HARDY MYERS
Attorney General

PETER D. SHEPHERD
Deputy Attorney General

DEPARTMENT OF JUSTICE
GENERAL COUNSEL DIVISION

September 19, 2006

VIA EMAIL AND HAND DELIVERY

Attention: Filing Center
Public Utility Commission of Oregon
550 Capitol Street NE, #215
PO Box 2148
Salem, OR 97308-2148
Puc.filingcenter@state.or.us

Re: *In the Matter of PACIFICORP Draft 2009 Request for Proposals to Order No. 91-1383*
PUC Docket No. UM 1208
DOJ File No. 330-030-GN0967-06

Enclosed please find the original Oregon Department of Energy's Initial Comments for filing today in the above-captioned matter.

Sincerely,

/s/ *Mark Schumock for*

Janet L. Prewitt
Assistant Attorney General
Natural Resources Section

Enclosures

c: Phil Carver, ODOE
UM 1208 Service List

JLP:jrs/GENR3538

BEFORE THE PUBLIC UTILITY COMMISSION

OF OREGON

UM 1208

In the Matter of PACIFCORP Draft 2009 Request for Proposals Pursuant to Order No. 91-1383	))))	OREGON DEPARTMENT OF ENERGY'S INITIAL COMMENTS

Overview and Context

It is hard to reconcile PacifiCorp's view of the world and the carbon constrained world we actually live in.

In December 2004 the Oregon Governor's Advisory Group on Global Warming proposed the following goals for Oregon and U.S. emissions of greenhouse gases:

1. *By 2010, arrest the growth of Oregon's greenhouse gas emissions (including, but not limited to CO_2) and begin to reduce them, making measurable progress toward meeting the existing benchmark for CO_2 of not exceeding 1990 levels.*
2. *By 2020, achieve a 10 percent reduction below 1990 greenhouse gas levels.*
3. *By 2050, achieve a "climate stabilization" emissions level at least 75 percent below 1990 levels.*

(see: page ii of http://oregon.gov/ENERGY/GBLWRM/docs/GWReport-FInal.pdf)

Governor Kulongoski has endorsed these goals. (*See* http://www.governor.oregon.gov/Gov/GNRO/global_warming_energy.shtml.) In September 2005 he appointed a Carbon Allocation Task Force to develop a load-based cap and trade legislative proposal for the electric sector to meet these goals. Governor Kulongoski also plans

to propose legislation to enact a renewable portfolio standard of 25 percent renewable power (MWhs) for Oregon by 2025.

ODOE Attachment 1 is slides from presentation that Dr. James E. Hansen made to the Climate Change Research Conference in Sacramento, California on September 13, 2006. Dr. Hansen is the Director of the Goddard Institute for Space Studies, the climate division of the National Aeronautics and Space Administration. (see http://www.giss.nasa.gov/about/). These slides present the science behind the Governor's greenhouse gas goal of a 75 percent reduction in emissions by 2050.

Dr. Hansen notes on slide 38 that for a 75 percent reduction by 2050 all new power plants built in developed countries after 2012 will need to geologically sequester their CO_2. All coal-fired power plants that do not sequester CO_2 must be "bulldozed" during the period 2025-2050. This, combined with a gradually increasing carbon tax and other measures, will stabilize the global temperature rise at 1 degree C (slide 18) beyond today's level.

The alternative of a business-as-usual strategy is a 3 degree C temperature rise this century, which would likely lead to extinction of 50 percent of multi-cellular plant and animal species and sea level rise of several meters this century. Many more meters of sea level rise would occur in the following centuries (slides 18 and 28).

A six meter sea level rise would displace 11 million Americans and hundreds of millions of people worldwide (slide 25). Equilibrium sea level rise for a temperature increase of about 3 degrees C is 25 meters (±10 m) which would occur over several centuries (slide 28). This rise would not occur at a smooth uniform rate. Nor would the impacts of sea level rise be gradual. The population displacement would occur during storm surges, as seen in New Orleans last year.

While that catastrophe was due primarily to poor dike construction and maintenance, it is a sample of future impacts from a business-as-usual policy.

The 2012 Baseload RFP and CO_2 Policy

The nexus of carbon policy and PacifiCorp's 2012 Baseload RFP is the carbon dioxide cost adder in PacifiCorp's IRP and RFP modeling. PacifiCorp plans to use an $8 per ton of CO_2 adder (2008$) phased in over the period 2010 through 2012 (Attachment 2, p, 5, PacifiCorp's response to ODOE data request No. 11). An $8 CO_2 adder represents little change from a business-as-usual carbon policy. It is likely that Oregon will begin to implement the Governor's greenhouse gas goals and that the US will implement comparable goals, which would imply much higher adders than the $8 in PacifiCorp's IRP and RFP modeling. This policy shift will likely occur before the benchmark pulverized coal plants in the 2012 RFP come on-line or shortly thereafter. If these plants are built they are unlikely operate as baseload units though their 40 year planned lives which would end in 2052 and 2053.

As an example of the rapidly changing political landscape, the California Senate and Assembly passed AB 32 on August 30 and 31, 2006. Governor Schwarzenegger has pledged to sign the bill which would require the state air resources board to adopt a statewide greenhouse gas emissions limit of the 1990 level to be achieved by 2020. This includes load-based emissions from the electric sector. This is consistent with Governor Schwarzenegger's greenhouse gas goals of:

- 2010: emissions at 2000 levels
- 2020: emissions at 1990 levels and
- 2050: emissions 80% below 1990 levels

California is not alone in this effort. At least 8 East Coast states are planning to cap their electric emissions. (See http://www.rggi.org/). They have adopted similar long-term goals for CO_2 reductions.

The RGGI program began in August, 2001 when the New England Governors and Eastern Canadian Premiers adopted a climate change action plan (http://www.negc.org/documents/NEG-ECP%20CCAP.PDF). The plan had the following goals (see page 8):

- In The **Short-term Goal**: Reduce regional GHG emissions to 1990 emissions by 2010.
- **Mid-term Goal:** Reduce regional GHG emissions by at least 10% below 1990 emissions by 2020, and establish an iterative five-year process, commencing in 2005, to adjust the goals if necessary and set future emissions reduction goals.
- **Long-term Goal:** Reduce regional GHG emissions sufficiently to eliminate any dangerous threat to the climate; current science suggests this will require reductions of 75–85% below current levels.

The science of global warming and recent state policy moves inform the forecast of the level of the CO_2 adder that should be used for resource planning. The dollar per ton adder will likely be whatever it takes to induce utilities to build coal-fired power plants that geologically sequester 80 to 90 percent of their CO_2 emissions. Forty dollars per ton of CO_2 is equivalent to 40 cent per gallon of gasoline. Although it has huge impact on unsequestered coal power costs, it is not a large carbon adder by international standards. European CO_2 allowances currently trade at about half this level for the modest Kyoto Protocol reductions. European and Japanese

gasoline taxes are ten times a 40 cent per gallon level. Policy makers will likely go after coal-fired emissions because large reductions are feasible and will cost less than in most other sectors.

Only coal-fired power plants that actually geologically sequester CO_2 should be considered reasonable during either the PacifiCorp IRP or RFP processes. PacifiCorp should remove the pulverized coal benchmark resources from its 2012 RFP and only pursue coal plants that can geologically sequester CO_2, i.e. integrated-gasification combined-cycle (IGCC) coal plants with geological sequestration.

At the September 14, 2006 meeting of PacifiCorp's IGCC Working Group, a representative from General Electric indicated that the process to build a sequestration-ready IGCC plant was feasible. It would require a site study of several hundred thousand to one million dollars to get indicative levels of price, performance, Engineering, Procurement, and Construction (EPC) terms, and performance guarantees. The study would complement the WorlyParsons study that PacifiCorp has completed. It may also be useful to pursue discussions with Siemens and Conoco-Phillips who are also developing EPC capability for IGCC plants.

In addition to pursuing the revised 2012 Baseload RFP with IGCC with geological sequestration as the benchmark and independently investigating a negotiated EPC contract for an IGCC plant with GE, Siemens or Conoco-Phillips, PacifiCorp should also issue a 2012 Renewable RFP to capture all the wind resources that are consistent with the benchmark IGCC plant with geological sequestration in this same time frame.

PacifiCorp indicated in its responses to ODOE data requests 3, and 4 (Attachment 2, pp. 1-2) and at the September 6, 2006 workshop that it is not pursuing wind resources with on-line dates beyond 2007. This is inconsistent with the OPUC Order No. 06-446 that requires "the overall fairness of the utility's proposed bidding process" (Guideline 7). To exclude wind

resource acquisitions and exclusively pursue baseload resources is imprudent and the Commission should instruct PacifiCorp that this may result in future disallowances of the costs of the resources acquired instead of lower-cost and lower-risk wind resources.

PacifiCorp has resisted a renewable RFP with on-line dates out to 2012. One reason given is that wind and other renewable contracts would have to be contingent on renewal of the Federal Production Tax Credit (PTC). This is correct, but it would be a prudent risk to accept, particularly if the alternative is the CO_2 regulatory risk of pulverized coal plants. Renewal of the Federal PTC has been episodic, but it has always been renewed. In the current political climate, it is highly likely it will continue to be renewed at the current level. It would a reasonable risk for PacifiCorp to enter into PTC contingent contracts to enable the phased development of wind projects through 2012 and the Commission should say so.

Still, renewable developers may not be ready to actively participate in a 2012 Renewable RFP. Their time frames are generally much shorter: only 3 or 4 years out. This is due in large part due to the refusal of utilities to issue RFPs for phased development. If participation in a 2012 renewable RFP is inadequate, PacifiCorp should allow the CEM model to pick appropriate levels of wind development in evaluating bids to the 2012 Baseload RFP.

At the September 6, 2006 workshop PacifiCorp indicated they would assume only 400 MW (nameplate) of wind for the whole company as the basis for evaluating resource bids from the 2012 Baseload RFP. The Capacity Expansion Model (CEM) and Planning and Risk (PaR) modeling will be used for this evaluation. This is an inadequate level of wind development. Even the use of 1,400 nameplate MW of renewables as assumed in the January, 2003 IRP would be inadequate. This level was artificially set by the way wind was modeled in the 2003 IRP and is not an output of the model.

Similarly, if there are not enough 10 year price-indexed power purchase contracts bid into the 2012 Baseload RFP, the CEM and PaR models should be allowed to optimize front-office transactions.

ODOE has limited ability to comment on the overall structure of the scoring in the 2012 Baseload RFP. One apparent flaw in the scoring is it does not evaluate the benefits of better ramp rates and lower minimum operating levels. These will be important for integrating large amounts of wind into PacifiCorp's system. The ramping characteristics of thermal power plants can vary substantially. (See Attachment 2, p. 4, PacifiCorp's response to ODOE data request no. 10) Note that if natural gas were available for the combined-cycle portion of an IGCC plant, its ramp rate would be comparable to the ramp rate for a CCCT.

In asking that the Commission approve the 2012 Baseload RFP, PacifiCorp is asking the Commission to approve the 2006 IRP inputs to its models, sight unseen. The Commission should condition its approval of the 2012 Baseload RFP on substantial increase in the CO_2 adders and other changes outlined below.

ODOE disagrees with the different lifetimes for wind and coal plants. These have not been adequately justified. See Attachment 2, p. 3, PacifiCorp's response to ODOE data request no. 8.). The response to ODOE request no. 8 is not empirical and is logically flawed. Wind plant equipment can be maintained and replaced over 40 years just as coal plant equipment can. The towers and blades do not wear out. Replacement of the mechanical parts of wind generating plants has not been done in the past because of technological improvements in wind. Turbines built in California in the 1980s have been replaced with new turbines because that is cheaper that maintaining the old turbines. This does not argue for a shorter economic lifetime for wind plants. Technological improvements can only decrease the 40 year cost of a wind plant.

The Commission should also condition its approval of the 2012 Baseload RFP on improvement in modeling the impacts on wholesale power markets of California's carbon policies. It is unclear how PacifiCorp plans to model the impacts of California's plan to restrict purchases of coal power by its utilities. This may strongly bifurcate the wholesale market and significantly reduce the value of unsequestered coal power. This should be addressed in the IRP/RFP modeling.

The Commission should also indicate that PacifiCorp should revisit its assumptions for regulatory cost adders of non-CO2 pollutants over the lifetimes of the plants. Recently, Idaho has effectively banned new coal plants by refusing to participate in mercury emissions trading. The Oregon Dept. of Environmental Quality is also questioning the stringency of the proposed federal mercury standard.

Summary

The Commission should indicate that the 2012 Baseload RFP and 2006 IRP process are fundamentally flawed. The Commission should reiterate its finding in IRP Order No. 06-029 that refused to acknowledge a pulverized coal plant and stated that that:

"…all parties commenting in this proceeding, including PacifiCorp, recognize the associated [CO_2] uncertainties and risks for ratepayers. That makes an IGCC plant with the ability to later add CO_2 sequestration, an attractive option ...."

The Commission should condition approval of the 2012 Baseload RFP on the following changes by PacifiCorp:

- Set its CO_2 adder value in its the 2006 IRP and 2006 Baseload RFP modeling processes to a level consistent with the difference between IGCC with geological sequestration installed and pulverized coal power costs
- Initiate a 2012 Renewable RFP
- Use only IGCC plants with geological sequestration installed as benchmark resources and its 2012 Baseload RFP.
- Update the other assumptions to the CEM and PaR models outlined above.

The Commission should indicate that if these instruction are not followed then PacifiCorp risks disacknowledgment when it files the final IRP and a draft-final RFP short list during 2007.

DATED this _____ day of September 2006.

Respectfully submitted,

HARDY MYERS
Attorney General

/s/ *Mark Schumock, #05511 for*
_____
Janet L. Prewitt, #85307
Assistant Attorney General
Of Attorneys for the Oregon
Department Of Energy

SERVICE LIST (UM 1208)

SUSAN K ACKERMAN ATTORNEY AT LAW PO BOX 10207 PORTLAND OR 97296-0207 susan.k.ackerman@comcast.net	LAURA BEANE **PACIFICORP** 825 MULTNOMAH STE 2000 PORTLAND OR 97232 laura.beane@pacificorp.com
PHILIP H CARVER **OREGON DEPARTMENT OF ENERGY** 625 MARION ST NE STE 1 SALEM OR 97301-3742 philip.h.carver@state.or.us	MELINDA J DAVISON - **CONFIDENTIAL** **DAVISON VAN CLEVE PC** 333 SW TAYLOR – STE 400 PORTLAND OR 97204 mail@dvclaw.com
OPUC DOCKETS **CITIZENS' UTILITY BOARD OF OREGON** 610 SW BROADWAY STE 308 PORTLAND OR 97205 dockets@oregoncub.org	JASON EISDORFER – **CONFIDENTIAL** 610 SW BROADWAY STE 308 PORTLAND OR 97205 jason@oregoncub.org
RANDALL J FALKENBERG **RFI CONSULTING INC** PMB 362 8351 ROSWELL RD ATLANTA GA 30350 consultrfi@aol.com	NATALIE HOCKEN **PACIFICORP** 825 MULTNOMAH #1800 PORTLAND OR 97232 natalie.hocken@pacificorp.com
ROBERT D KAHN **NW INDEPENDENT POWER PRODUCERS** 7900 SE 28TH ST STE 200 MERCER ISLAND WA 98040 rkahn@nippc.org	**RENEWABLE NORTHWEST PROJECT** 917 SW OAK STE 303 PORTLAND OR 97205 ann@rnp.org
LISA C SCHWARTZ - **CONFIDENTIAL** SENIOR ANALYST **OREGON PUBLIC UTILITY COMMISSION** PO BOX 2148 SALEM OR 97308-2148 lisa.c.schwartz@state.or.us	JOHN W STEPHENS **ESLER, STEPHENS & BUCKLEY** 888 SW FIFTH, SUITE 700 PORTLAND OR 97204-2021 stephens@eslerstephens.com
MICHAEL T WEIRICH- **CONFIDENTIAL** ASSISTANT ATTORNEY GENERAL **OREGON DEPARTMENT OF JUSTICE** REGULATED UTILITY & BUSINESS SECTION 1162 COURT ST NE SALEM OR 97301-4096 michael.weirich@doj.state.or.us	STEVEN WEISS **NORTHWEST ENERGY COALITION** 4422 OREGON TRAIL CT NE SALEM OR 97305 steve@nwenergy.org

CERTIFICATE OF SERVICE

I hereby certify that on the 19th day of September, I served the foregoing OREGON DEPARTMENT OF ENERGY'S INITIAL COMMENTS, upon, the persons named on the attached service list, by mailing a full, true and correct copy thereof addressed to the persons at the addresses on the UM 1208 service list (with the exception of those parties having waived paper service).

DATED: September 19, 2006.

/s/ *Mark Schumock, #05511 for*

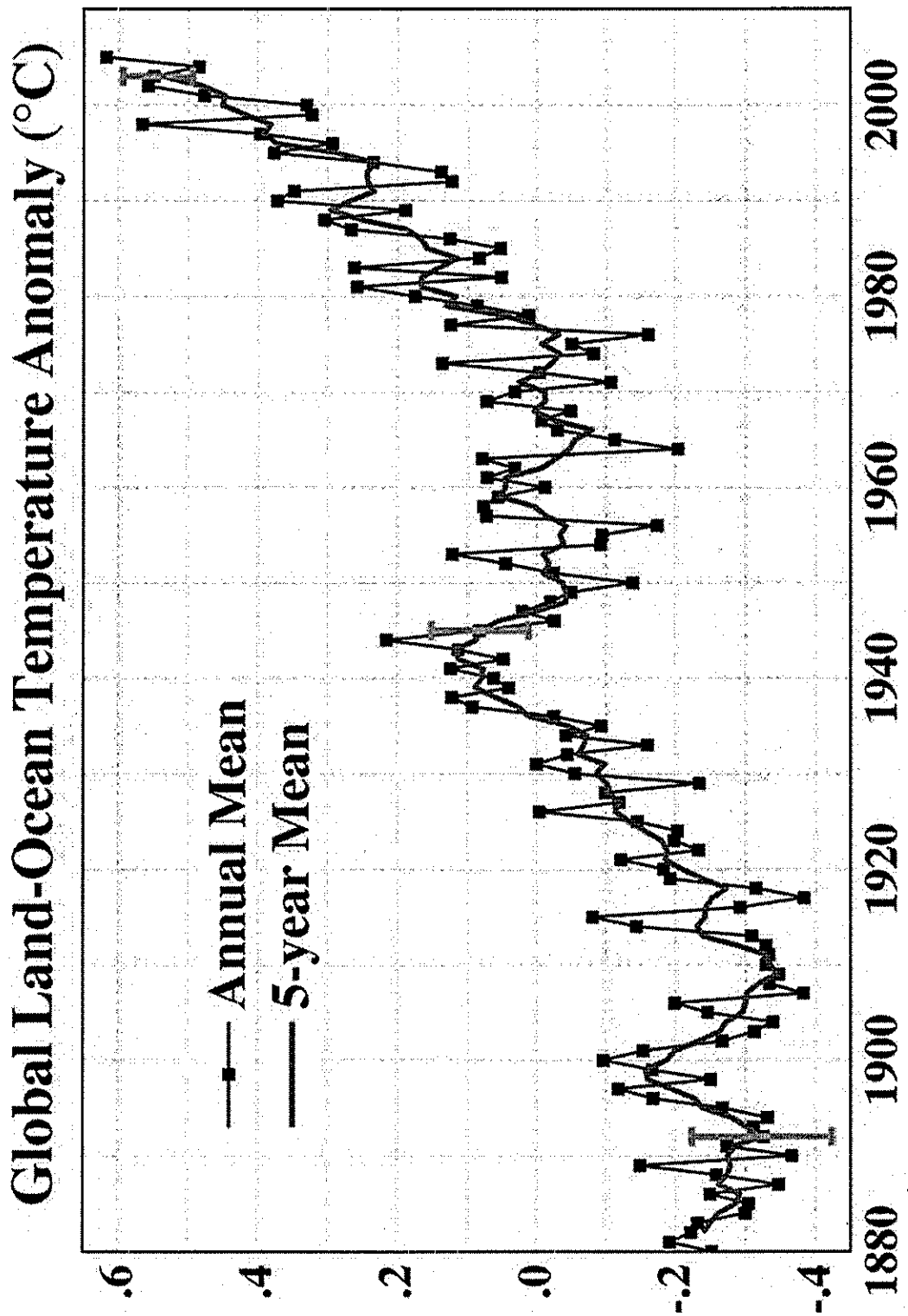
Janet L. Prewitt, #85307
Assistant Attorney General

Global Climate Change
Is There Still Time to Avoid Disastrous Effects?

