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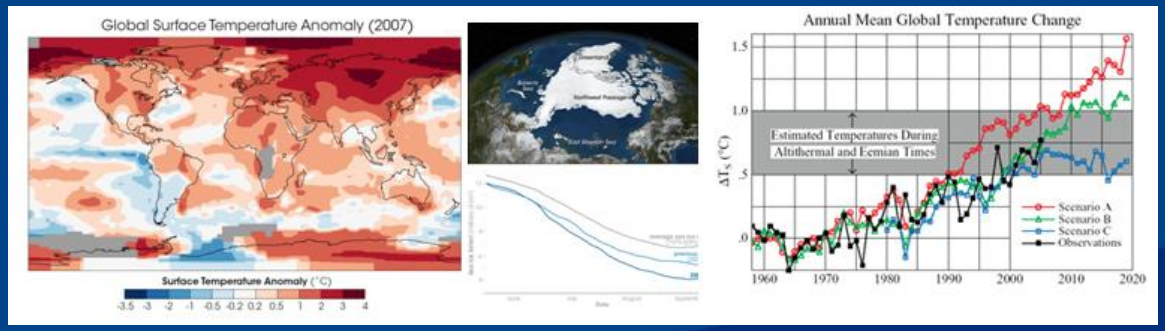

Climate Change Q&A **Seminar #2**

Can we distinguish between natural and human- induced climate change?

Professor Barry W. Brook

Sir Hubert Wilkins Chair of Climate Change

Director, Research Institute for Climate Change and Sustainability

School of Earth and Environmental Sciences

The University of Adelaide

Email: barry.brook@adelaide.edu.au

Climate Change Q&A

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6 lectures – step-by-step guide to the key questions

- 8 Aug: Is the Earth really warming?
- **22 Aug: Natural vs Human causes**
- 5 Sept: Future climate change scenarios?
- 19 Sept: Are impacts being overstated?
- 10 Oct: Will it cost the Earth to avoid this?
- 24 Oct: Greenhouse denial: the 'pretend debate'

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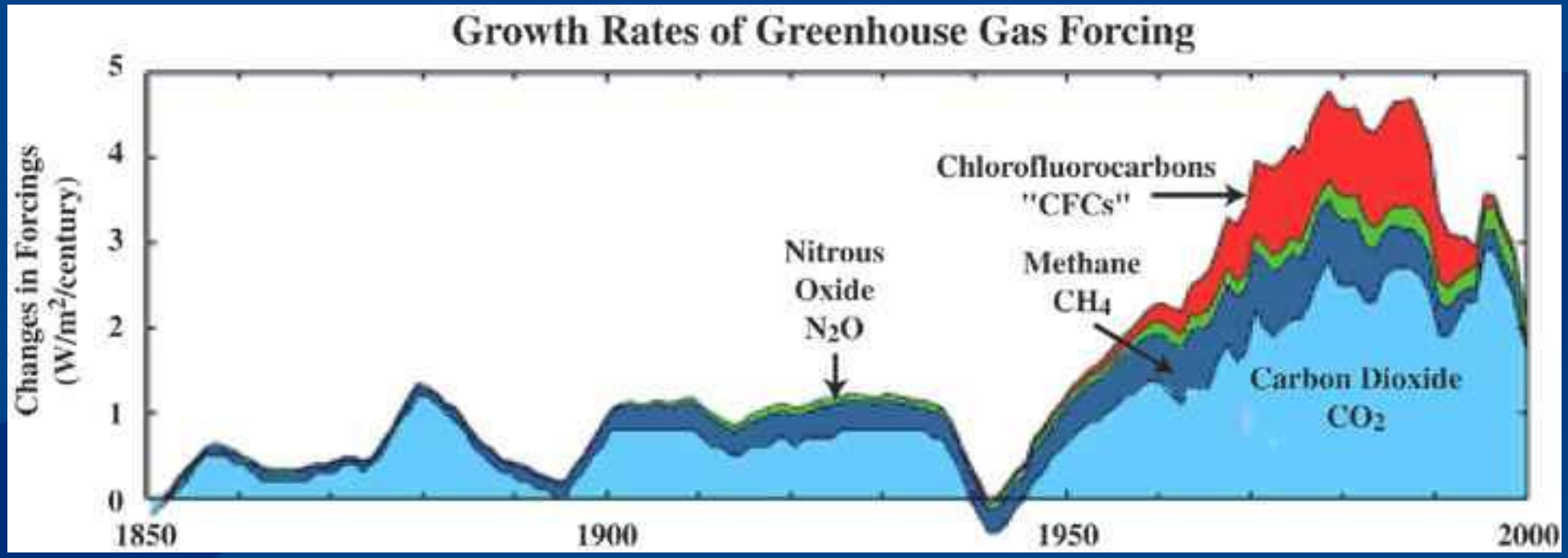

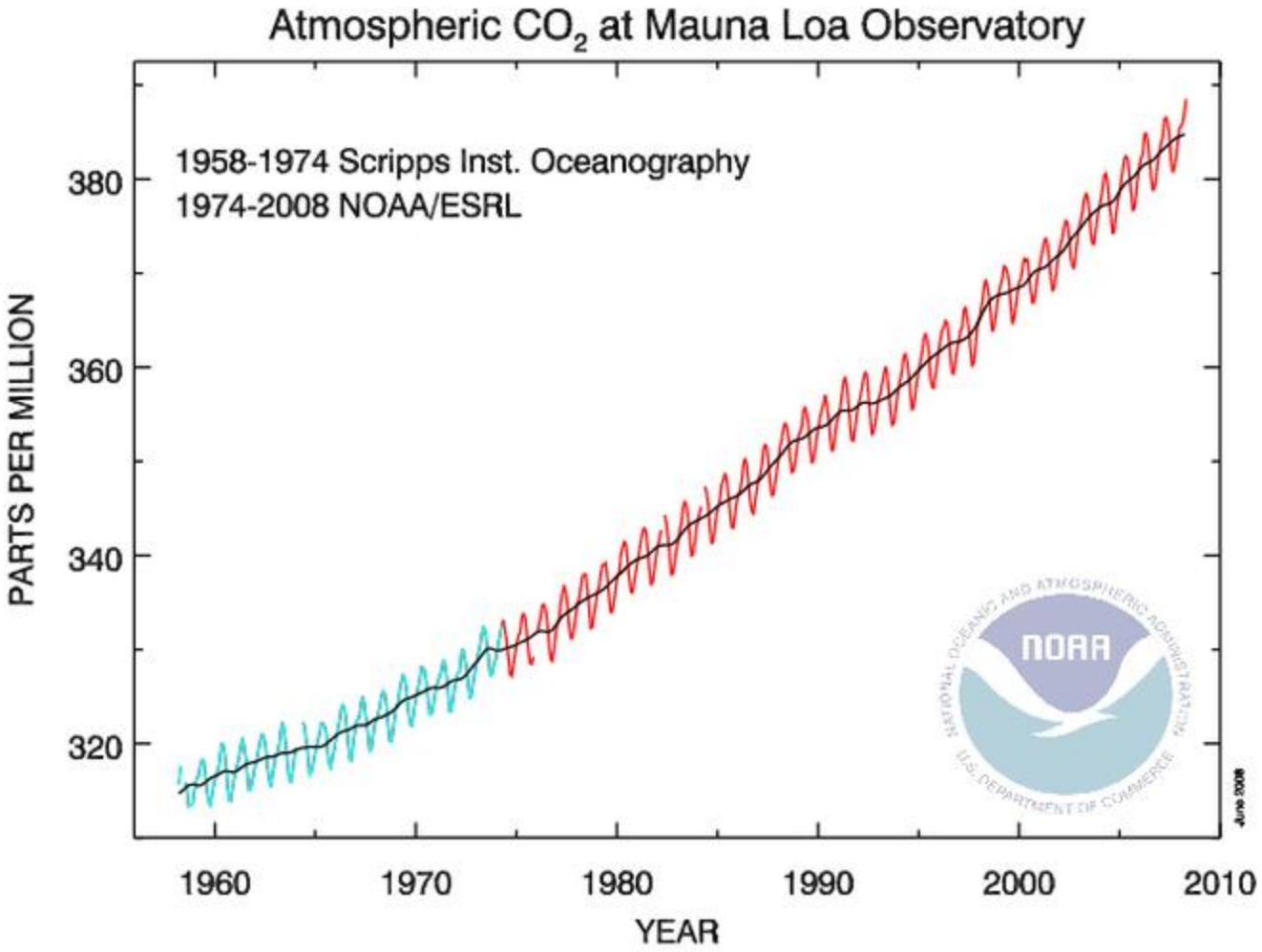
Atmospheric CO_2 at Mauna Loa Observatory
1958-1974 Scripps Inst. Oceanography
1974-2008 NOAA/ESRL
PARTS PER MILLION
380
360
340
320
1960
1970
1980
1990
2000
2010
YEAR
NOAA
June 2008

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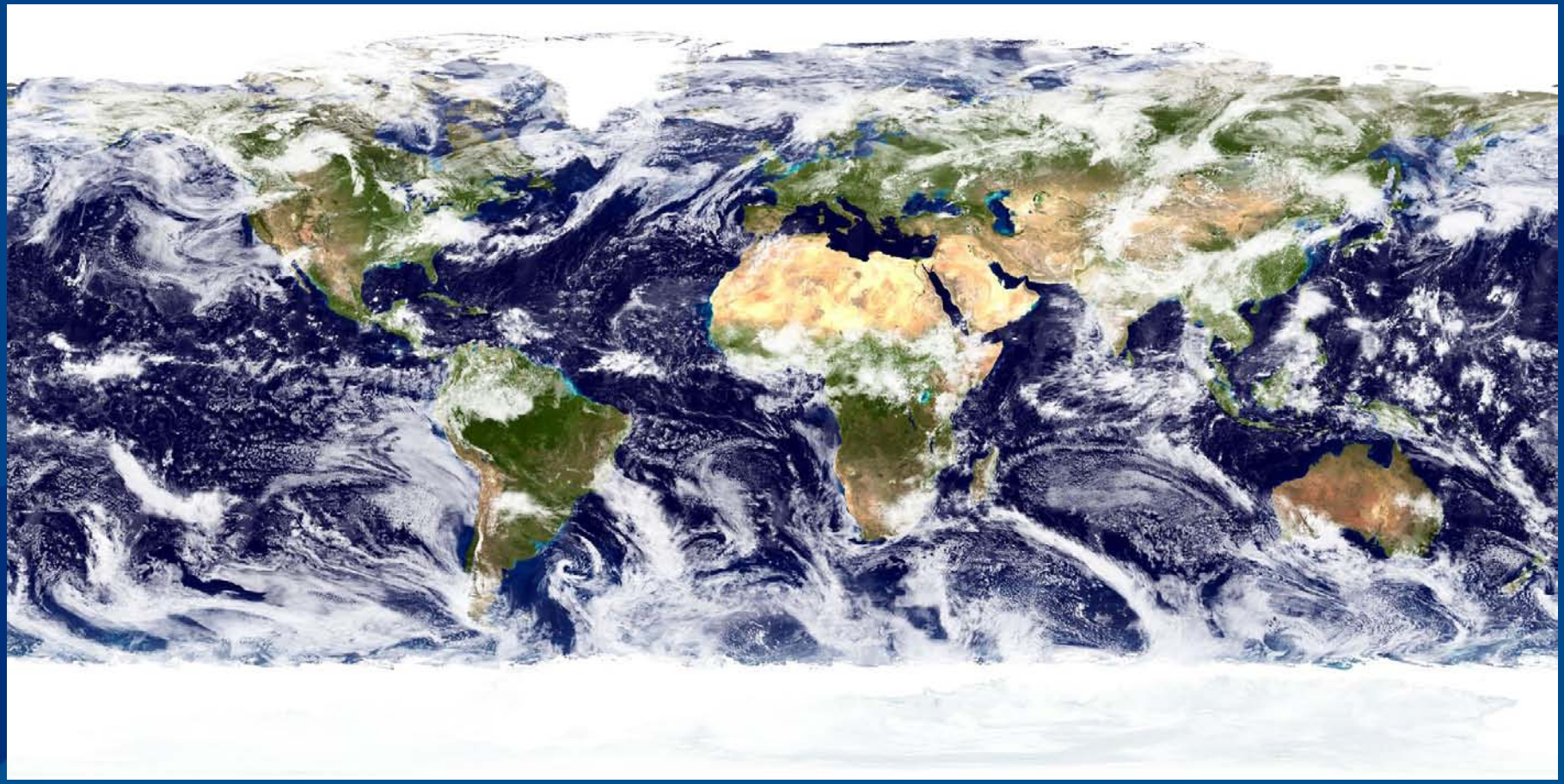

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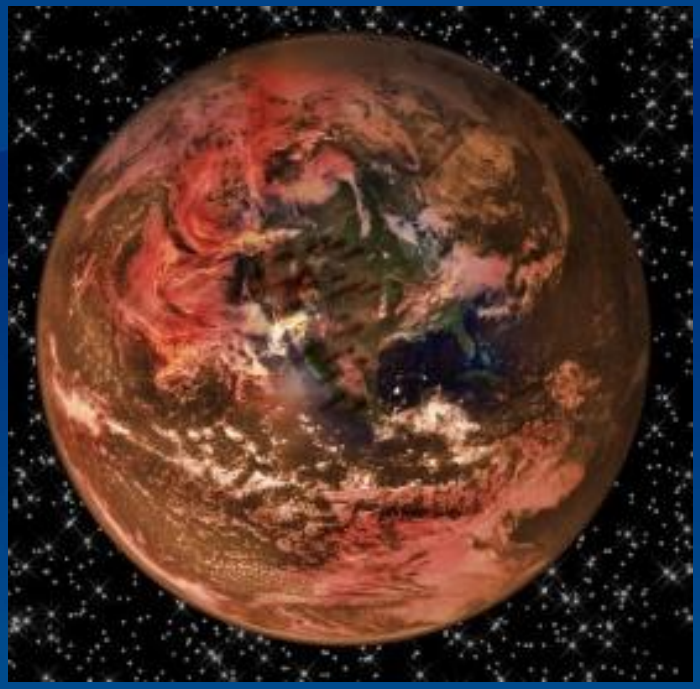

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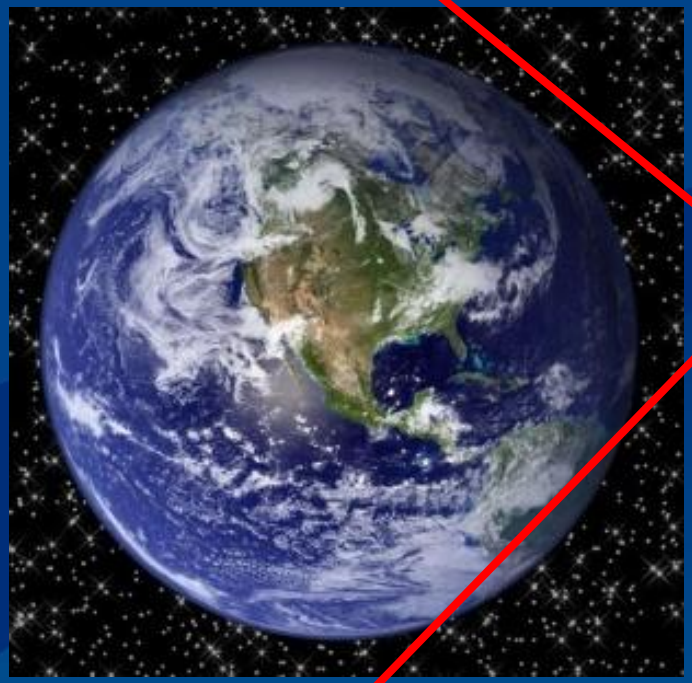

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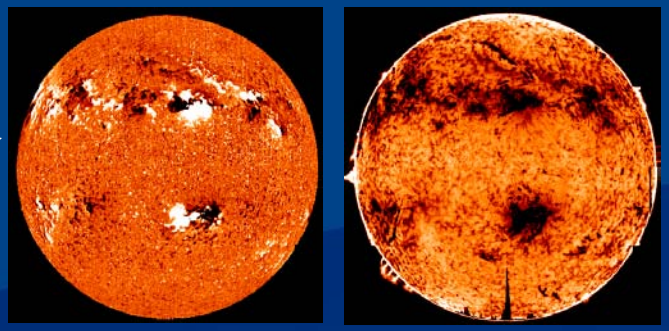
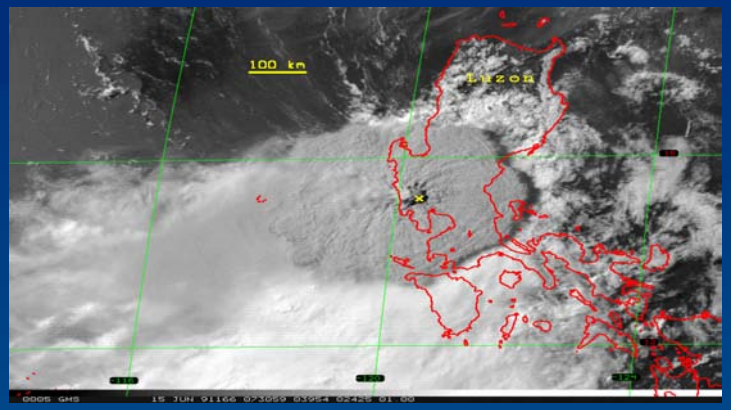
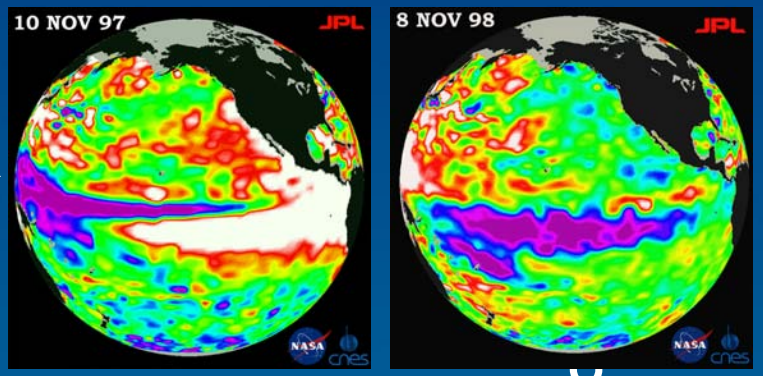
Natural mechanisms

- Changes in the Sun
- Changes in the amount of volcanic dust in the atmosphere
- Internal variability of the coupled atmosphere-ocean system

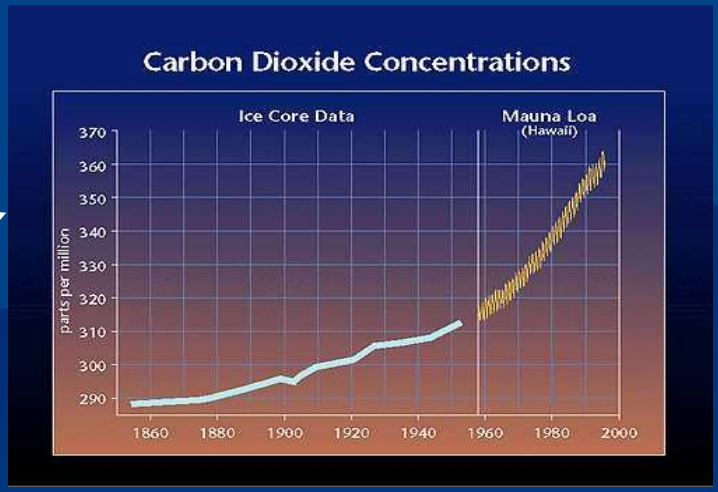






Non-natural mechanisms

- Changes in atmospheric concentrations of greenhouse gases
- Changes in aerosol particles from burning fossil fuels and biomass
- Changes in the reflectivity (albedo) of the Earth's surface



Smoke from fires in Guatemala and Mexico (May 14, 1998)

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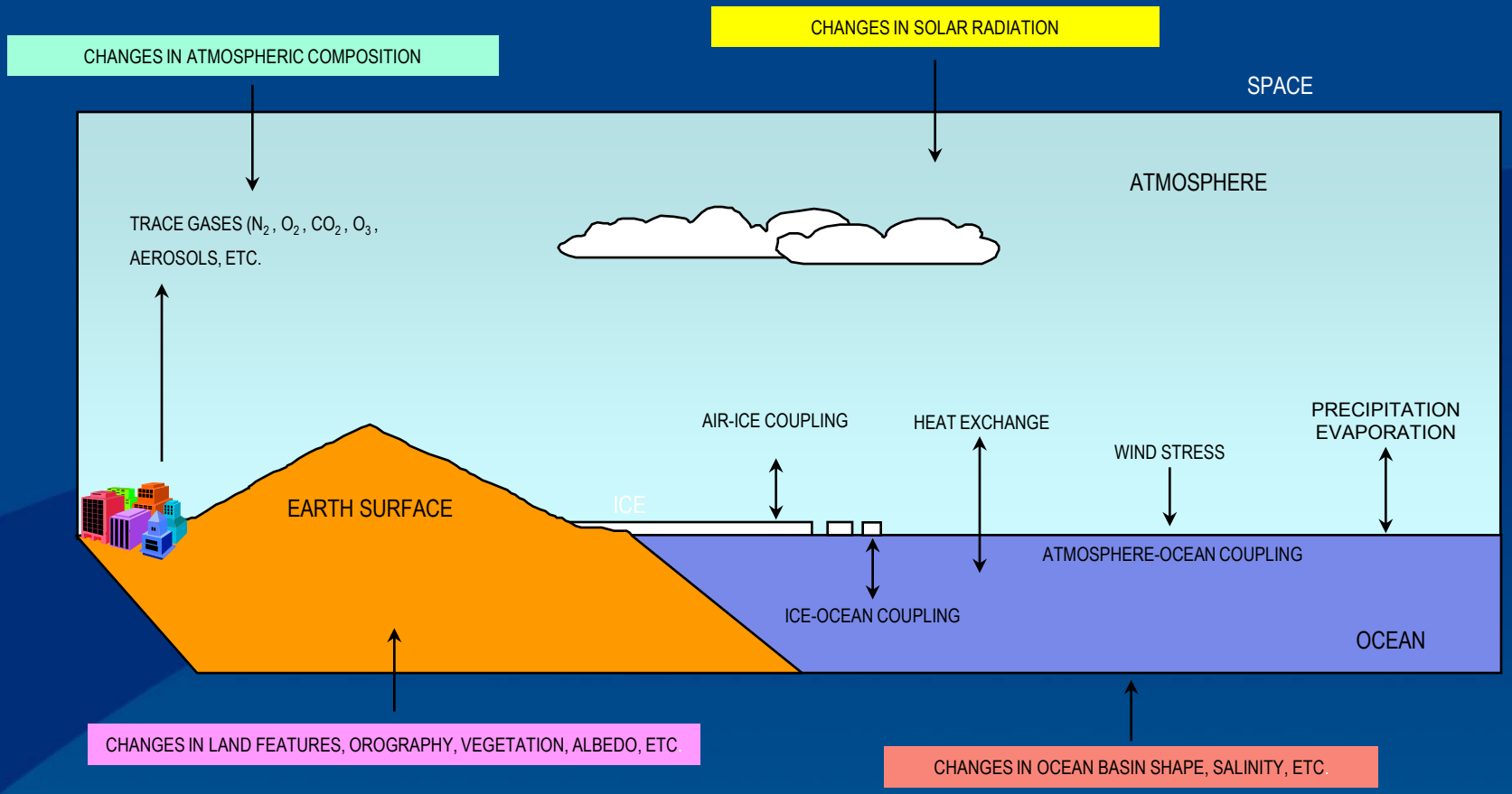

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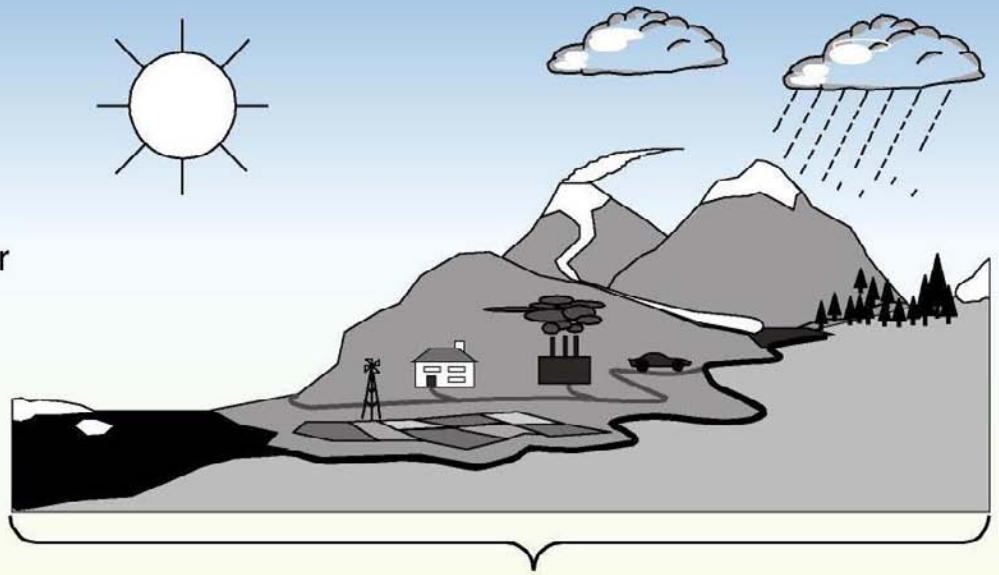
Key questions about the climate system and its relation to human kind

What changes have occurred?

Observations:

- temperatures
- precipitation
- snow / ice cover
- sea level
- circulation
- extremes

How well are the past and present climates understood?



What changes could lie ahead?

