data toward a “crisis” perspective:
 - Giving highest trust to climate models, when they are actually most questionable
 - Minimizing the impact of solar variations
 - Minimizing urban island heat effects on global temperature data
- The key temperature-CO₂ lag from ice cores was left in the details (WG1, Chapter 6, p.449) but completely ignored in summaries and press reports.
- The IPCC reports avoid mentioning:
 - The assumptions required for either 450 ppm or 550 ppm CO₂ thresholds.
 - That a 2°C temperature increase can be expected to occur naturally.
 - Many solar variability data, including Danish Space Research Institute.
 - That many of the forecasted outcomes are expected to occur naturally.
 - That hurricane severity is not expected due to high-altitude wind shear.
 - The inadequacy of predicting species extinctions based on projected stress.
 - That sea levels are expected to rise another 10 to 70 feet naturally.
- The IPCC purposely misled Himalayan glacier melt data (2350 to 2035).

The Log Effect with Feedback and the Implied IPCC Curve

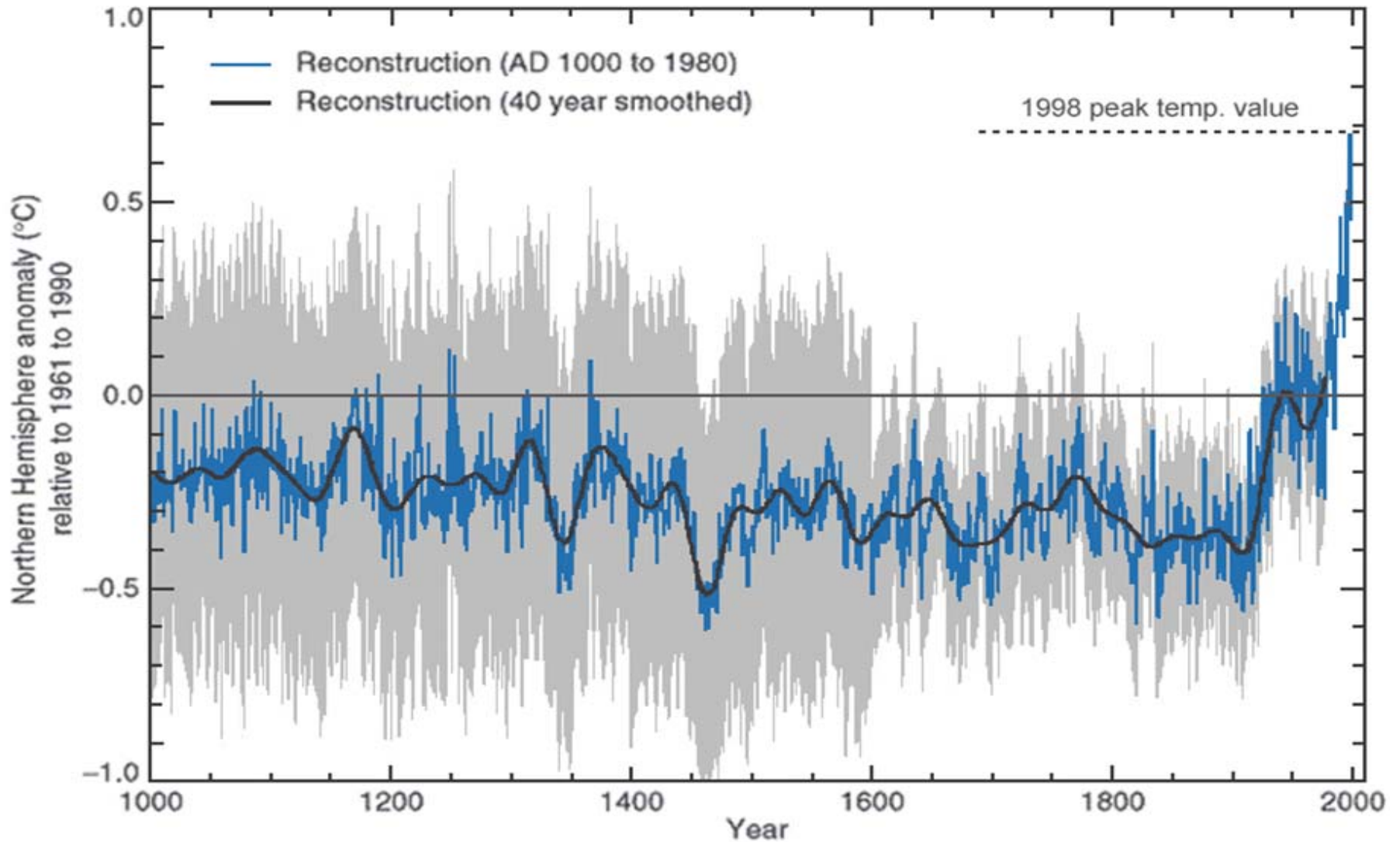


Weather Station Data

Surface Stations and Global Temperatures

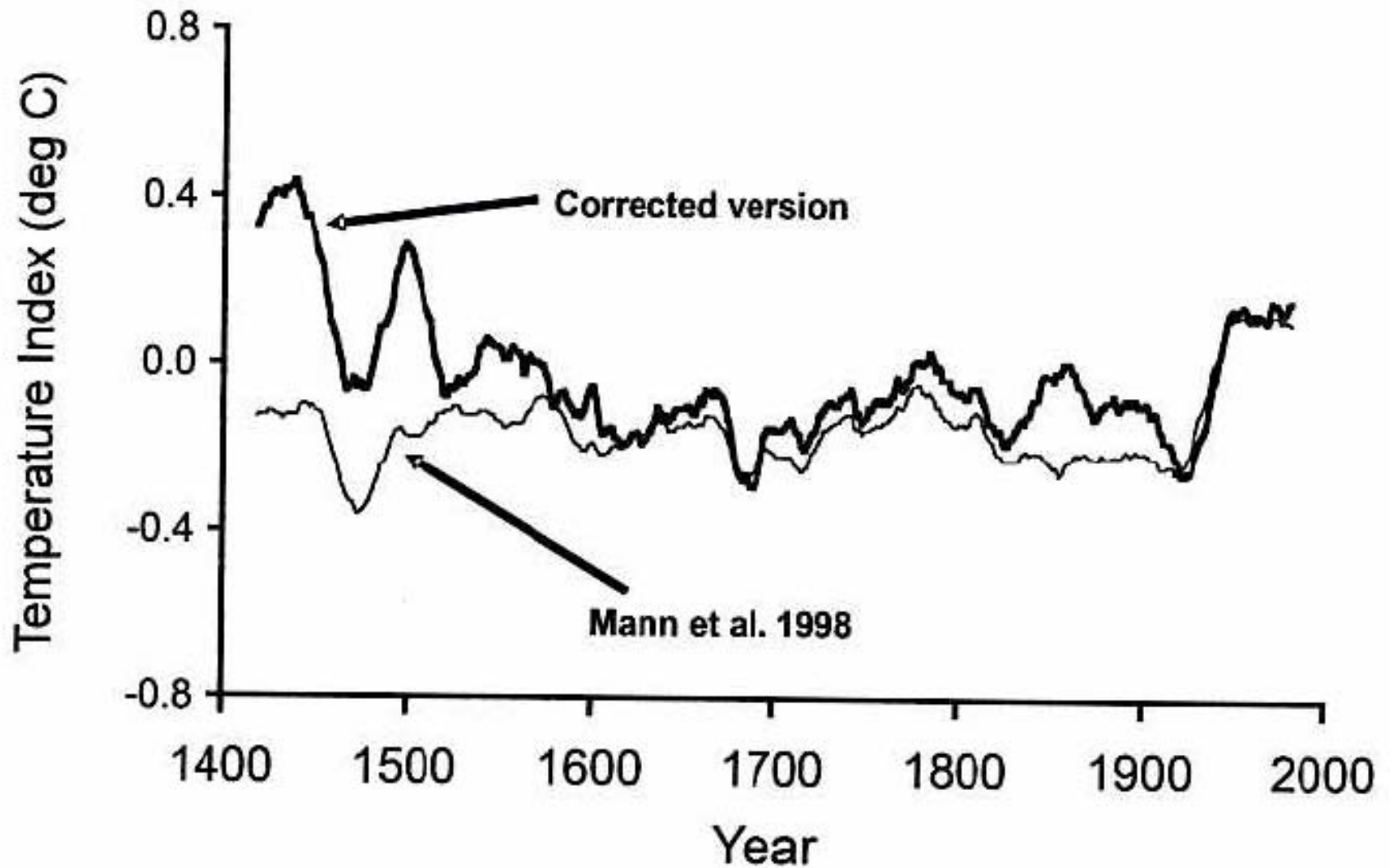


MBH98 (the Hockey Stick)





MBH98, Michael Mann “hockey stick” corrected.



Source: *Energy & Environment*, November 2003