Jim Hansen

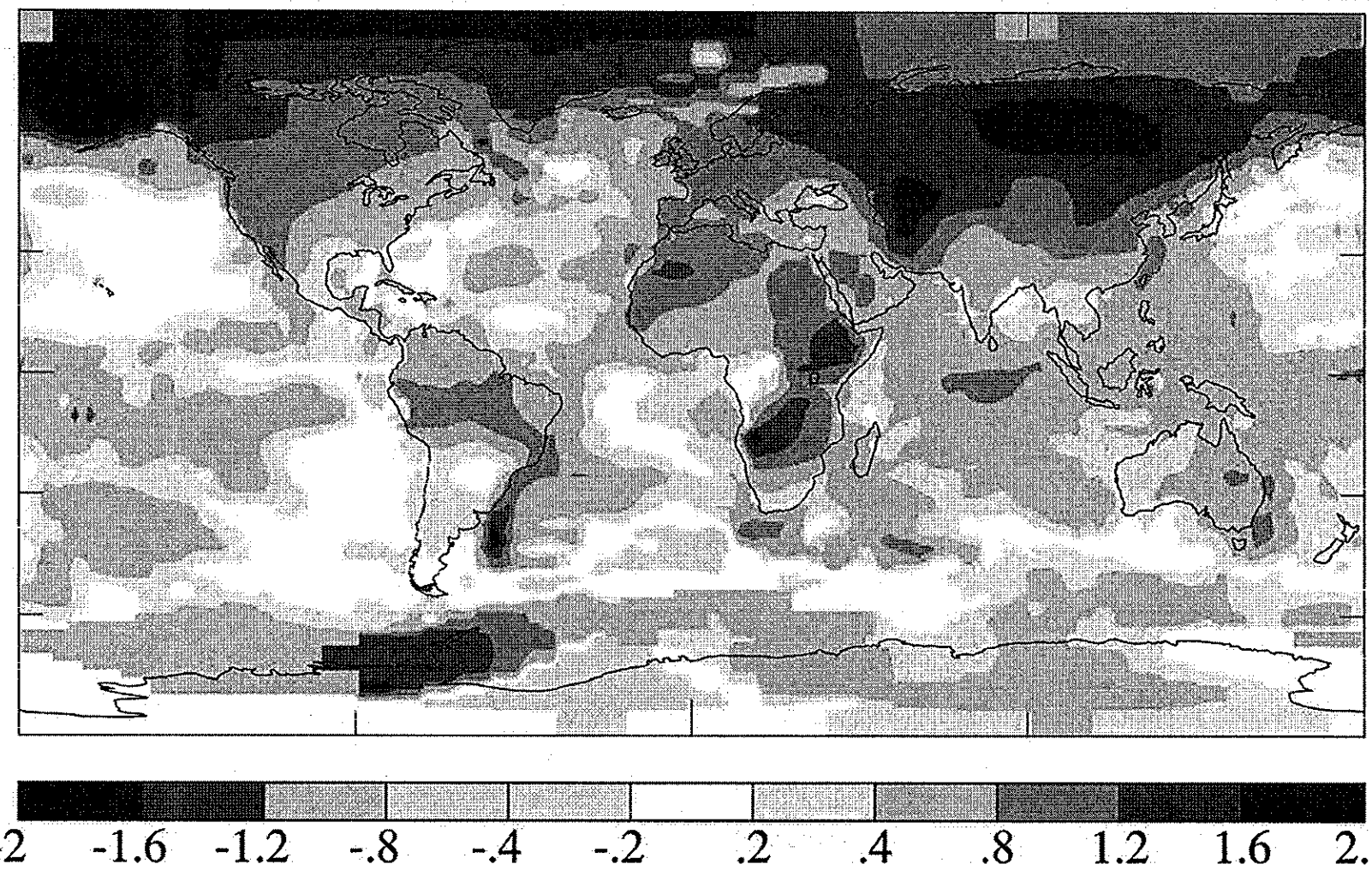
13 September 2006

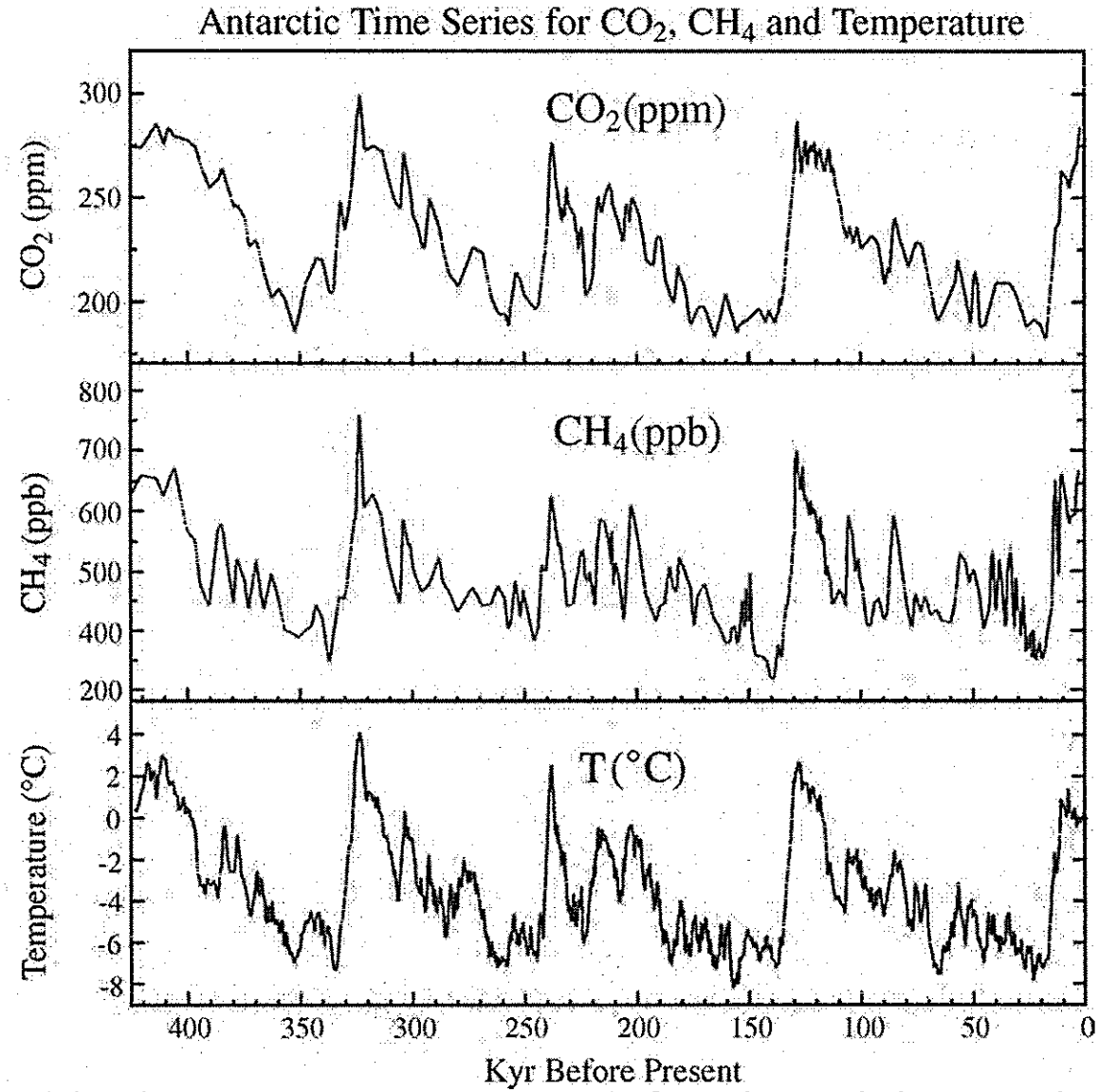
Climate Change Research Conference
Sacramento, California


Global Land-Ocean Temperature Anomaly (°C)
Annual Mean
5-year Mean
.6
.4
.2
.0
-.2
-.4
1880
1900
1920
1940
1960
1980
2000

2001-2005 Mean Surface Temperature Anomaly (°C)

Base Period = 1951-1980 Global Mean = 0.53

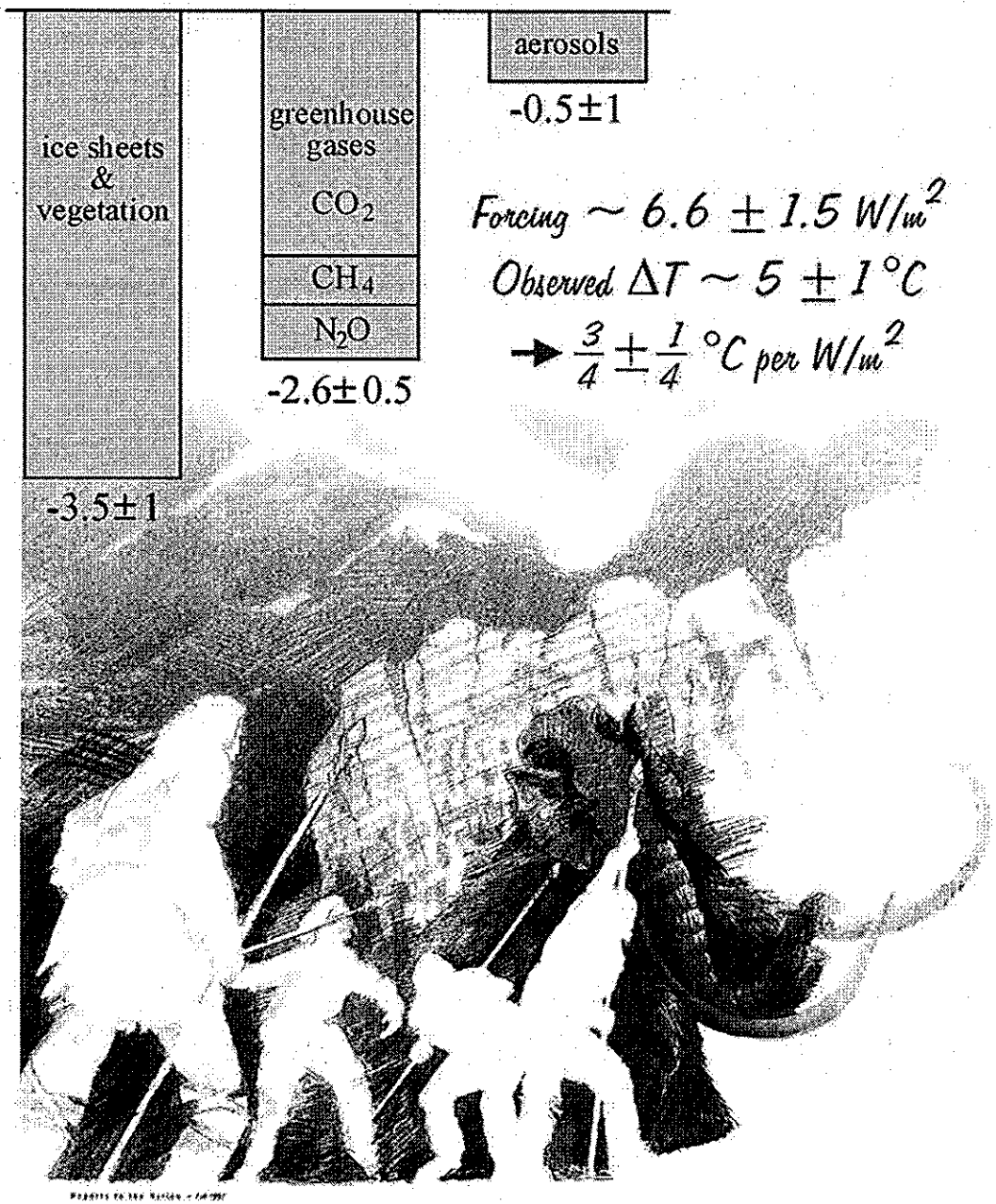




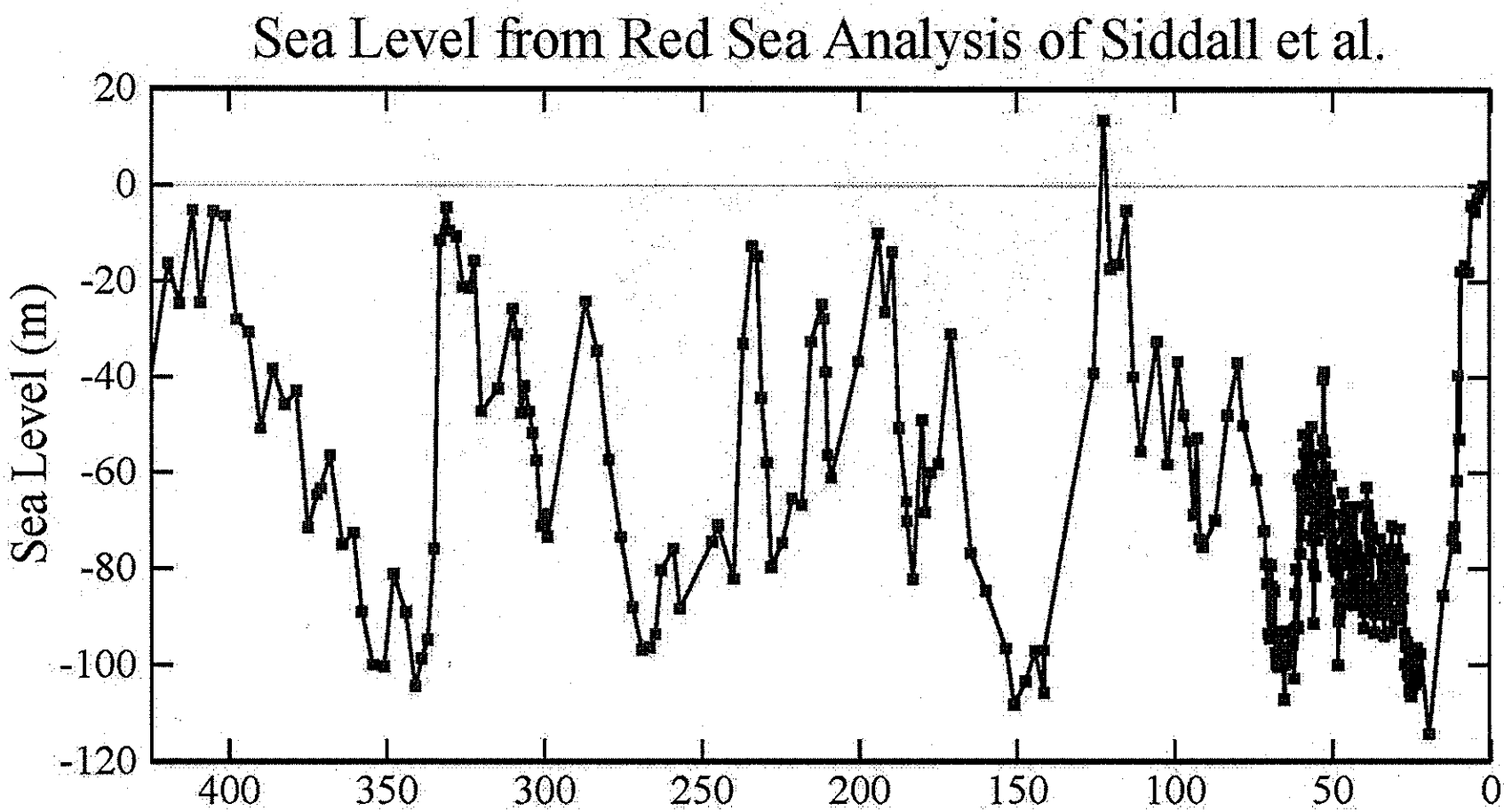
CO_2, CH_4 and temperature records from Antarctic ice core data

Source: Vimeux, F., K.M. Cuffey, and Jouzel, J., 2002, "New insights into Southern Hemisphere temperature changes from Vostok ice cores using deuterium excess correction", *Earth and Planetary Science Letters*, **203**, 829-843.

Ice Age Forcings Imply Global Climate Sensitivity ~ ¾°C per W/m².

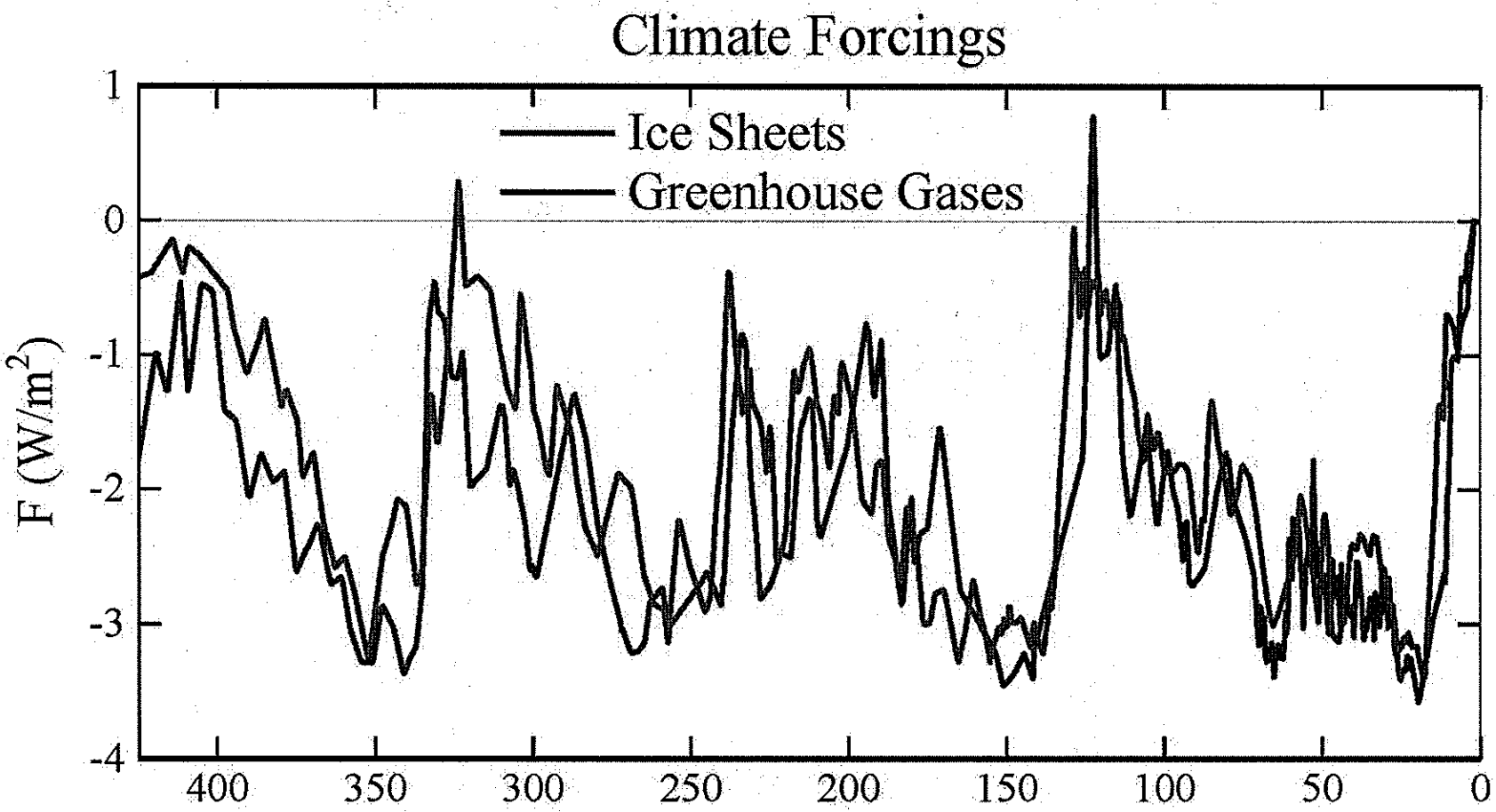


Source: Hansen et al., *Natl. Geogr. Res. & Explor.*, **9**, 141, 1993.



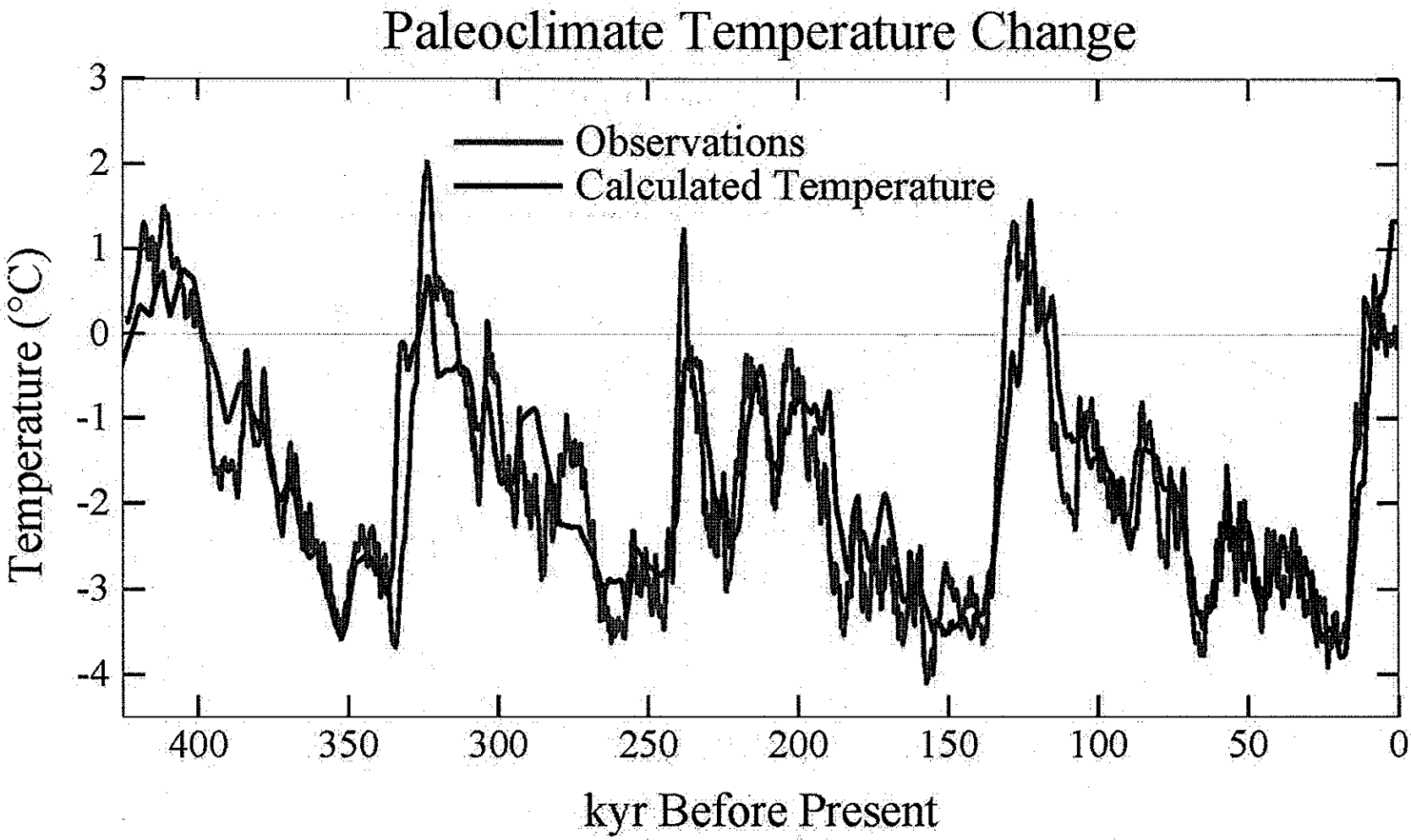
Global sea level extracted, via a hydraulic model, from an oxygen isotope record for the Red Sea over the past 470 kyr (concatenates Siddall's MD921017, Byrd, & Glacial Recovery data sets; AMS radiocarbon dating).

Source: Siddall et al., *Nature*, **423**, 853-858, 2003.