Simulations:

- natural variation
- forcing agents
- global climate
- regional climate
- high impact events
- stabilisation

Observations vis-à-vis Simulations

Timeline: Palaeo & Instrumental Periods → The Present → The Future

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The greenhouse effect is a myth

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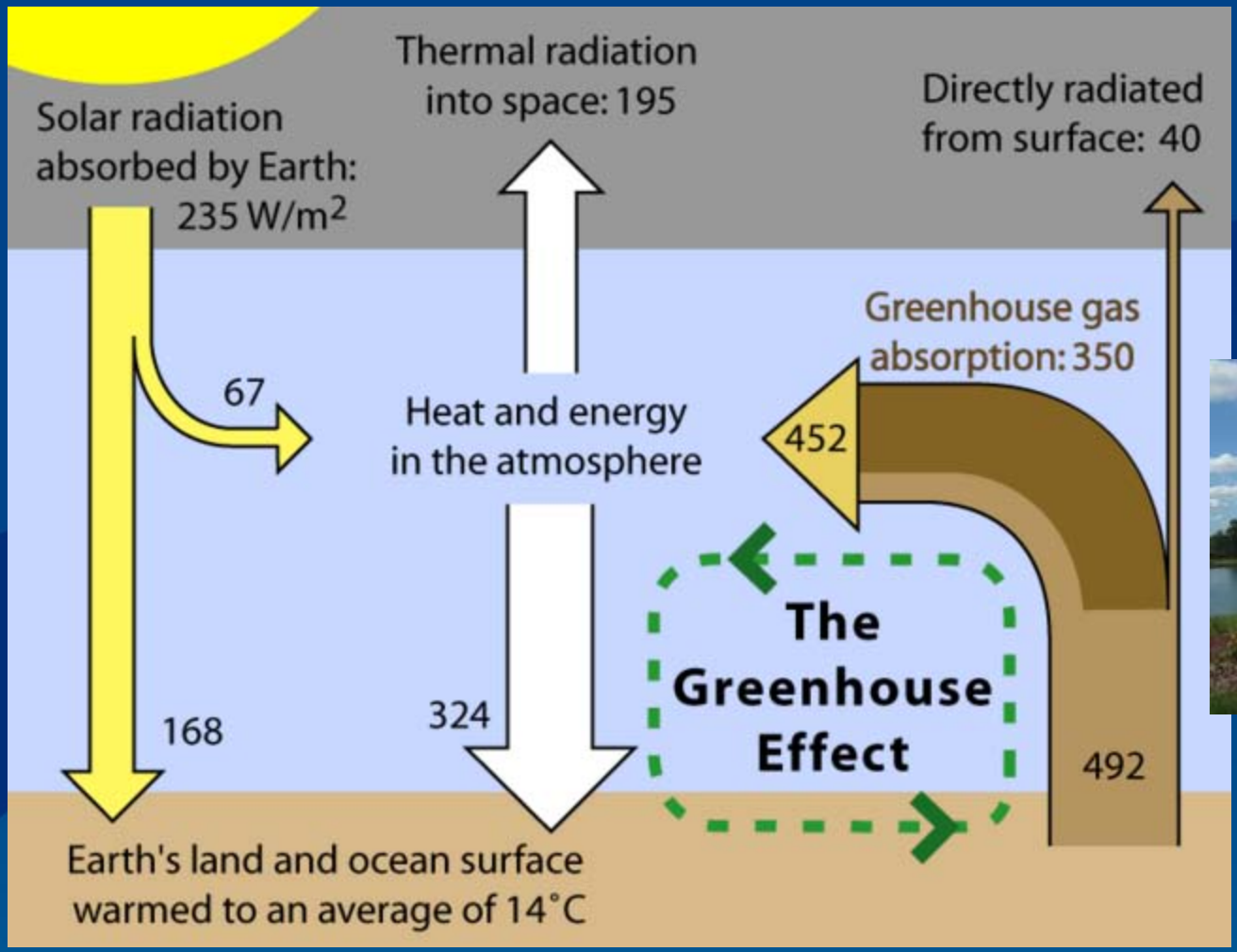

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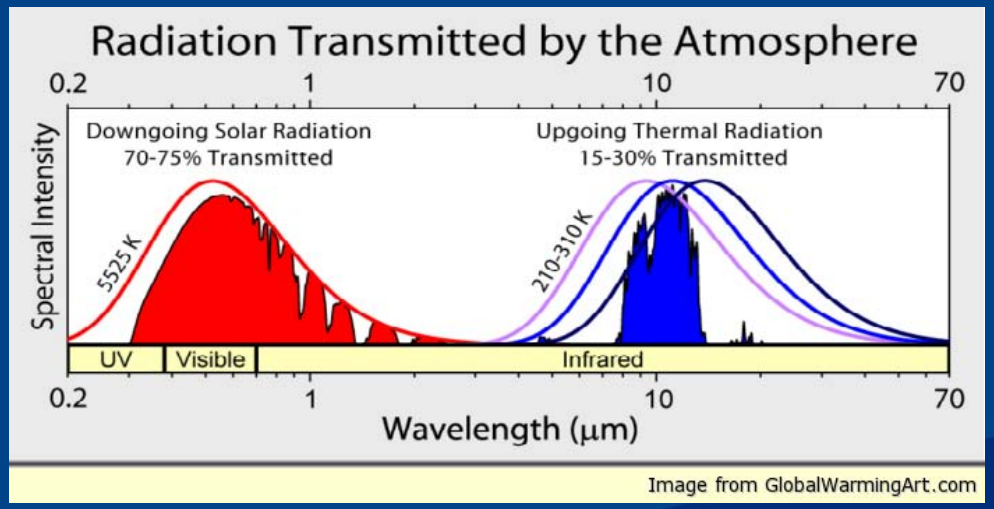


Image from GlobalWarmingArt.com

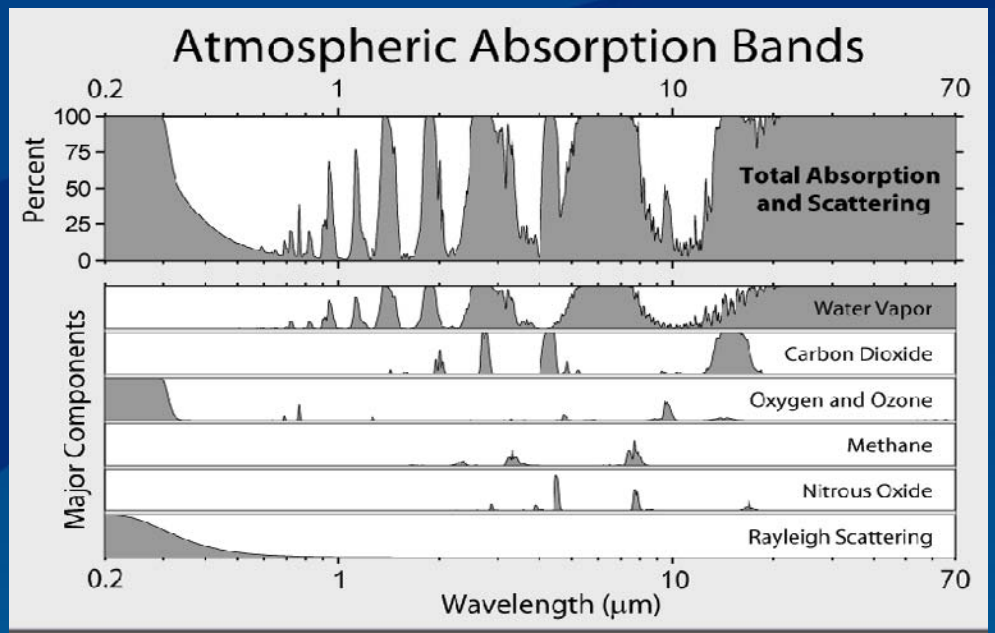
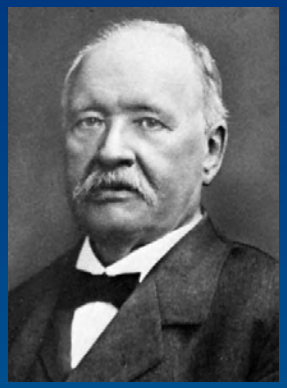
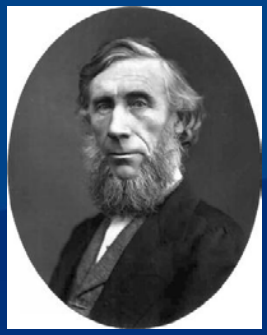
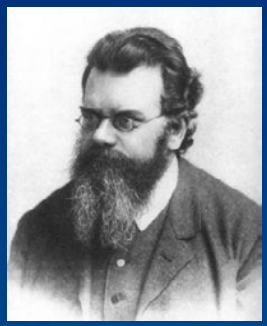


Image from GlobalWarmingArt.com
http://www.globalwarmingart.com/wiki/Image:Atmospheric_Absorption_Bands_png







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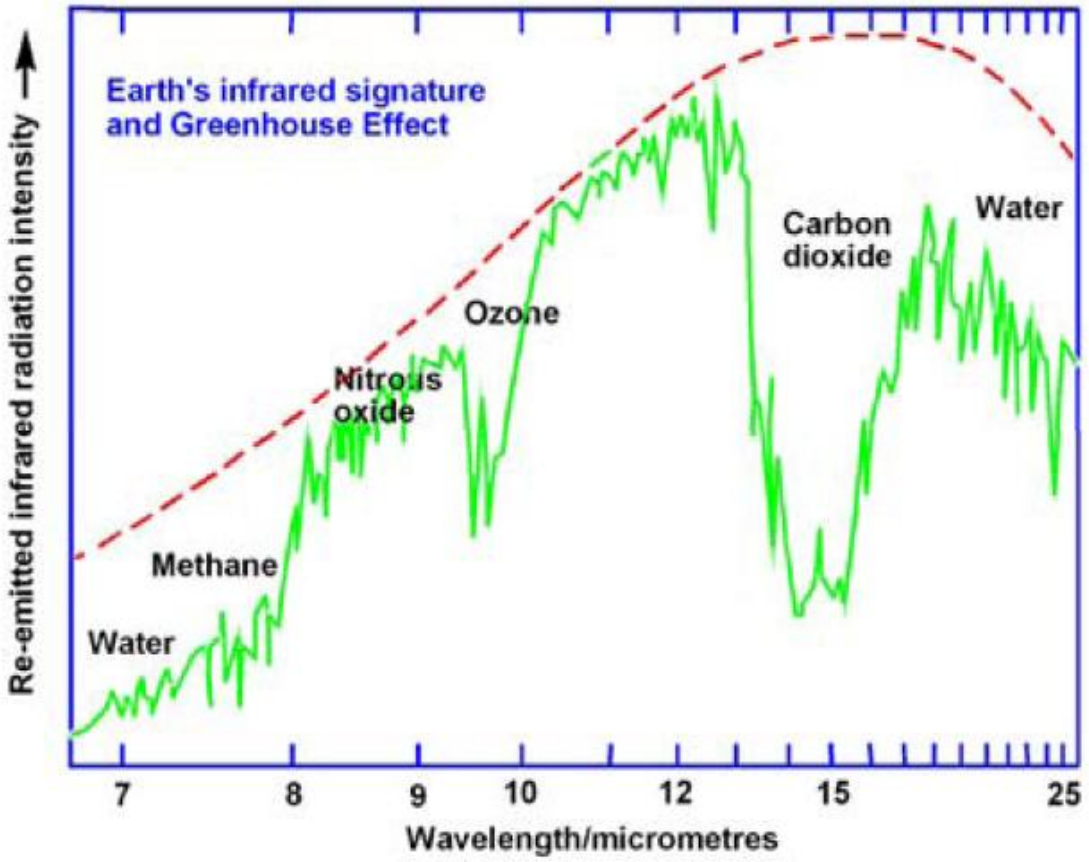
Earth's Atmospheric Infrared (Heat) Absorption Spectrum

Broken line shows amount of infrared radiation (heat) that would escape in absence of atmosphere.

Solid line shows amount of infrared radiation (heat) that actually escapes.

Difference between lines is the infrared (heat) absorption by greenhouse gases (greenhouse effect).



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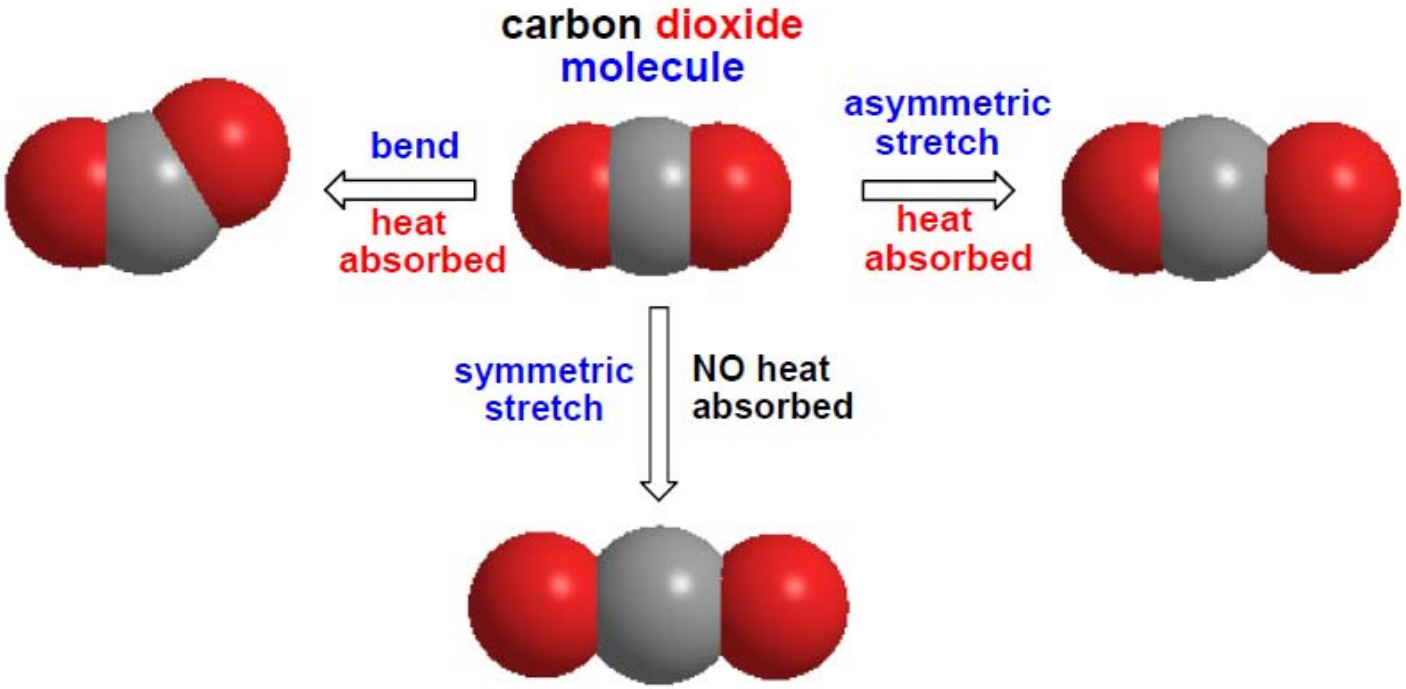
The Greenhouse Effect – Carbon Dioxide

Absorbtion of Infrared Radiation (heat) by Carbon Dioxide



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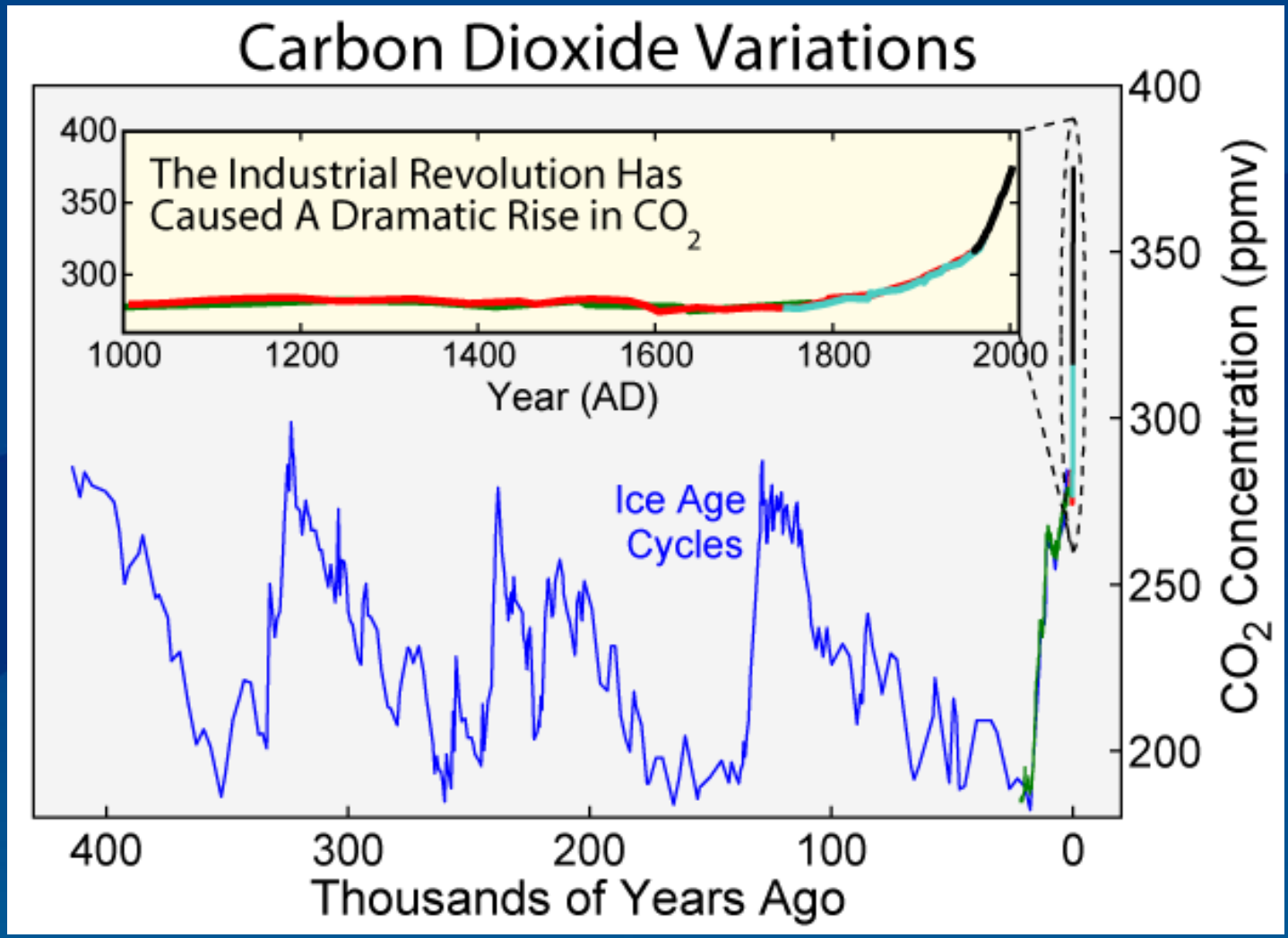

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Circumstantial evidence

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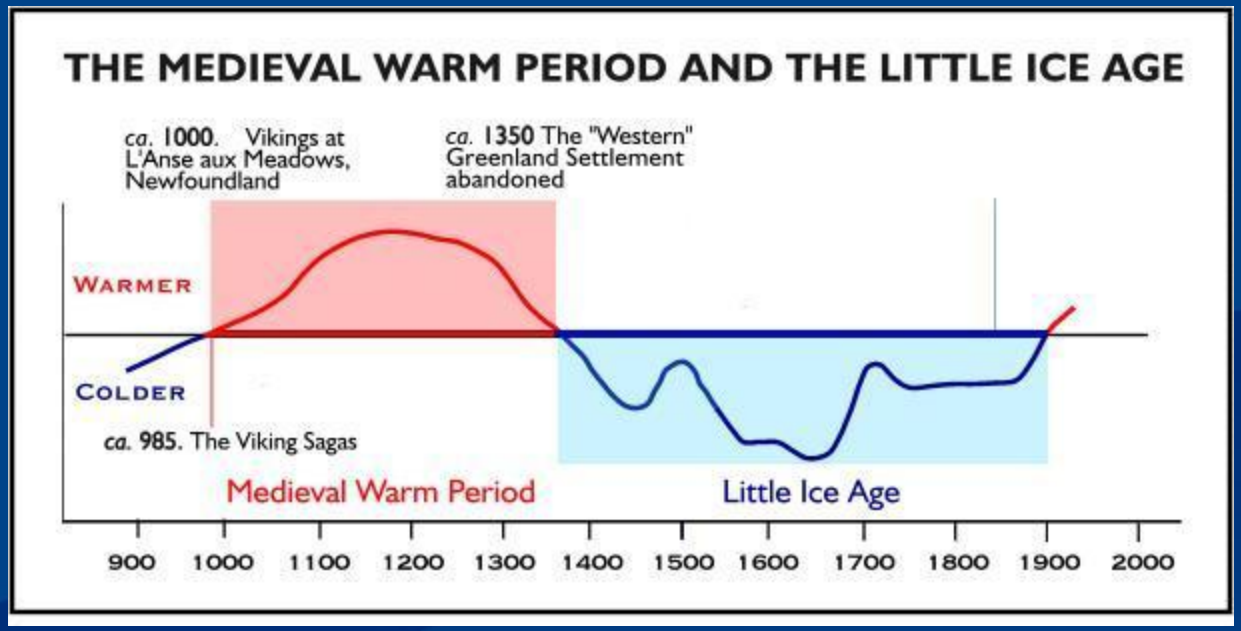

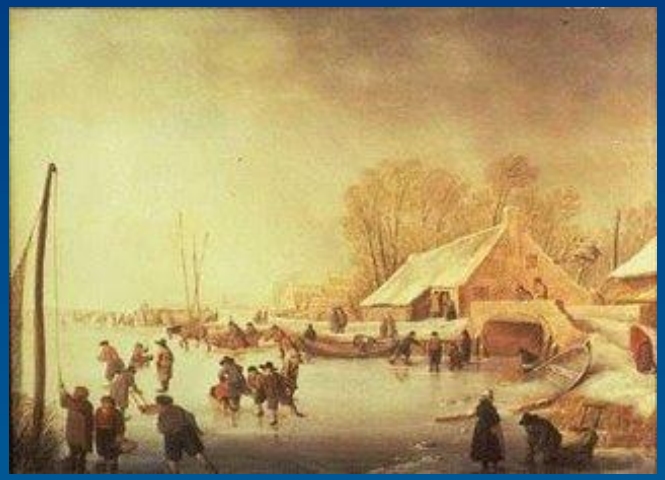

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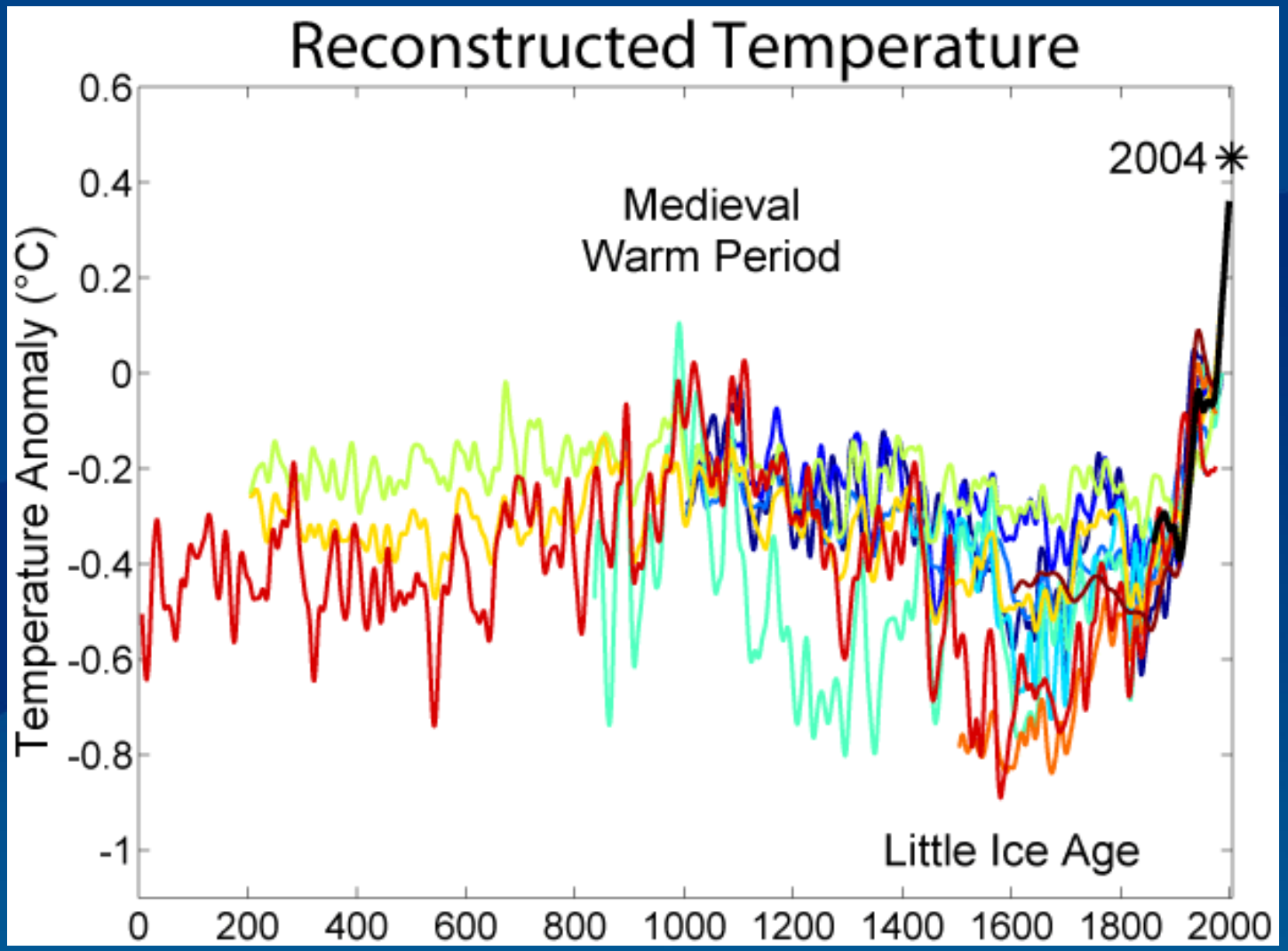

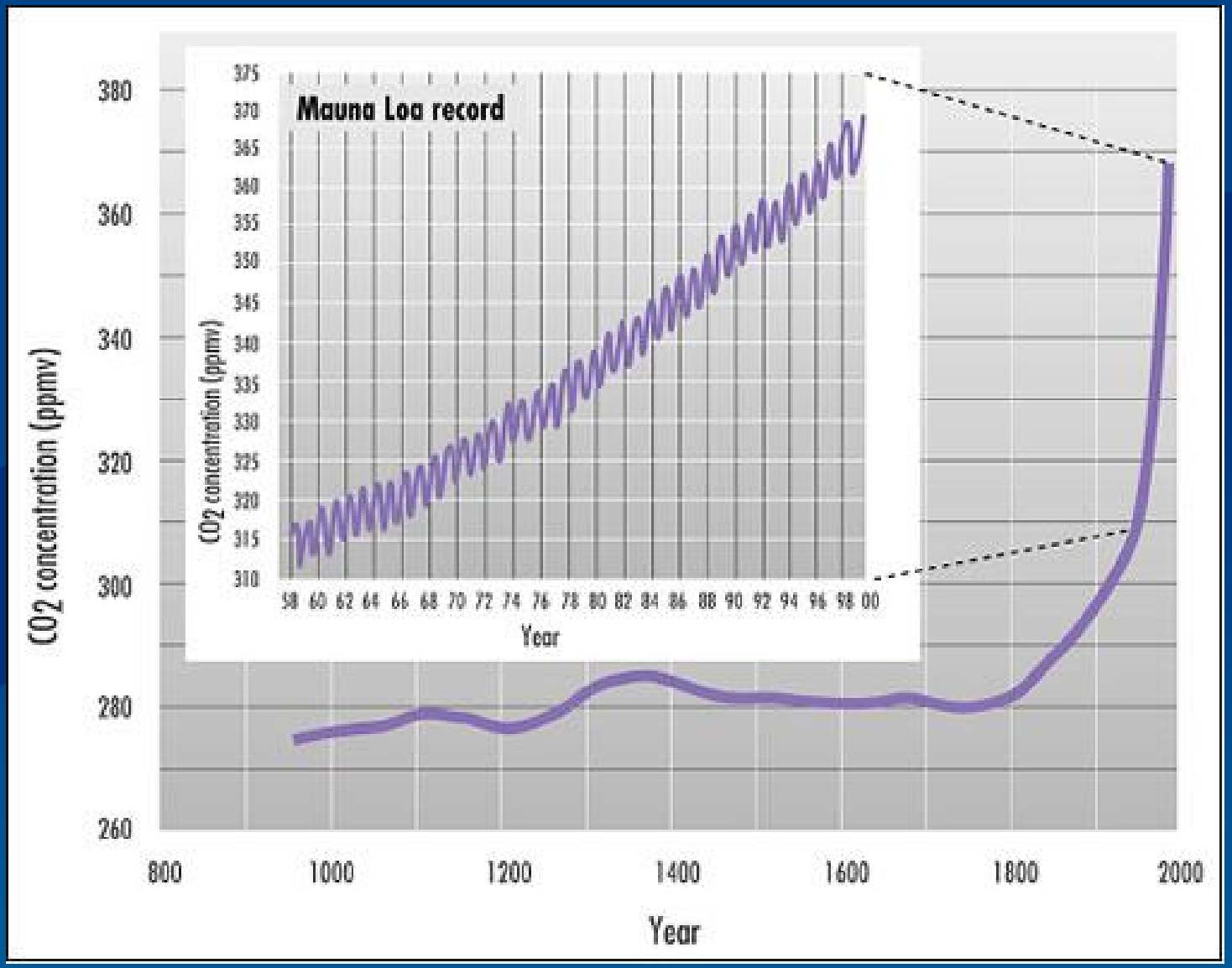
Mauna Loa record
CO2 concentration (ppmv)
Year
380
360
340
320
300
280
260
800
1000
1200
1400
1600
1800
2000
375
370
365
360
355
350
345
340
335
330
325
320
315
310
58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 00

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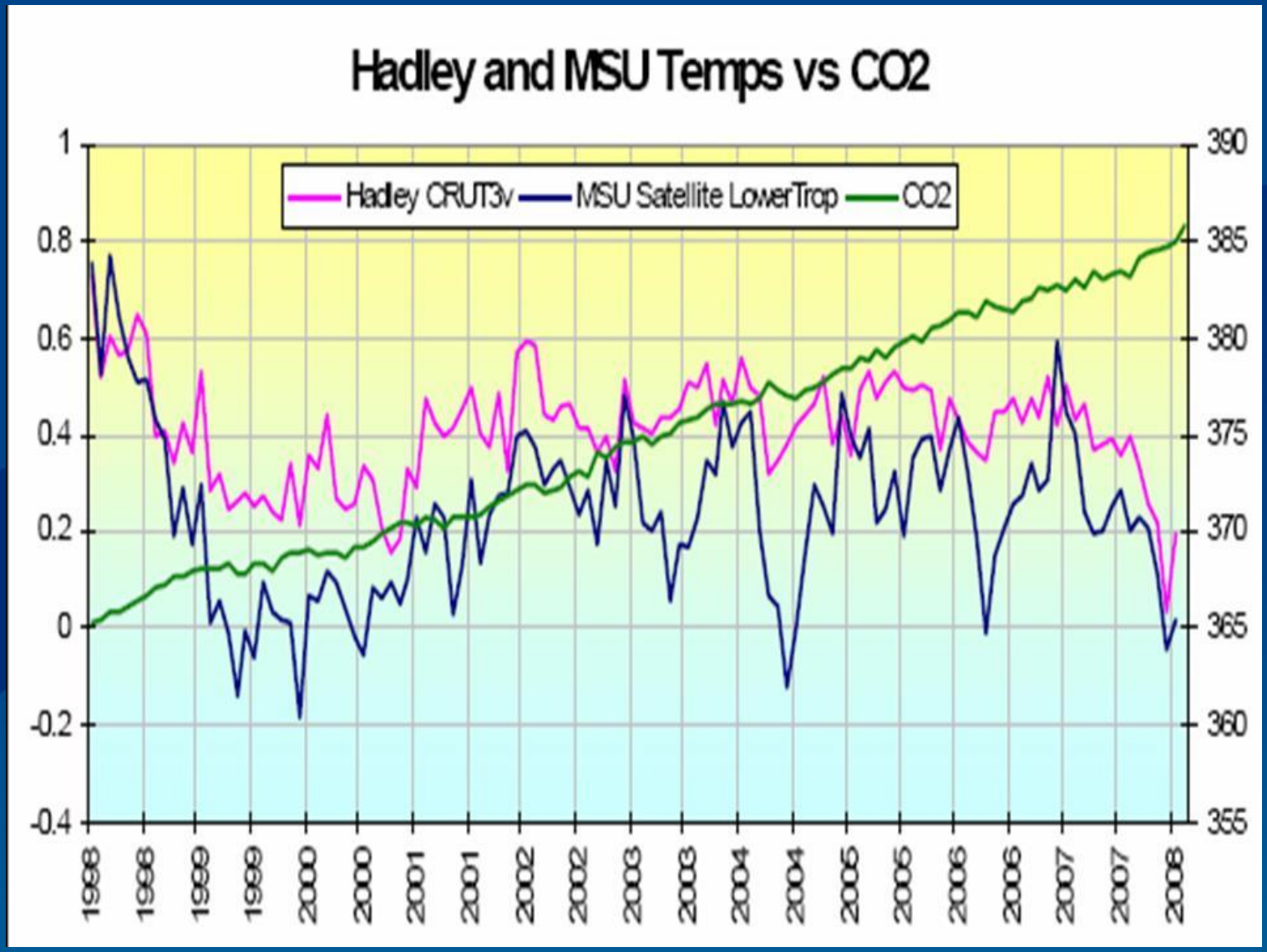

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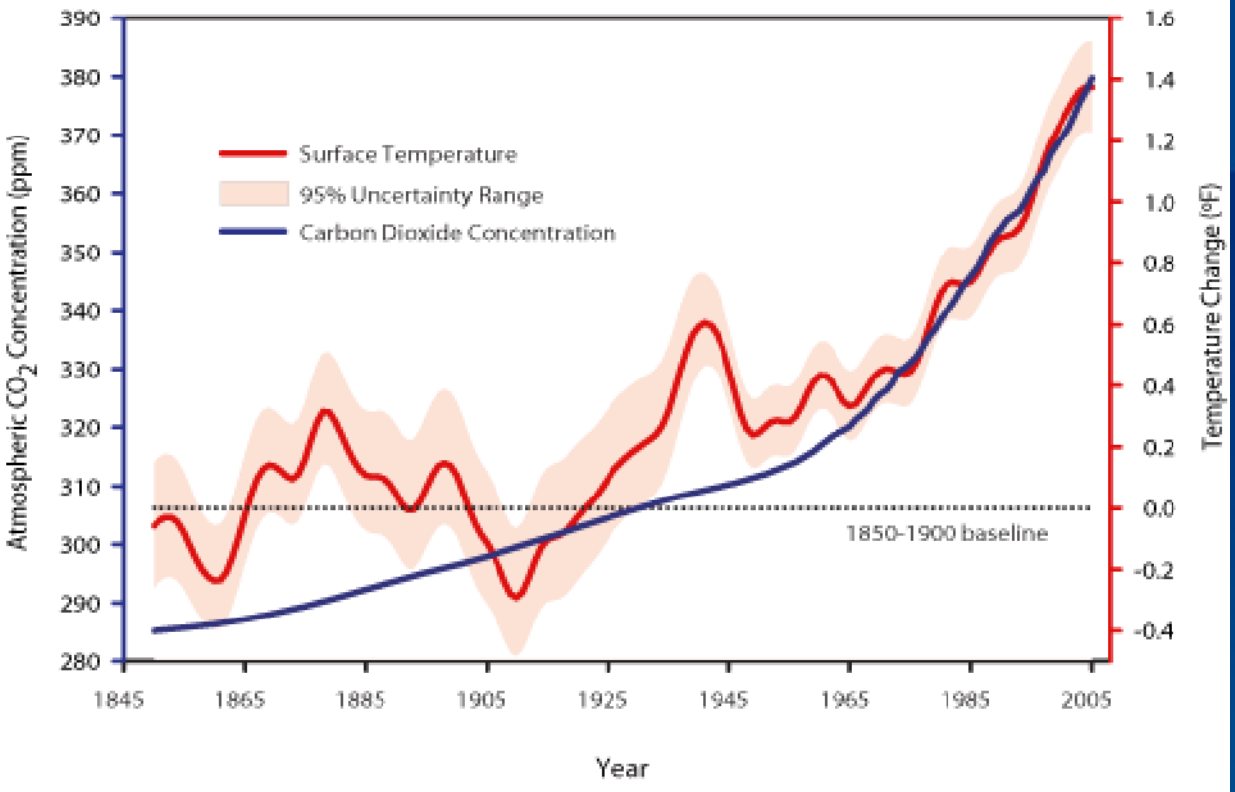
Atmospheric CO_2 & Global Surface Temperature Trends

1800 - 2005



Source of CO_2 Concentration data: Keeling, C.D. and T.P. Whorf. 2005. Atmospheric CO_2 records from sites in the SIO air sampling network. In Trends: A Compendium of Data on Global Change. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. DOE, Oak Ridge, Tenn., U.S.A.