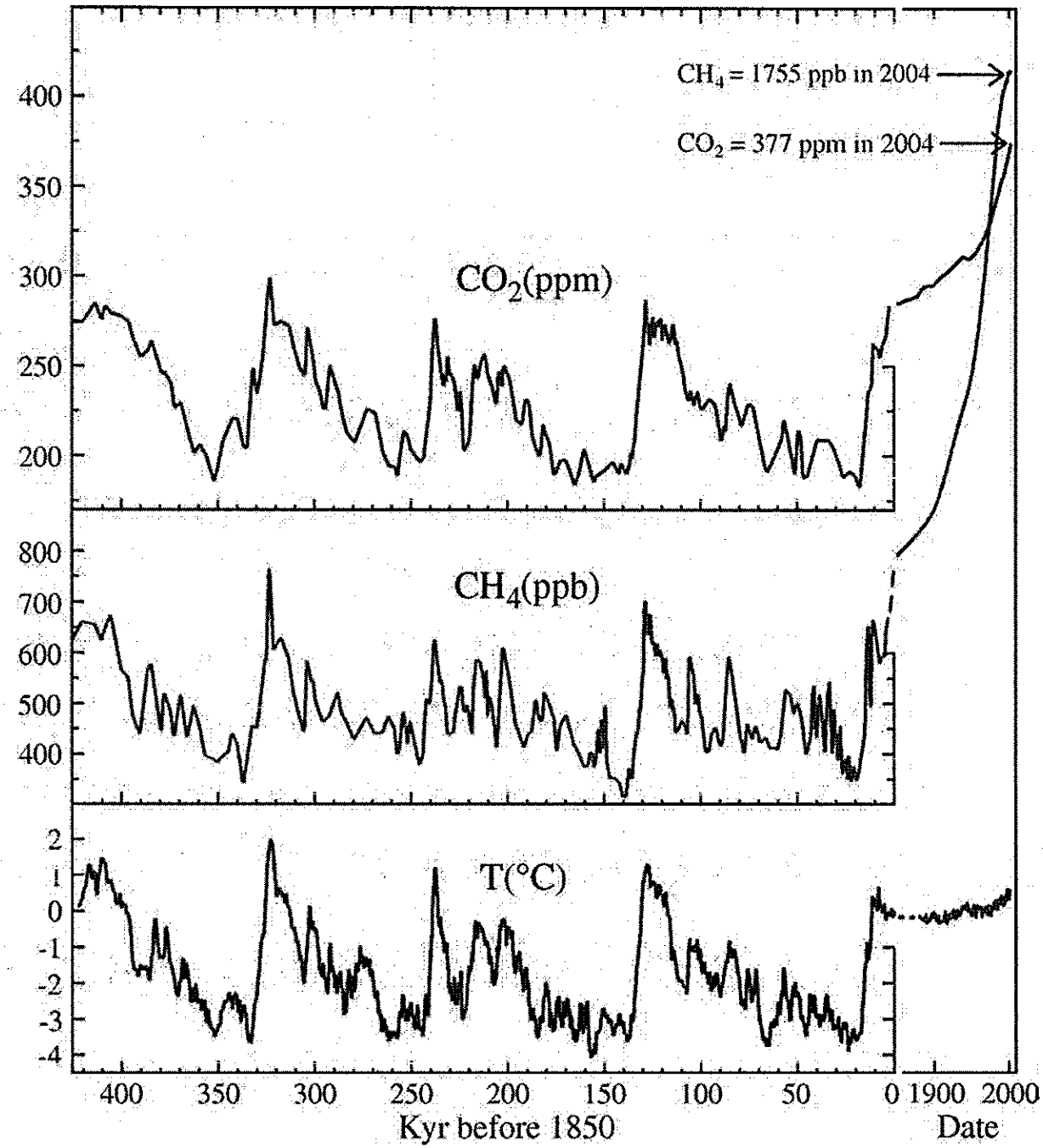
Ice sheet forcing ≅ (sea level)$^{2/3}$

GHGs = CO_2 + CH_4 + N_2O (0.15 forcing of CO_2 + CH_4)



Observations = Vostok ΔT/2.
Calculated temperature = Forcing x 0.75°C /W/m²

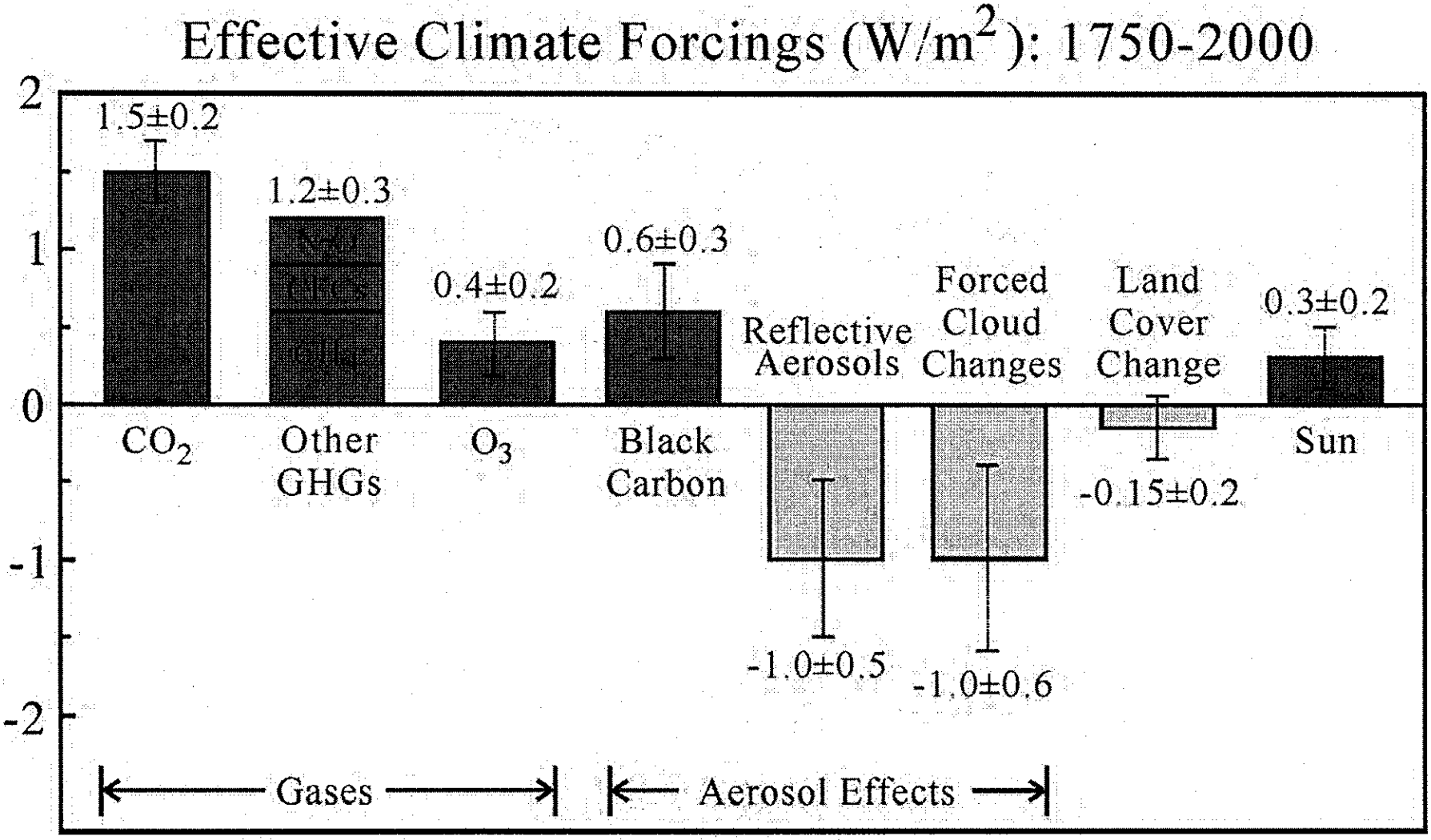
CO_2,CH_4 and estimated global temperature (Antarctic $\Delta T/2$ in ice core era) 0 = 1880-1899 mean.



Source: Hansen, *Clim. Change*, **68**, 269, 2005.

Implications of Paleo Forcings and Response

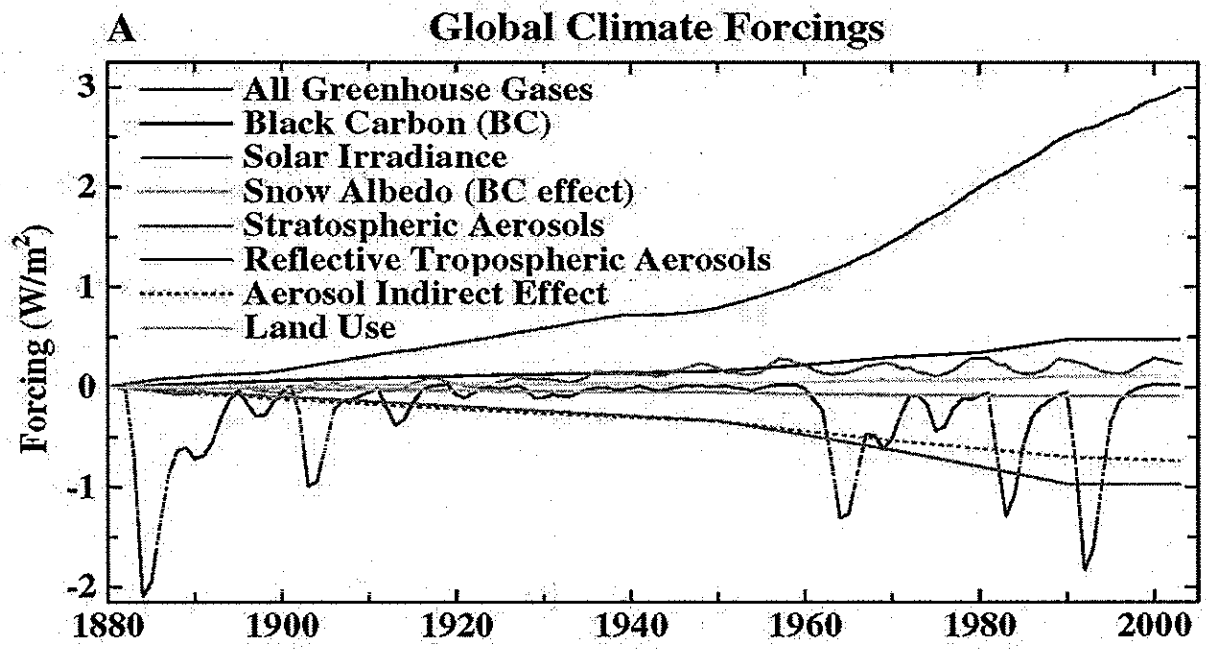
1. "Feedbacks" (GHGs & ice area) are the chief mechanisms for paleo temperature changes.
2. Instigators of climate change include: orbital variations, any other small forcings, chaos.
3. Climate on long time scales is very sensitive to even small forcings.
4. Another "ice age" cannot occur unless humans become extinct.
5. Humans now control global climate, for better or worse.



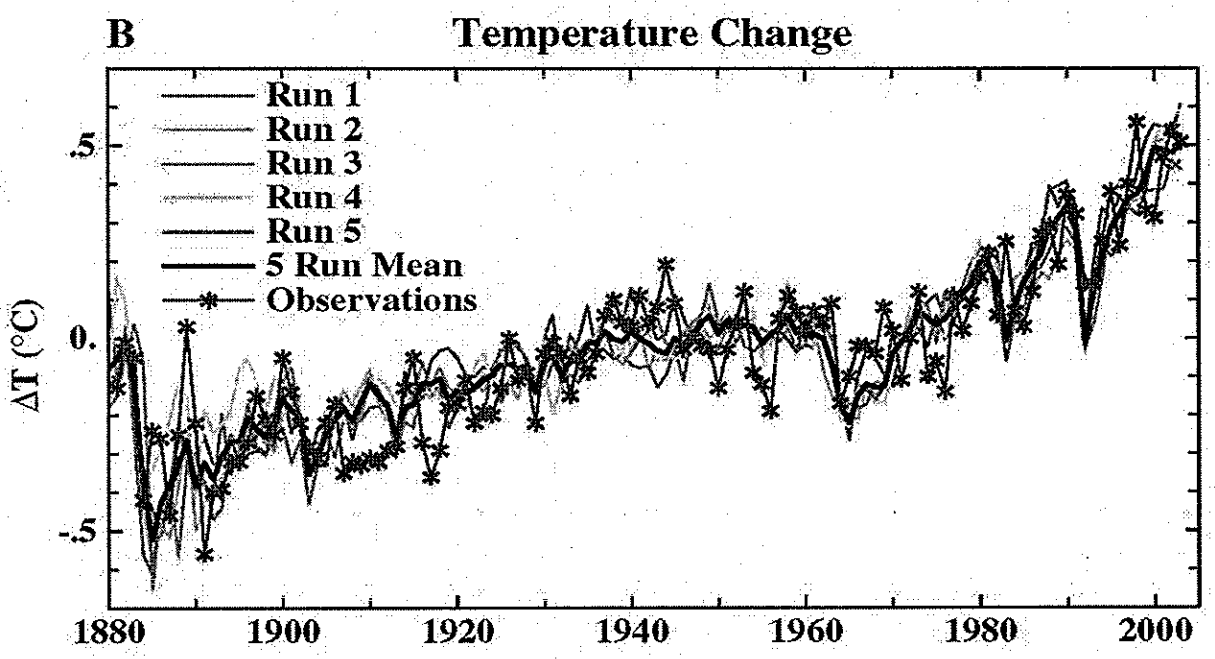
Climate forcing agents in the industrial era. "Effective" forcing accounts for "efficacy" of the forcing mechanism

Source: Hansen et al., JGR, **110**, D18104, 2005.

(A) Forcings used to drive climate simulations.

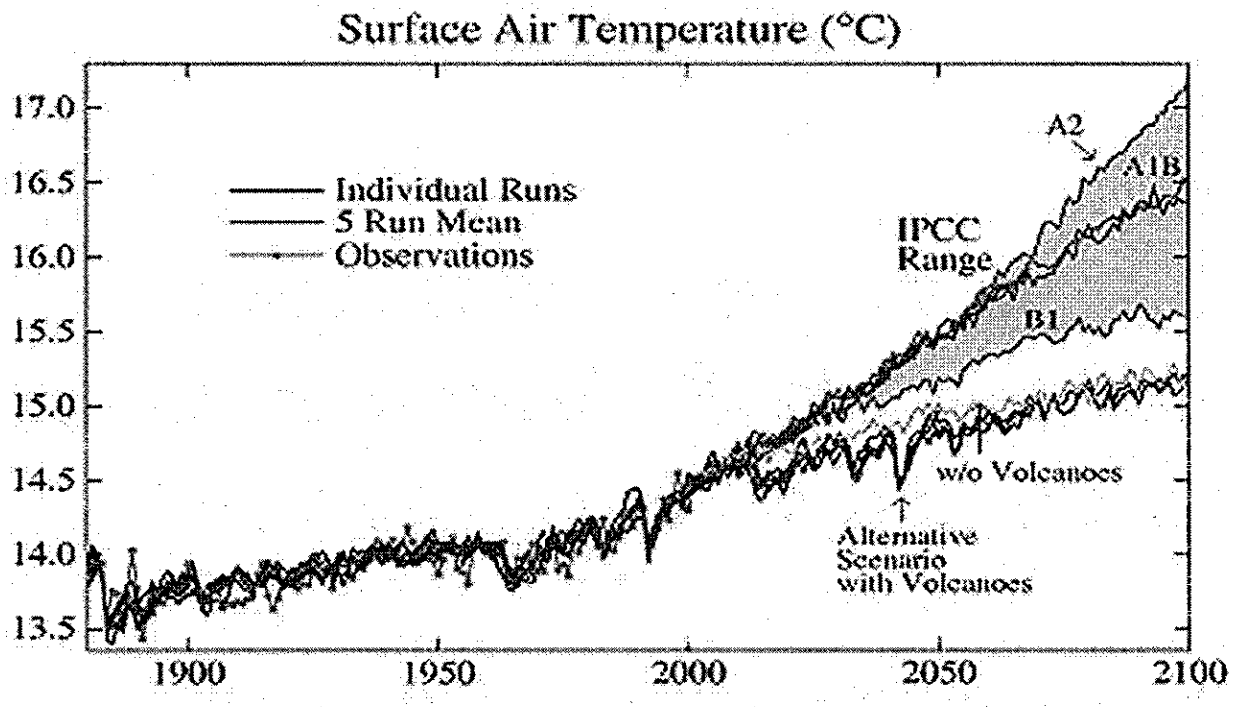


(B) Simulated and observed surface temperature change.



Source: Earth's energy imbalance: Confirmation and implications. *Science* **308**, 1431, 2005.

21st Century Global Warming



Climate Simulations for IPCC 2007 Report

- **Climate Model Sensitivity 2.7-2.9°C for $2xCO_2$**
  (consistent with paleoclimate data & other models)
- **Simulations Consistent with 1880-2003 Observations**
  (key test = ocean heat storage)
- **Simulated Global Warming < 1°C in Alternative Scenario**

Conclusion: Warming < 1°C if additional forcing ~ 1.5 W/m²

Source: Hansen et al., *to be submitted to J. Geophys. Res.*

United Nations
Framework Convention on Climate Change

Aim is to stabilize greenhouse gas emissions…

"…at a level that would prevent dangerous anthropogenic interference with the climate system."

Metrics for "Dangerous" Change

Extermination of Animal & Plant Species

1. Extinction of Polar and Alpine Species
2. Unsustainable Migration Rates

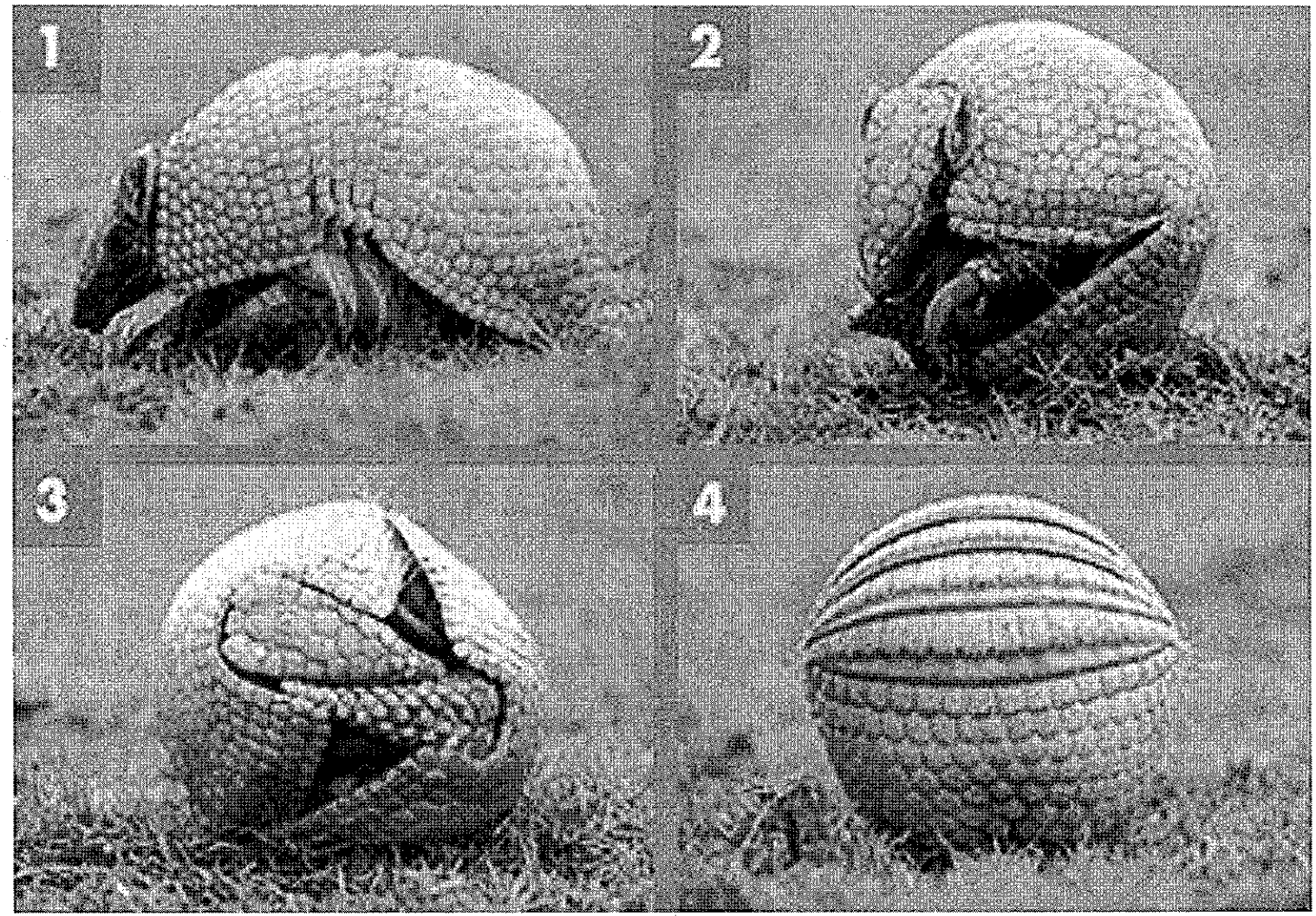
Ice Sheet Disintegration: Global Sea Level

1. Long-Term Change from Paleoclimate Data
2. Ice Sheet Response Time

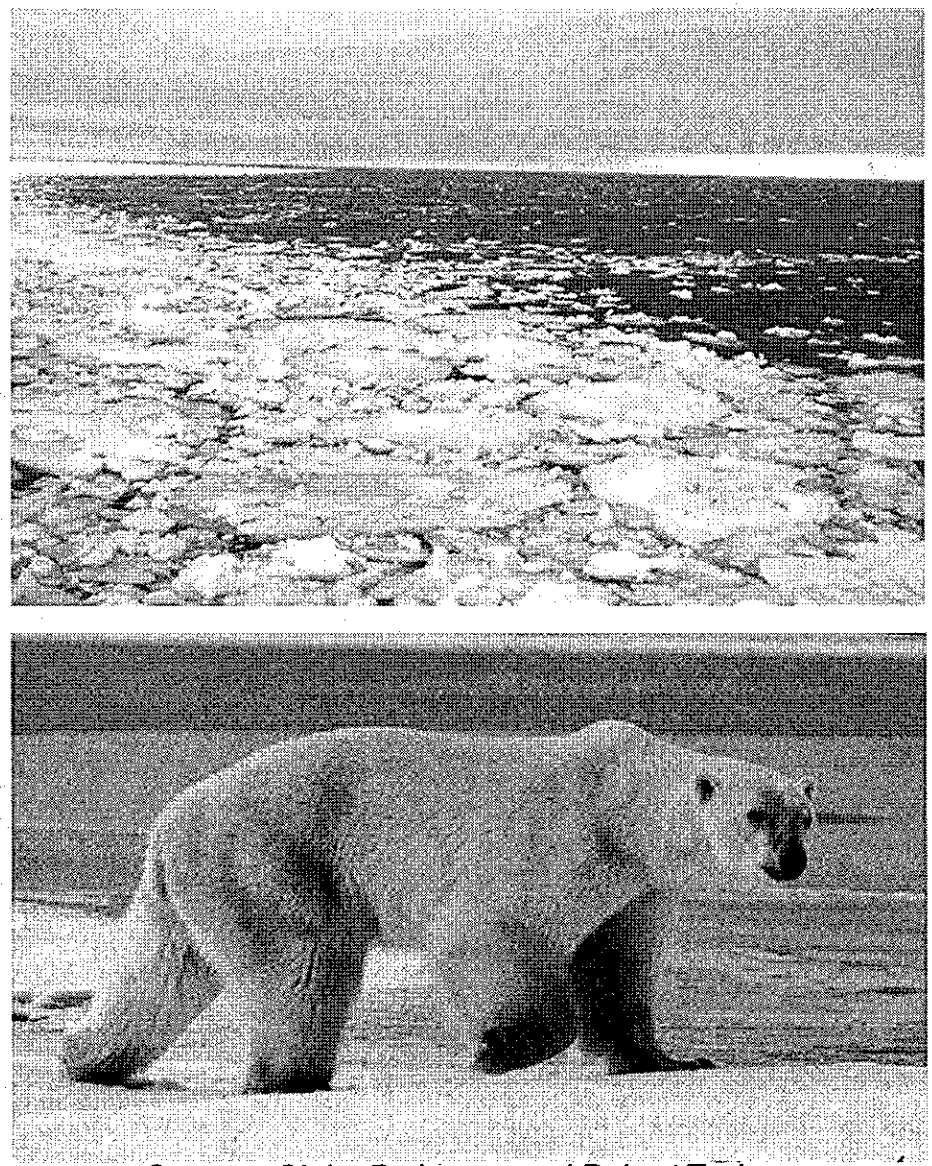
Regional Climate Change

1. General Statement
2. Arctic, Tropical Storms, Droughts/Floods

Armadillos: One of the Surviving Species?