Source of Temperature data: Brohan, P., J. J. Kennedy, I. Haris, S. F. B. Tett, and P. D. Jones. 2006. Uncertainty estimates in regional and global observed temperature changes: a new dataset from 1850. Journal of Geophysical Research 111: D12106, doi:10.1029/2003JA009974.

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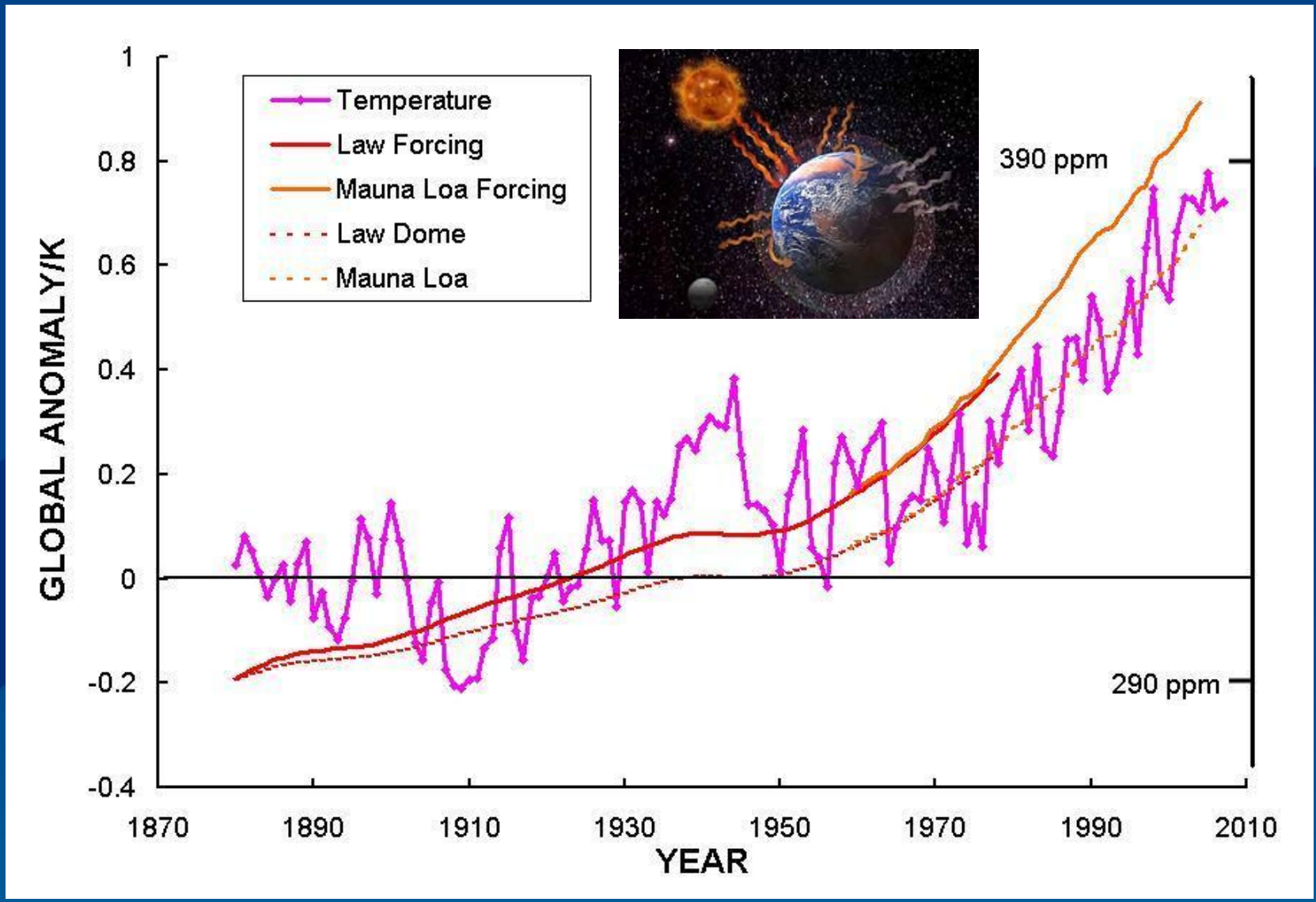
Temperature
Law Forcing
Mauna Loa Forcing
Law Dome
Mauna Loa
390 ppm
290 ppm
GLOBAL ANOMALY/K
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
1870
1890
1910
1930
1950
1970
1990
2010
YEAR

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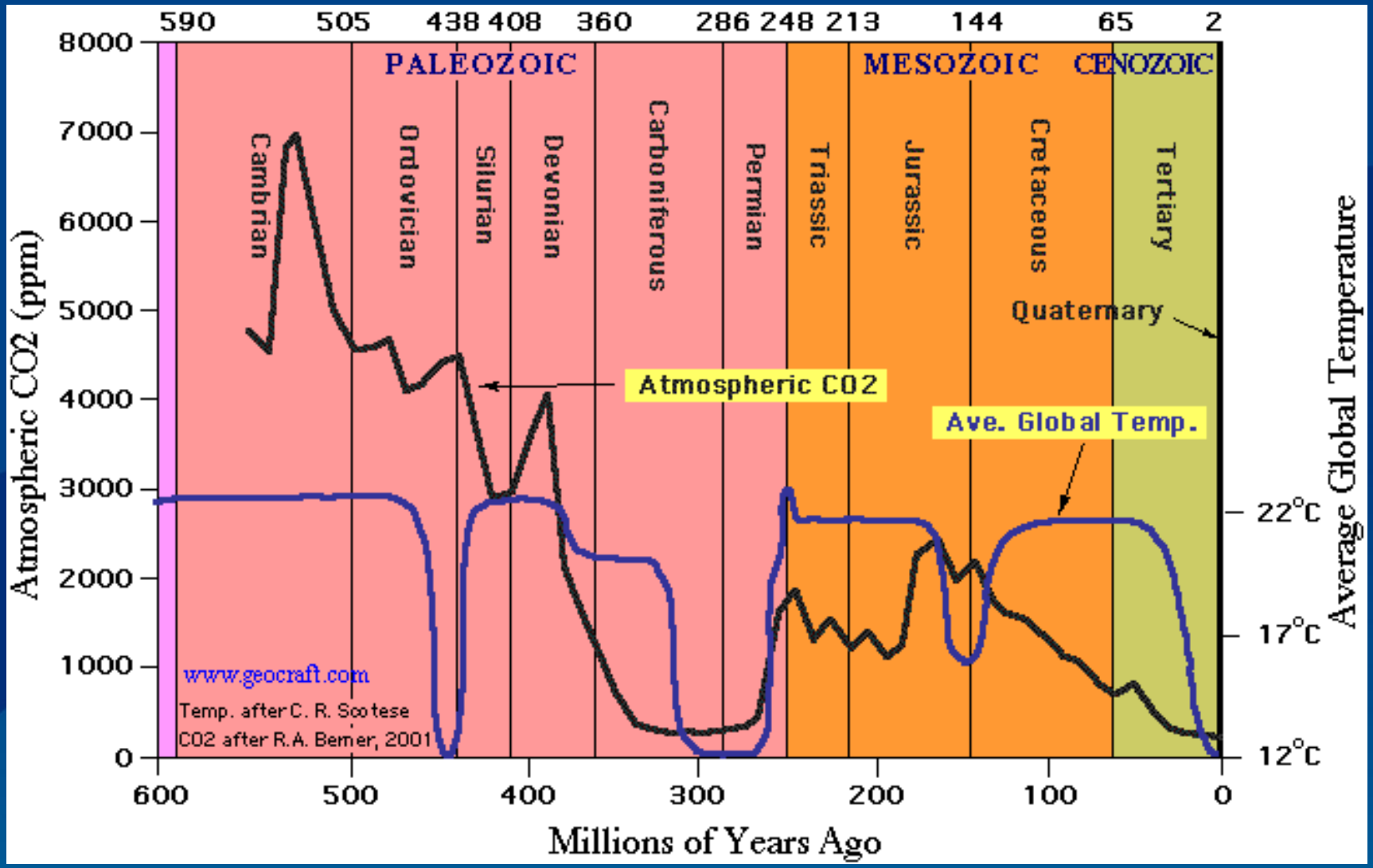
Climate has changed before


590
505
438 408
360
286 248 213
144
65
2
PALEOZOIC
MESOZOIC
CENOZOIC
Cambrian
Ordovician
Silurian
Devonian
Carboniferous
Permian
Triassic
Jurassic
Cretaceous
Tertiary
Quaternary
Atmospheric CO2
Ave. Global Temp.
Atmospheric CO2 (ppm)
8000
7000
6000
5000
4000
3000
2000
1000
0
22°C
17°C
12°C
Average Global Temperature
600
500
400
300
200
100
0
Millions of Years Ago
www.geocraft.com
Temp. after C. R. Scotese
CO2 after R.A. Berner, 2001

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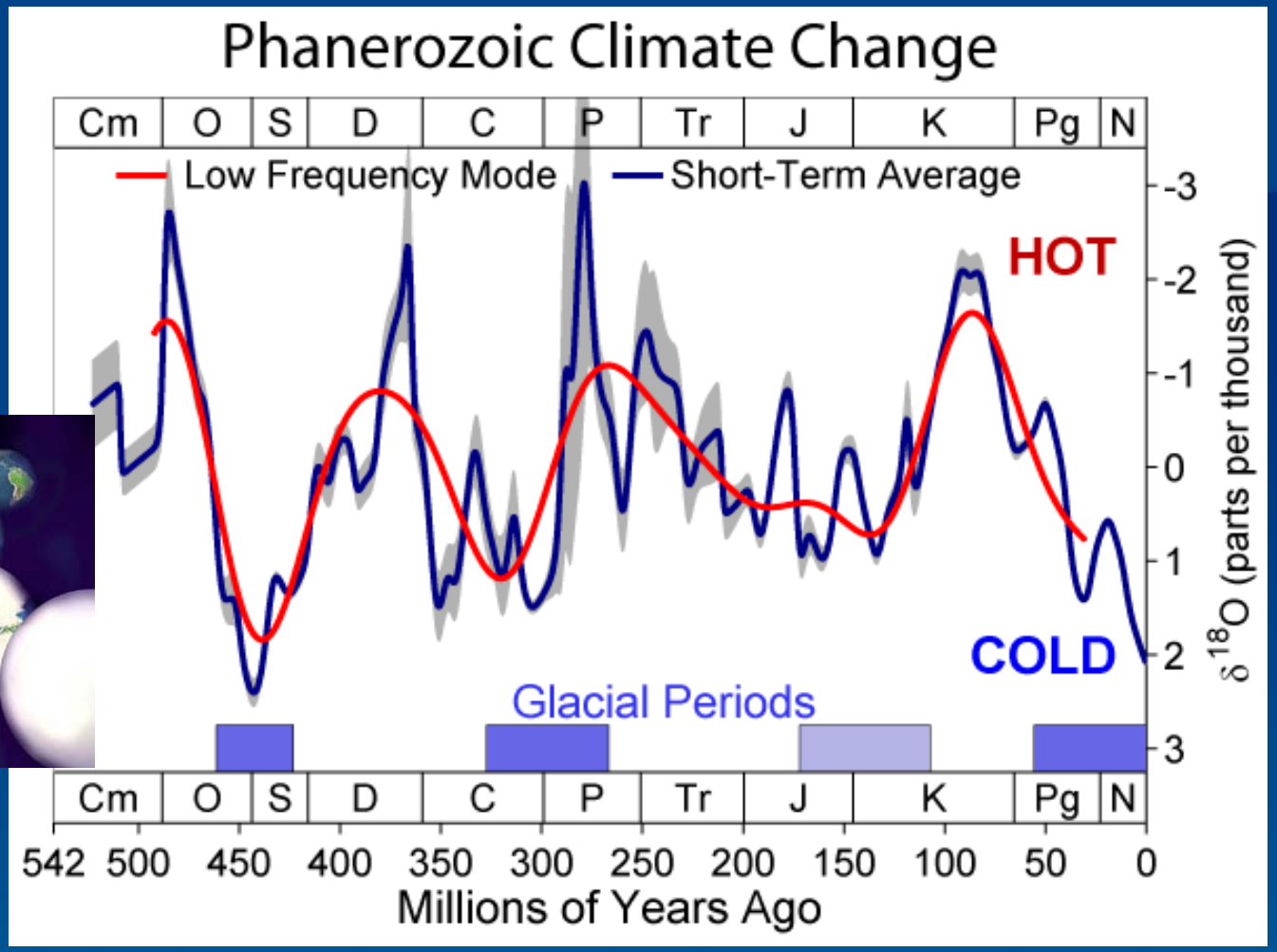

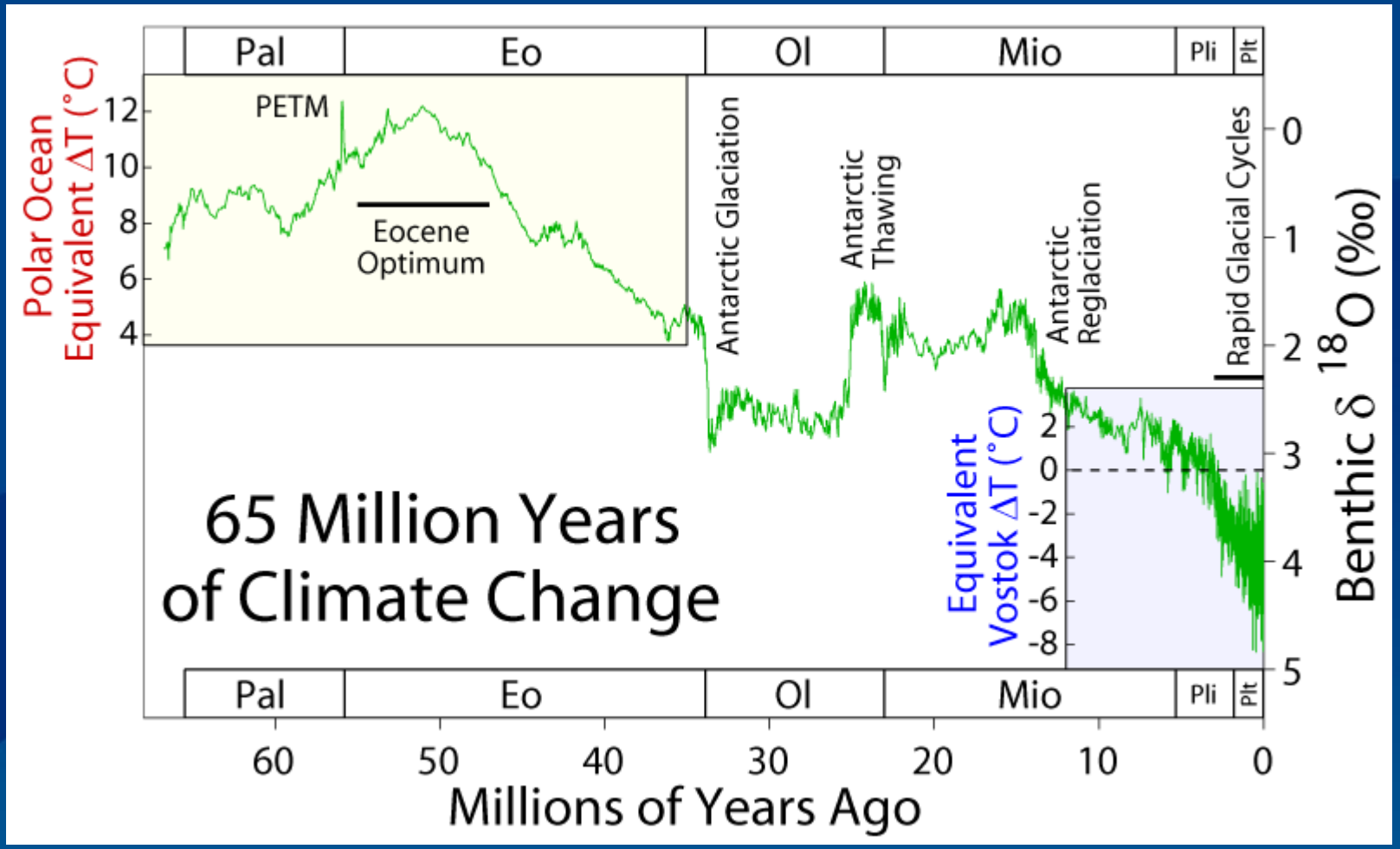
Pal
Eo
Ol
Mio
Pli
Plt
PETM
Eocene Optimum
Antarctic Glaciation
Antarctic Thawing
Antarctic Reglaciation
Rapid Glacial Cycles
Polar Ocean Equivalent ΔT (°C)
12
10
8
6
4
Equivalent Vostok ΔT (°C)
2
0
-2
-4
-6
-8
Benthic δ 18O (‰)
0
1
2
3
4
5
65 Million Years of Climate Change
60
50
40
30
20
10
0
Millions of Years Ago

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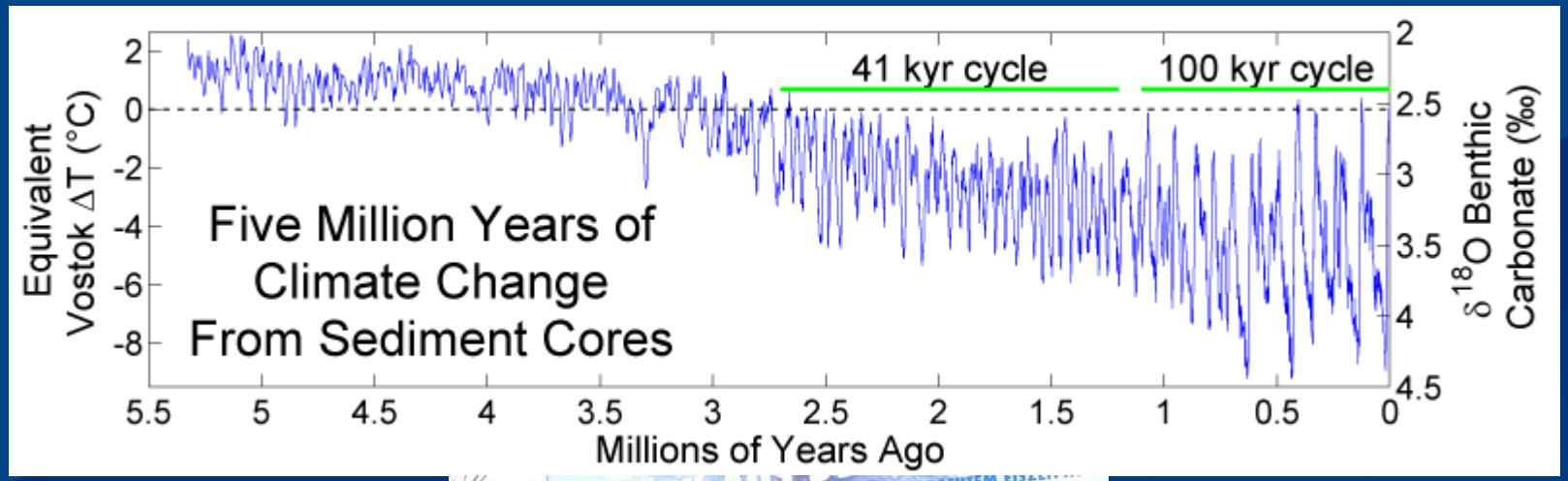

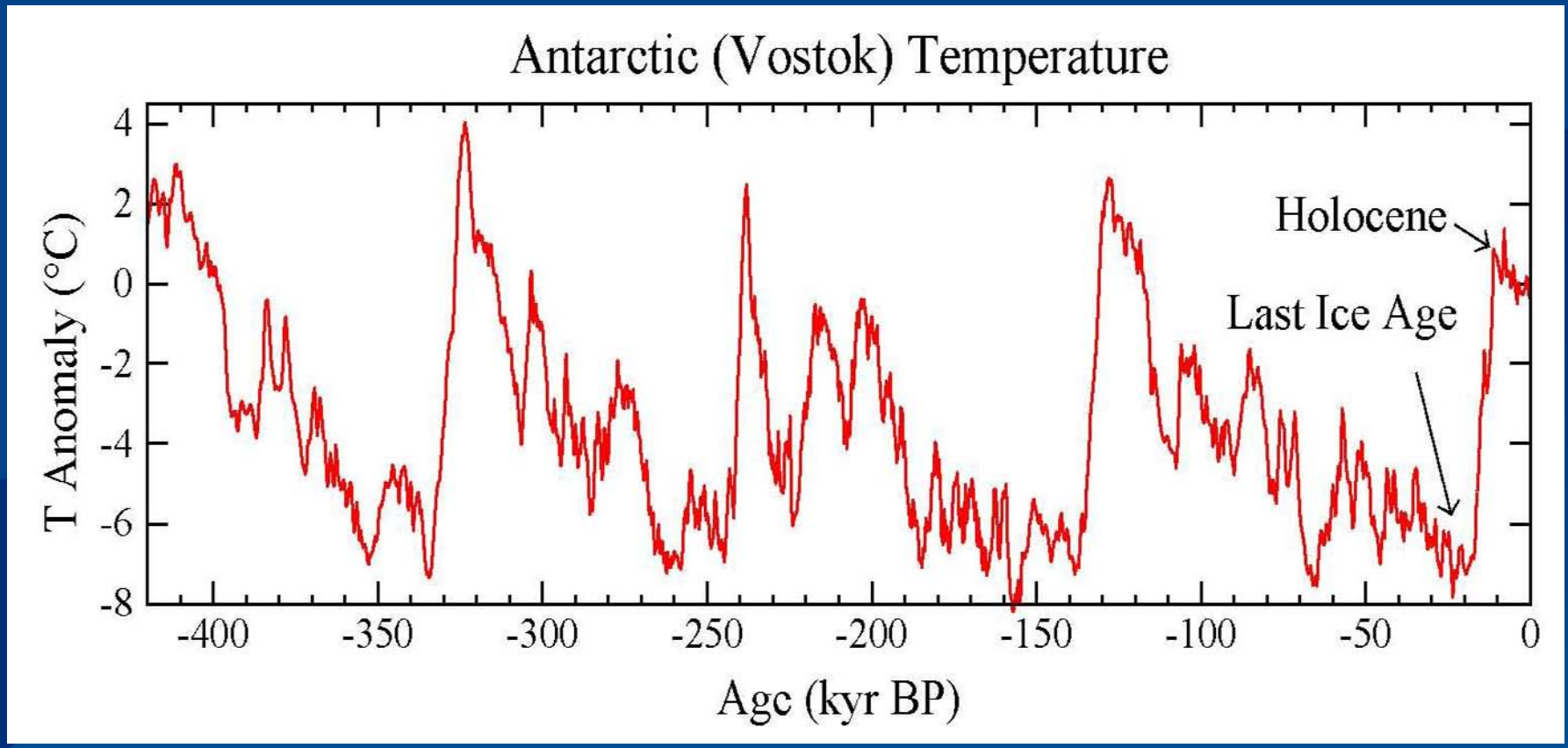
Antarctic (Vostok) Temperature
T Anomaly (°C)
4
2
0
-2
-4
-6
-8
-400
-350
-300
-250
-200
-150
-100
-50
0
Age (kyr BP)
Holocene
Last Ice Age

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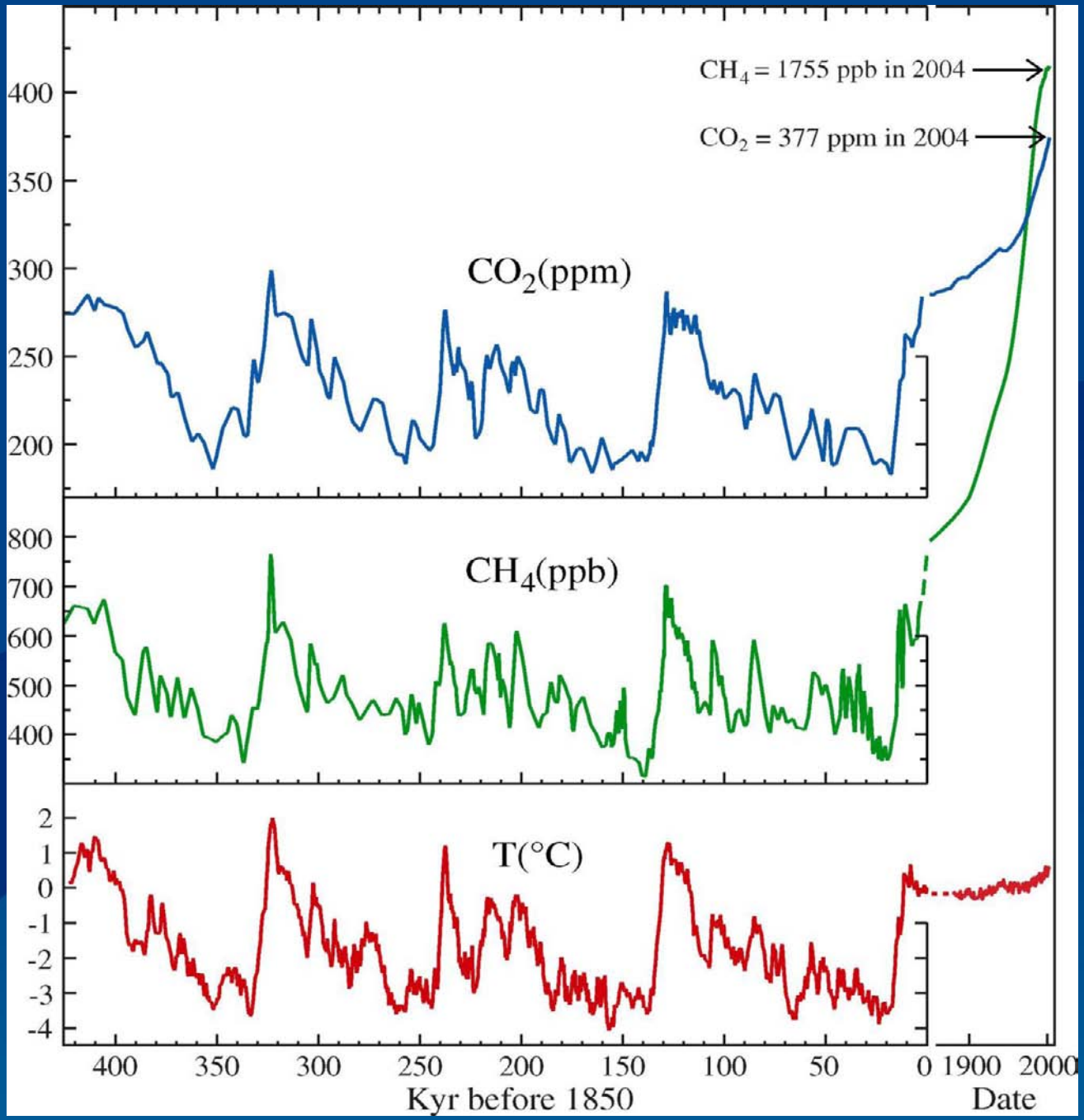
CO_2 lags temperature



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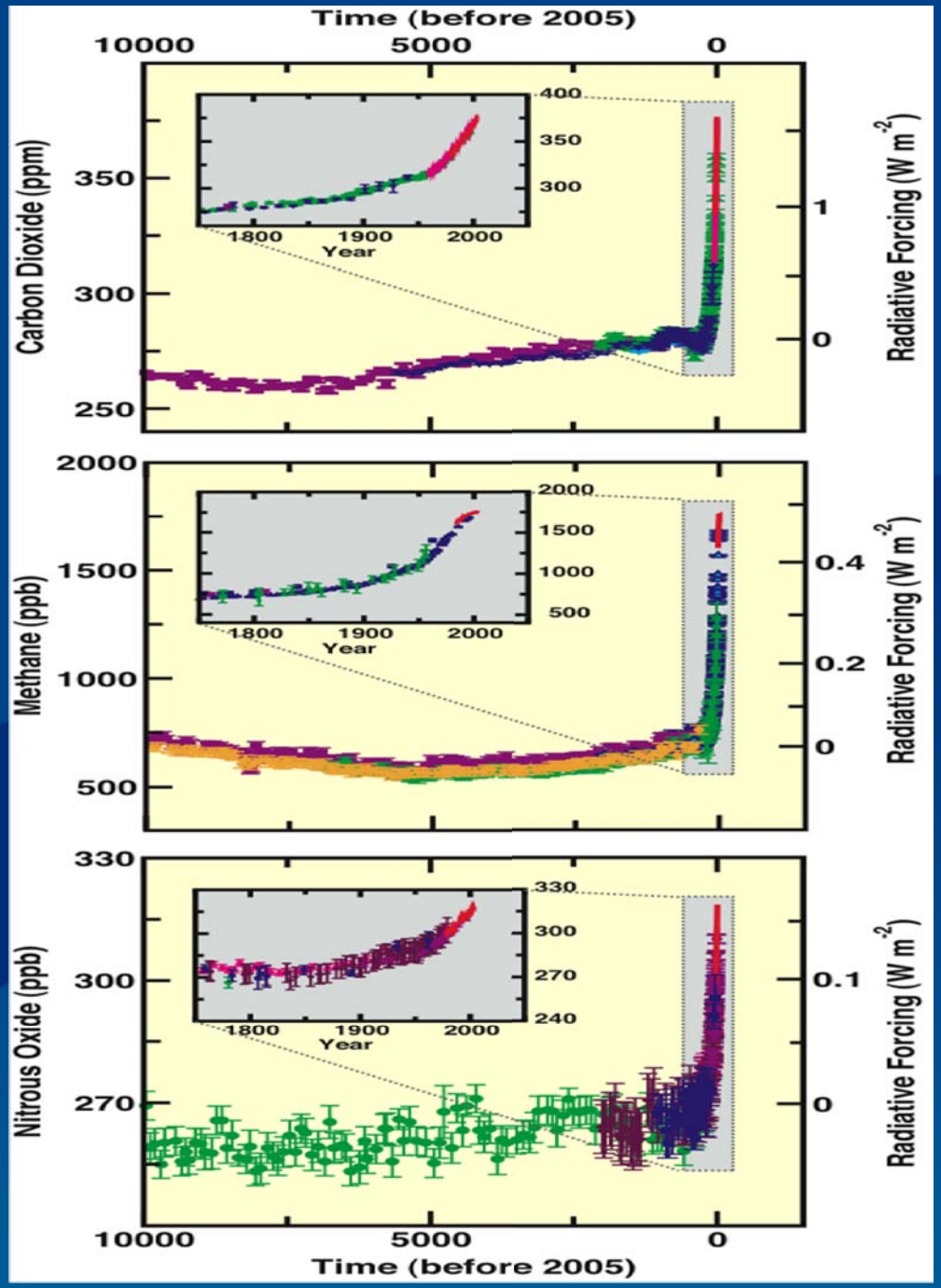

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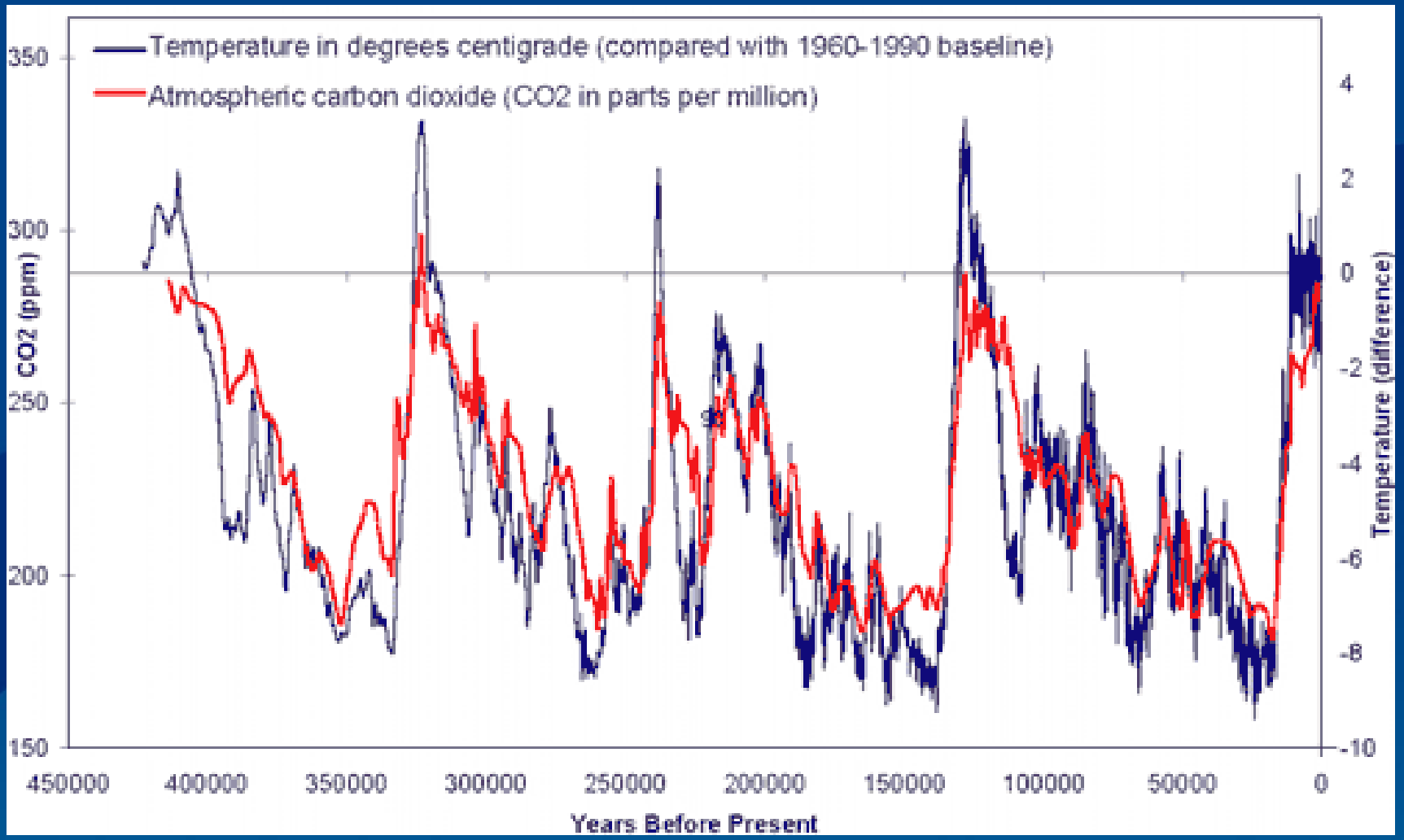

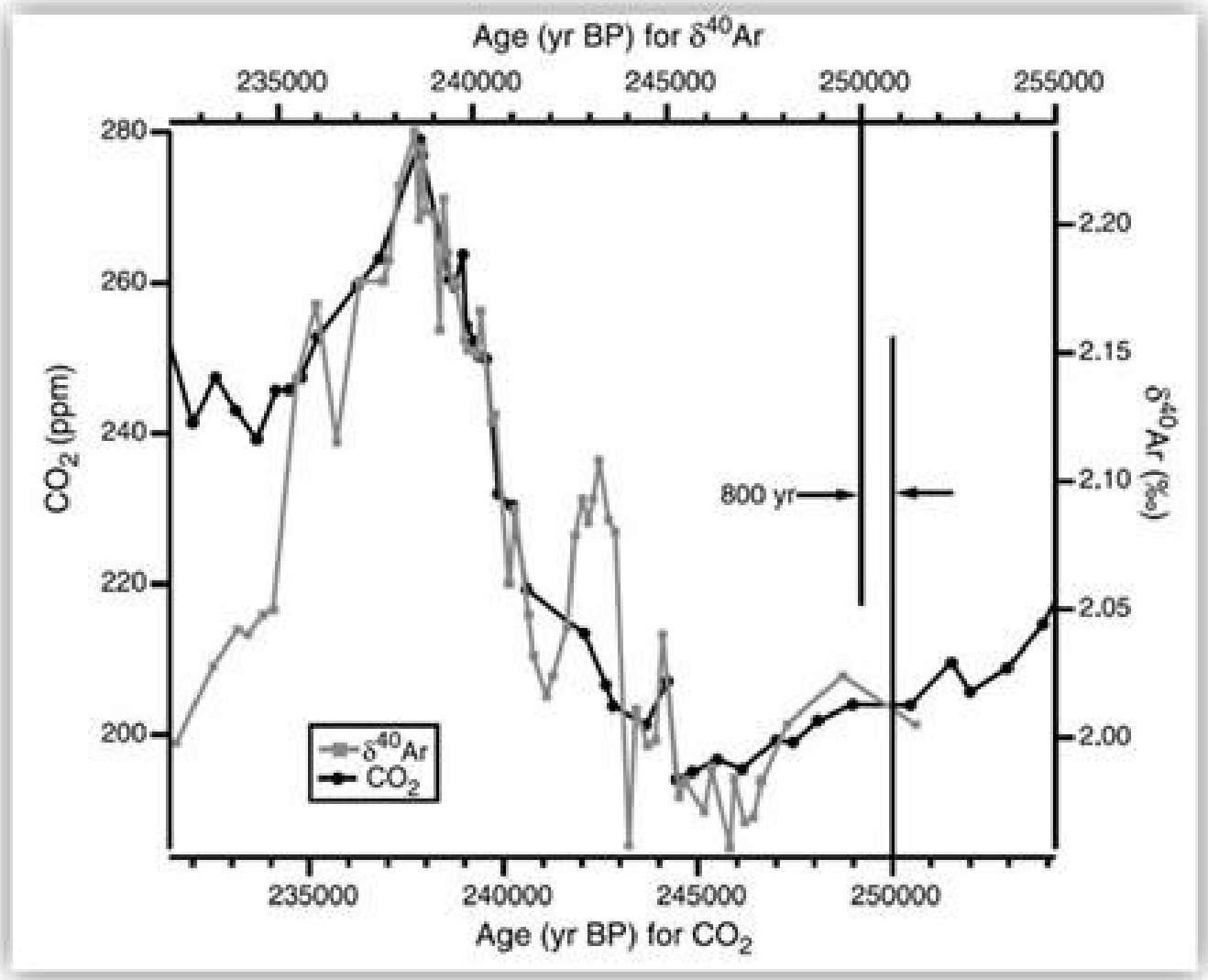
Age (yr BP) for δ^{40}Ar
235000
240000
245000
250000
255000
280
260
240
220
200
CO_2 (ppm)
2.20
2.15
2.10
2.05
2.00
δ^{40}Ar (‰)
800 yr
δ^{40}Ar
CO_2
235000
240000
245000
250000
Age (yr BP) for CO_2

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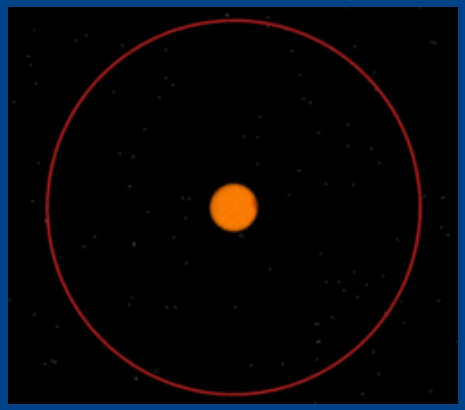

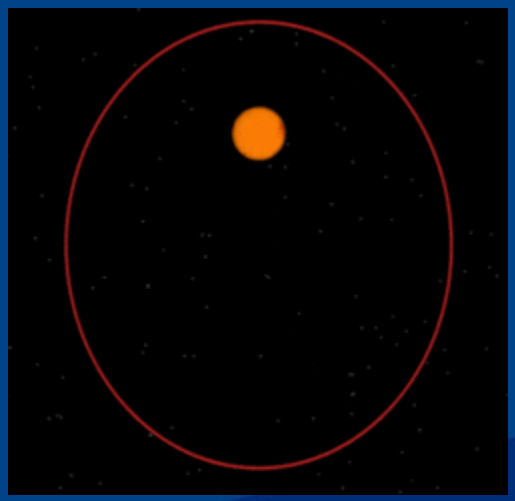

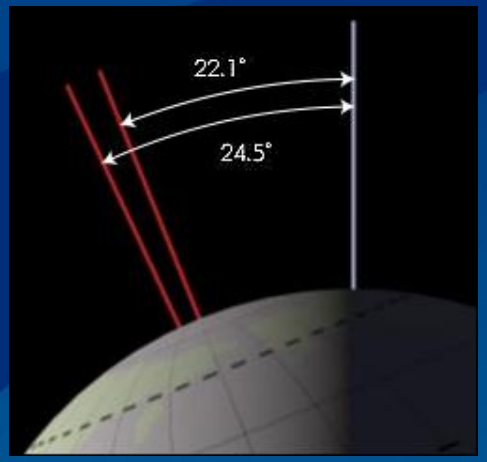

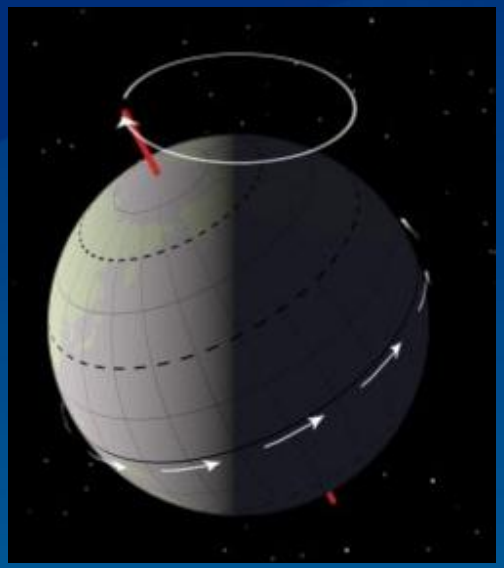

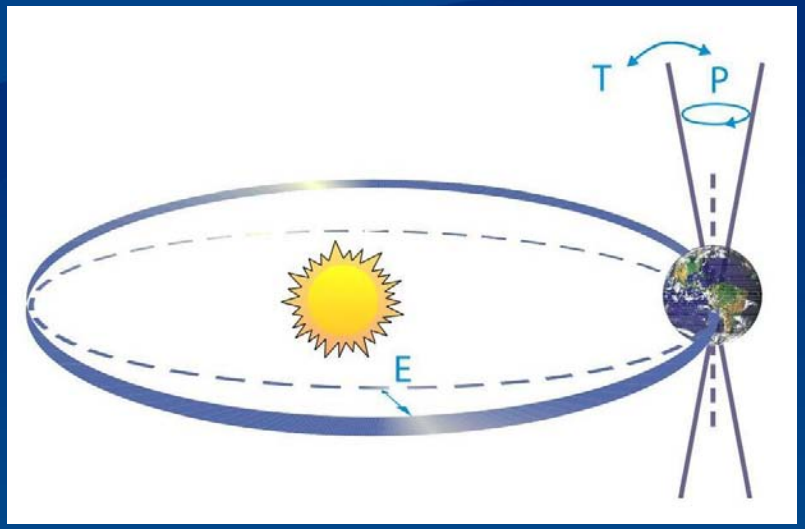

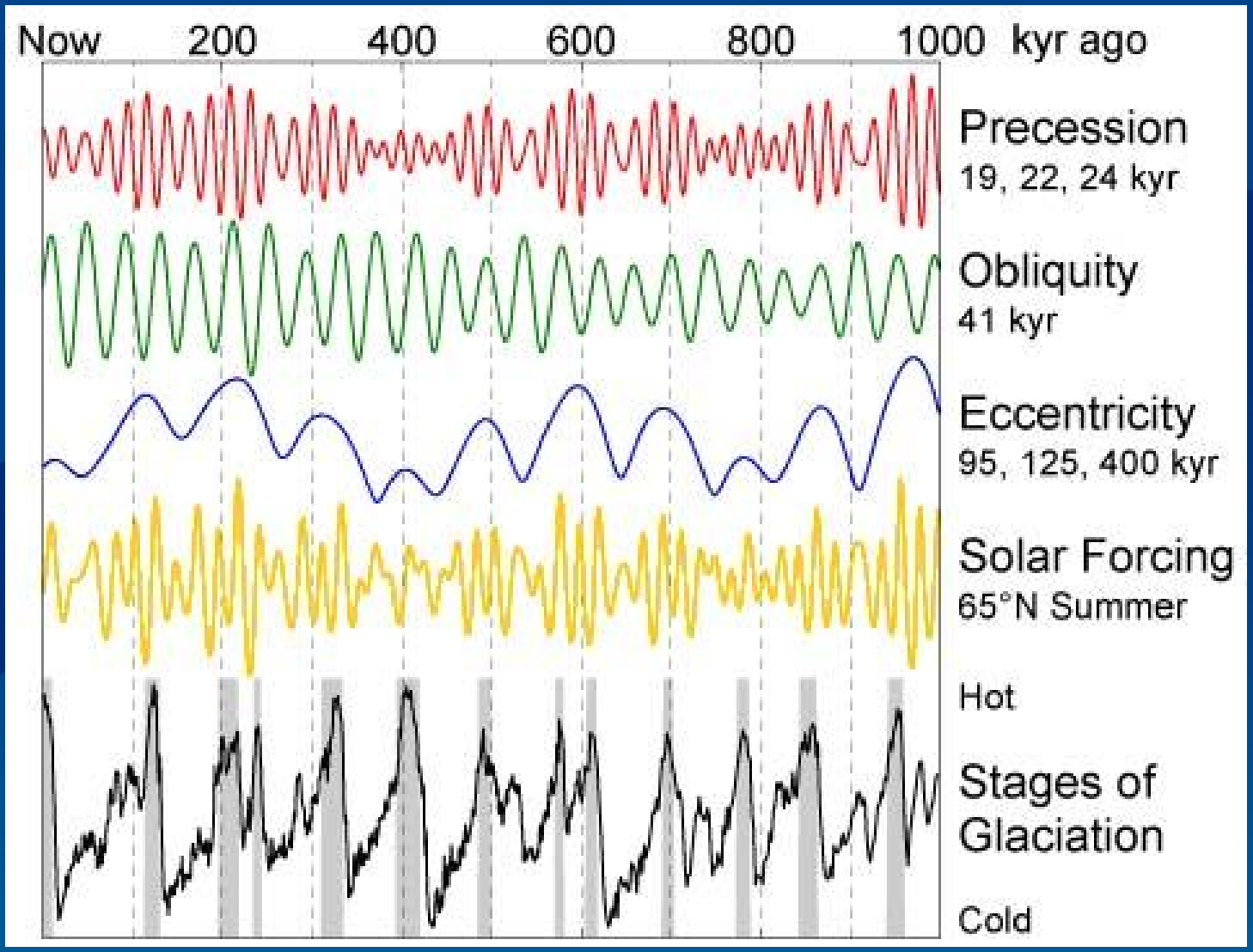
Now
200
400
600
800
1000
kyr ago
Precession
19, 22, 24 kyr
Obliquity
41 kyr
Eccentricity
95, 125, 400 kyr
Solar Forcing
65°N Summer
Hot
Stages of Glaciation
Cold

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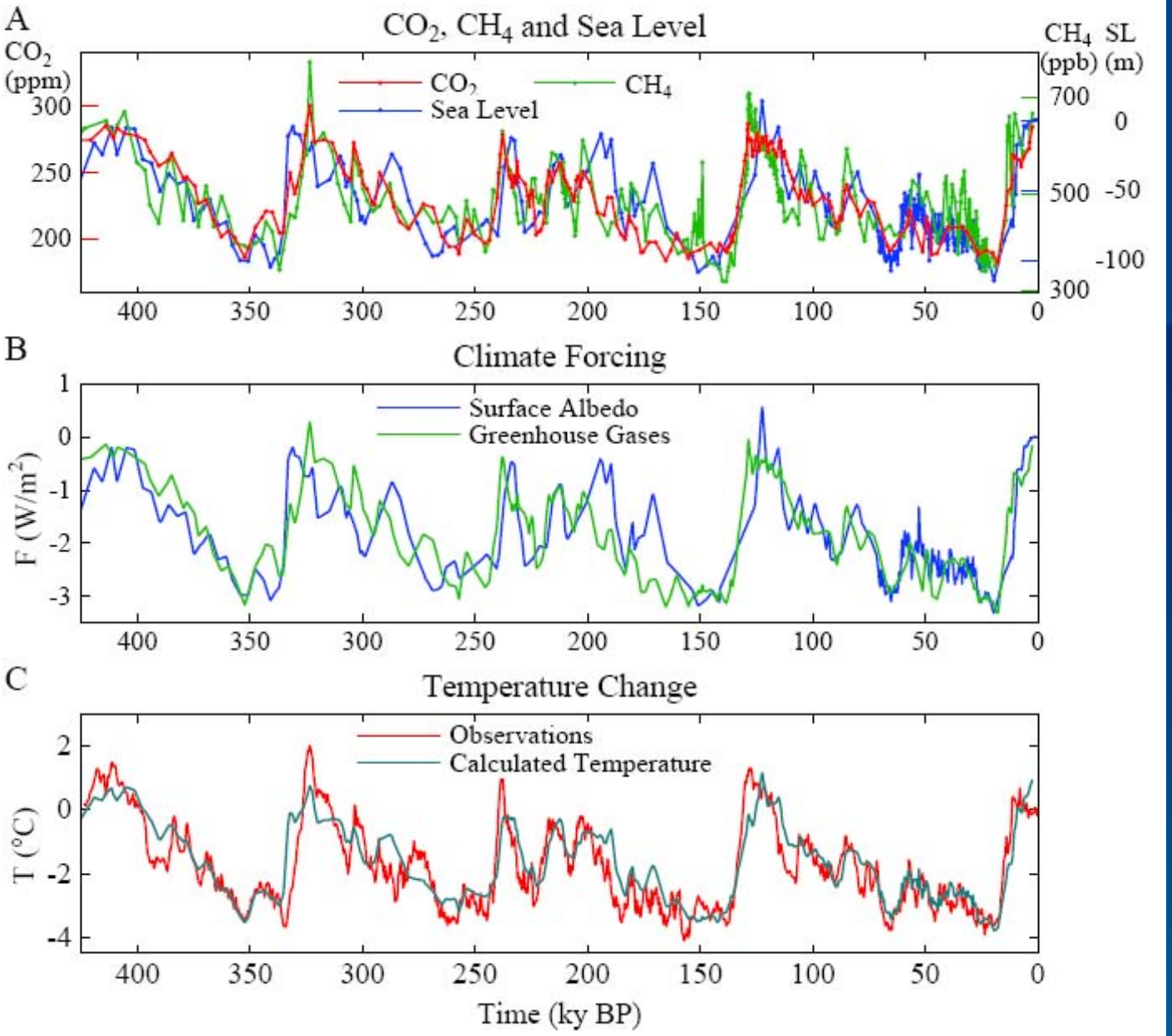
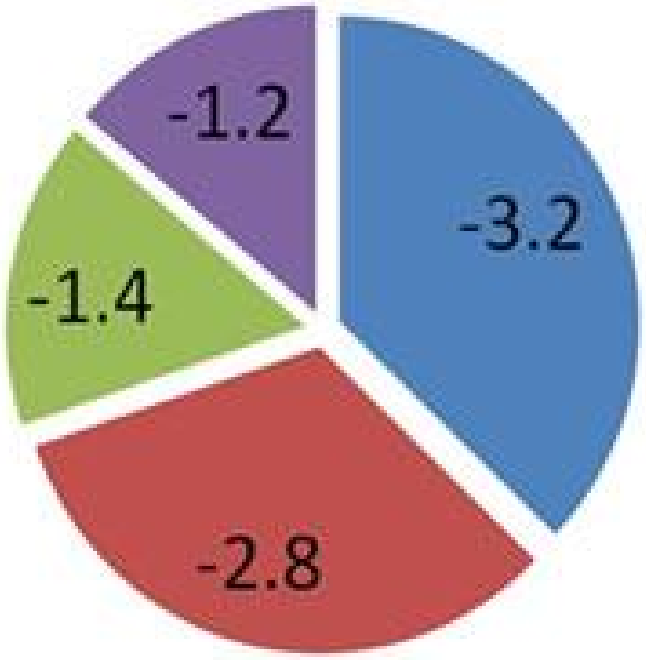
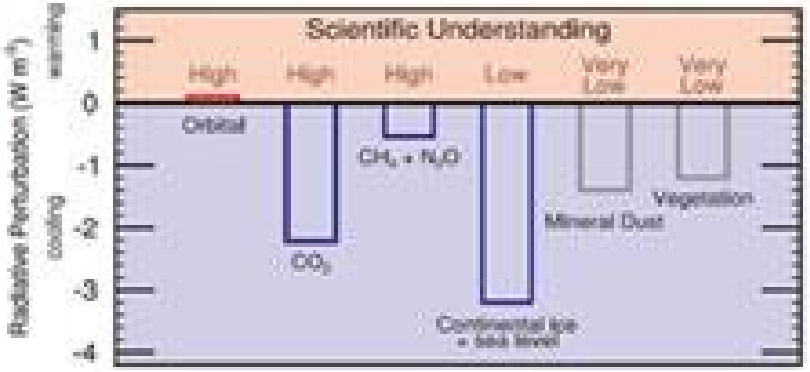


Radiative Forcing during Last Glacial Maximum (LGM)

(watts per square meter)



- Ice & Sea Level Albedo
- Greenhouse Gases
- Vegetation
- Mineral Dust



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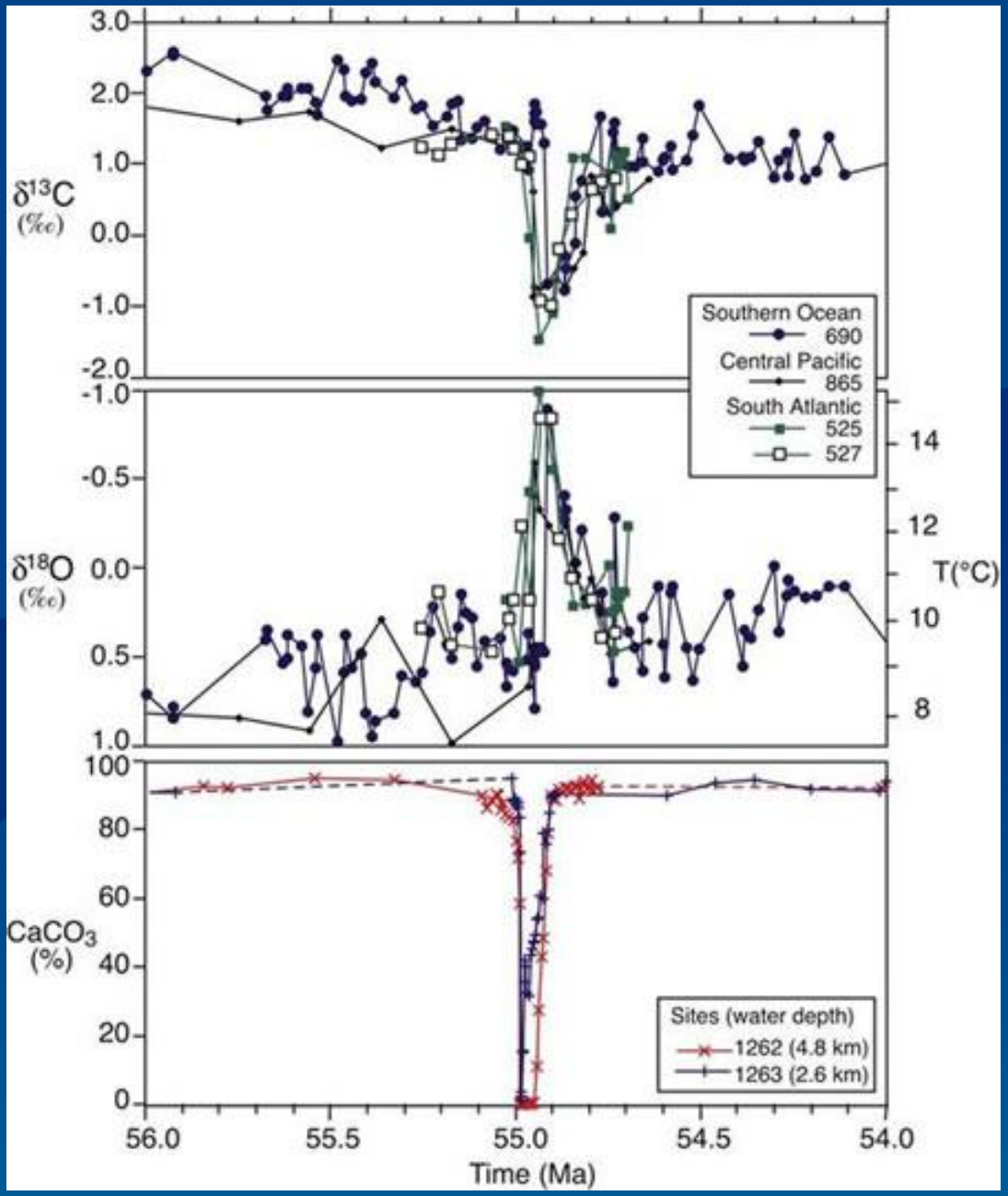
SUB CRUCE LUMEN



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Natural sources dwarf human emissions