Arctic Climate Impact Assessment (ACIA)



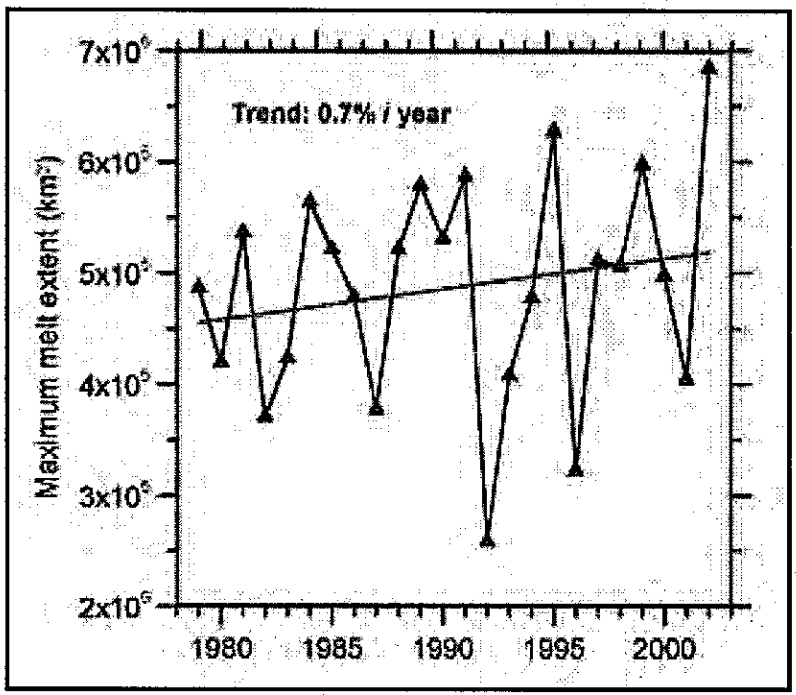
Sources: Claire Parkinson and Robert Taylor

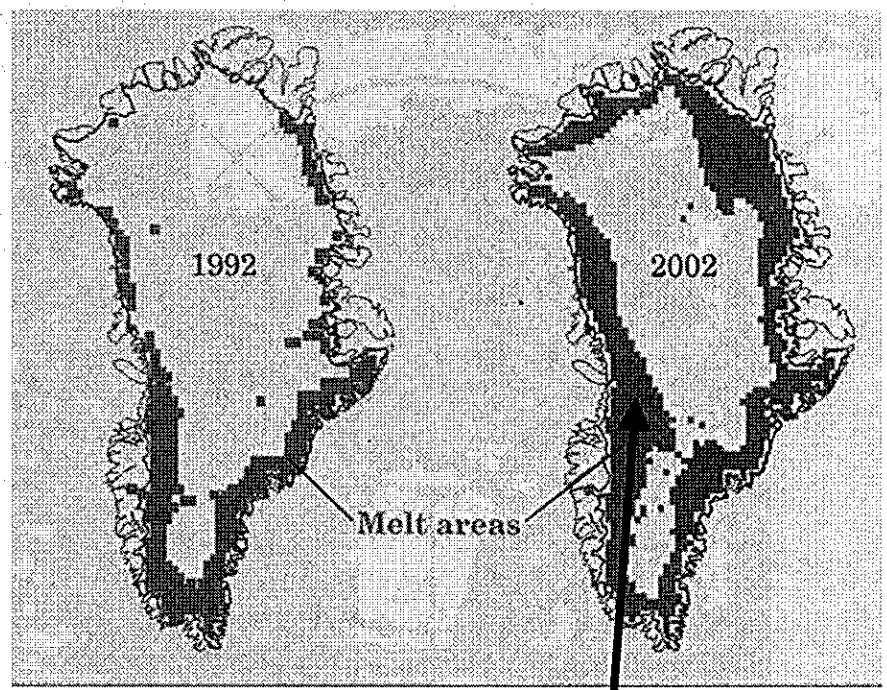
Survival of Species

1. "Business-as-Usual" Scenario
   - Global Warming ~ 3ºC
   - Likely Extinctions ~ 50 percent
2. "Alternative" Scenario
   - Global Warming ~ 1ºC
   - Likely Extinctions ~ 10 percent

<u>Climate Feedbacks → Scenario Dichotomy</u>

Increasing Melt Area on Greenland





- 2002 all-time record melt area
- Melting up to elevation of 2000 m
- 16% increase from 1979 to 2002

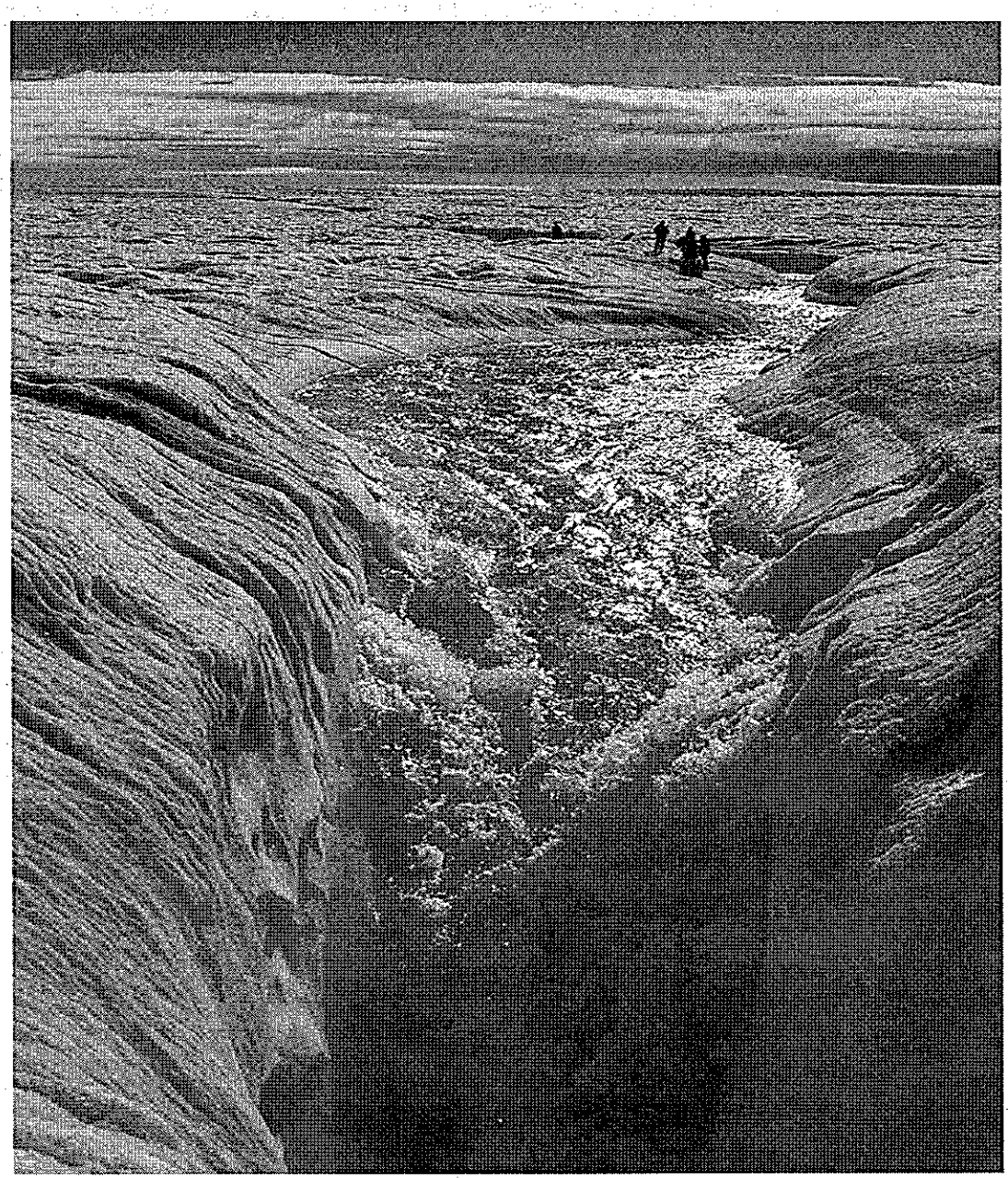
70 meters thinning in 5 years

Satellite-era record melt of 2002 was exceeded in 2005.

Source: Waleed Abdalati, Goddard Space Flight Center

Surface Melt on Greenland

Melt descending into a moulin, a vertical shaft carrying water to ice sheet base.



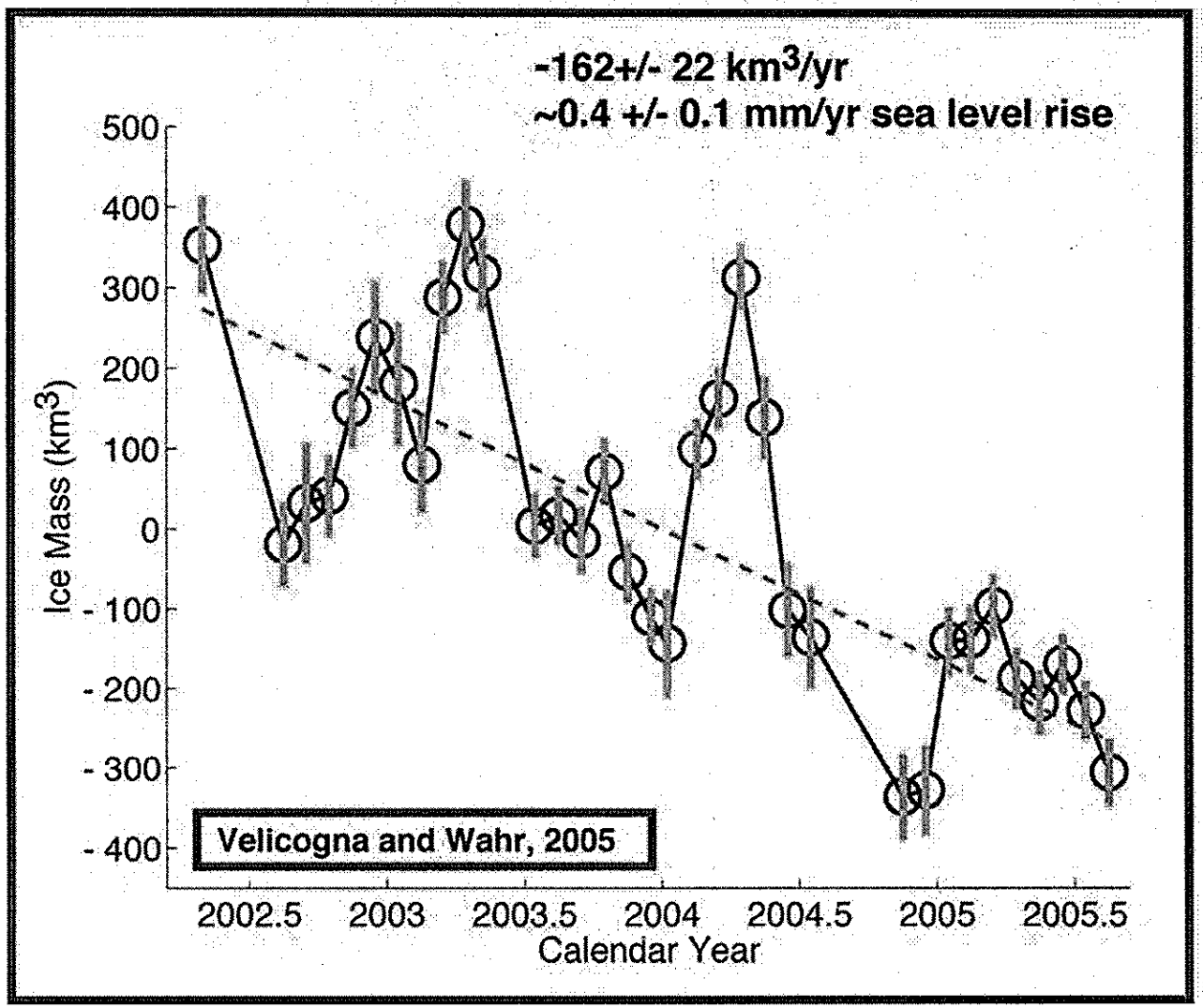
Source: Roger Braithwaite, University of Manchester (UK)

Jakobshavn Ice Stream in Greenland

Discharge from major Greenland ice streams is accelerating markedly.

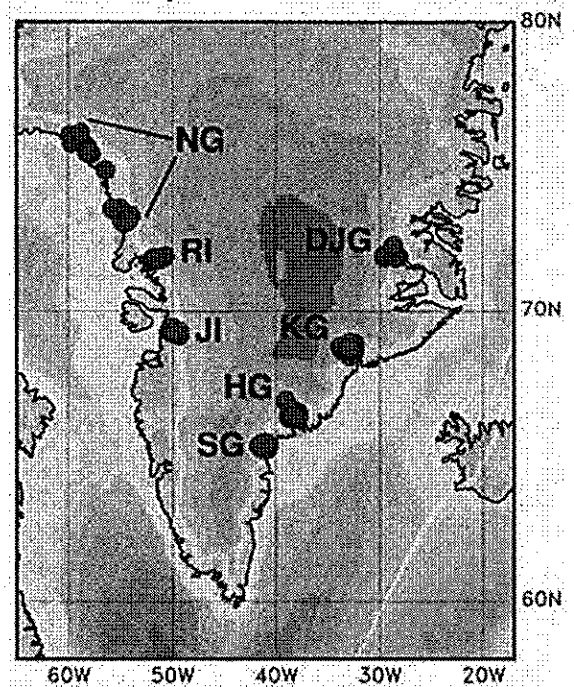
Source: Prof. Konrad Steffen, Univ. of Colorado

Greenland Mass Loss – From Gravity Satellite

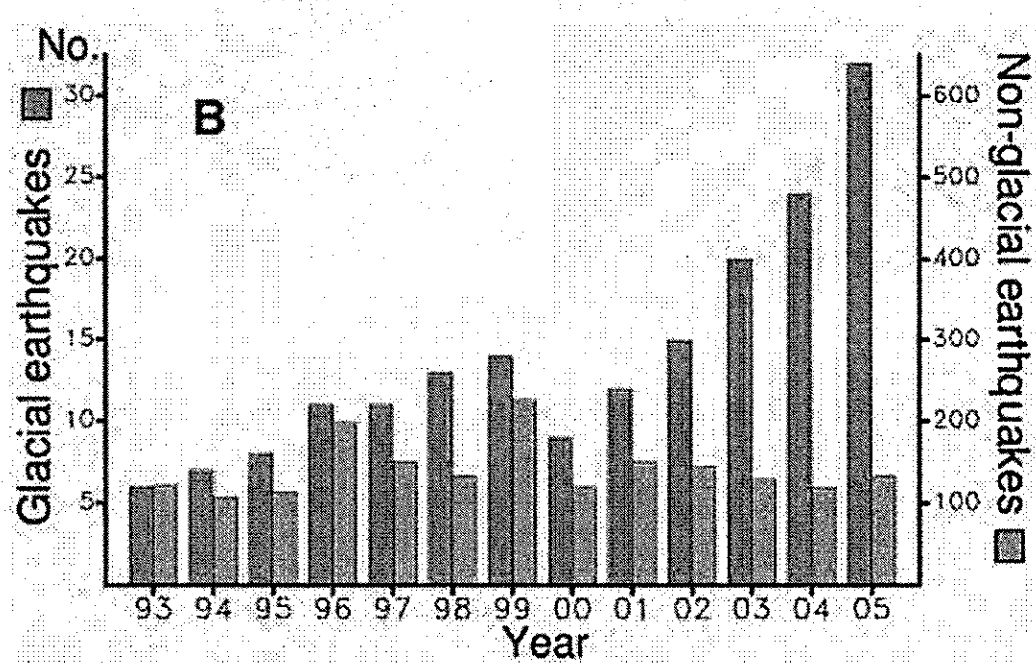


Glacial Earthquakes on Greenland

Earthquake Locations



Annual Number of Quakes*



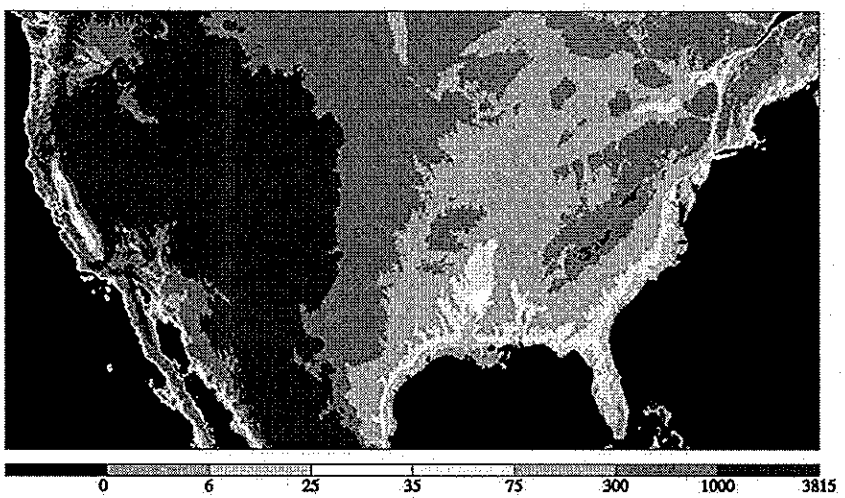
* 2005 bars capture only first 10 months of 2005

Location and frequency of glacial earthquakes on Greenland. Seismic magnitudes are in range 4.6 to 5.1.

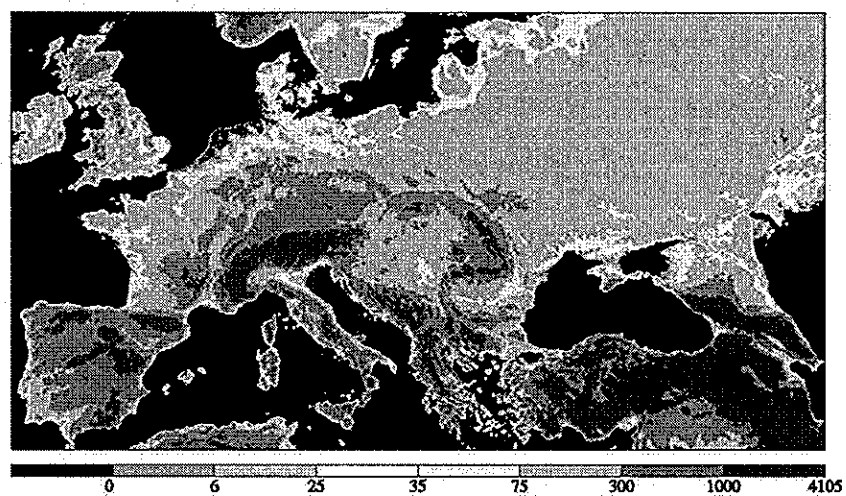
Source: Ekstrom, Nettles and Tsai, *Science*, **311**, 1756, 2006.

Areas Under Water: Four Regions

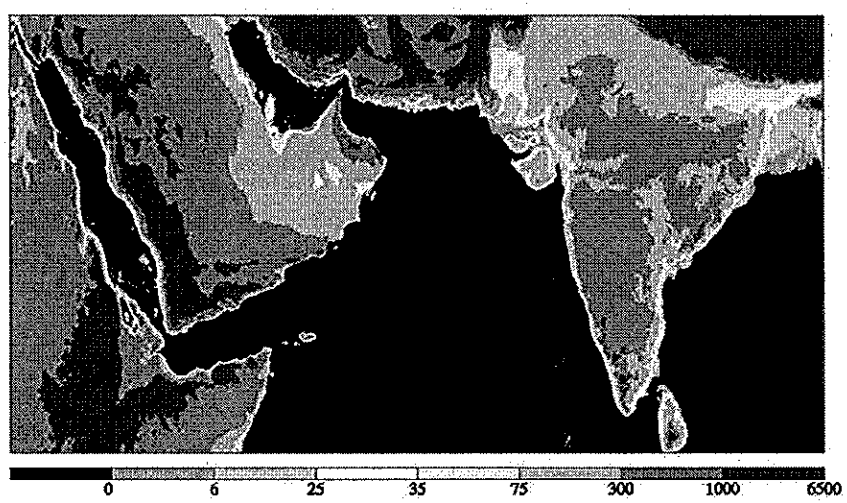
U.S. Area Under Water



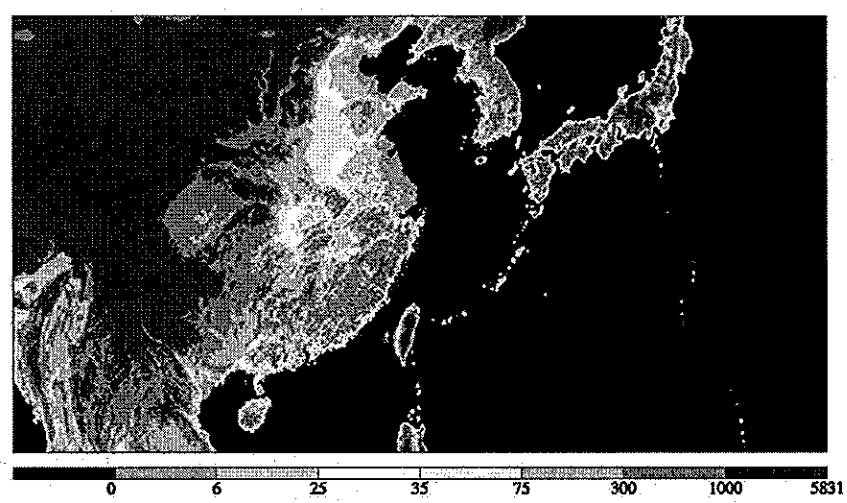
Europe Area Under Water



Central Asia: Area under Water



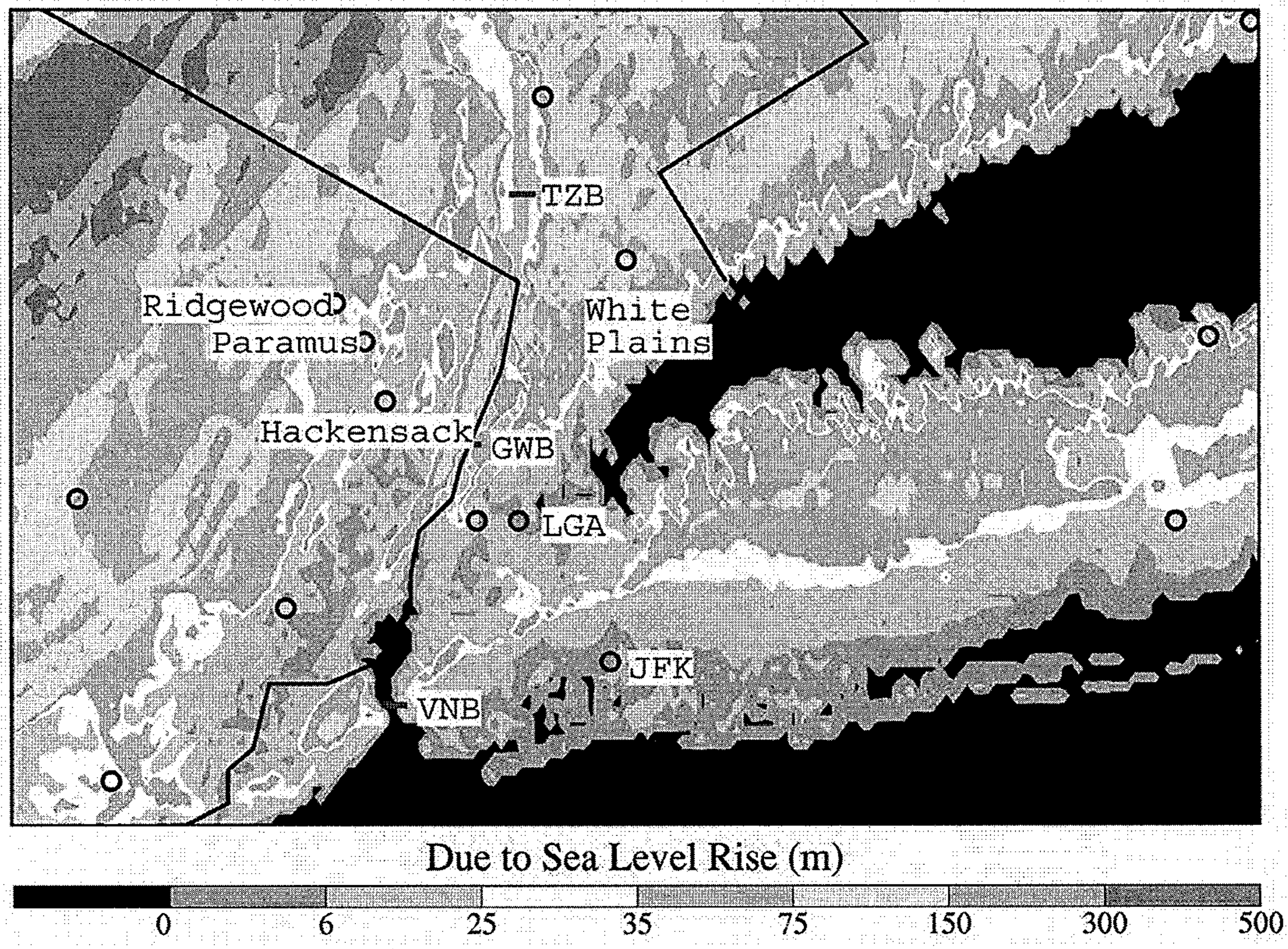
Far East: Area under Water



Population (millions) in 2000

Region (total population)	Population Under Water (for given sea level rise)			
	6m	*25 m*	*35m*	*75m*
United States (283)				
East Coast	9	41	51	70
West Coast	2	6	9	19
China + Taiwan (1275+23)	93	224	298	484
India + Sri Lanka (1009+19)	46	146	183	340
Bangladesh (137)	24	109	117	130
Indonesia + Malaysia (212+22)	23	72	85	117
Japan (127)	12	39	50	73
Western Europe (454)	26	66	88	161

Area under Water (New York Region)



Paleoclimate Sea Level Data

1. Rate of Sea Level Rise

- Data reveal numerous cases of rise of several m/century (e.g., MWP 1A)

2. "Sub-orbital" Sea Level Changes

- Data show rapid changes ~ 10 m within interglacial & glacial periods

<u>Ice Sheet Models Do Not Produce These</u>

Summary: Ice Sheets

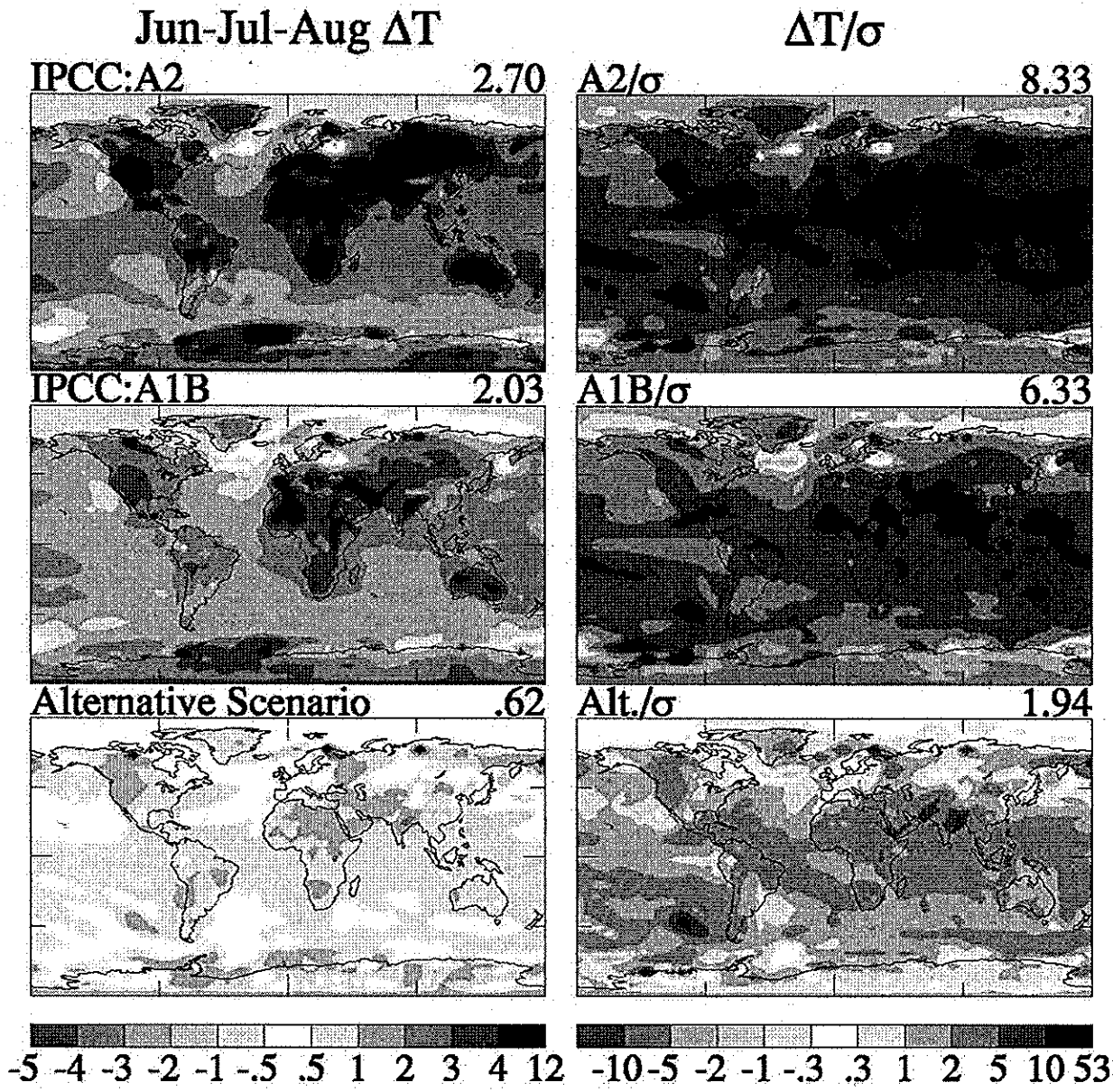
1. Human Forcing Dwarfs Paleo Forcing and Is Changing Much Faster

2. Ice Sheet Disintegration Starts Slowly but Multiple Positive Feedbacks Can Lead to Rapid Non-Linear Collapse

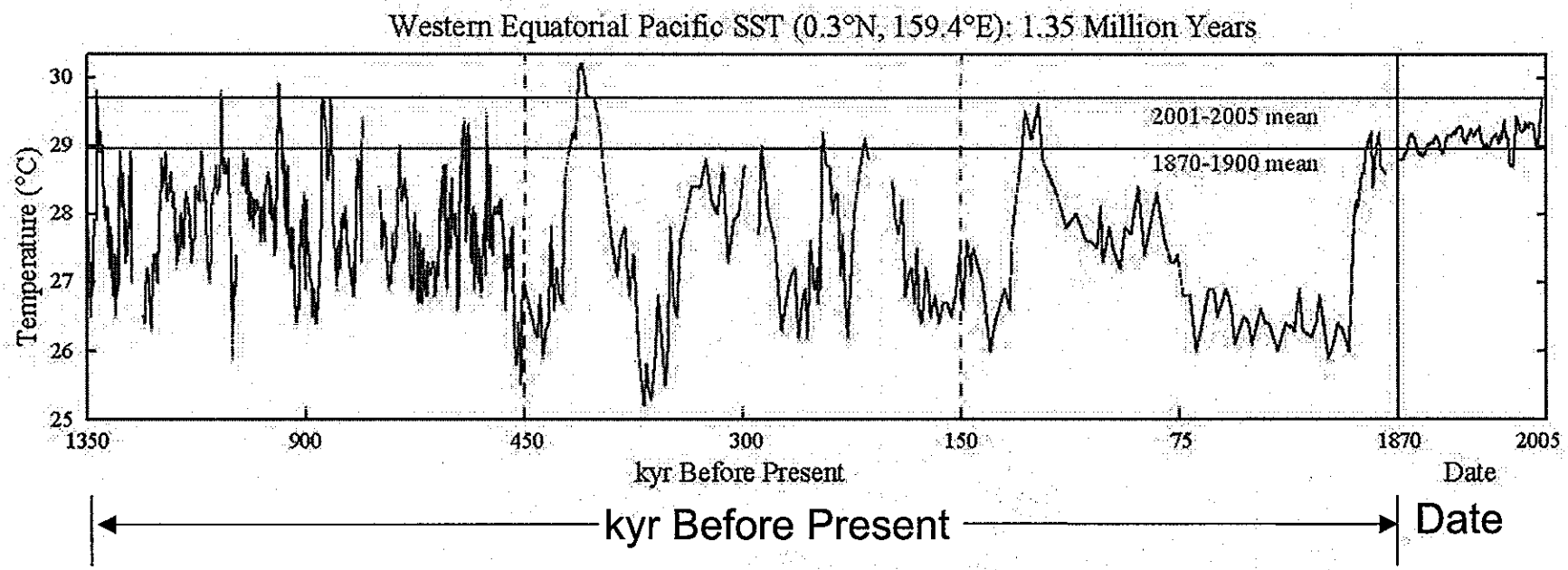
3. Equilibrium Sea Level Rise for ~3C Warming (25±10 m = 80 feet) Implies the Potential for Us to Lose Control

Simulated 2000-2100 Temperature Change

σ is interannual standard deviation of observed seasonal mean temperature for period 1900-2000.



Source: Hansen et al., *J. Geophys. Res.*, submitted.



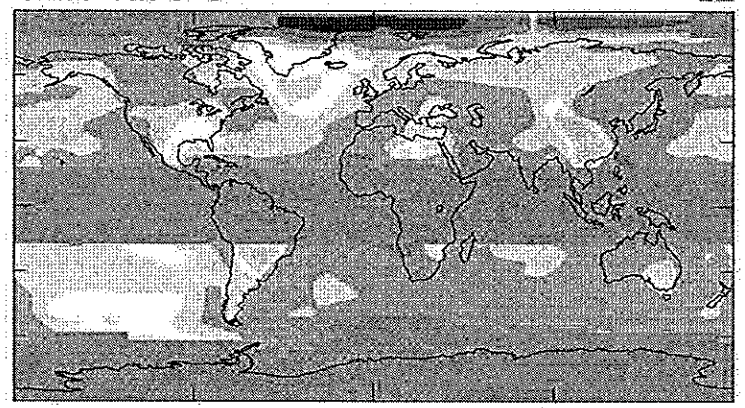
SST in Pacific Warm Pool (ODP site 806B, 0°N, 160°E) in past millennium. Time scale expanded in recent periods. Data after 1880 is 5-year mean.

Source: Medina-Elizalde and Lea, ScienceExpress, 13 October 2005;data for 1880-1981 based on Rayner et al., *JGR*, **108**, 2003, after 1981 on Reynolds and Smith, *J. Climate*, **7**, 1994.

Poleward Migration Rate of Isotherms (km/decade)