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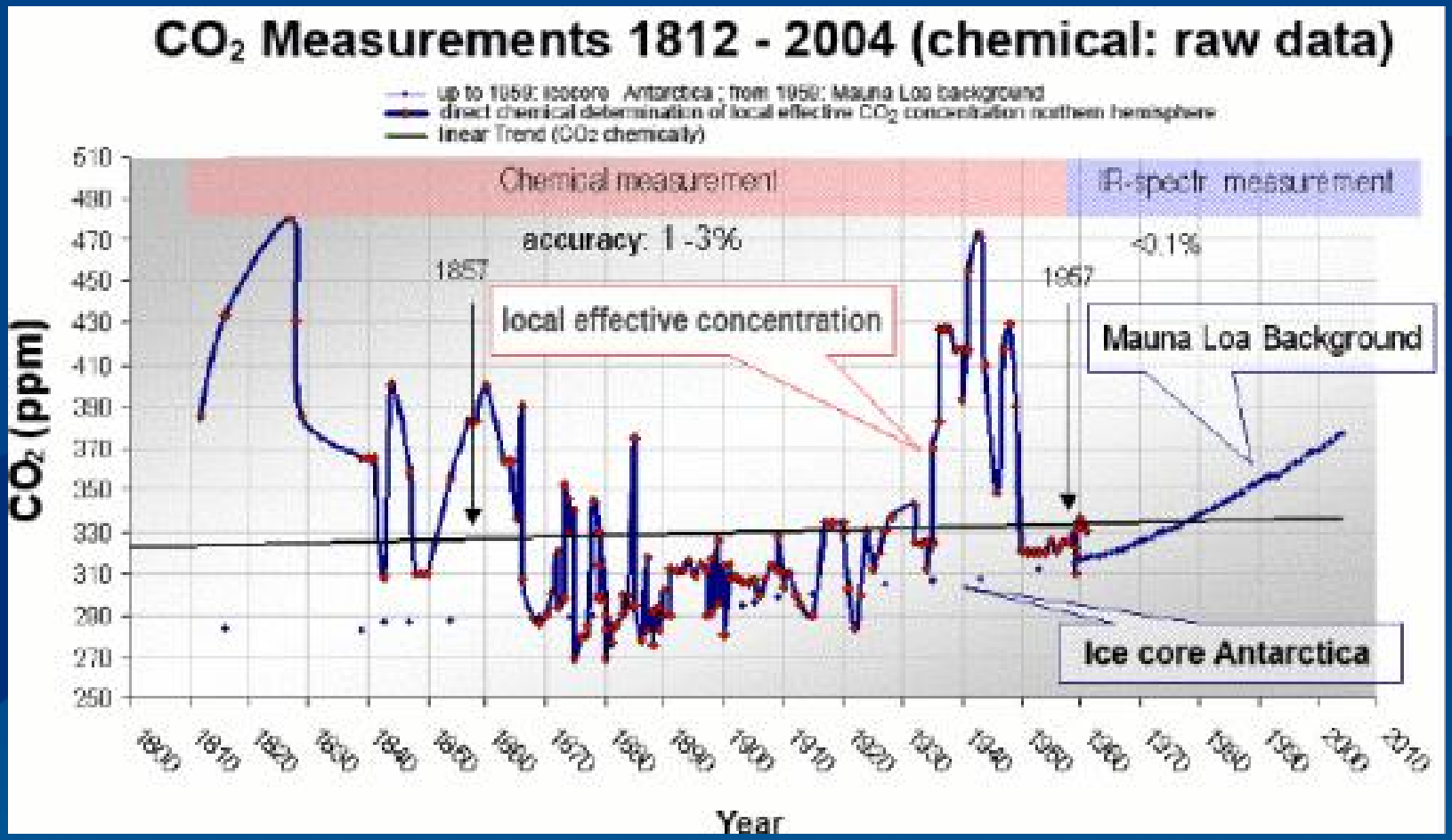
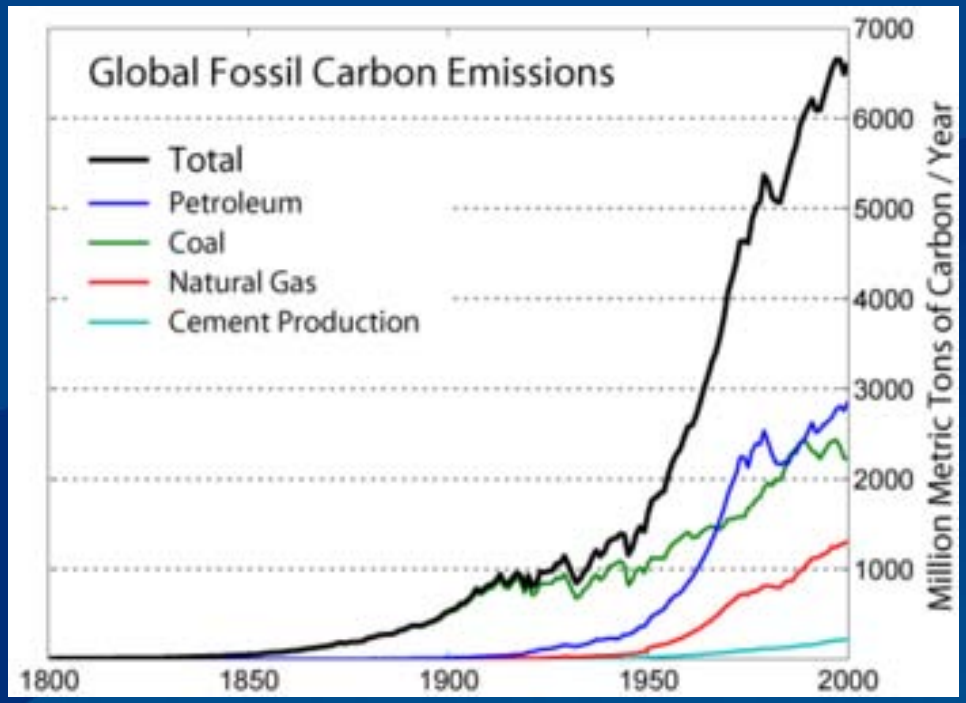
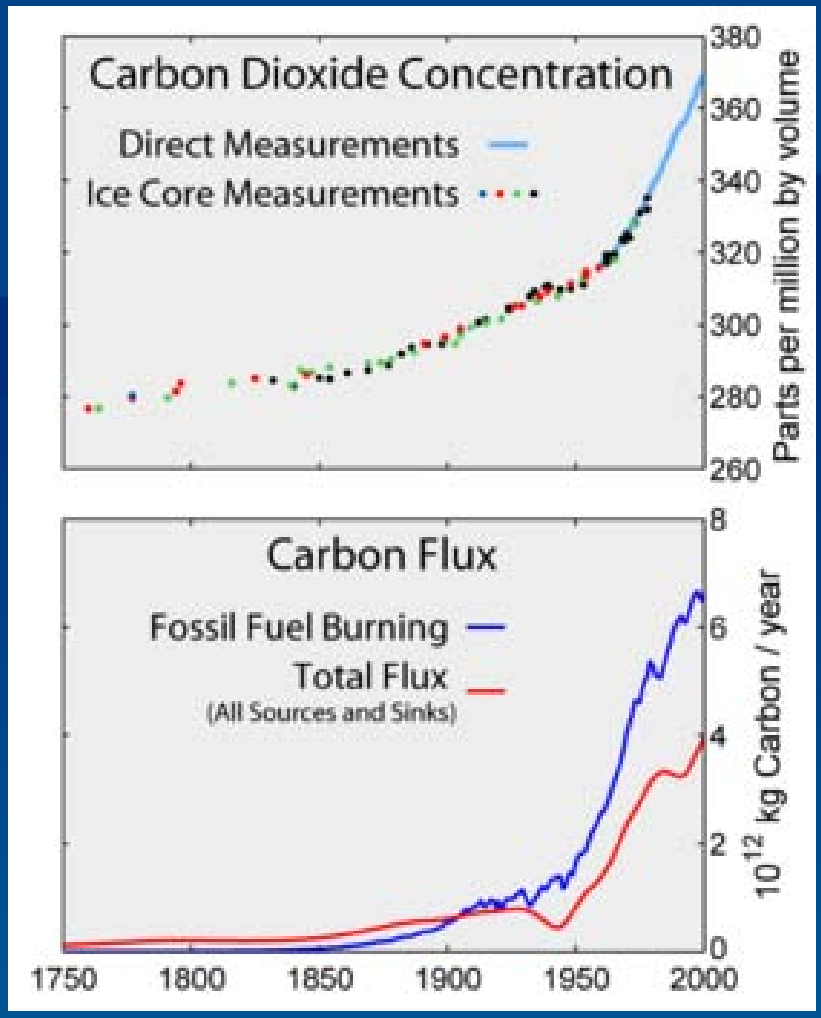
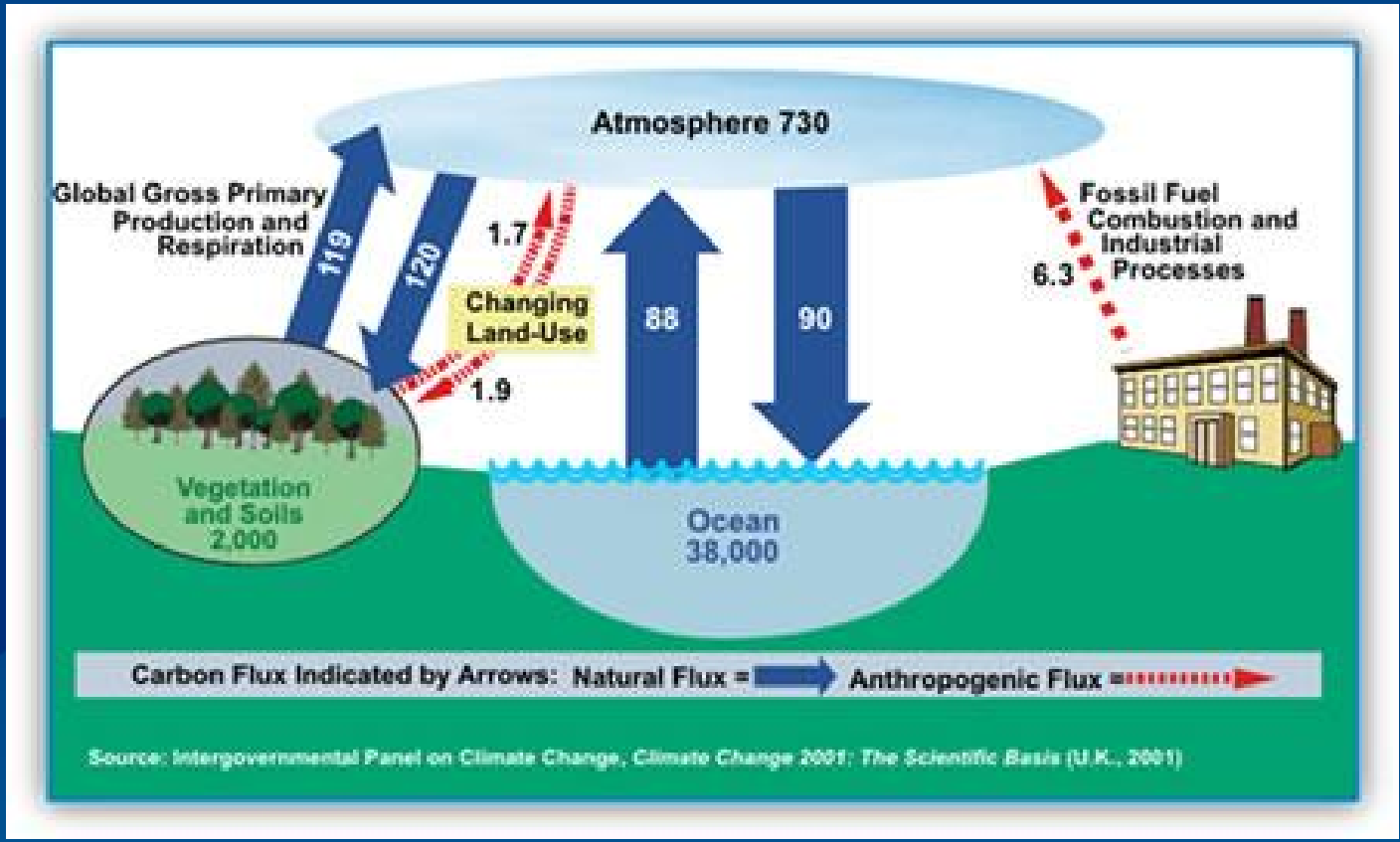
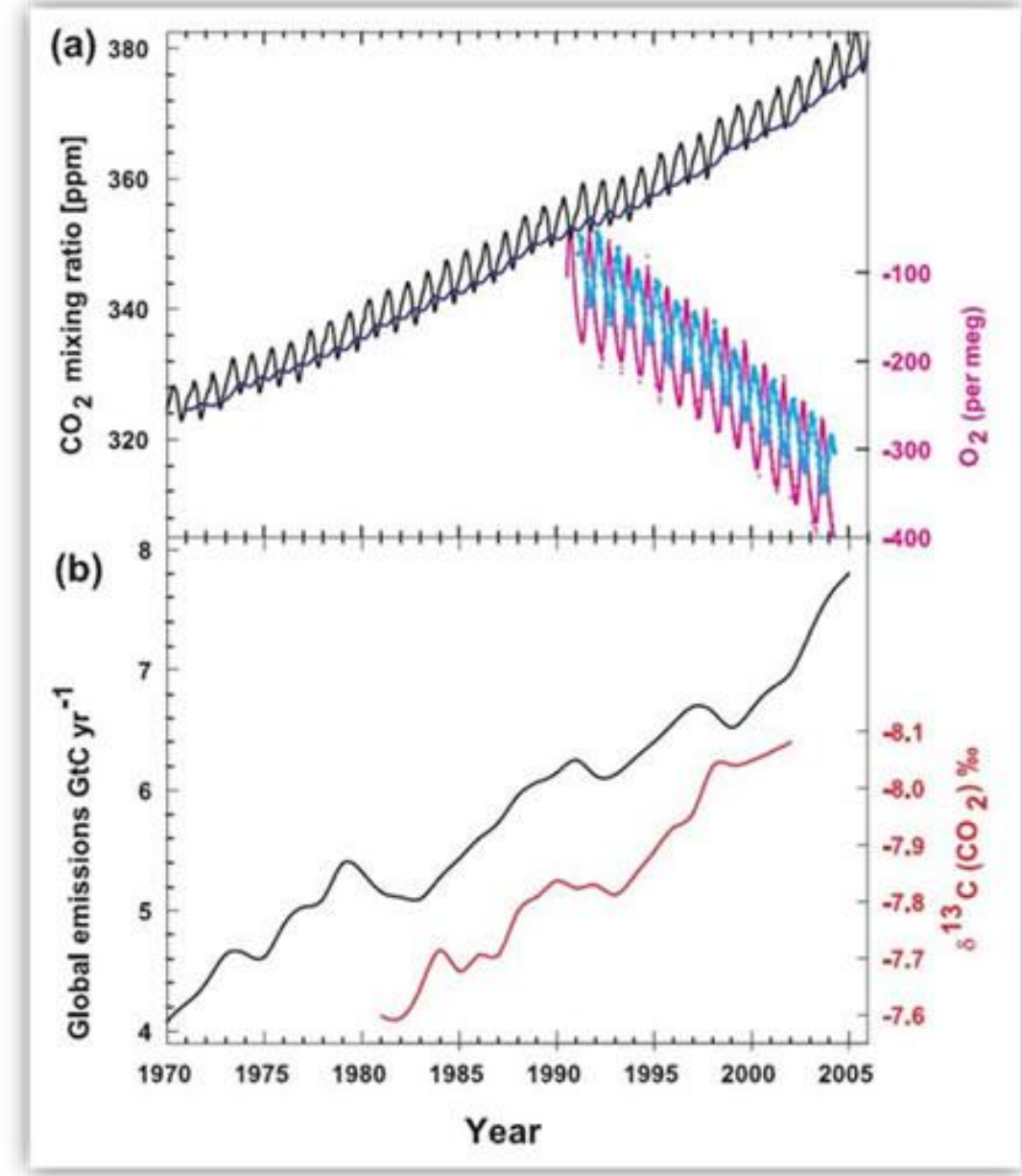



Global Fossil Carbon Emissions
Total
Petroleum
Coal
Natural Gas
Cement Production
Million Metric Tons of Carbon / Year
7000
6000
5000
4000
3000
2000
1000
1800
1850
1900
1950
2000


Carbon Dioxide Concentration
Direct Measurements
Ice Core Measurements
Parts per million by volume
380
360
340
320
300
280
260
Carbon Flux
Fossil Fuel Burning
Total Flux
(All Sources and Sinks)
10^{12} kg Carbon / year
8
6
4
2
0
1750
1800
1850
1900
1950
2000


Atmosphere 730
Global Gross Primary Production and Respiration
119
120
1.7
Changing Land-Use
1.9
88
90
Fossil Fuel Combustion and Industrial Processes
6.3
Vegetation and Soils 2,000
Ocean 38,000
Carbon Flux Indicated by Arrows: Natural Flux = Anthropogenic Flux =
Source: Intergovernmental Panel on Climate Change, Climate Change 2001: The Scientific Basis (U.K., 2001)


(a)
380
360
340
320
CO_2 mixing ratio [ppm]
-100
-200
-300
-400
O_2 (per meg)
(b)
8
7
6
5
4
Global emissions GtC yr^{-1}
-8.1
-8.0
-7.9
-7.8
-7.7
-7.6
$\delta^{13}C$ (CO_2) ‰
1970
1975
1980
1985
1990
1995
2000
2005
Year

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It warmed before 1940 when CO_2 was low

NASA GISS

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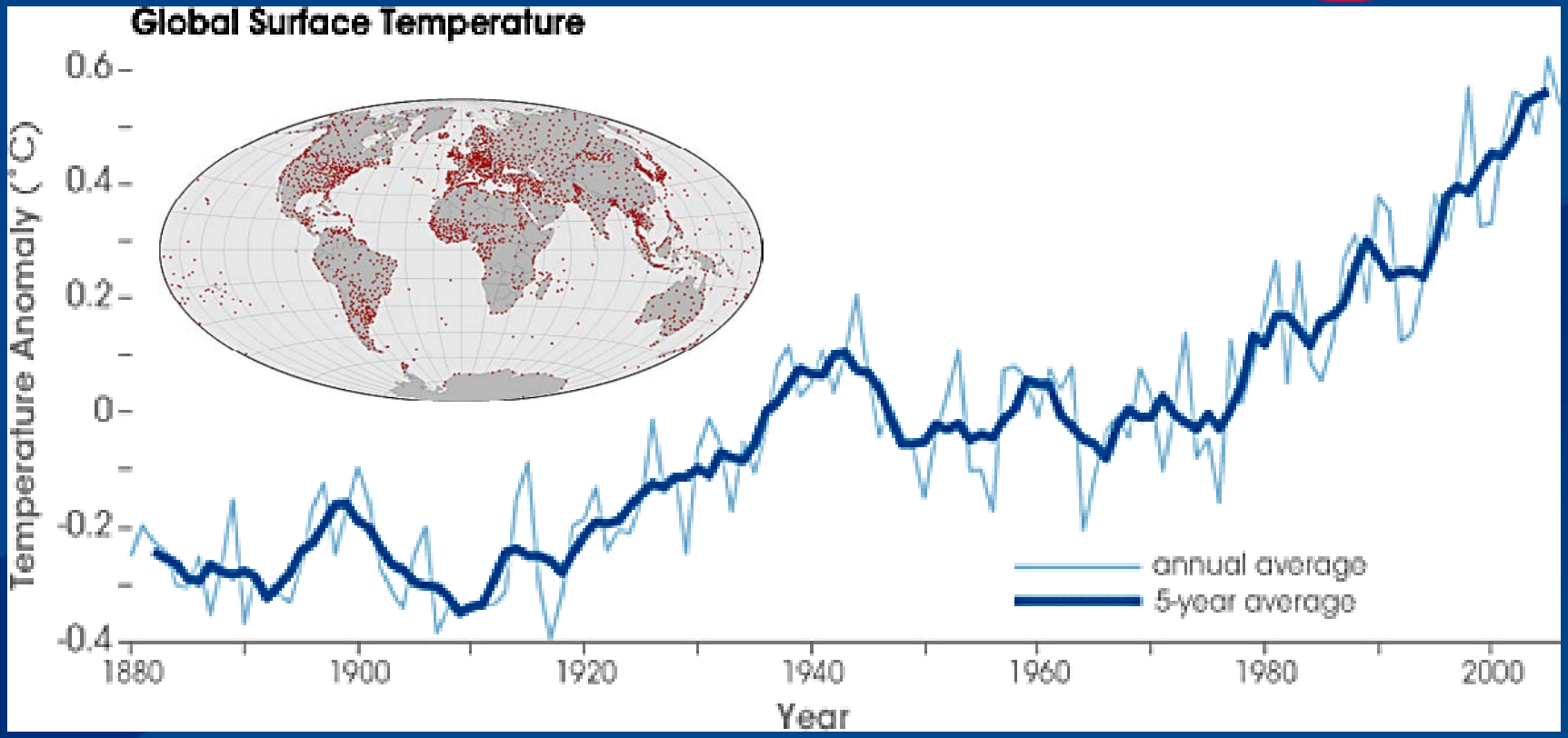

NASA GISS

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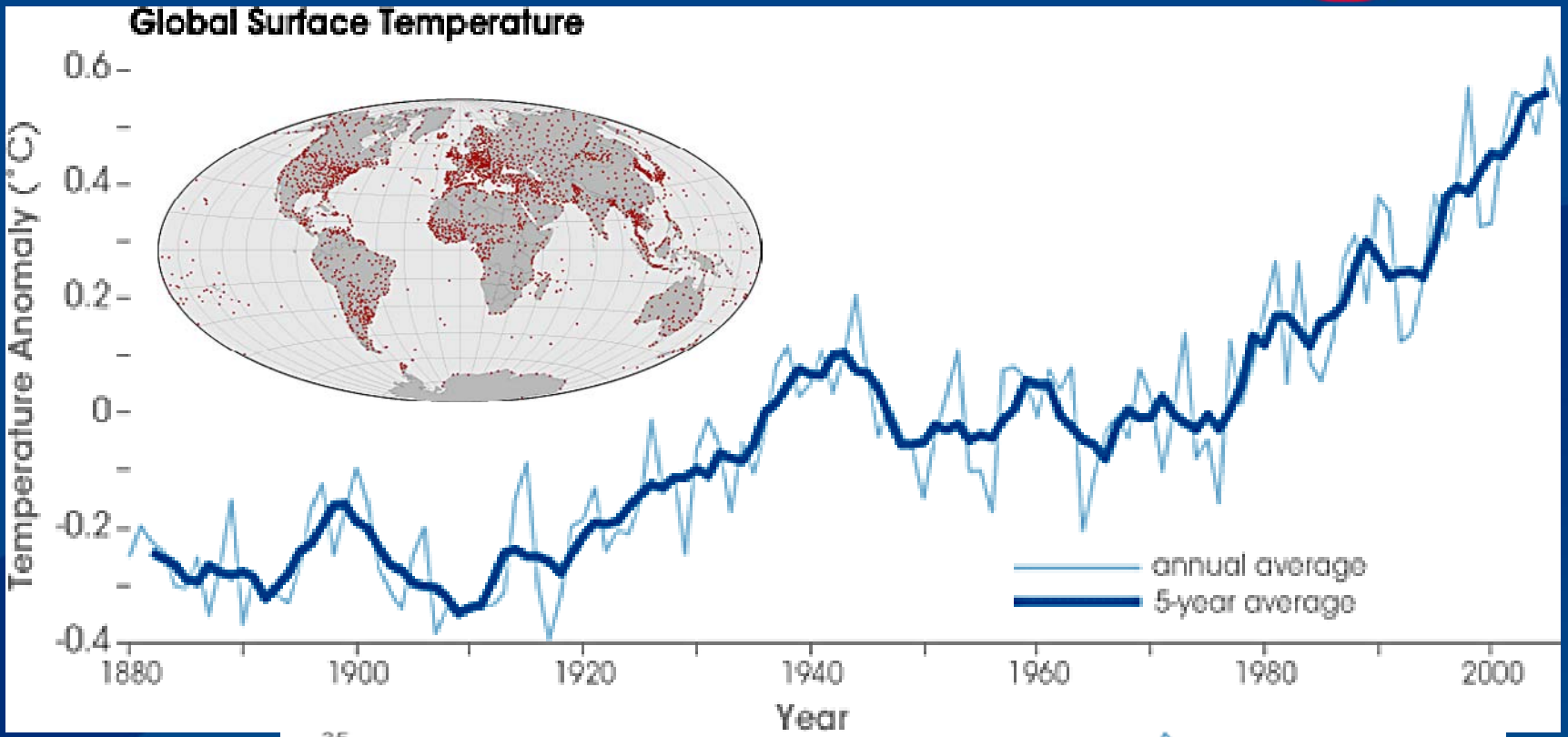
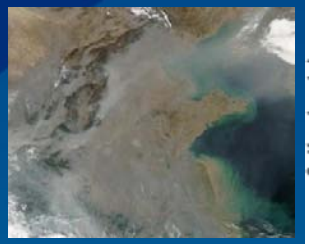
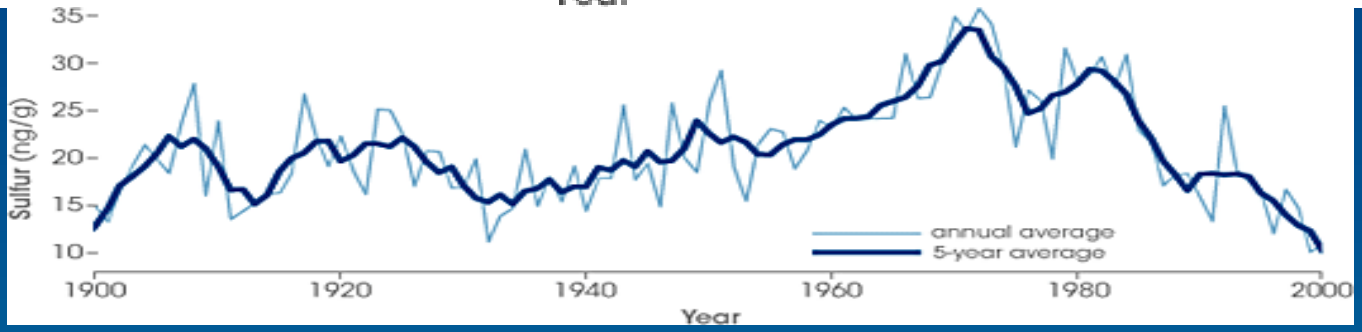
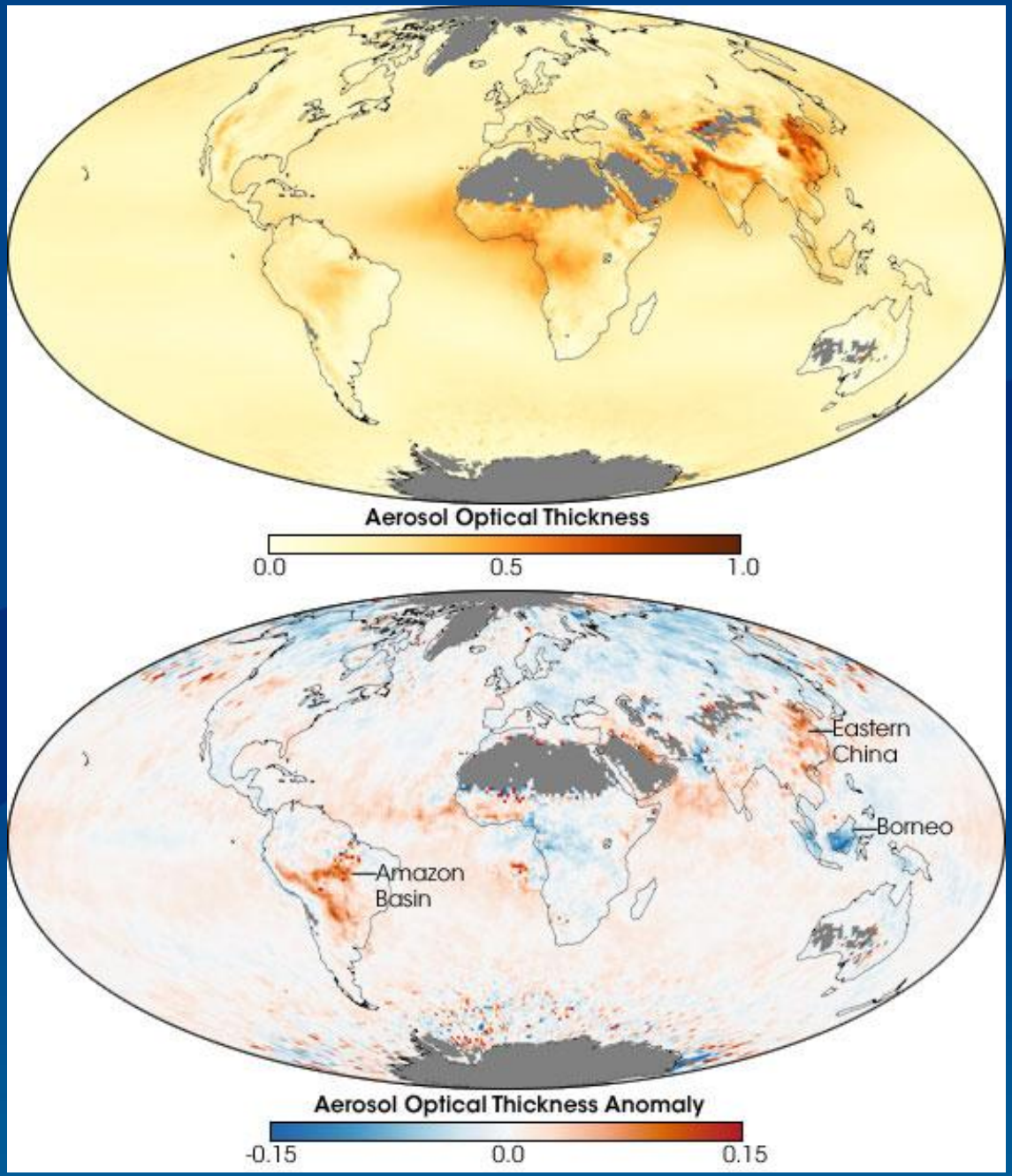
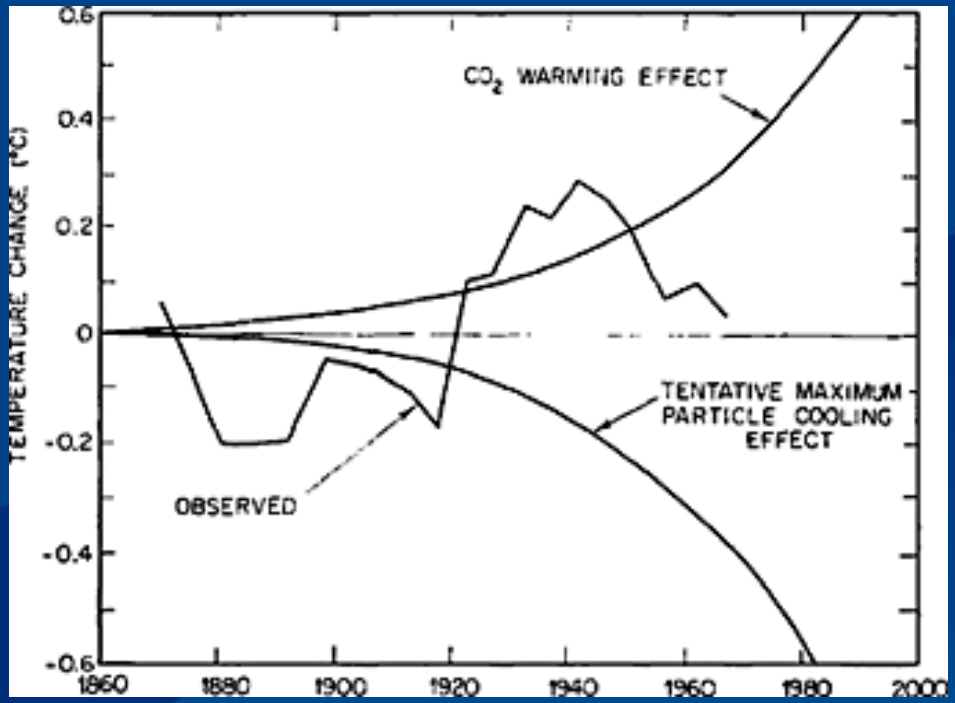
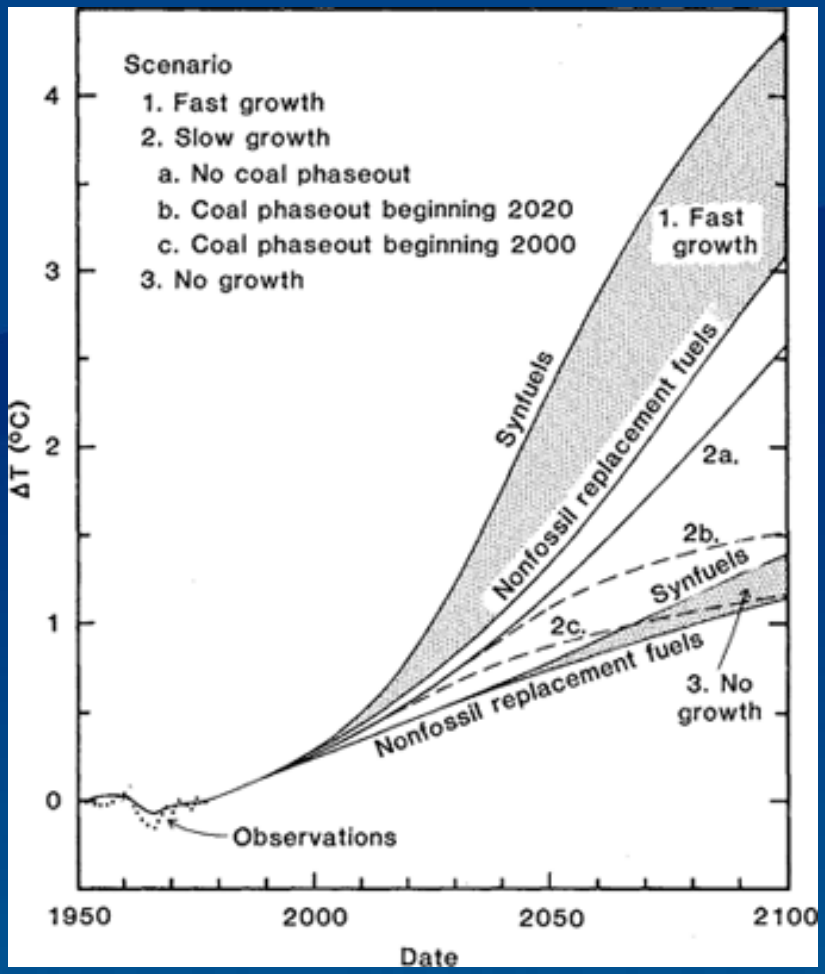