20th Century

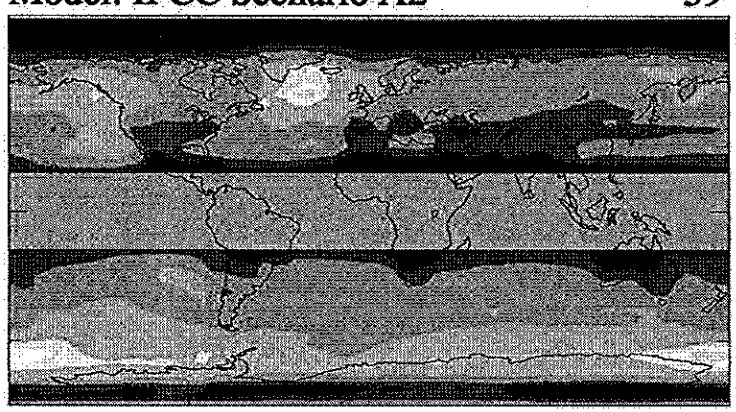
Observations 12



-100 -60 -30 -10 -3 3 10 30 60 100 200

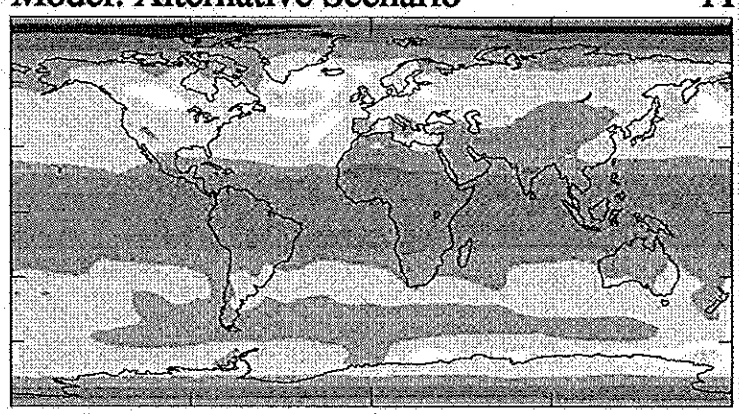
21st Century

Model: IPCC Scenario A2 59

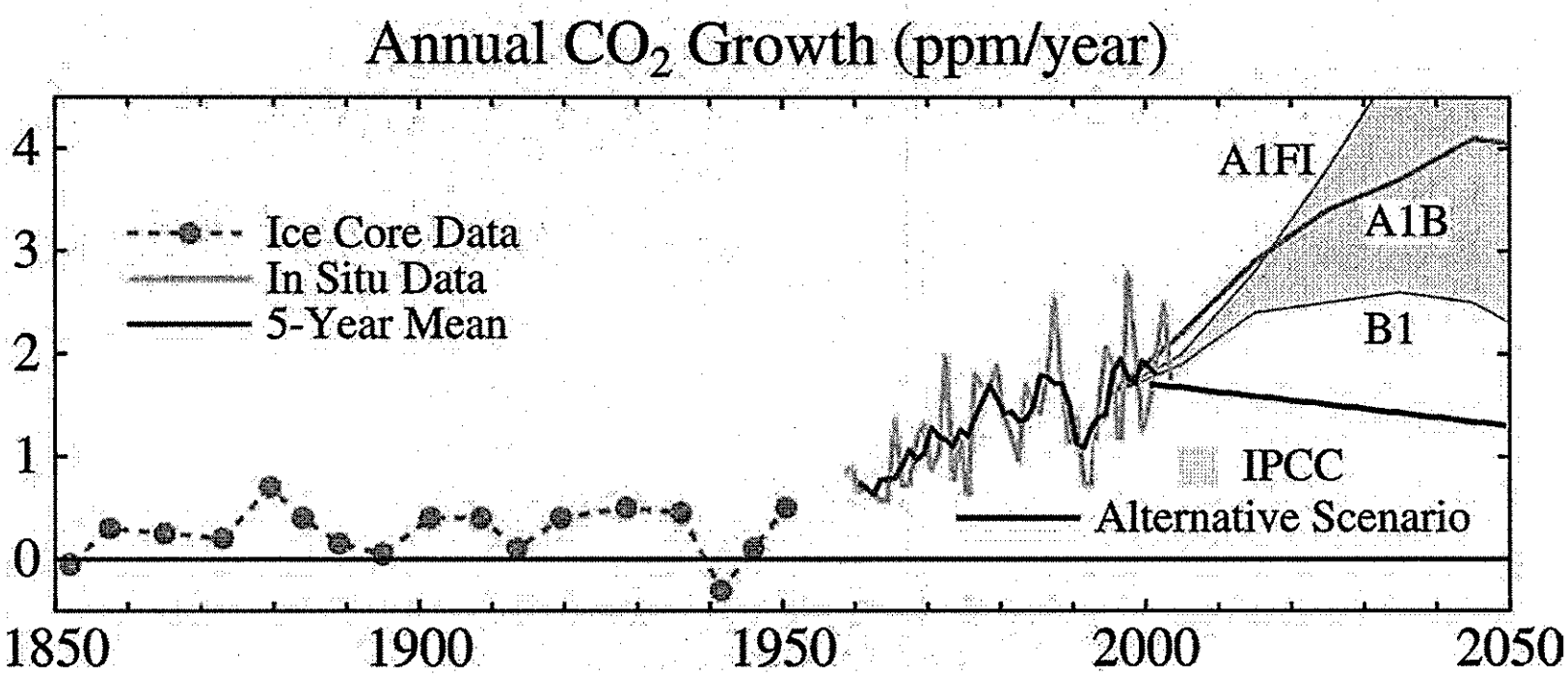


-100 -60 -30 -10 -3 3 10 30 60 100 265

Model: Alternative Scenario 11

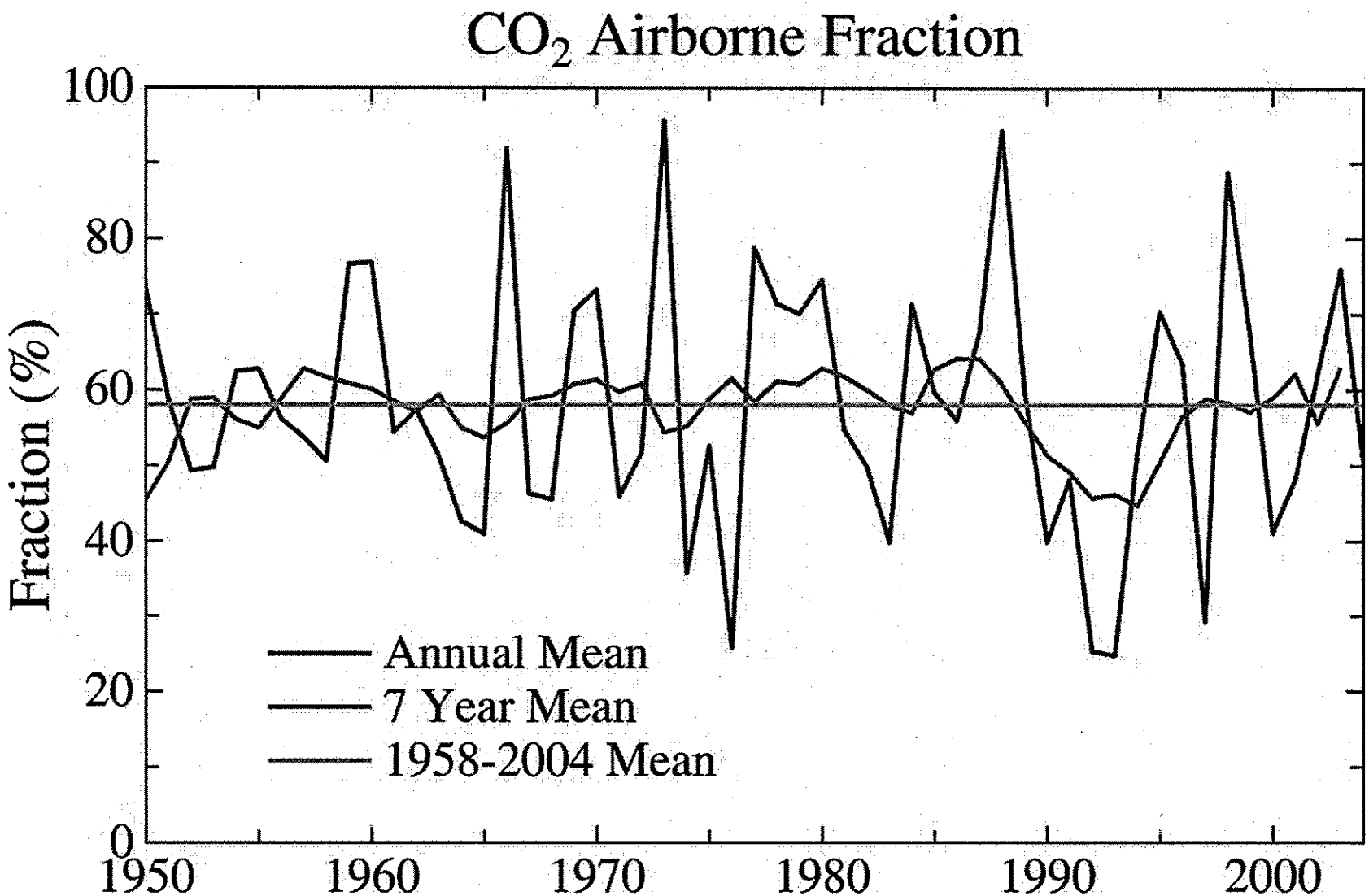


-100 -60 -30 -10 -3 3 10 30 60 100 200



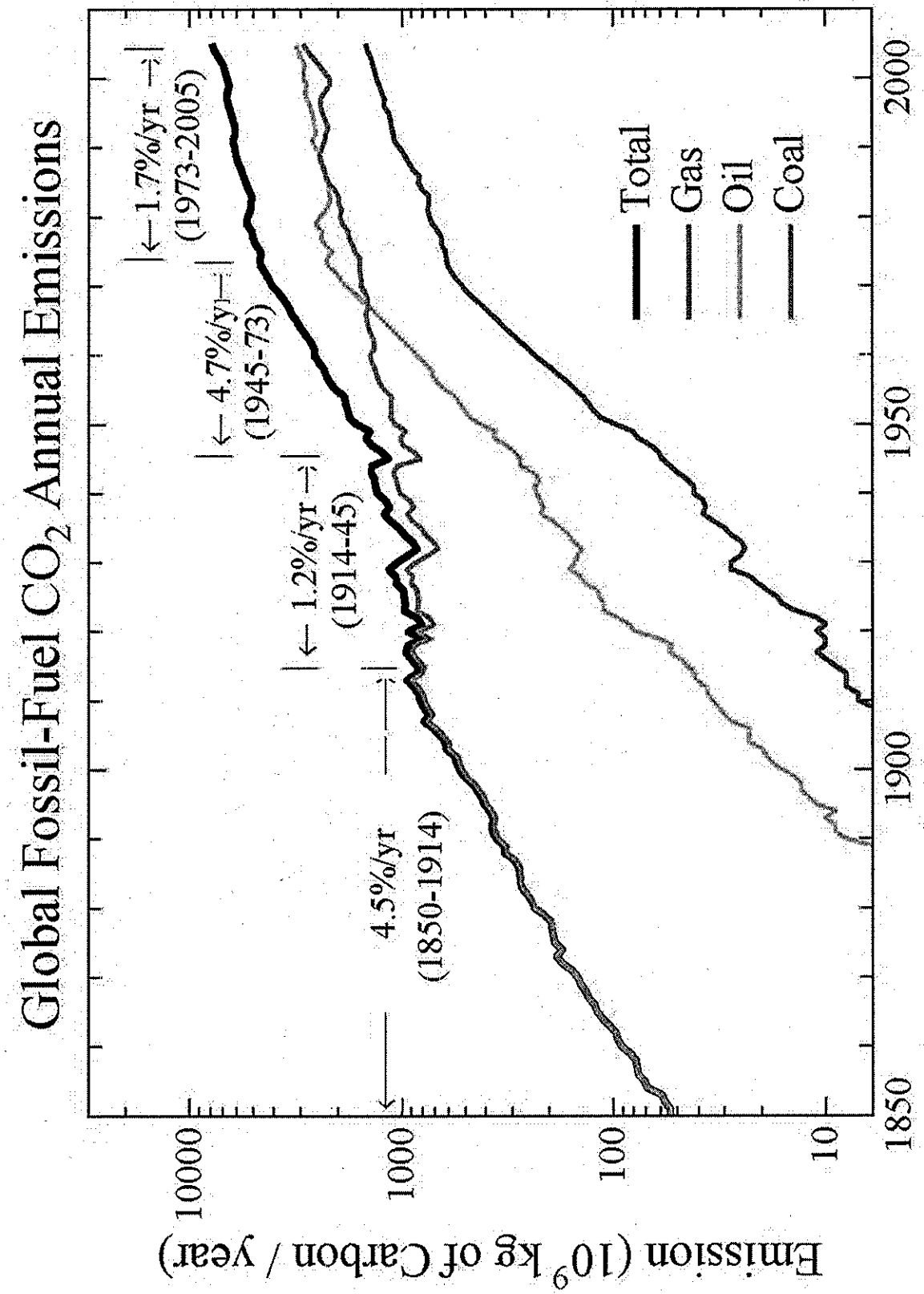
Growth rate of atmospheric CO_2 (ppm/year).

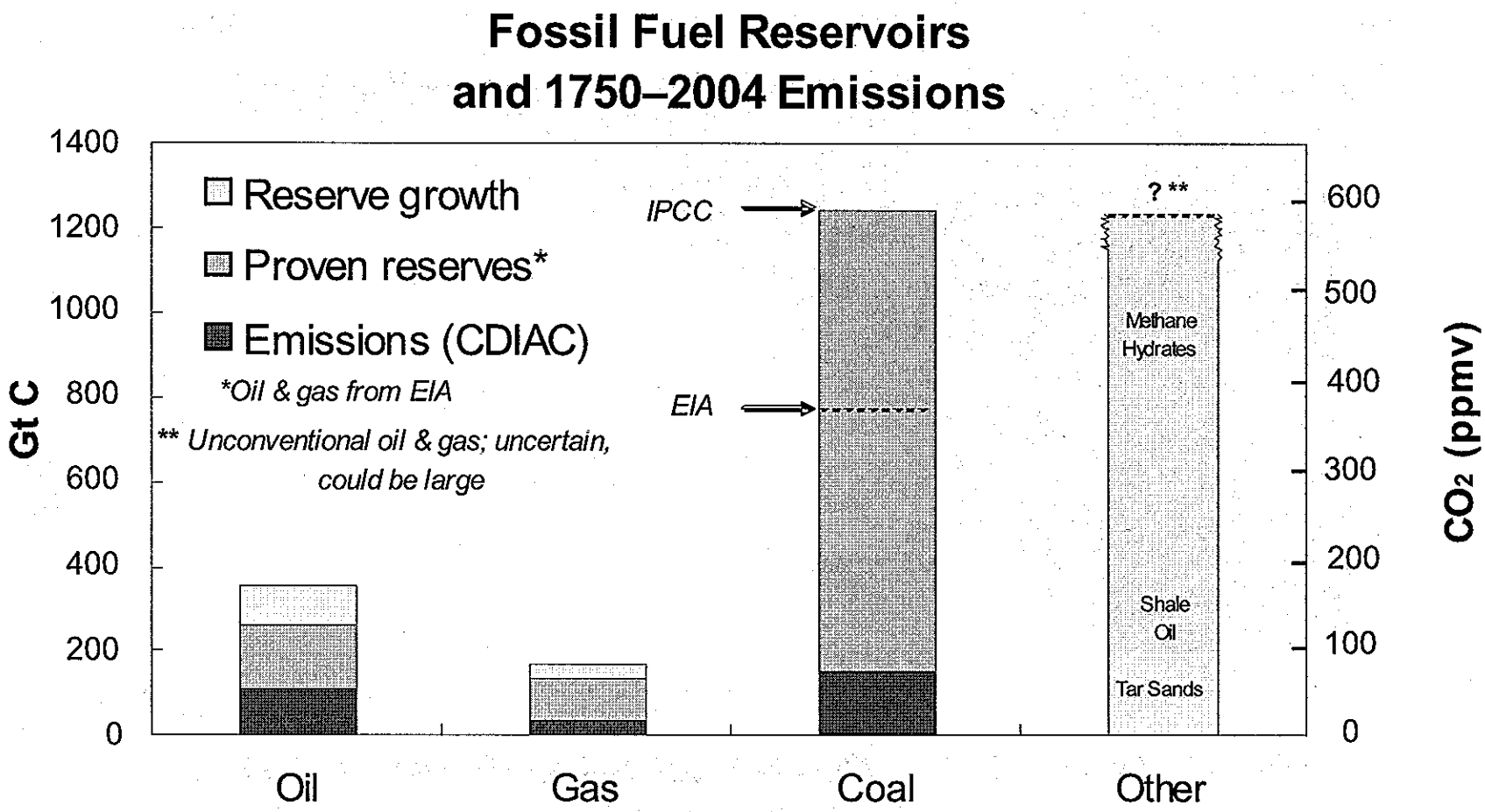
*Source: Hansen and Sato, PNAS, **101**, 16109, 2004.*

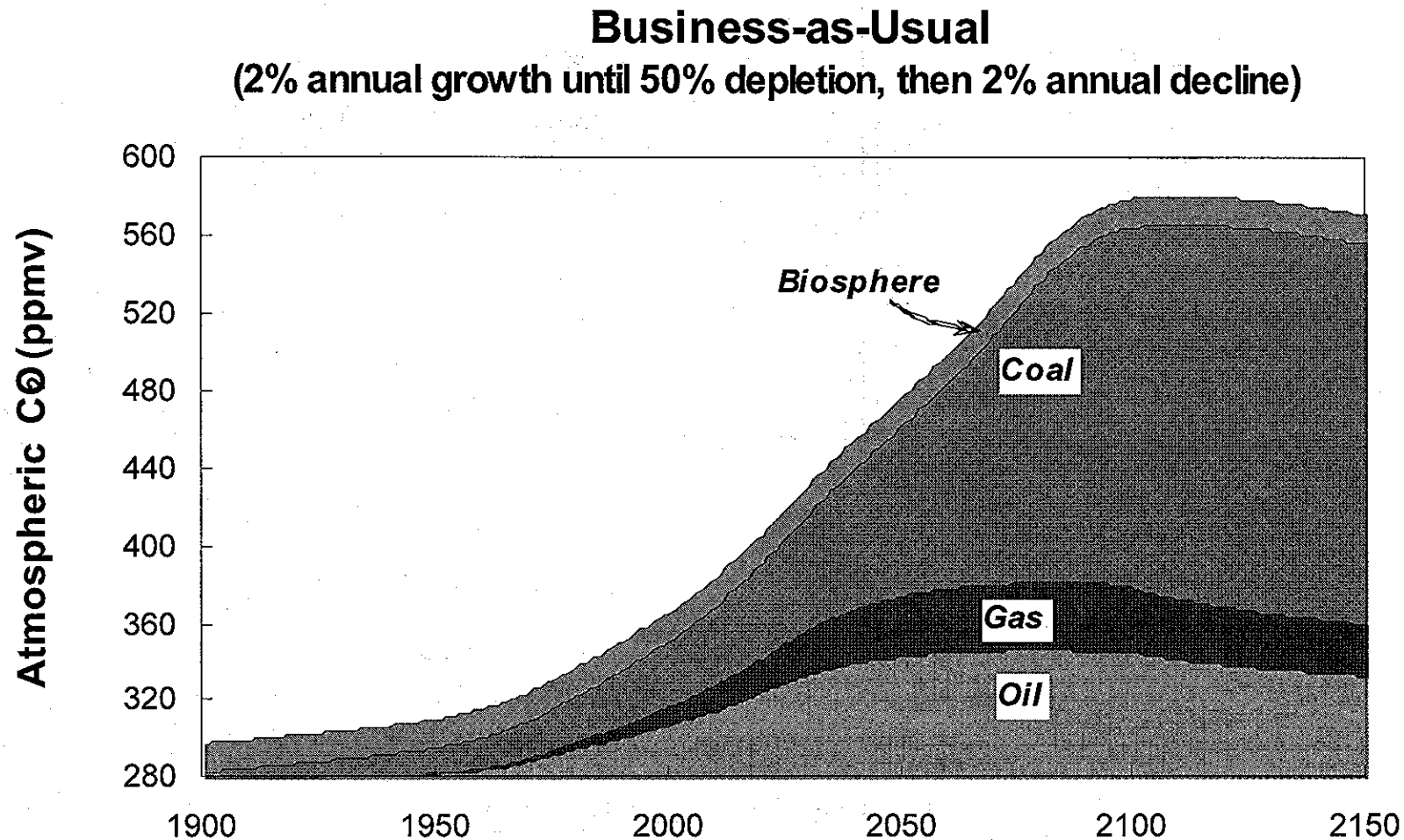


CO_2 airborne fraction, i.e., ratio of annual atmospheric CO_2 increase to annual fossil fuel CO_2 emissions.

Source: Hansen and Sato, *PNAS,* **101**, 16109, 2004.

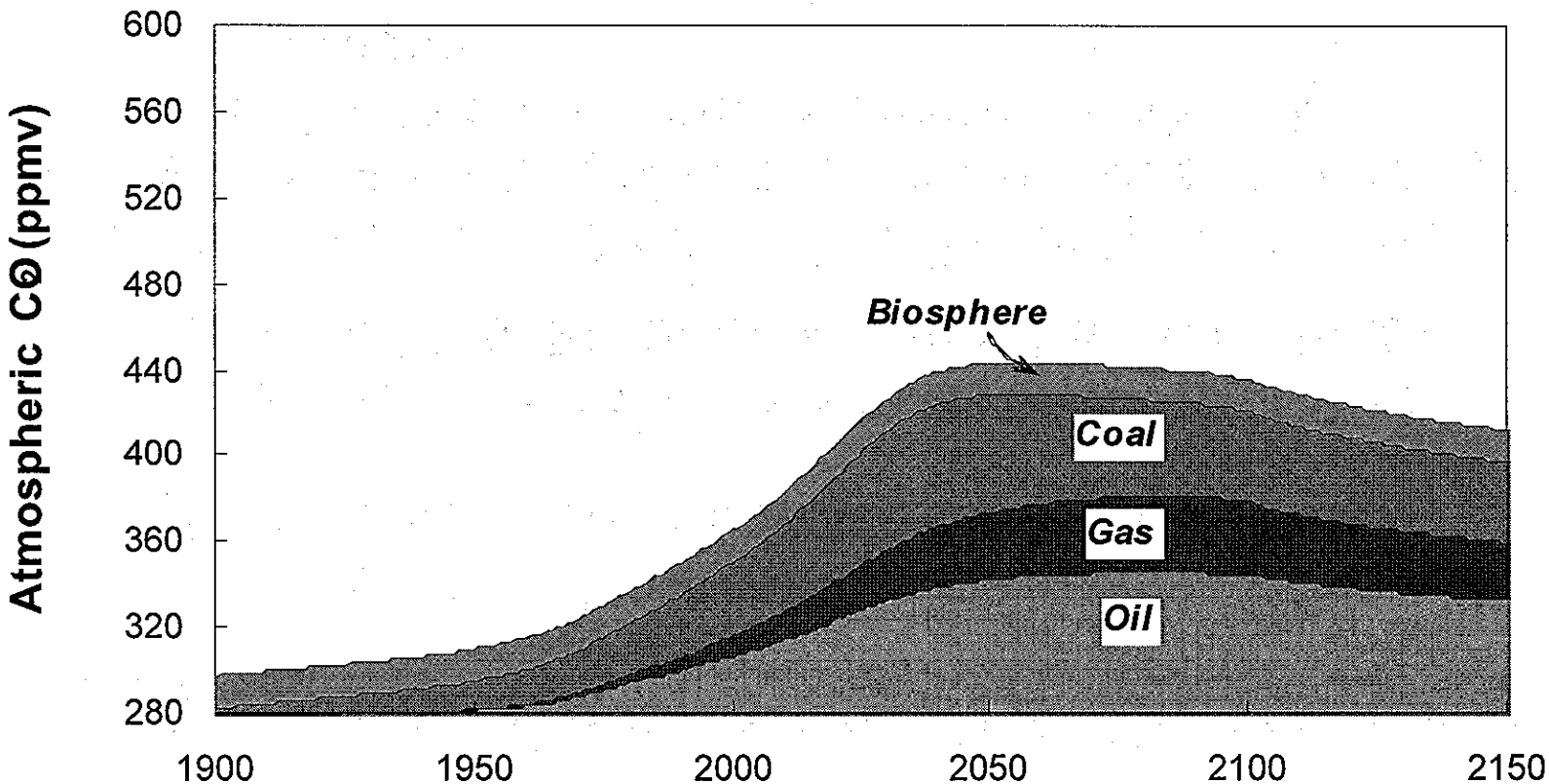

Global Fossil-Fuel CO_2 Annual Emissions
Emission (10^9 kg of Carbon / year)
10000
1000
100
10
1850
1900
1950
2000
Total
Gas
Oil
Coal
4.5%/yr
(1850-1914)
1.2%/yr
(1914-45)
4.7%/yr
(1945-73)
1.7%/yr
(1973-2005)


Fossil Fuel Reservoirs
and 1750–2004 Emissions
Gt C
1400
1200
1000
800
600
400
200
0
Reserve growth
Proven reserves*
Emissions (CDIAC)
*Oil & gas from EIA
** Unconventional oil & gas; uncertain, could be large
IPCC
EIA
? **
Methane Hydrates
Shale Oil
Tar Sands
600
500
400
300
200
100
0
CO2 (ppmv)
Oil
Gas
Coal
Other


Business-as-Usual
(2% annual growth until 50% depletion, then 2% annual decline)
Atmospheric CO2 (ppmv)
600
560
520
480
440
400
360
320
280
1900
1950
2000
2050
2100
2150
Biosphere
Coal
Gas
Oil

Alternative Case: Coal Phaseout

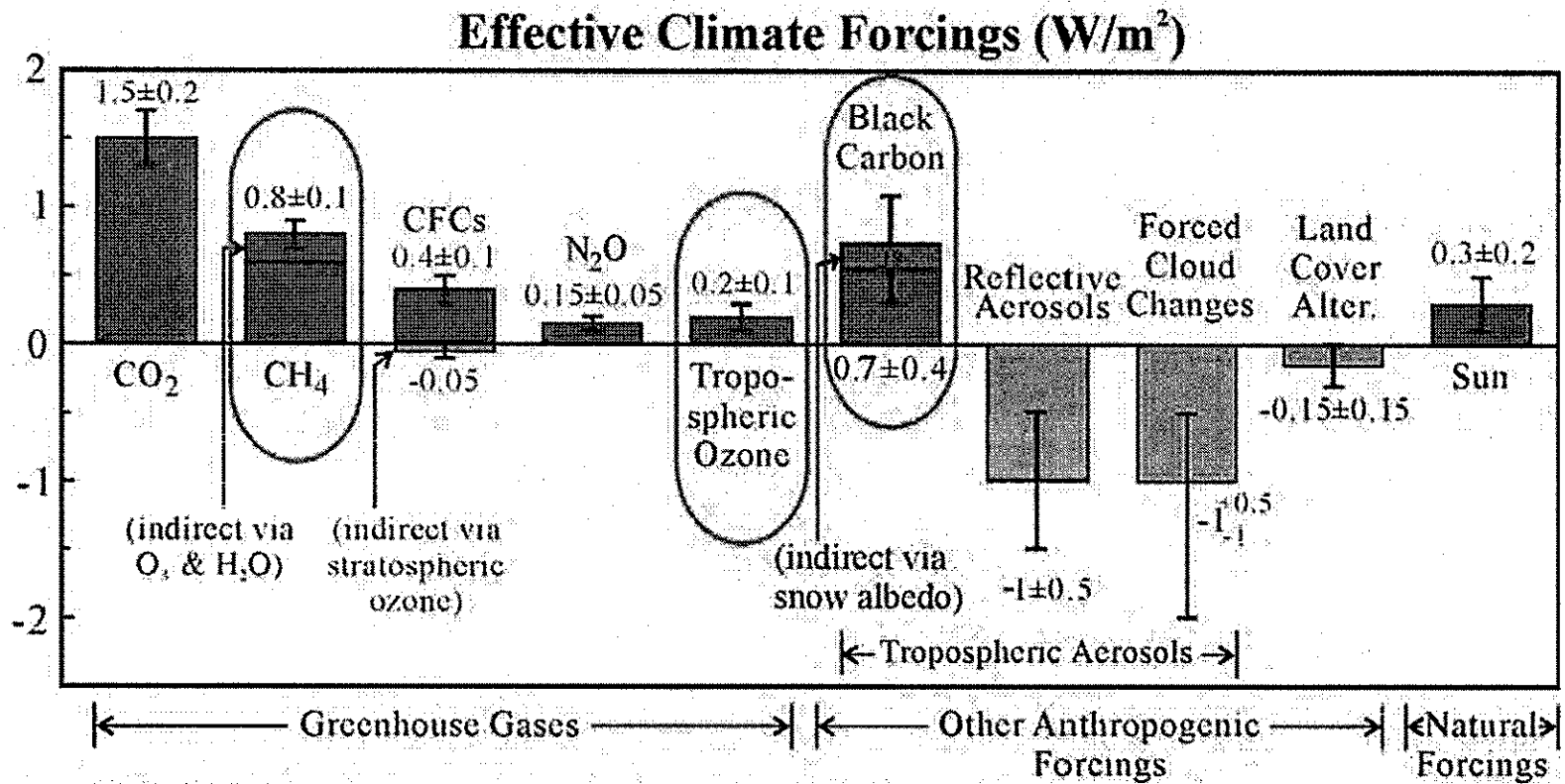
(+2%/yr to 2012; +1%/yr to 2022; linear shutdown between 2025-2050)



Is Alternative Scenario Feasible?

Example: Phase-Out of 'Dirty' Coal

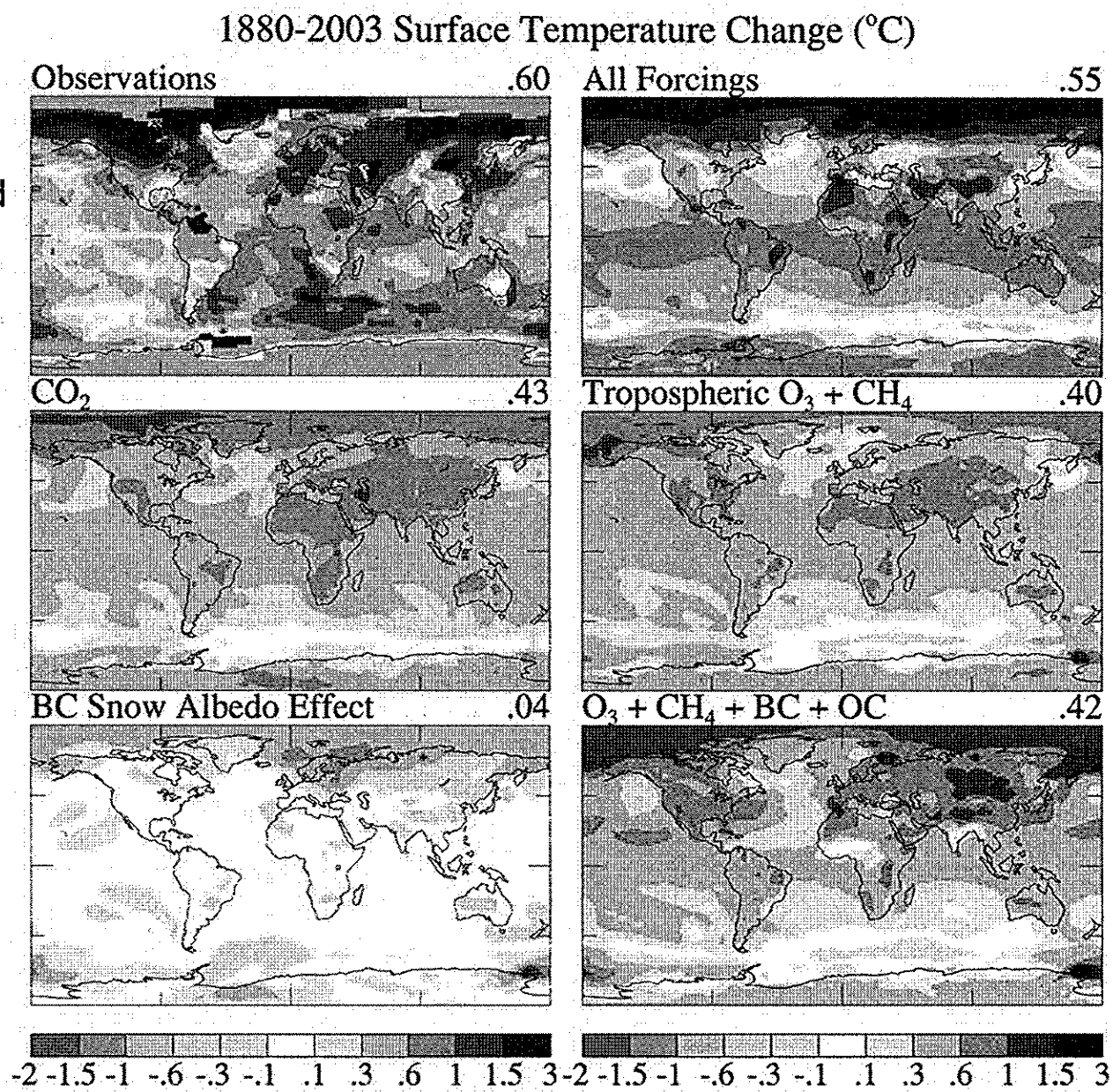
- CO_2 Sequestered at New Coal Power Plants after 2012/2022 in Developed/Developing Countries
- Coal Power Plants w/o Sequestration Bull-Dozed During 2025-2050 (Decision required by ~2020)
- Slowly Increase Carbon Tax, Stretch Conventional Oil/Gas, Avoiding Use of Non-Conventional Fossil Fuels, Permitting Time to Develop non-CO_2 Technologies
- Non-CO_2 Climate Forcings Reduced Via Clean Development Incentives



Circled forcings are prime contributors to air pollution.

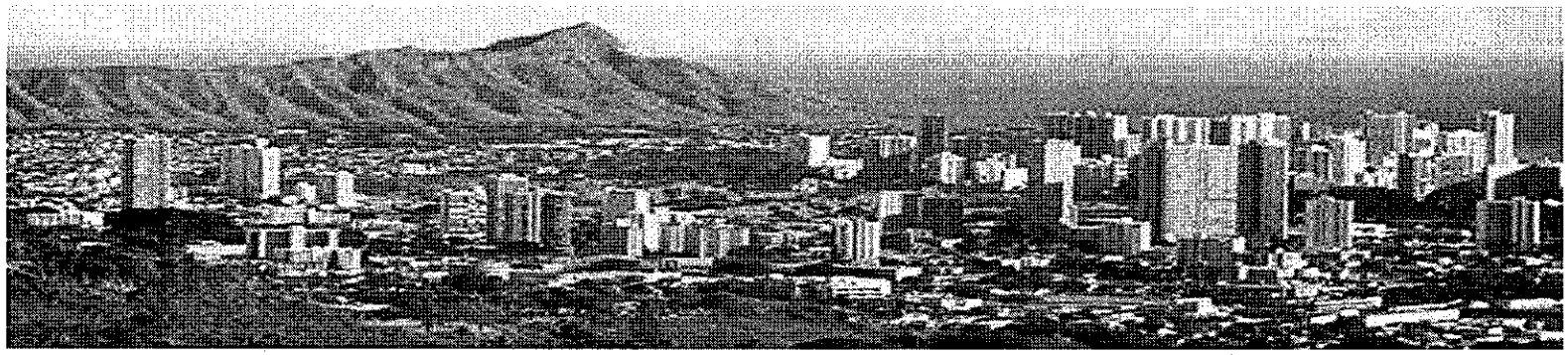
Temperature change observed and simulated for different forcing mechanisms.

Aerosol forcing (negative) is thought to be slightly excessive in in the 'all forcing' simulation.



Source: Hansen et al., *J. Geophys. Res.*, submitted.

Workshop at East-West Center, Honolulu



April 4-6, 2005; Local Host: Intn'l. Center for Climate & Society, Univ. Hawaii

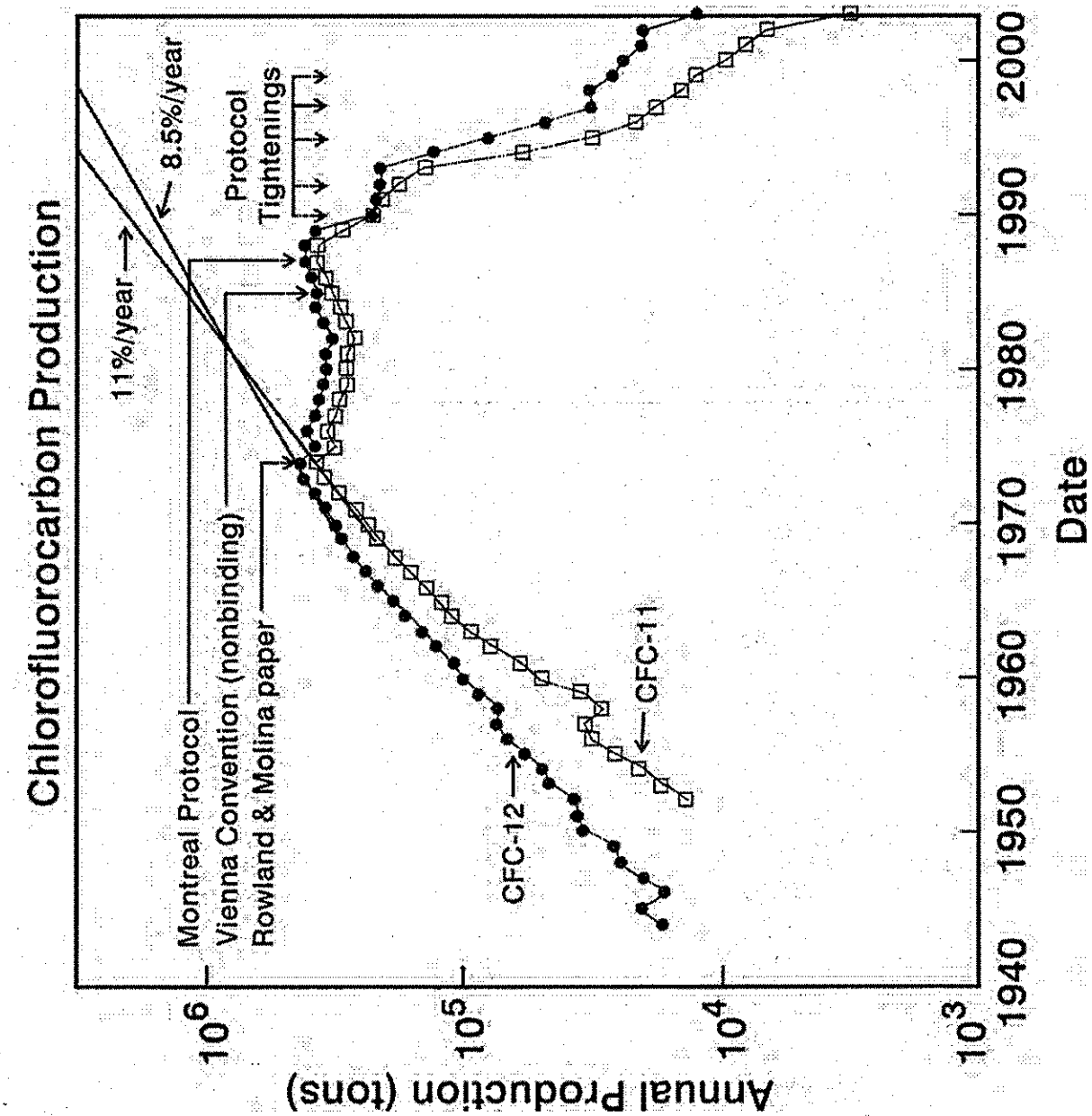
"Air Pollution as Climate Forcing: A Second Workshop"

- **Multiple Benefits by Controlling CH_4 and CO**
  (benefits climate, human health, agriculture)
- **Multiple Benefits from Near-Term Efficiency Emphasis**
  (climate & health benefits, avoid undesirable infrastructure)
- **Targeted Soot Reduction to Minimize Warming from Planned Reductions of Reflective Aerosols**
  (improved diesel controls, biofuels, small scale coal use)
- **Targeted Improvements in Household Solid Fuel Use**
  (reduces CH_4, CO, BC; benefits climate, human health, agriculture)

Conclusion: Technical Cooperation Offers Large Mutual Benefits to Developed & Developing Nations.

References:

▶**Air Pollution as Climate Forcing: 2002 Workshop; 2005 Workshop** http://www.giss.nasa.gov/meetings/pollution02/ and 2005/


Chlorofluorocarbon Production
11%/year
8.5%/year
Protocol Tightenings
Montreal Protocol
Vienna Convention (nonbinding)
Rowland & Molina paper
CFC-12
CFC-11
Annual Production (tons)
Date
10^6
10^5
10^4
10^3
1940
1950
1960
1970
1980
1990
2000

Ozone Success Story

_1. Scientists : Clear warning

_2. Media : Transmitted the message well

_3. Special Interests : Initial skepticism, but forsook disinformation, pursued advanced technologies

___4. Public : quick response; spray cans replaced; no additional CFC infrastructure built

_5. Government : U.S./Europe leadership; allow delay & technical assistance for developing countries

Global Warming Story

1. Scientists : Fail to make clear distinction between climate change & BAU = A Different Planet

2. Media : False "balance", and leap to hopelessness

3. Special Interests : Disinformation campaigns, emphasis on short -term pr ofits

4. Public : understandably confused, un interested

5. Government : Seems affected by special interests; fails to lead – no Winston Churchill today

As it appears that the world may pass a tipping point soon, beyond which it will be impossible to avert massive future impacts on humans and other life on the planet:

Who Bears (Legal/Moral) Responsibility?

1. Scientists?

2. Media?

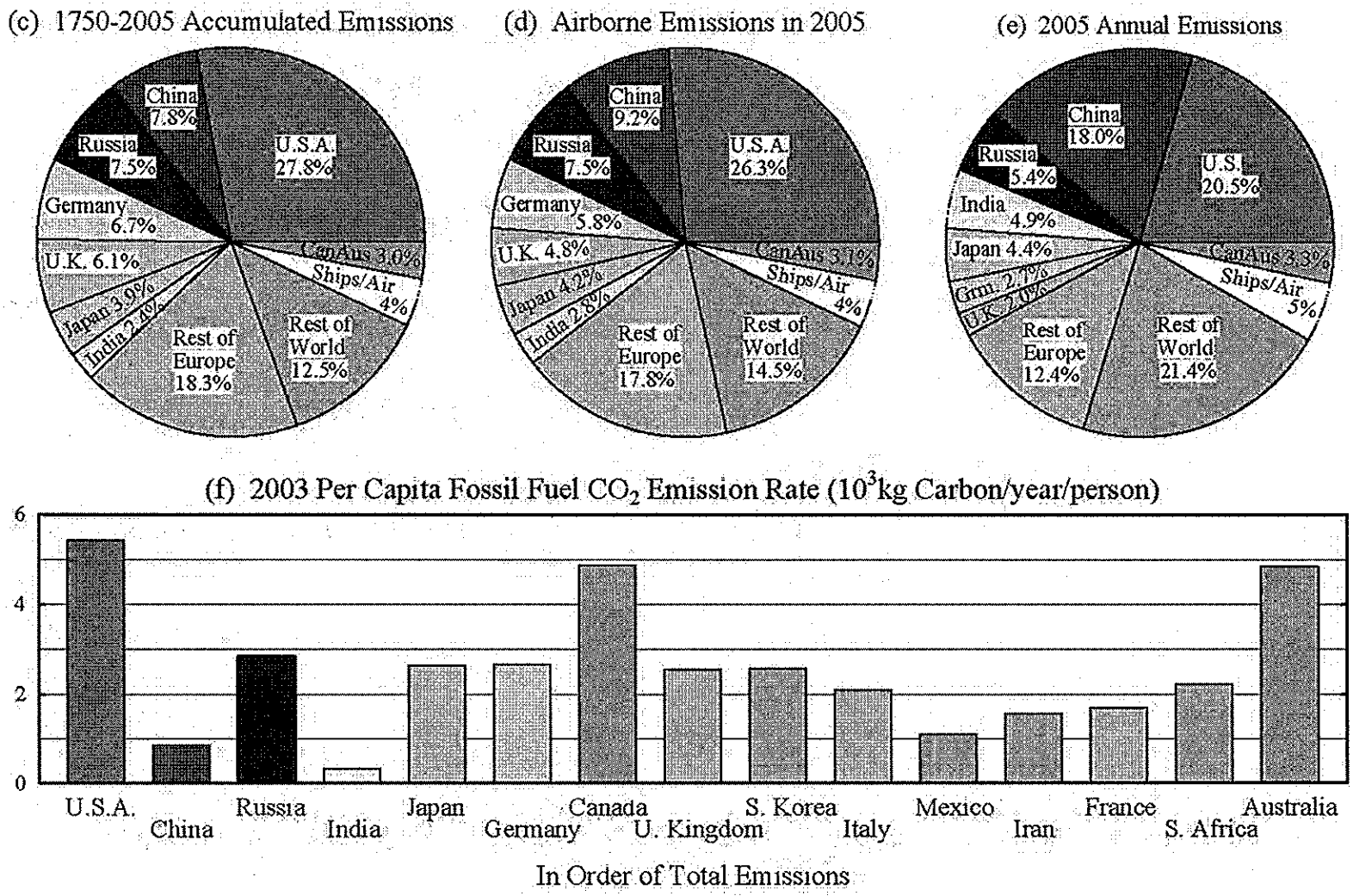
3. Special Interests?

4. U.S. Politicians?

5a. Today's U.S. Public?

5b. U.S. Children/Grandchildren?

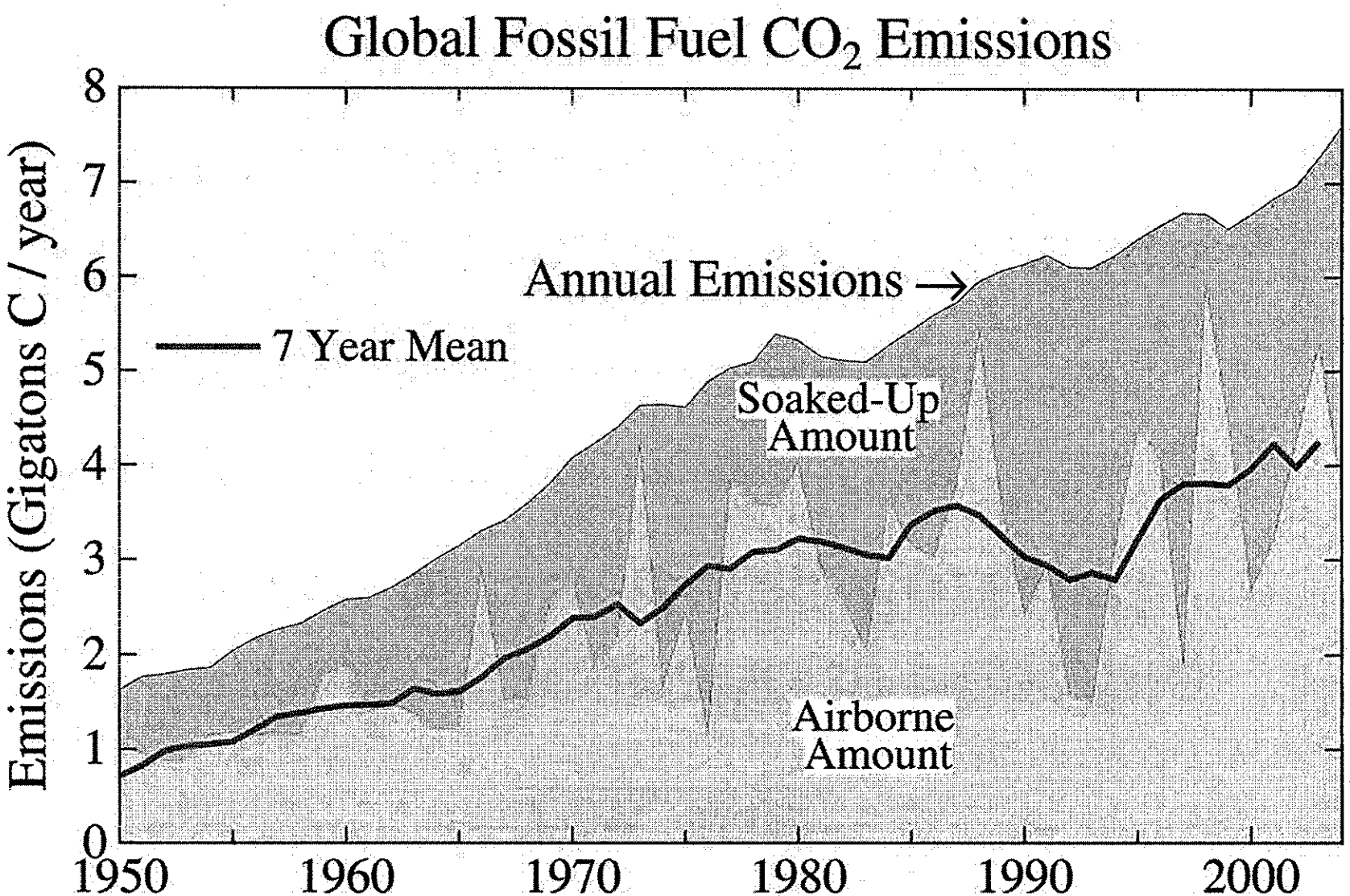
Who Will Pay?


(c) 1750-2005 Accumulated Emissions
China 7.8%
Russia 7.5%
U.S.A. 27.8%
Germany 6.7%
U.K. 6.1%
CanAus 3.0%
Ships/Air 4%
Japan 3.9%
India 2.8%
Rest of Europe 18.3%
Rest of World 12.5%
(d) Airborne Emissions in 2005
China 9.2%
Russia 7.5%
U.S.A. 26.3%
Germany 5.8%
U.K. 4.8%
CanAus 3.1%
Ships/Air 4%
Japan 4.2%
India 2.8%
Rest of Europe 17.8%
Rest of World 14.5%
(e) 2005 Annual Emissions
China 18.0%
Russia 5.4%
U.S. 20.5%
India 4.9%
Japan 4.4%
CanAus 3.3%
Ships/Air 5%
Grm. 2.7%
U.K. 2.0%
Rest of Europe 12.4%
Rest of World 21.4%
(f) 2003 Per Capita Fossil Fuel CO_2 Emission Rate (10^3kg Carbon/year/person)
6
4
2
0
U.S.A.
China
Russia
India
Japan
Germany
Canada
U. Kingdom
S. Korea
Italy
Mexico
Iran
France
S. Africa
Australia
In Order of Total Emissions

Summary: Is There Still Time?