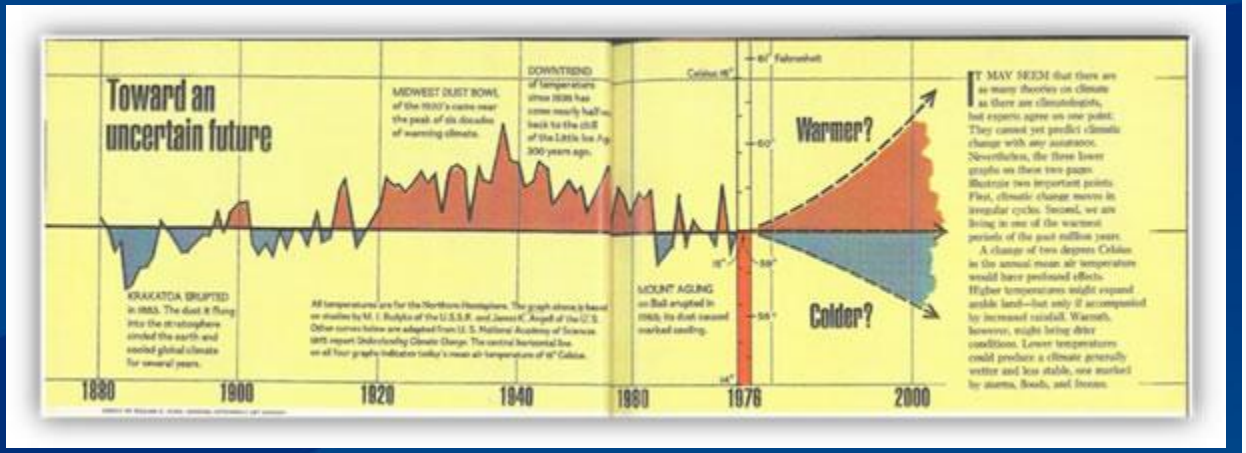


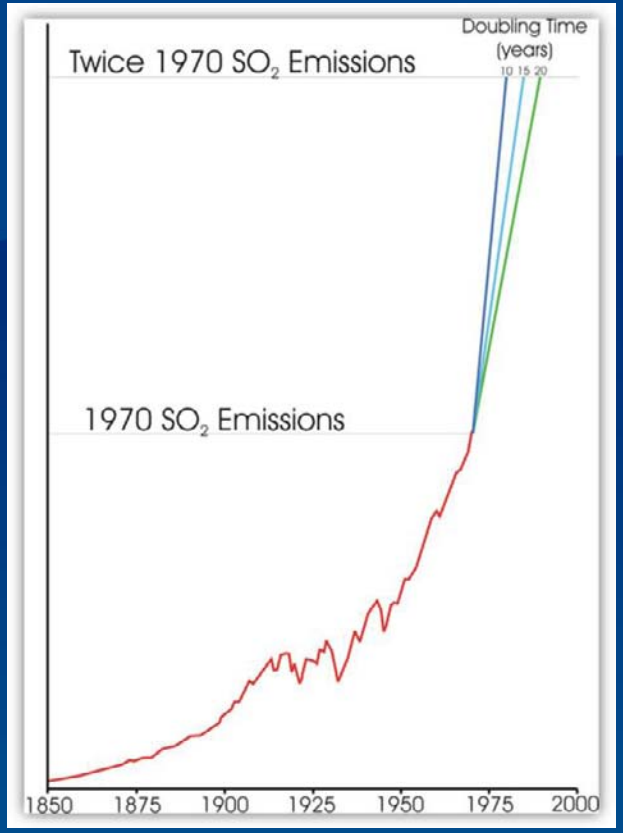



Aerosol Optical Thickness
0.0
0.5
1.0
Eastern China
Borneo
Amazon Basin
Aerosol Optical Thickness Anomaly
-0.15
0.0
0.15


TEMPERATURE CHANGE (°C)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
1860
1880
1900
1920
1940
1960
1980
2000
CO_2 WARMING EFFECT
TENTATIVE MAXIMUM PARTICLE COOLING EFFECT
OBSERVED


Scenario
1. Fast growth
2. Slow growth
a. No coal phaseout
b. Coal phaseout beginning 2020
c. Coal phaseout beginning 2000
3. No growth
ΔT (°C)
4
3
2
1
0
1950
2000
2050
2100
Date
1. Fast growth
Synfuels
Nonfossil replacement fuels
2a.
2b.
Synfuels
2c.
Nonfossil replacement fuels
3. No growth
Observations


Toward an uncertain future
MIDWEST DUST BOWL
DOWNTREND
KRAKATOA ERUPTED
MOUNT AGUNG
Warmer?
Colder?
1880
1900
1920
1940
1960
1976
2000


Doubling Time (years)
10 15 20
Twice 1970 SO_2 Emissions
1970 SO_2 Emissions
1850
1875
1900
1925
1950
1975
2000

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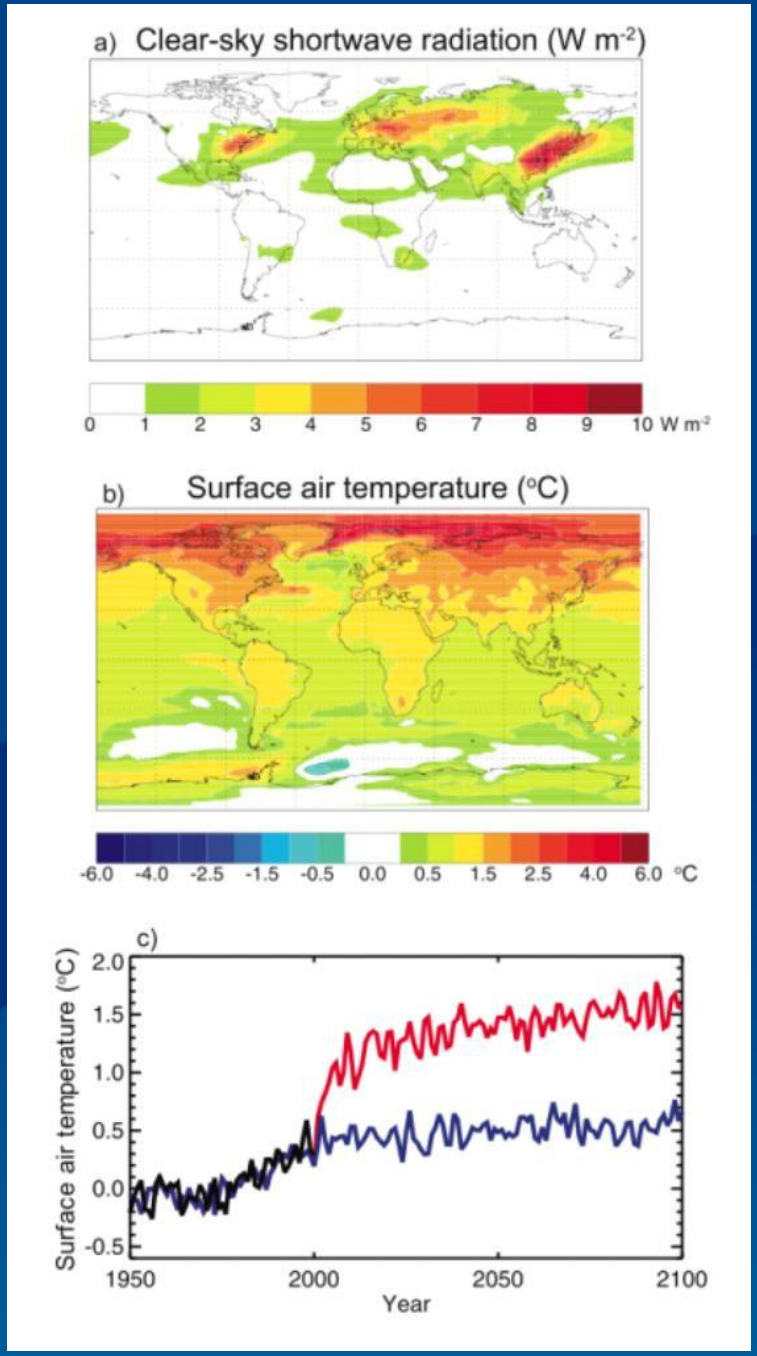

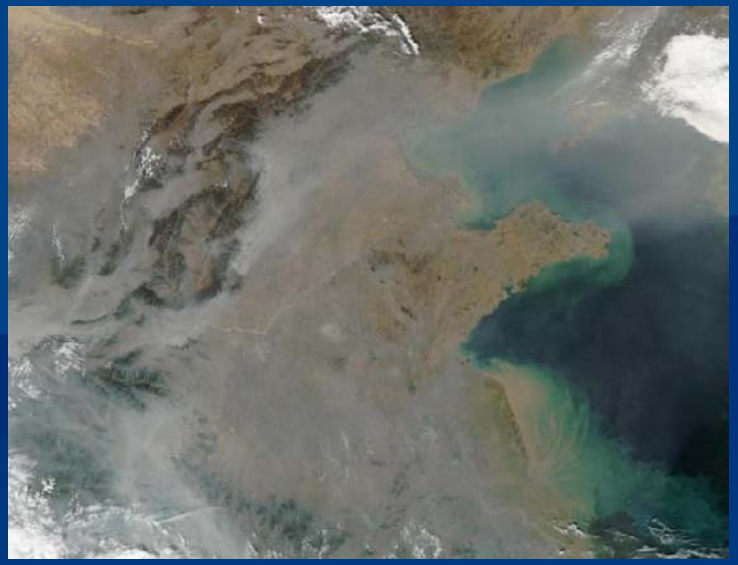

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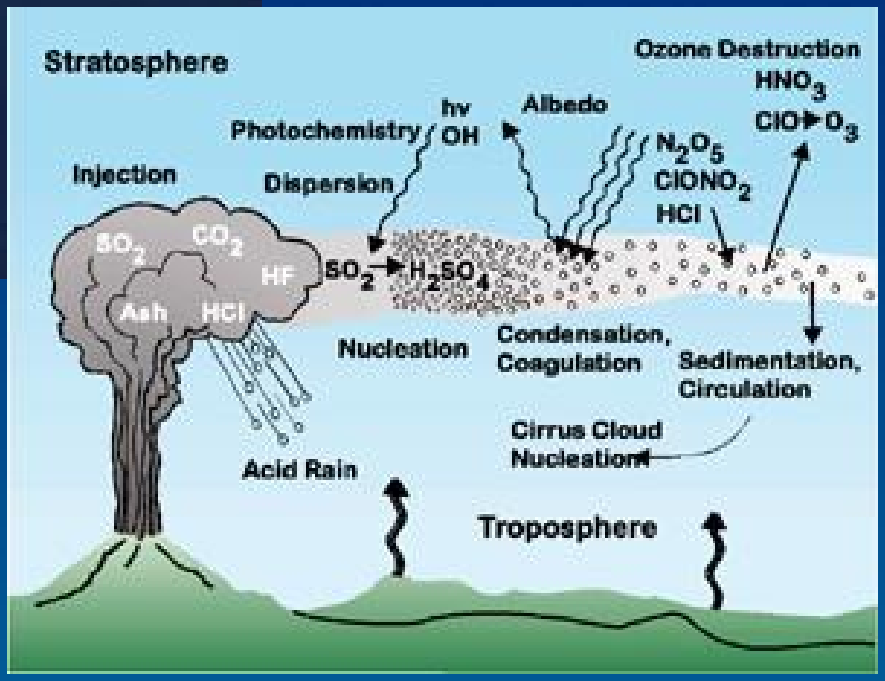
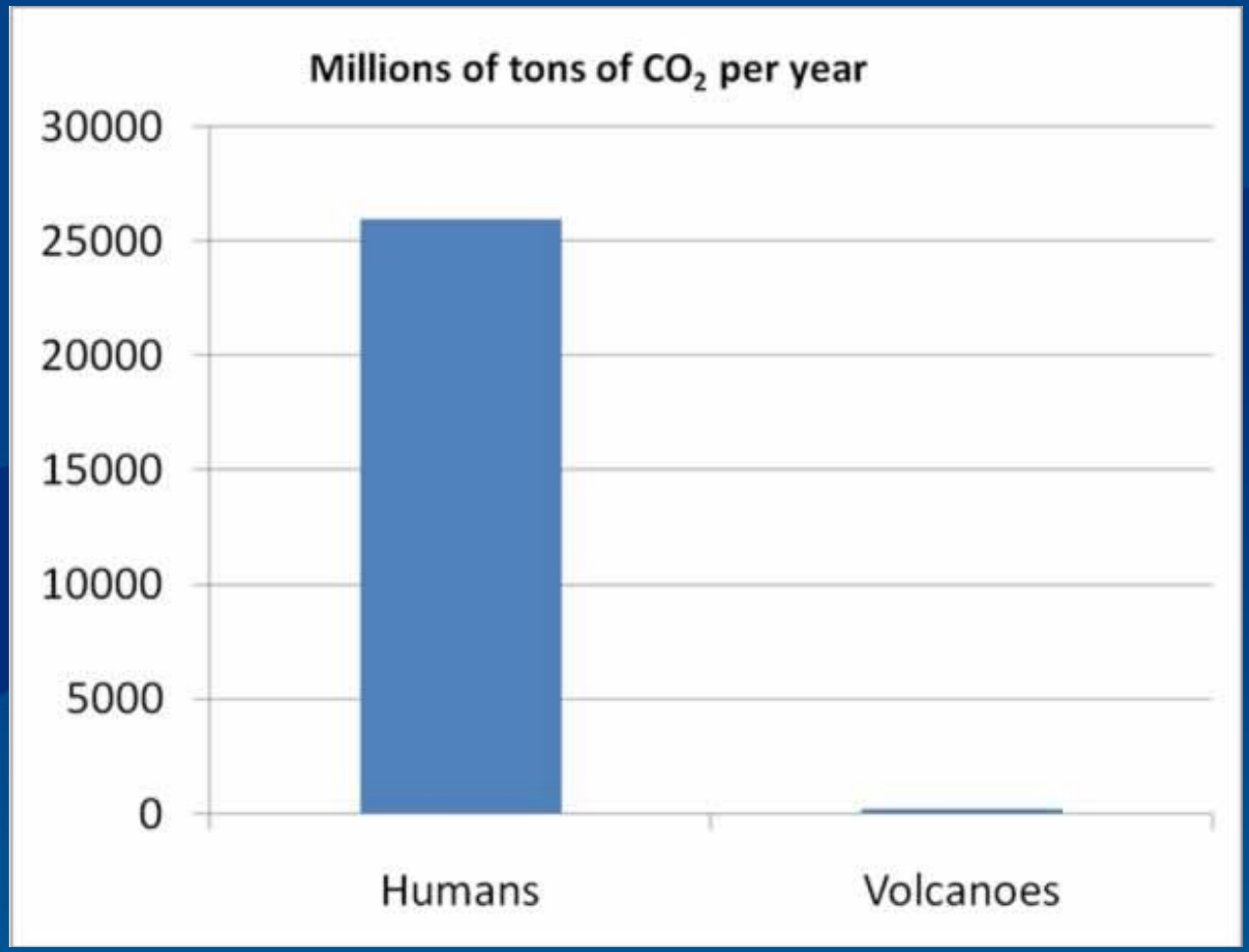
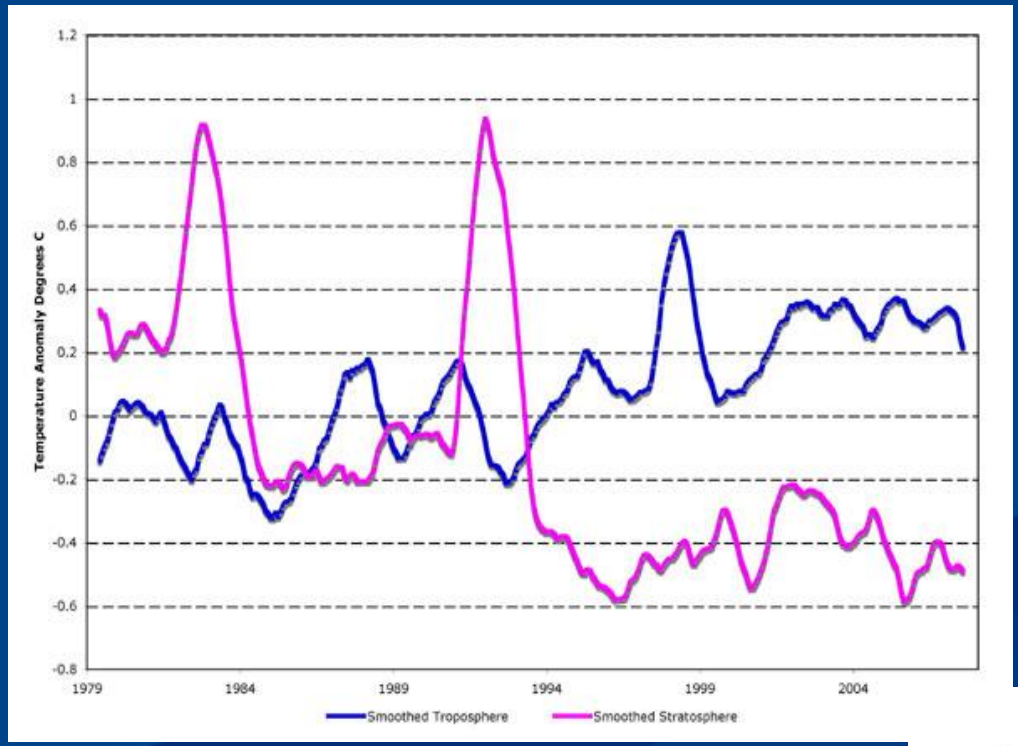
It’s volcanoes (or lack thereof)


Stratosphere
Ozone Destruction
HNO_3
ClO
O_3
hv
OH
Photochemistry
Albedo
N_2O_5
$ClONO_2$
HCl
Injection
Dispersion
SO_2
CO_2
HF
Ash
HCl
SO_2
H_2SO_4
Nucleation
Condensation,
Coagulation
Sedimentation,
Circulation
Cirrus Cloud
Nucleation
Acid Rain
Troposphere


Millions of tons of CO_2 per year
30000
25000
20000
15000
10000
5000
0
Humans
Volcanoes



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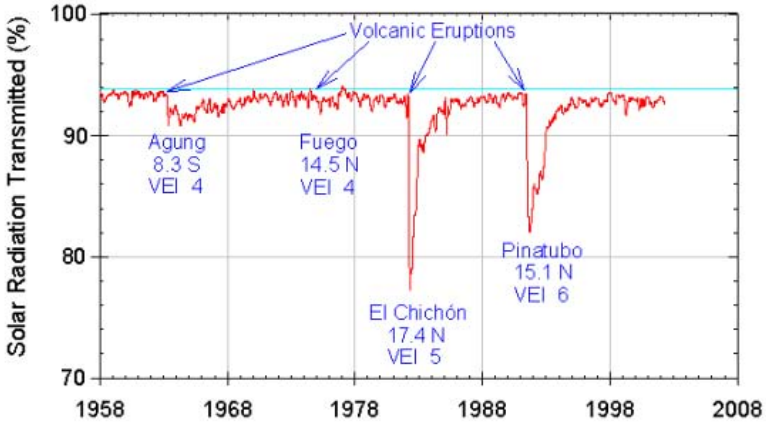
Mauna Loa Observatory Atmospheric Transmission



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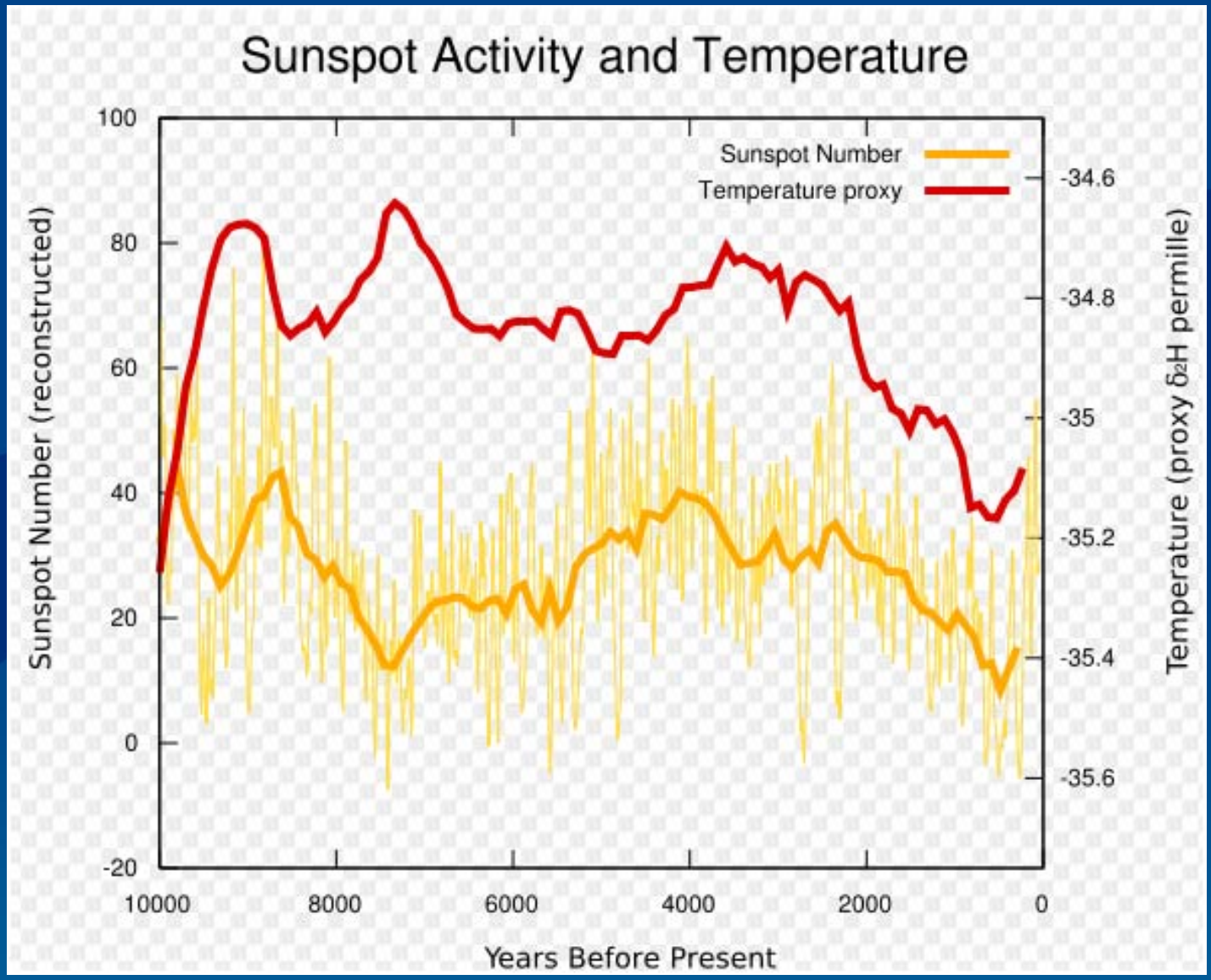

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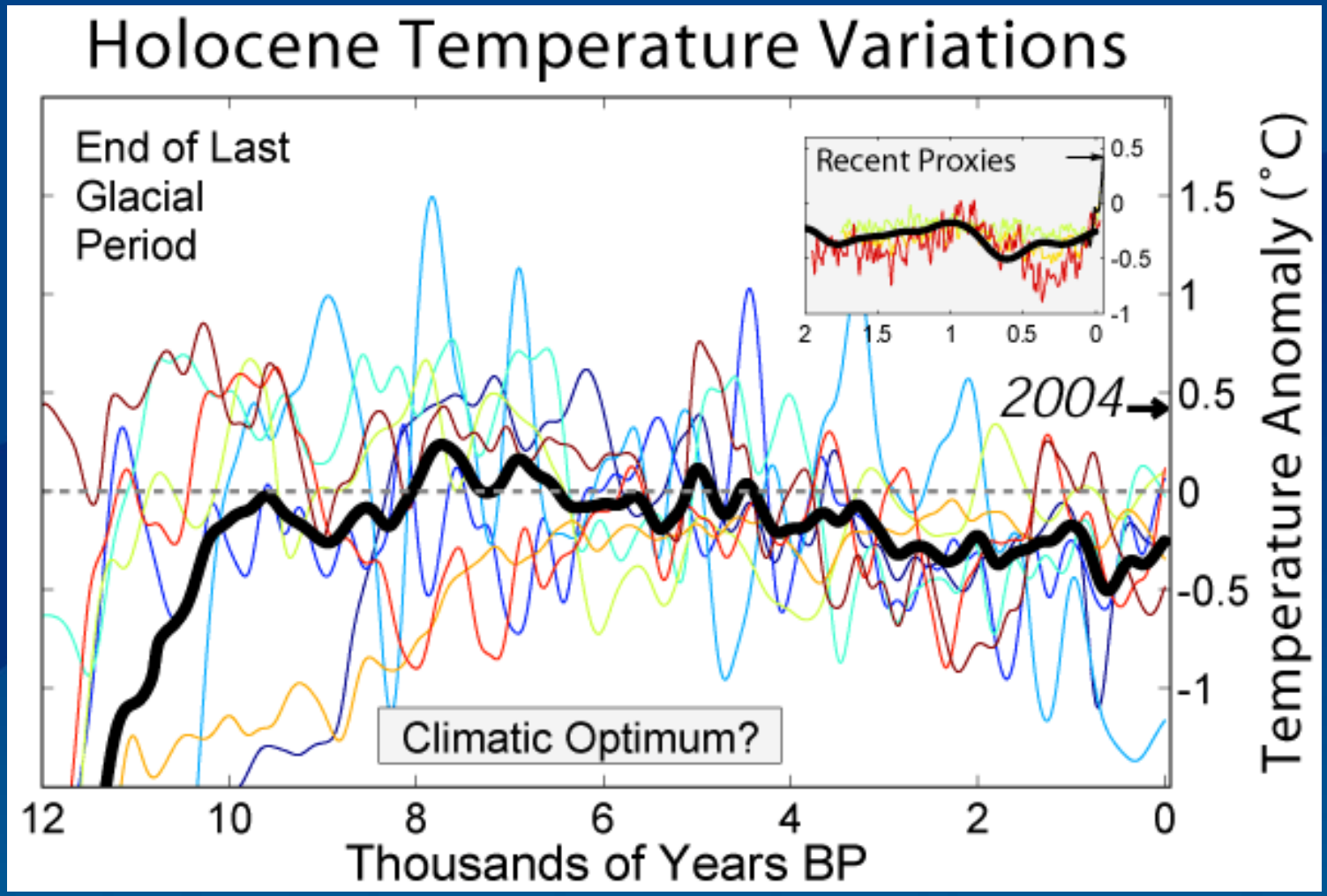

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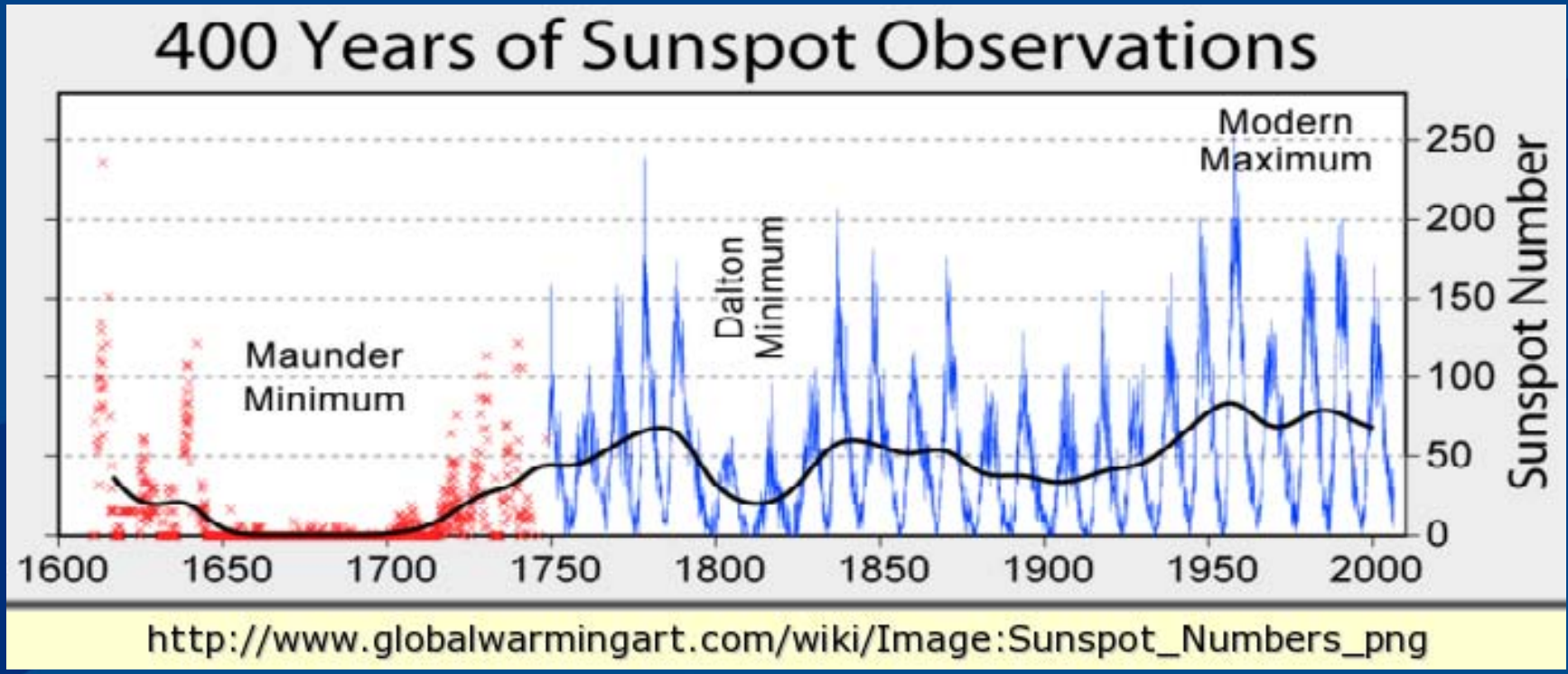

http://www.globalwarmingart.com/wiki/Image:Sunspot_Numbers_png

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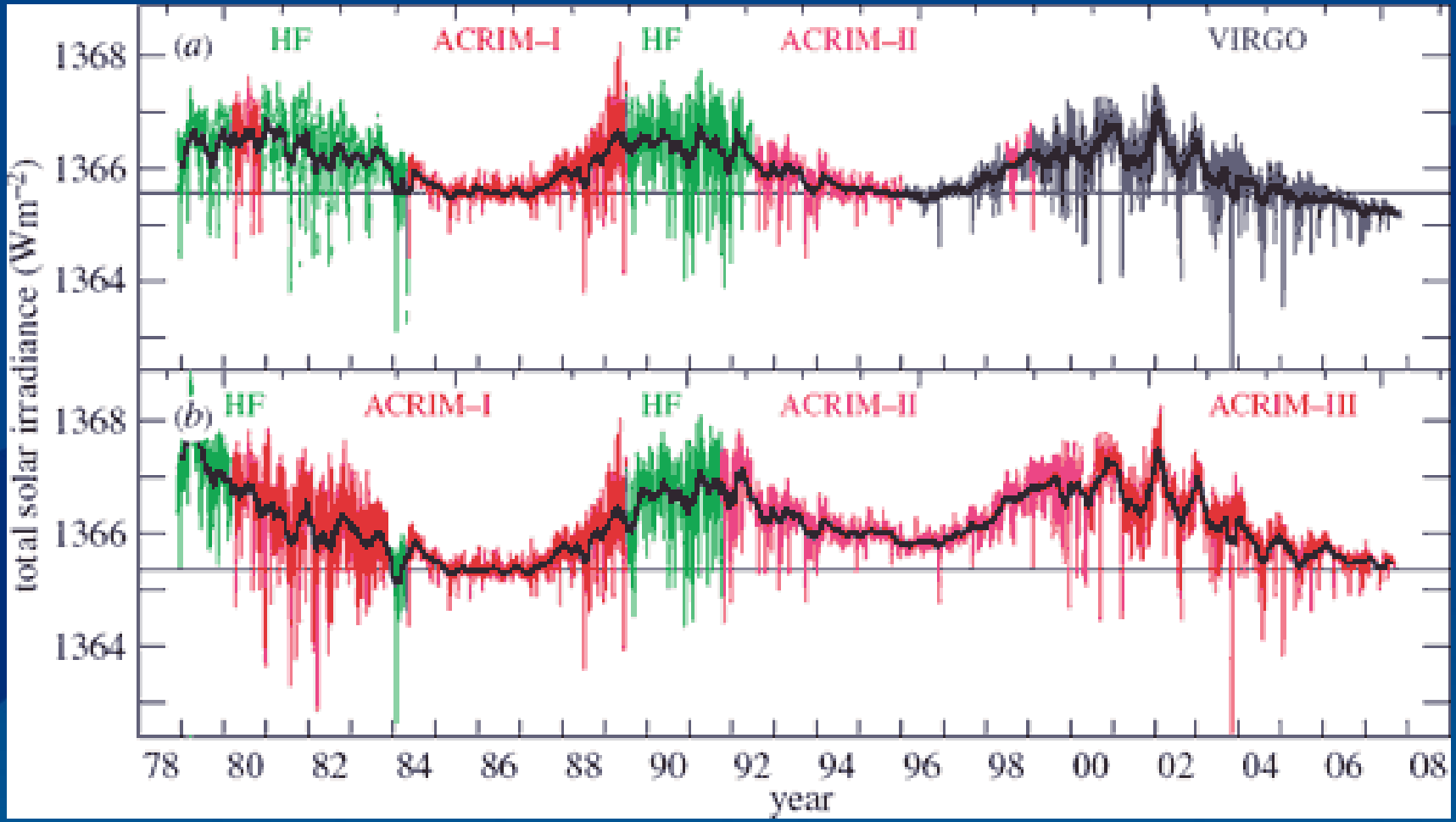
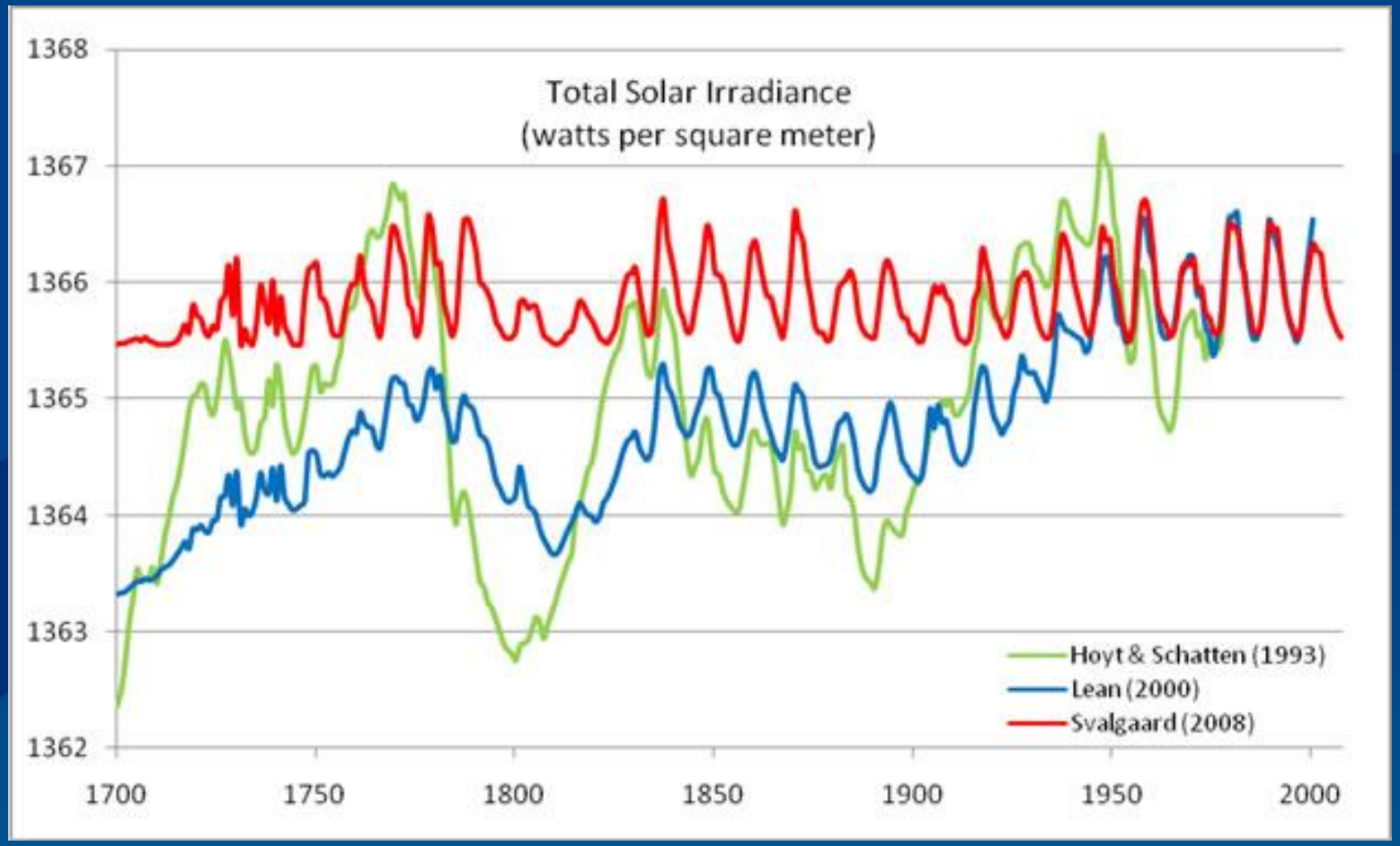
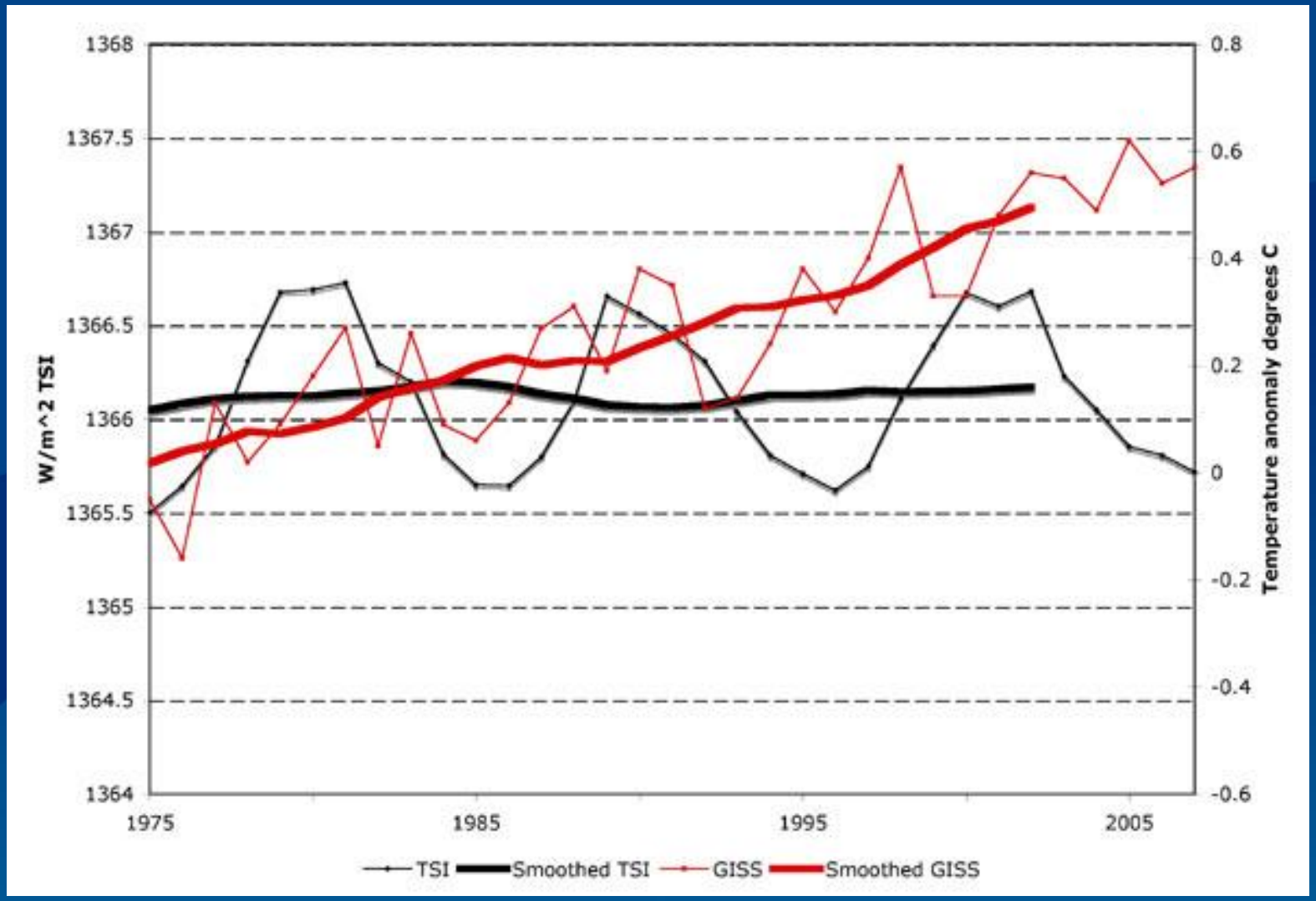



Total Solar Irradiance
(watts per square meter)
1368
1367
1366
1365
1364
1363
1362
1700
1750
1800
1850
1900
1950
2000
Hoyt & Schatten (1993)
Lean (2000)
Svalgaard (2008)


1368
1367.5
1367
1366.5
1366
1365.5
1365
1364.5
1364
W/m^2 TSI
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
Temperature anomaly degrees C
1975
1985
1995
2005
TSI
Smoothed TSI
GISS
Smoothed GISS

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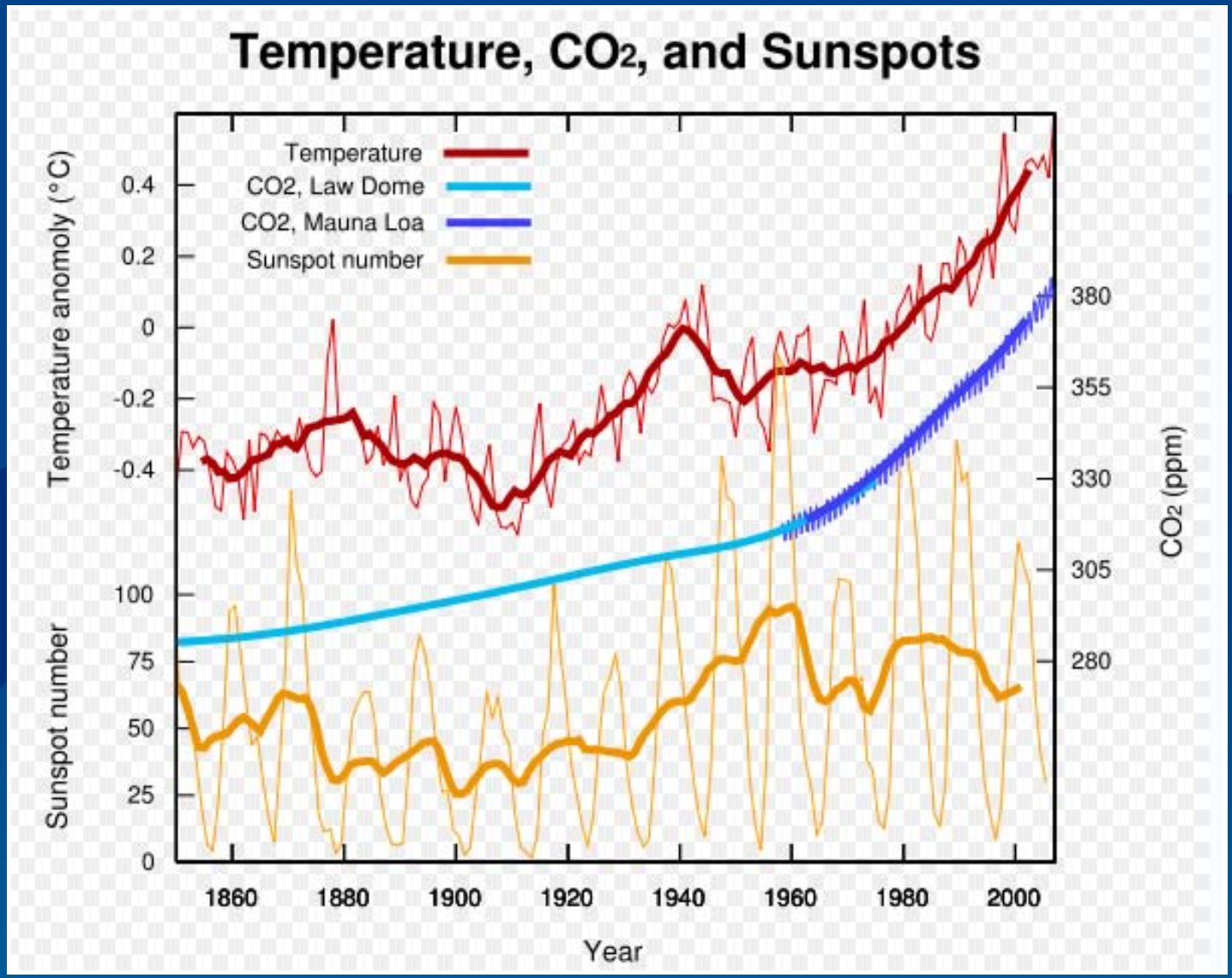
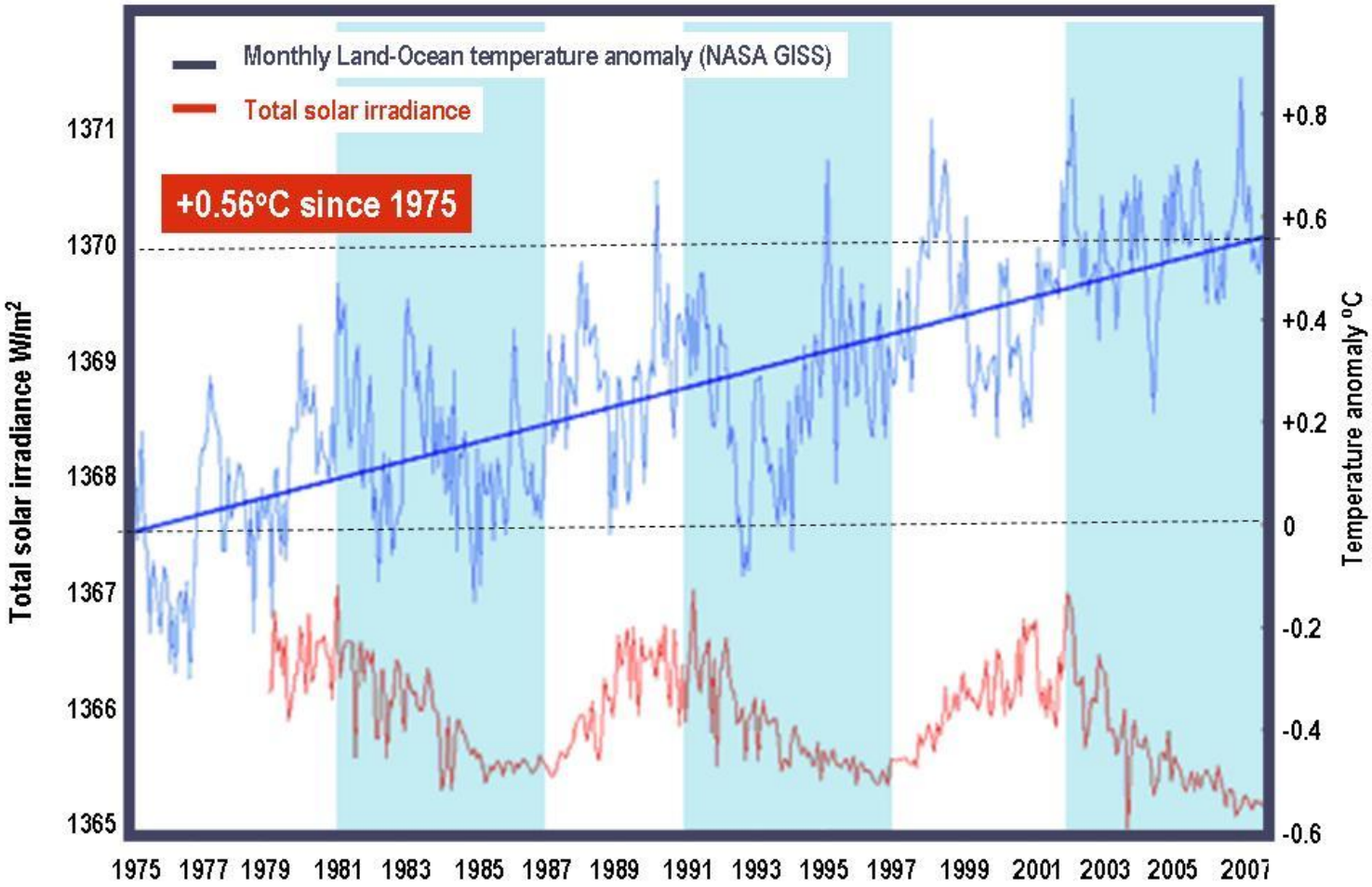
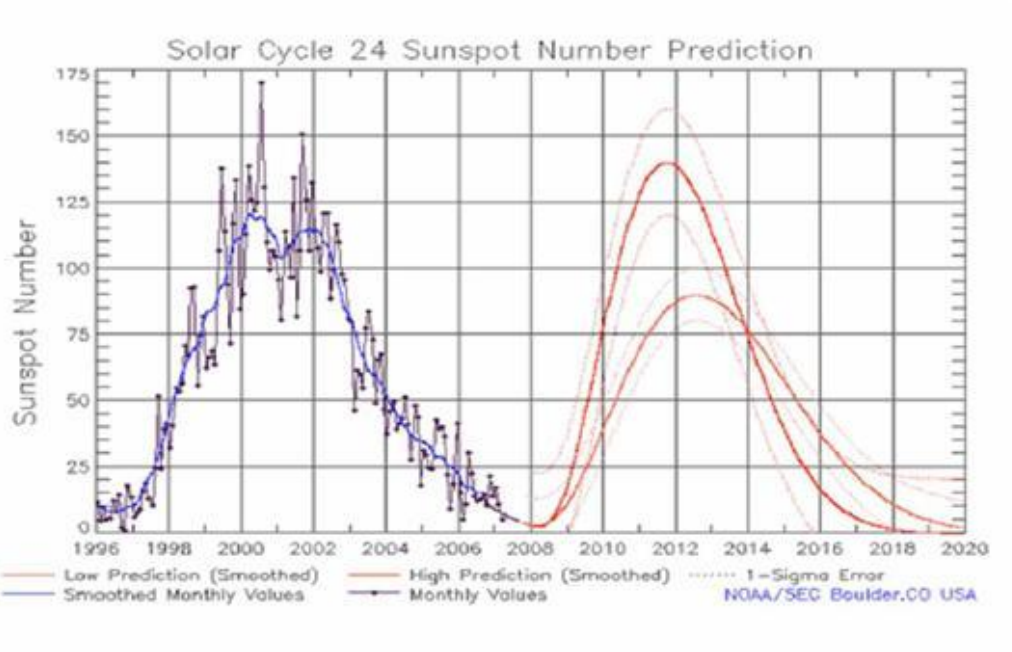
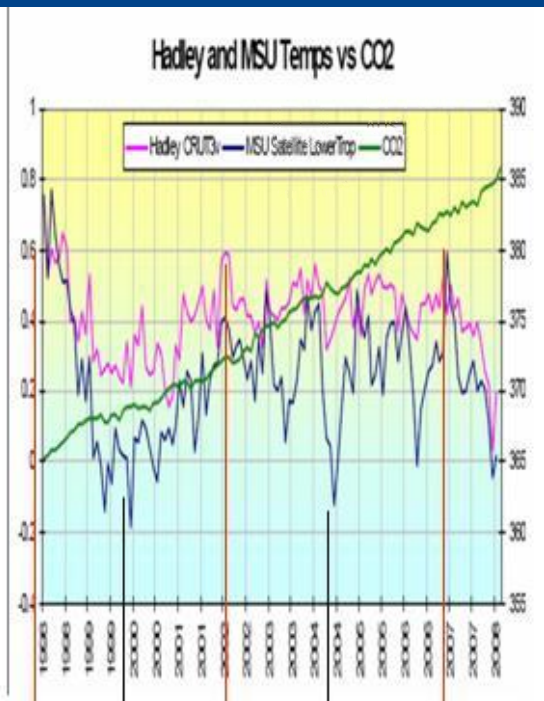
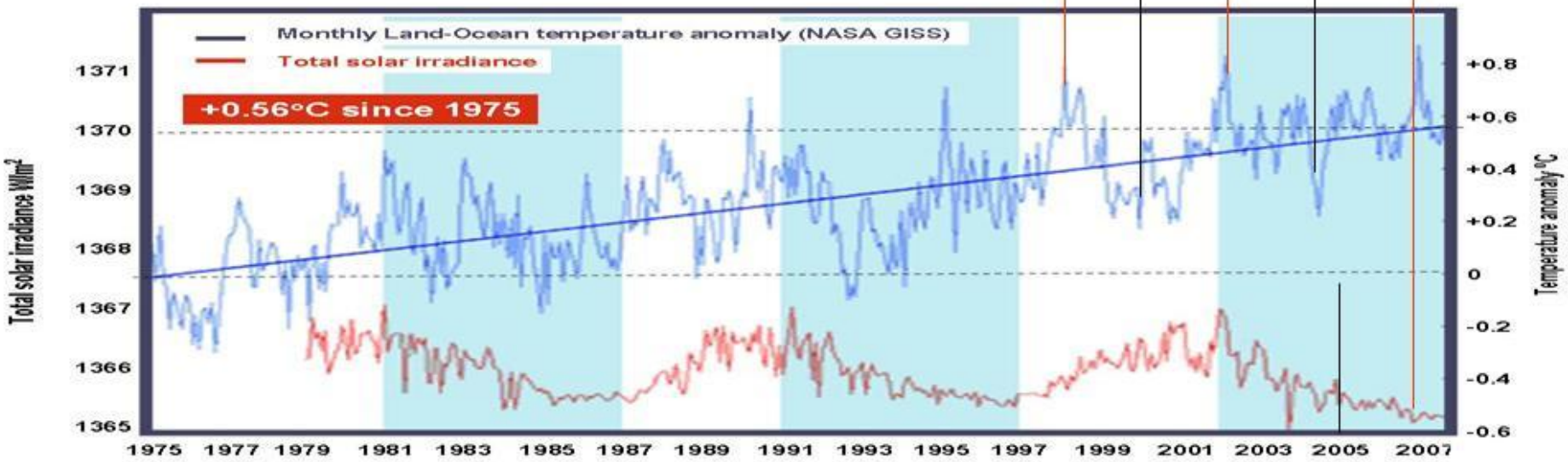