Yes, But:

- Alternative Scenario is Feasible, But It Is Not Being Pursued
- Action needed now; a decade of BAU eliminates Alter. Scen.
- Best Hope: Public Must Become Informed and Get Angry

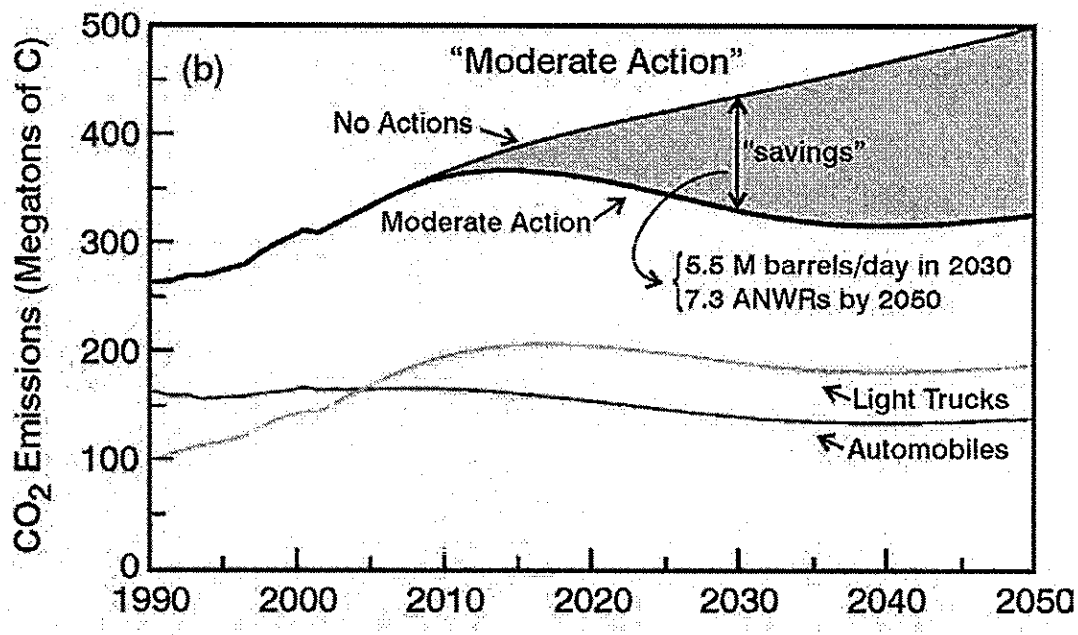


Global fossil fuel CO_2 emissions with division into portions that remain airborne or are soaked up by the ocean and land.

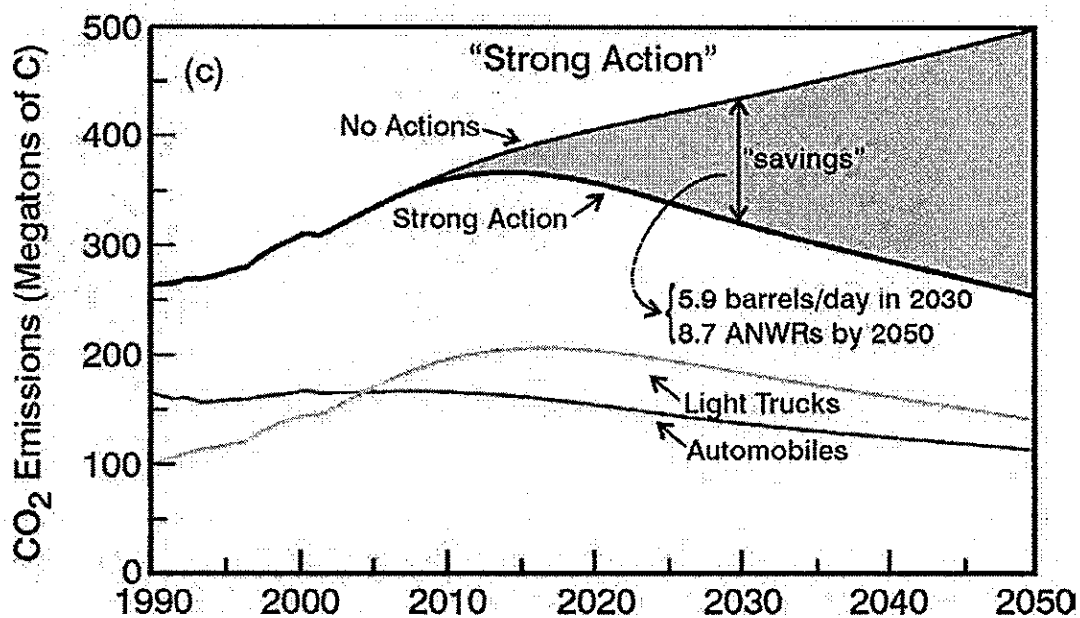
Source: Hansen and Sato, *PNAS*, **101**, 16109, 2004.

U.S. Auto & Light Truck CO_2 Emissions

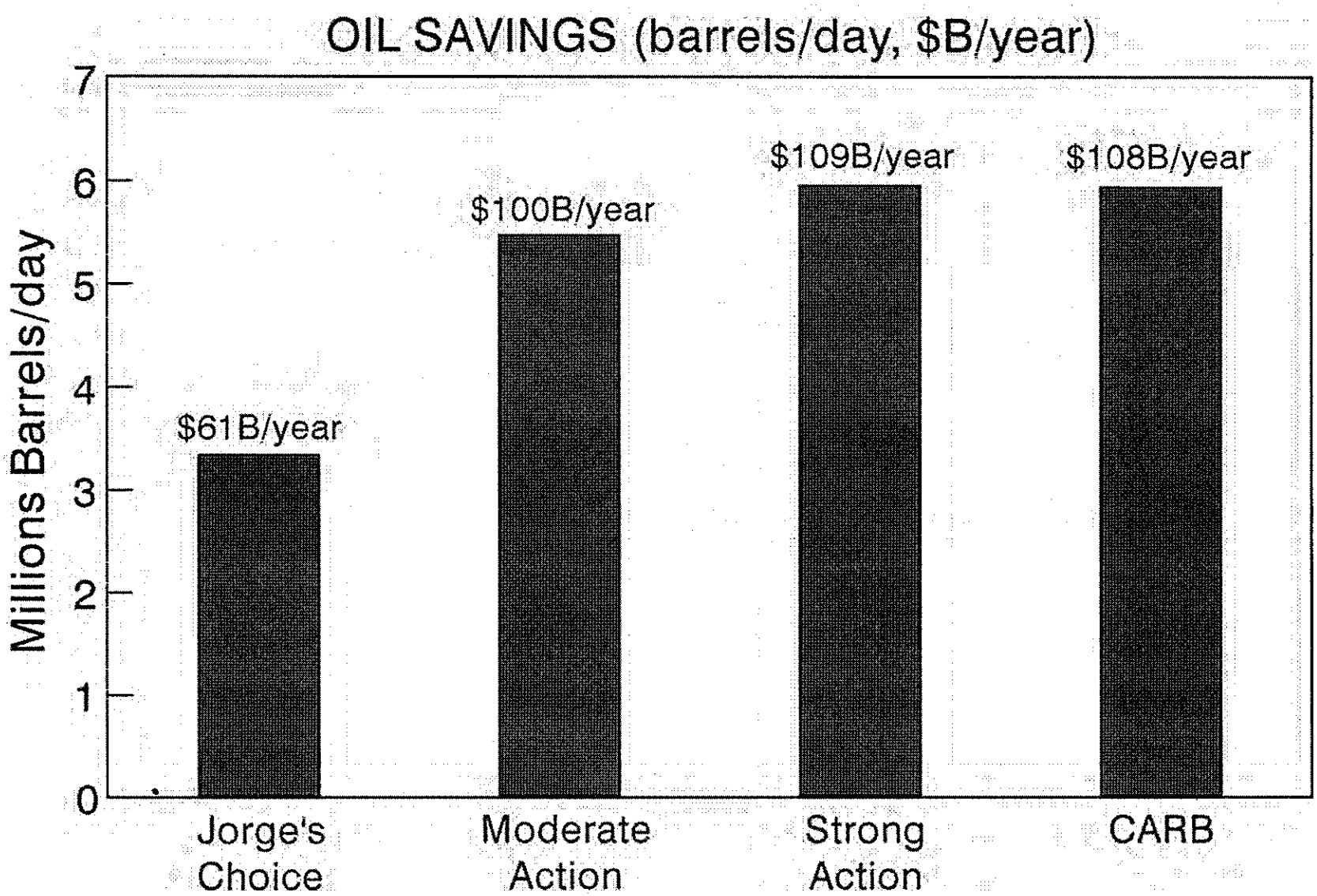
"Moderate Action" is NRC "Path 1.5" by 2015 and "Path 2.5" by 2030.



"Strong Action" adds hydrogen-powered vehicles in 2030 (30% of 2050 fleet).
Hydrogen produced from non-CO_2 sources only.



Source: On the Road to Climate Stability, Hansen, J., D. Cain and R. Schmunk., *to be submitted*.



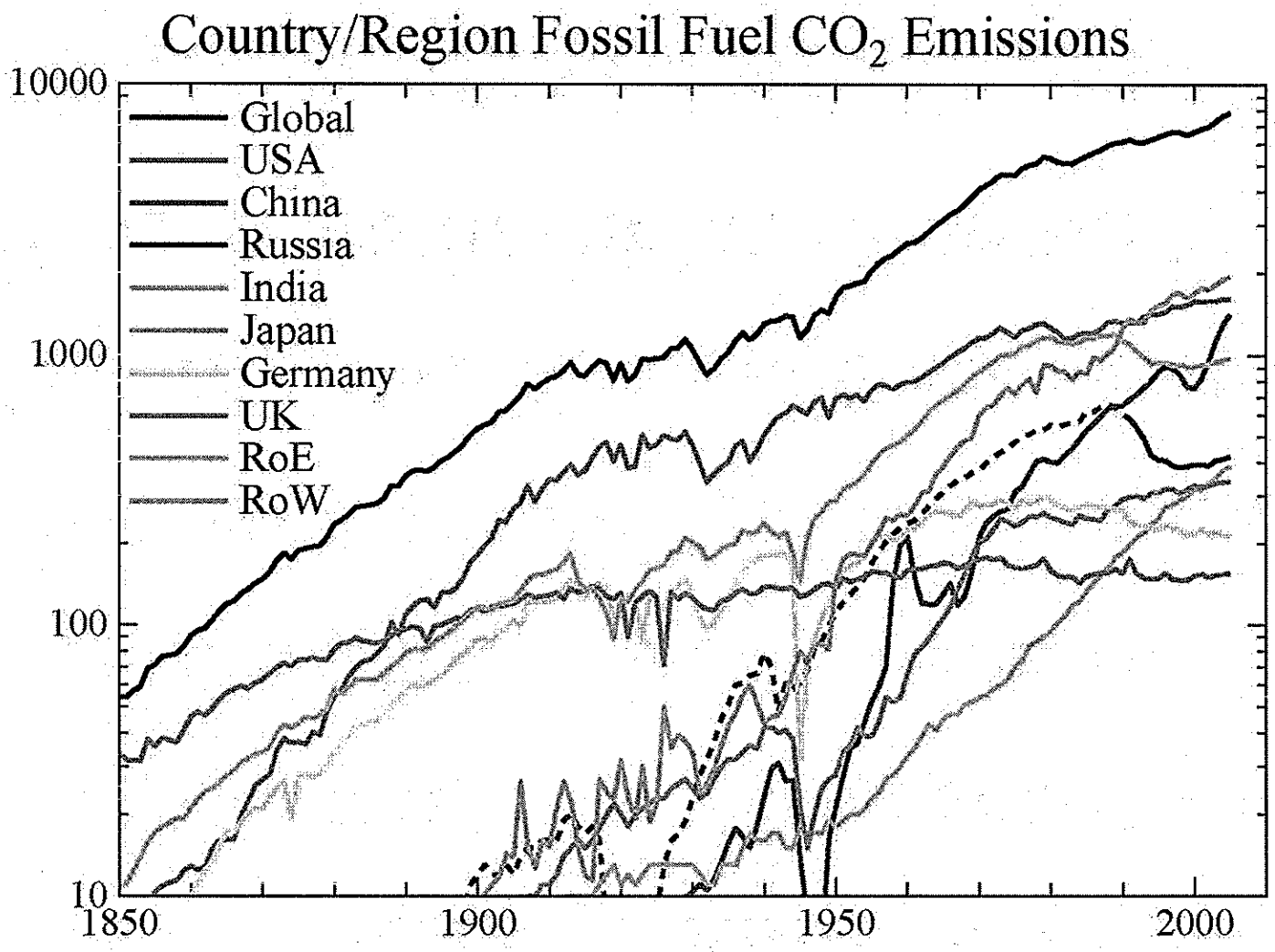
United States annual savings (at $50/barrel, today's dollars) in 2030 for alternative automotive efficiency improvements.

Source: On the Road to Climate Stability, Hansen, J., D. Cain and R. Schmunk., to be submitted.

Public Needs to Know Facts of Life

- CO_2 < 450ppm or 'Different Planet'
- ~ ¼ of Emissions are 'Forever'
- Gradual Carbon 'Tax' is Essential
- Except Oil/Gas, Must Sequester C
- Must → Renewables Eventually

What's So Bad About Clean Air?


Country/Region Fossil Fuel CO_2 Emissions
10000
1000
100
10
1850
1900
1950
2000
Global
USA
China
Russia
India
Japan
Germany
UK
RoE
RoW

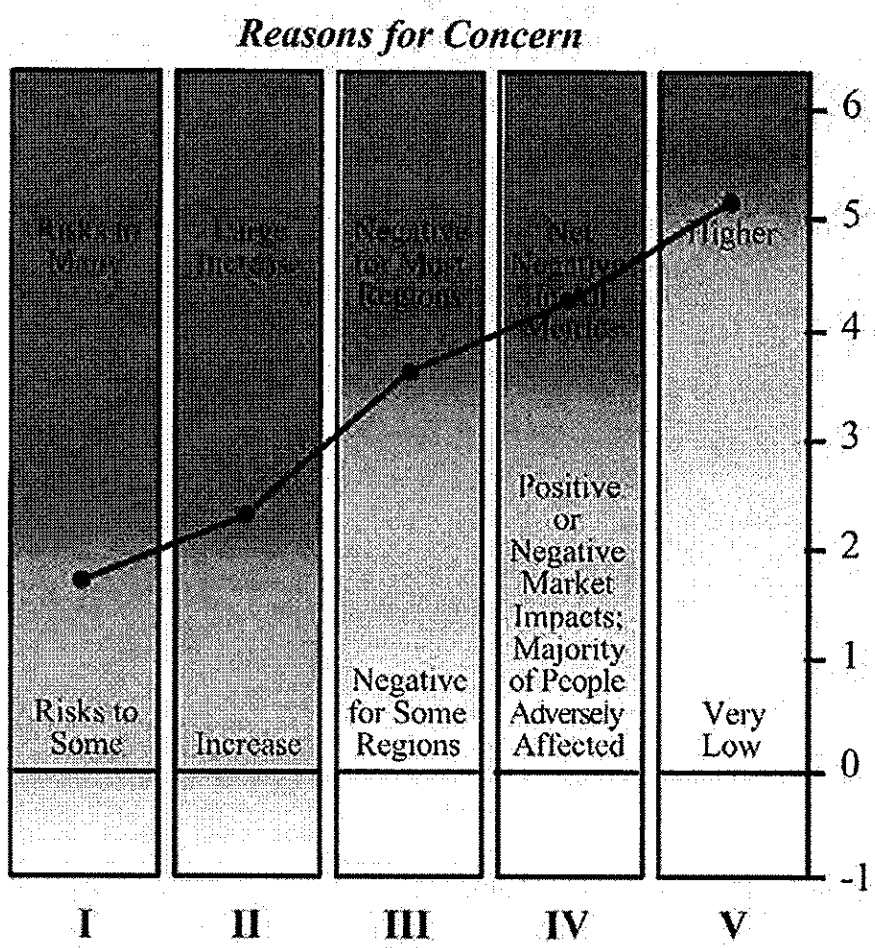
IPCC Burning Embers

White: neutral or small positive or negative impacts

Yellow: negative impacts for some systems or low risks

Red: negative impacts or risks that are more widespread and/or greater in magnitude

I	Risks to Unique and Threatened Systems
II	Risks from Extreme Climate Events
III	Distribution of Impacts
IV	Aggregate Impacts
V	Risks from Future Large-Scale Discontinuities



Reasons for concern about projected climate change impacts

Source: IPCC *Climate Change 2001;* S. Schneider & M. Mastrandrea, *PNAS,* **102**, 15728, 2005.

ODOE Data Request 3

If the answer to question number 2 is "yes", will PacifiCorp allow new bids or a refresh of bids to its Renewable RFP so these bids can be evaluated in a consistent manner with responses to the Baseload RFP? If not, how will a consistent determination be made?

Response to ODOE Data Request 3

The company refreshed its renewable RFP in March, 2006 and is currently in the process of working with bidders to acquire new wind resources. Therefore, there are no plans to allow new bids or a refresh of bids in the renewable RFP. The company will also be filing a plan with the Commission on September 21, 2006, that shows how the company plans to meet its commitment to add 1,400 megawatts of new renewable resources to its portfolio by 2015

The Integrated Resource Planning process, rather than the RFP process, provides a means of reviewing all resources on a comparable and consistent basis. Once the Integrated Resource Plan is complete, targeted RFPs can be issued to separately acquire demand side resources, wind, and high capacity factor resources

ODOE Data Request 4

Page 34 of the Baseload RFP states: "The final short list will be derived utilizing the Capacity Expansion Model (CEM) and the Planning and Risk Model (PaR). Both of these models are production cost models. From the initial short list which is made up of the top bids for each Resource Alternative, the CEM will construct portfolios by optimizing for lowest cost." If the answers to questions number 1 and 3 above are "no", please explain how can PacifiCorp make a comparable determination on renewable and baseload resources in the CEM and PaR modeling.

Response to ODOE Data Request 4

See Response to ODOE Data Request 3.

ODOE Data Request 8

Page 4 of the Baseload RFP states: the "Life of asset will be evaluated consistent with IRP Table C.27 and C.28." Table C.27 "Supply Side Options (East Side)" of the Technical Appendix of the last IRP states that wind resources will have a "Design Plant Life in Years" of 20 years but that coal plants have a design plant life of 40 years and gas-fired power plants have design plant lives of 25 to 35 years. Please explain the basis for these differences. Please include any available information that PacifiCorp has on the operations and maintenance costs on these resources in the years 10-to-20, 20-to-30 and 30-to-40, as applicable.

Response to ODOE Data Request 8

The plant life values used in the latest IRP Supply Side Resource Tables are consistent with plant life assumptions used in the 2004 IRP Update. These plant lives have been consistently used by PacifiCorp over the last five years. In October 2002, Barry Cunningham, then Senior Vice President of Generation, addressed assumed plant life issues as a part of depreciation testimony filed in OPUC Docket No. UM 1064. A stipulation was approved by the OPUC on July 24, 2003. Gas turbine life assumptions are based on the type of machine (aero-derivative versus frame) and the expected operating profile (peaking versus intermediate). Based on information provided by suppliers of the major components of frame-based simple and combined cycle gas turbines, the design life is 30 years; we assume that with proper care and maintenance an overall plant design life of 35 years is reasonable. Given the relatively recent introduction of aeroderivative gas turbines for power generation, a design life of 25 years was selected for aero-derivative gas turbines; there is no operating experience with these types of machines to justify a design life greater than 25 years at this time. For wind turbines, a 20 year life has been chosen for a number of reasons. Current power sales agreements with wind turbine developers are for a 20-year term. Mitsubishi and General Electric, both major suppliers of wind turbines, have indicated that the design lives of their equipment are 20 years. At the current time, PacifiCorp does not have operating experience with wind turbines to assume a design life greater than 20 years. PacifiCorp is not aware of any existing studies of operating and maintenance costs which break down those costs by age.

ODOE Data Request 10

Please provide all available data on the ramp rates and minimum operating levels for the East Side coal and natural gas Supply Options listed in Table C 27 of the Technical Appendix of the last IRP.

Response to ODOE Data Request 10

The following table has been compiled in terms of generation type and fuel type. It should be noted that there are a number of equipment and site specific issues that affect the achievable minimum loads and ramp rates.

DESCRIPTION	Min Load	Ramp Rate	Notes
Coal	% of Full Load	%/Minute	
Supercritical Pulverized Coal	30%	4.00%	
Subcritical Pulverized Coal	35%	2.00%	
IGCC (based on 2x1 CCCT)	50%	2.50%	Minimum load depends on turbine type/supplier, whether one or two gas turbines are operating, & permit limits. Ramp rate depends on turbine type/supplier. If one gas turbine is operating the minium load can be reduced to one half of the stated minimum load value.
Natural Gas			
2x1CCCT	70%	5.0%	Minimum load depends on turbine type/supplier, whether one or two gas turbines are operating, & permit limits. Ramp rate depends on turbine type/supplier. If one gas turbine is operating, the minium load can be reduced to one half of the stated minimum load value.
Duct Firing	30%	20%	Ramp rate depends on load. Power augmentation ramp rates are lower (5%/minute).
SCCT Aero	25%	50%	
Internal Combustion Engines	3%	10%	Minimum load depends on number of engine sets operating.

ODOE Data Request 11

Page 26 of the Baseload RFP states: "Bidders should refer directly to the IRP for the Company's estimated cost and availability of new resource alternatives. Bidders are reminded that the IRP is a planning document and certain resource assumptions were used as a proxy for planning purposes. As such, the Company shall rely on the outcome from this RFP to ascertain the most prudent resource decision. Bidders should note that the IRP is a useful document for information purposes and Bidders should not infer in any way that the IRP should prescriptively guide their specific proposal. The Company intends to use then-current assumptions in its evaluation of bids. These assumptions may be different than the assumptions contained in the IRP." (emphasis in original). Also, on page 27 the RFP states:

> "The variable generation costs will include, but are not limited to, the following components:
> The variable energy commodity price, which, depending on structure, will likely be variable, tied to a natural gas price (including variable gas transportation costs) and a contractual or manufacturer recommended heat rate and capacity at the time of delivery (adjusted for temperature) In certain structures, the variable energy commodity price will be fixed, or potentially fixed with an annual escalation. Variable O&M ($/MWh).
>
> Potential C02 costs ($/ton) ($/NM based on a $/ton C02 basis)...."

Please explain how PacifiCorp will set the value for C02 costs or provide the tentative value, if one has been set, for calculating the adjusted price project on page 32 of the RFP.

Response to ODOE Data Request 11

The Company plans to use CO_2 costs that are consistent with the Integrated Resource Plan for calculating the adjusted price projections in the RFP. The Integrated Resource Plan assumes an inflation-adjusted $8 per ton (2008 dollars) phased in over the period 2010 through 2012. The IRP also simulates a CO2 emissions cap-and-trade scheme where each ton of CO2 emitted above an annual system allowance is charged the CO2 dollar per ton cost. Details on how CO2 costs are quantified can be found on pages 75 and 76 of the 2004 IRP