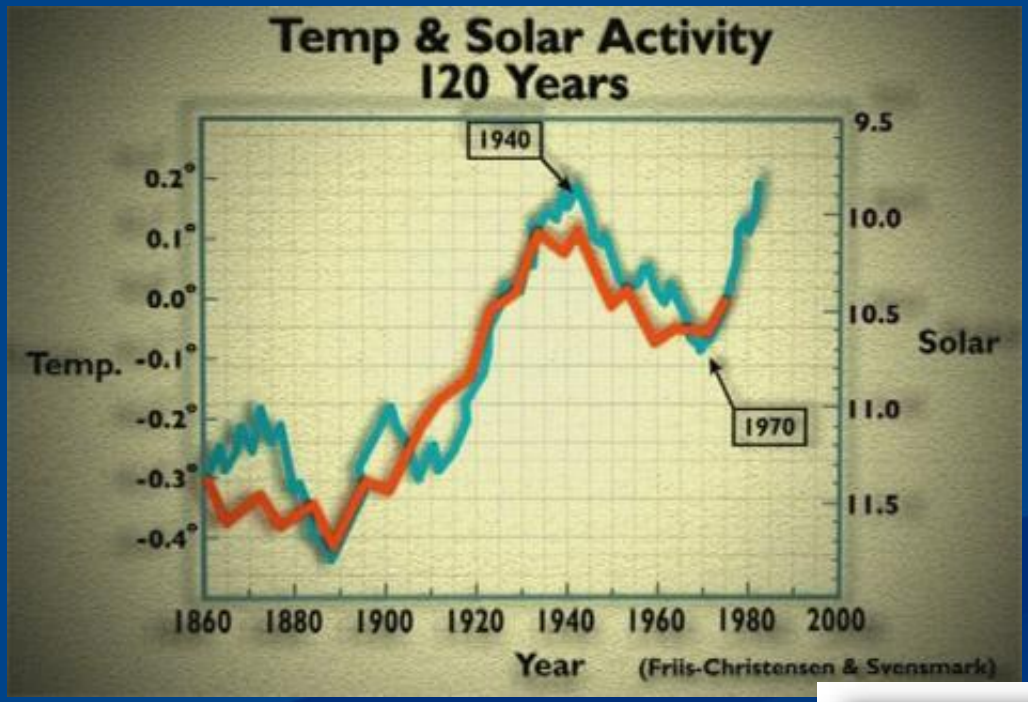
http://www.skepticalscience.com/Global-warming-stopped-in-1981.html

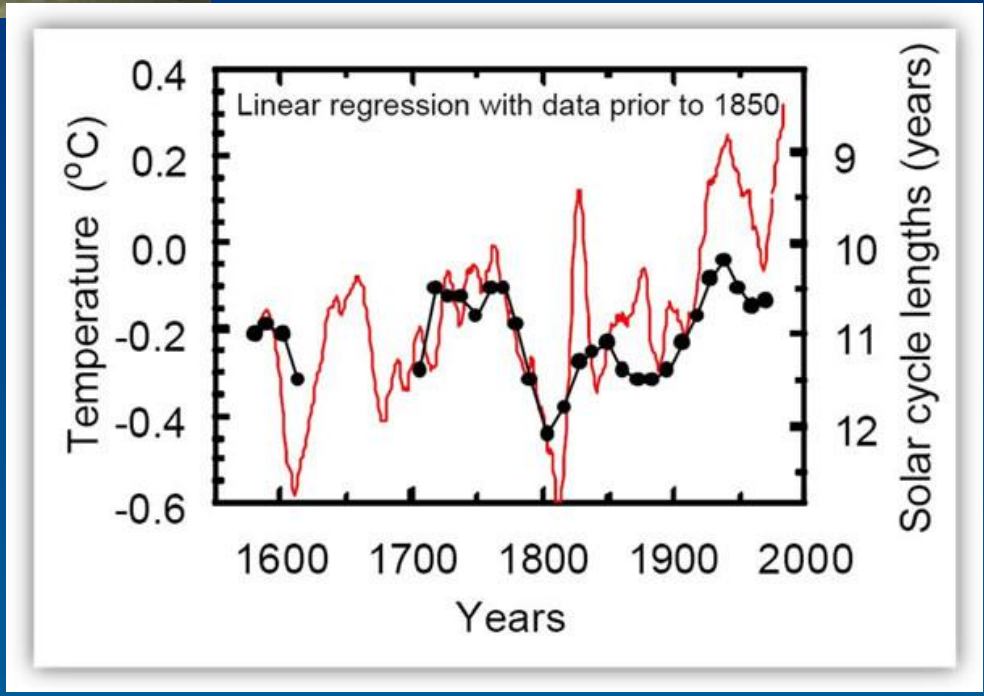






http://www.skepticalscience.com/Global-warming-stopped-in-1981.html


Temp & Solar Activity
120 Years
1940
1970
0.2°
0.1°
0.0°
-0.1°
-0.2°
-0.3°
-0.4°
Temp.
9.5
10.0
10.5
11.0
11.5
Solar
1860 1880 1900 1920 1940 1960 1980 2000
Year
(Friis-Christensen & Svensmark)


Linear regression with data prior to 1850
Temperature (°C)
0.4
0.2
0.0
-0.2
-0.4
-0.6
Solar cycle lengths (years)
9
10
11
12
1600 1700 1800 1900 2000
Years

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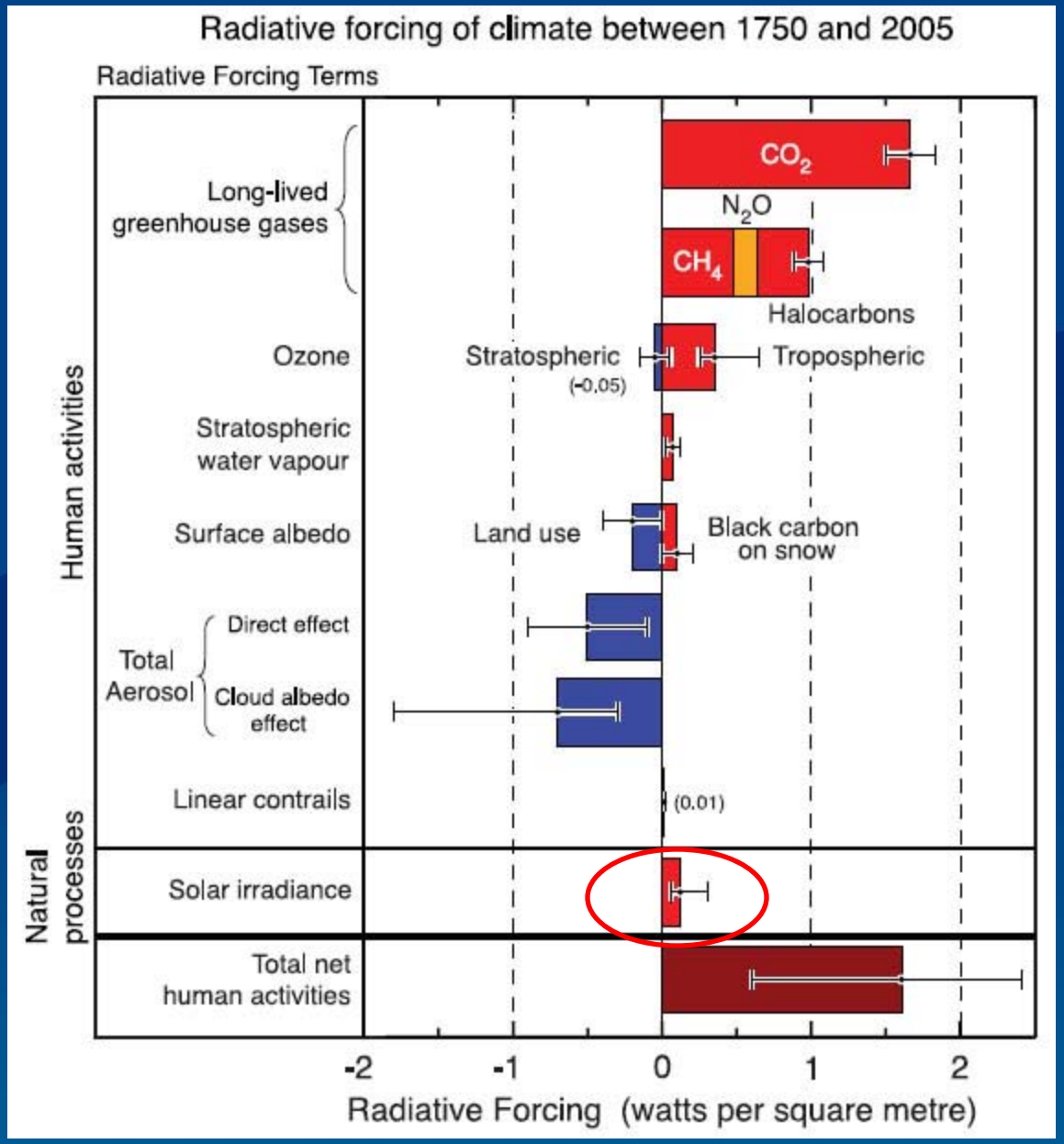

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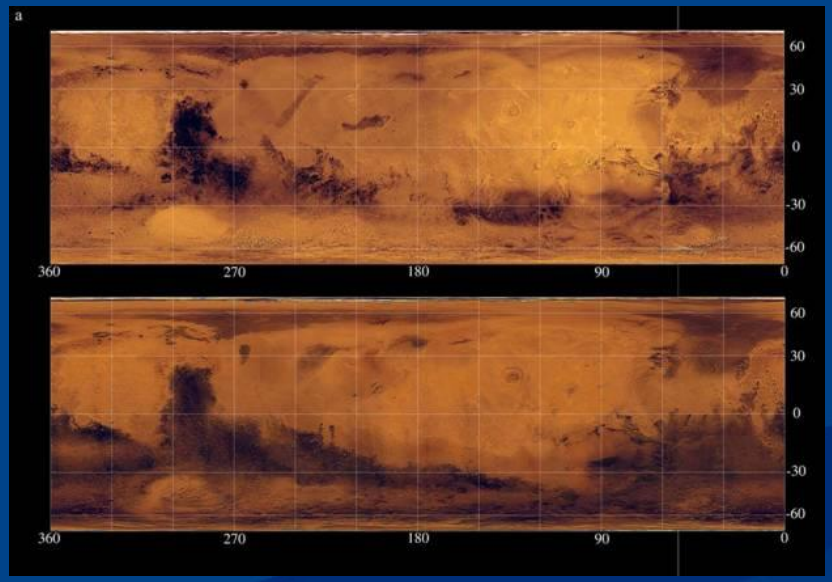
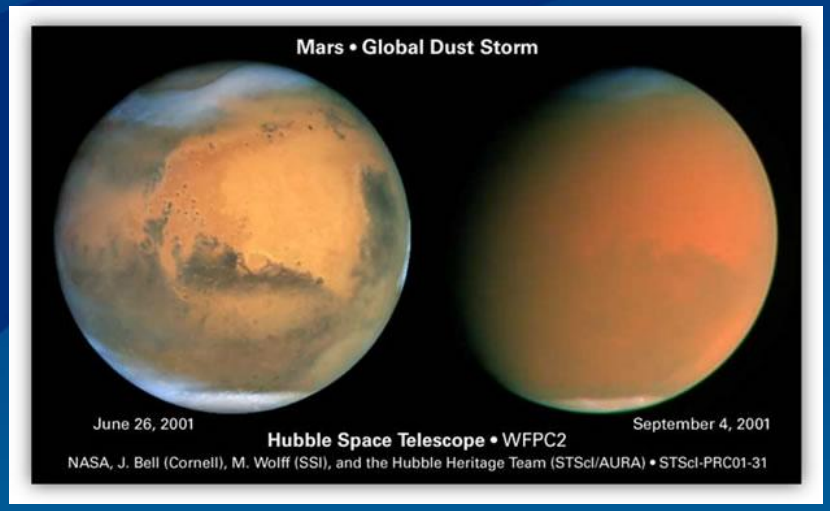
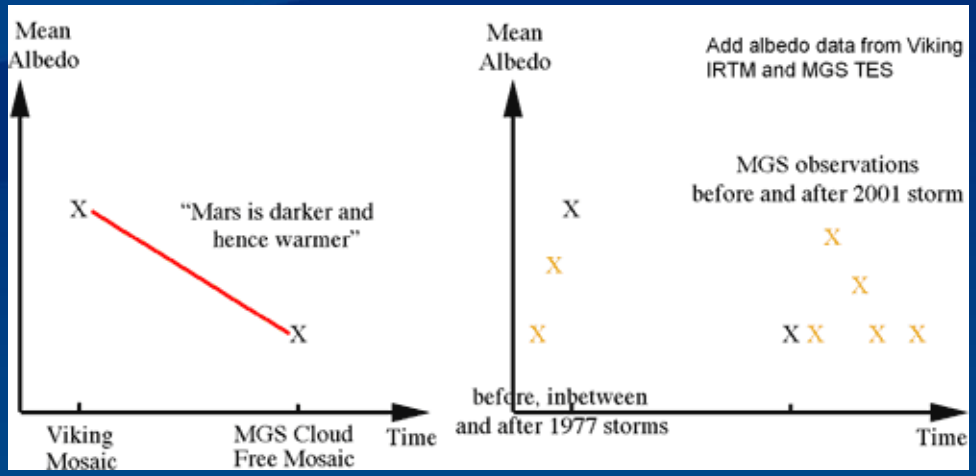
Other planets are warming


a
60
30
0
-30
-60
360
270
180
90
0


Mars • Global Dust Storm
June 26, 2001
September 4, 2001
Hubble Space Telescope • WFPC2
NASA, J. Bell (Cornell), M. Wolff (SSI), and the Hubble Heritage Team (STScI/AURA) • STScI-PRC01-31


Mean Albedo
"Mars is darker and hence warmer"
Viking Mosaic
MGS Cloud Free Mosaic
Time
Mean Albedo
Add albedo data from Viking IRTM and MGS TES
MGS observations before and after 2001 storm
before, inbetween and after 1977 storms
Time

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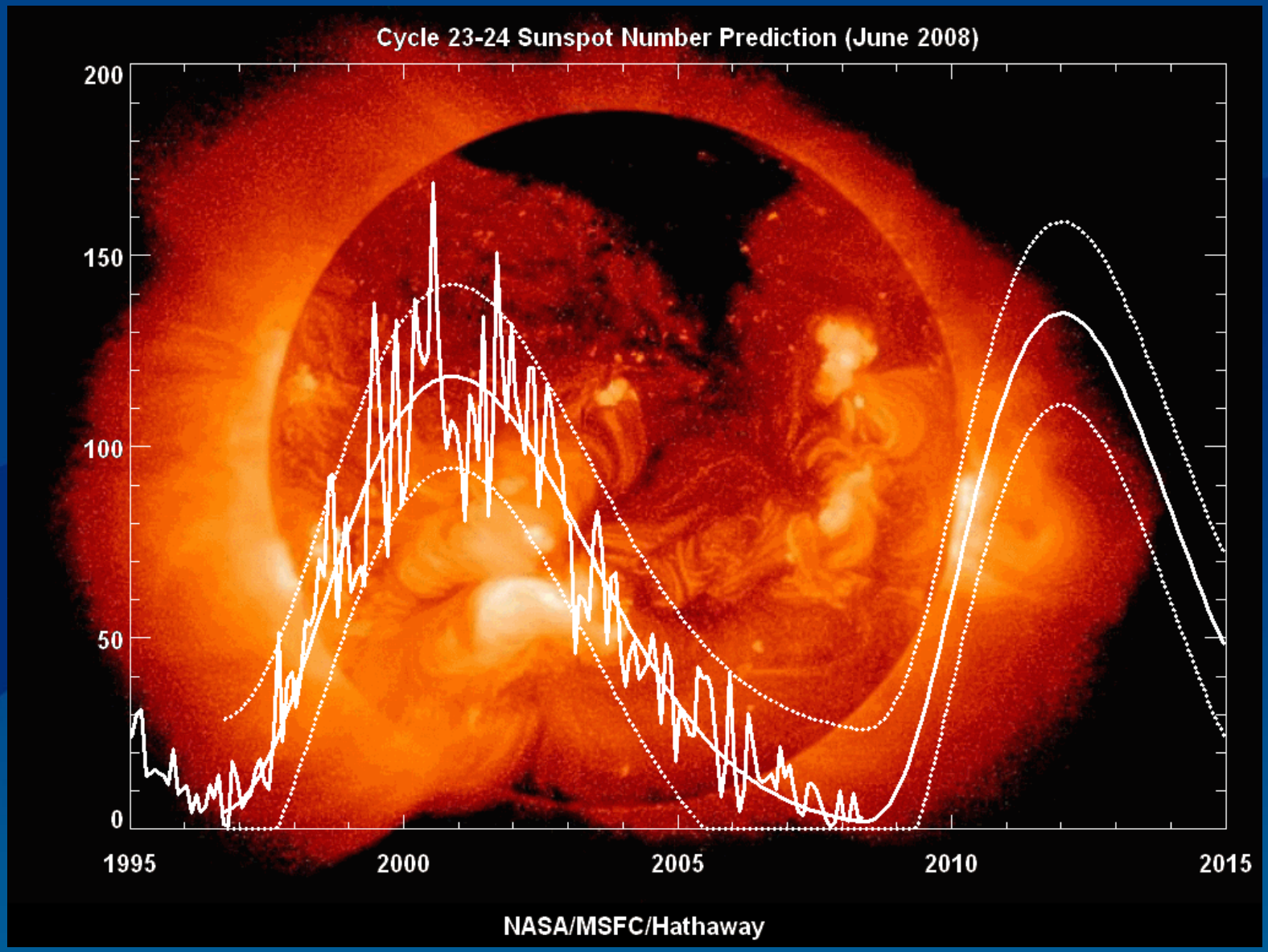

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It’s cosmic rays

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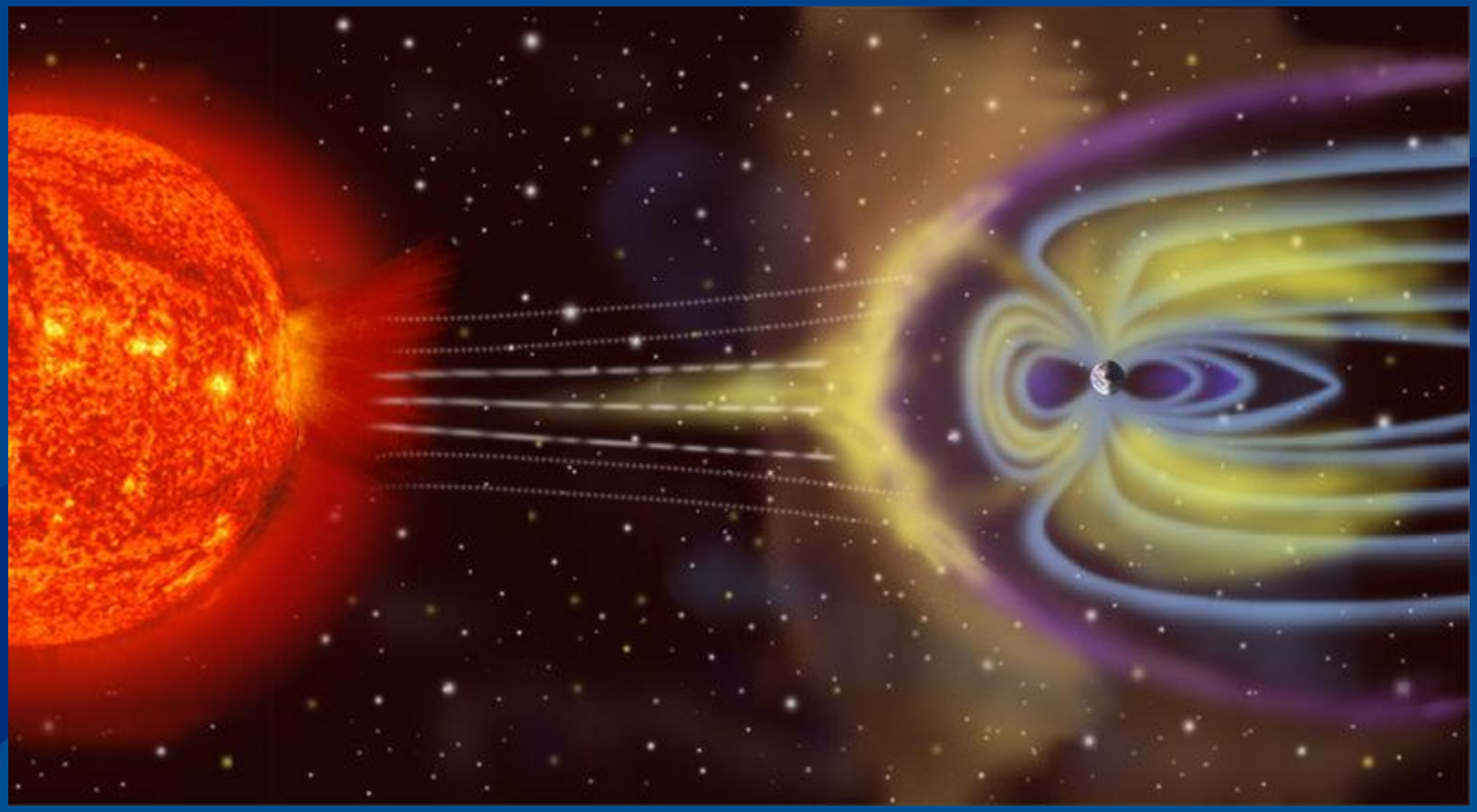

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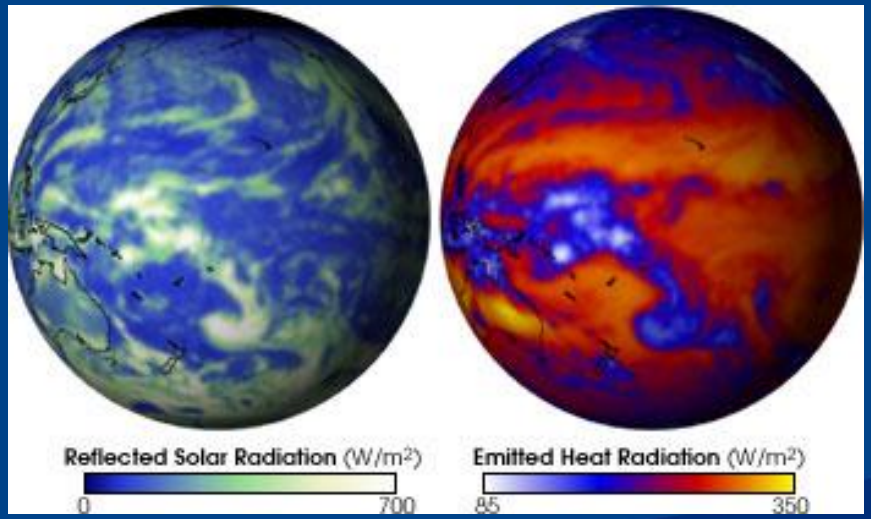

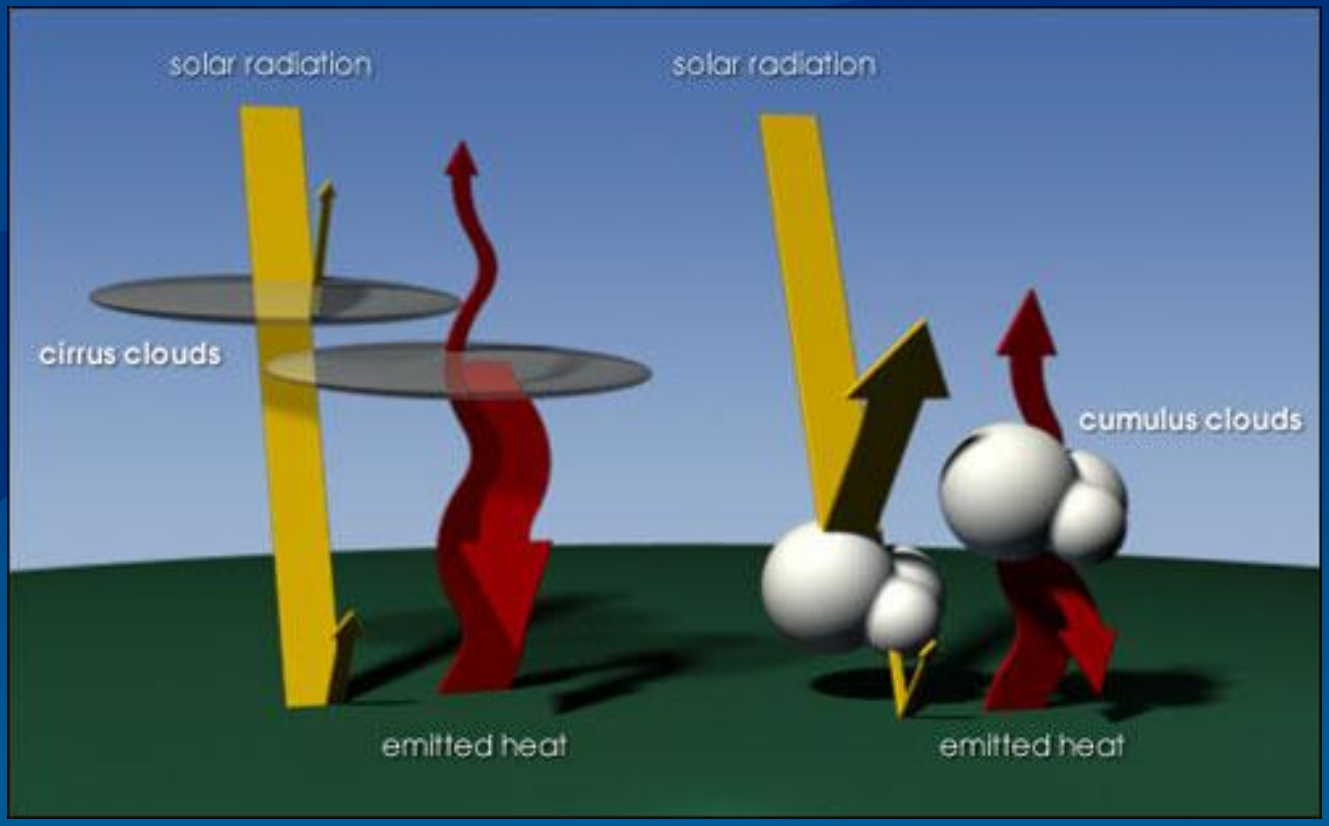

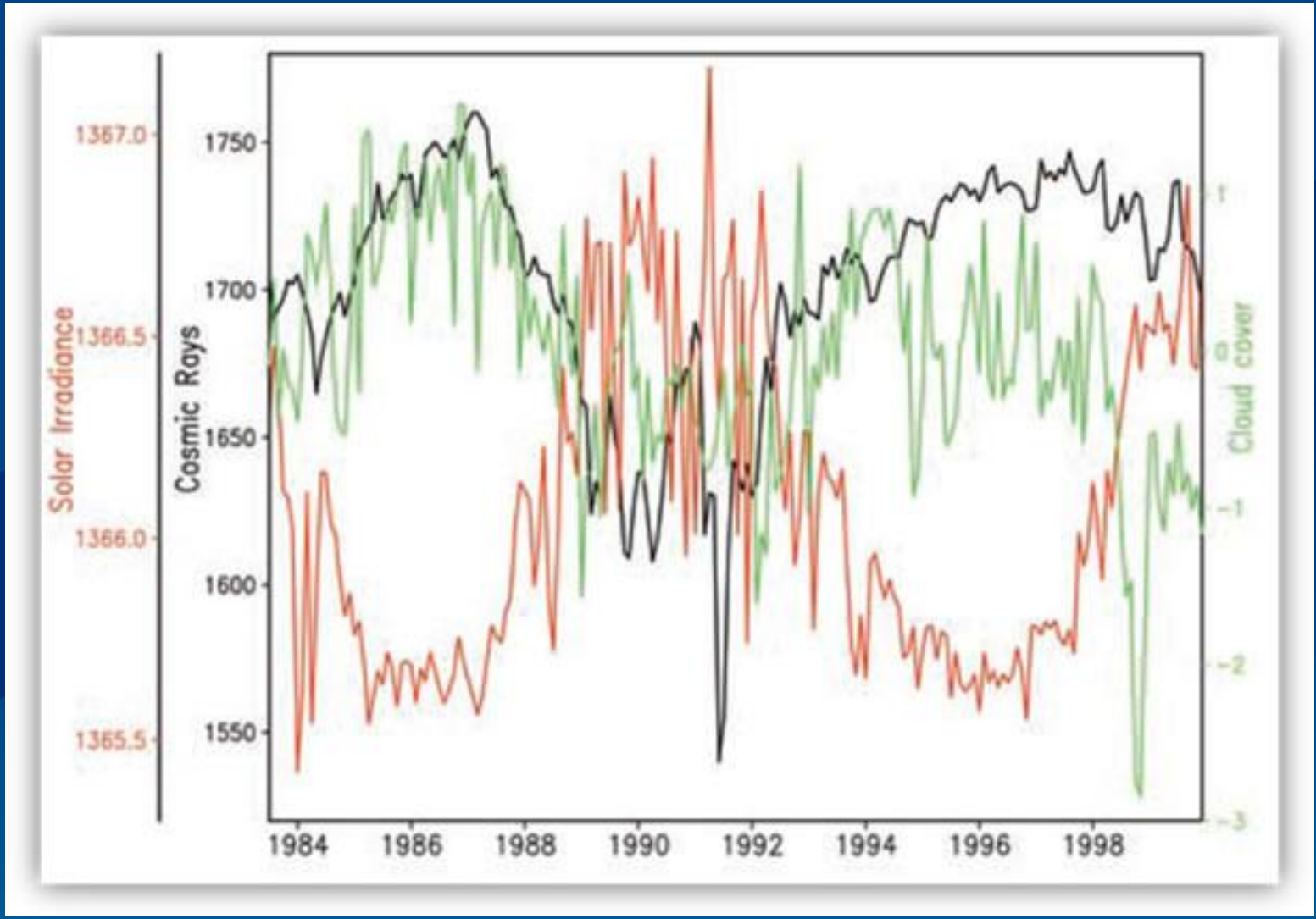
Solar Irradiance
1367.0
1366.5
1366.0
1365.5
Cosmic Rays
1750
1700
1650
1600
1550
Cloud cover
1
0
−1
−2
−3
1984
1986
1988
1990
1992
1994
1996
1998

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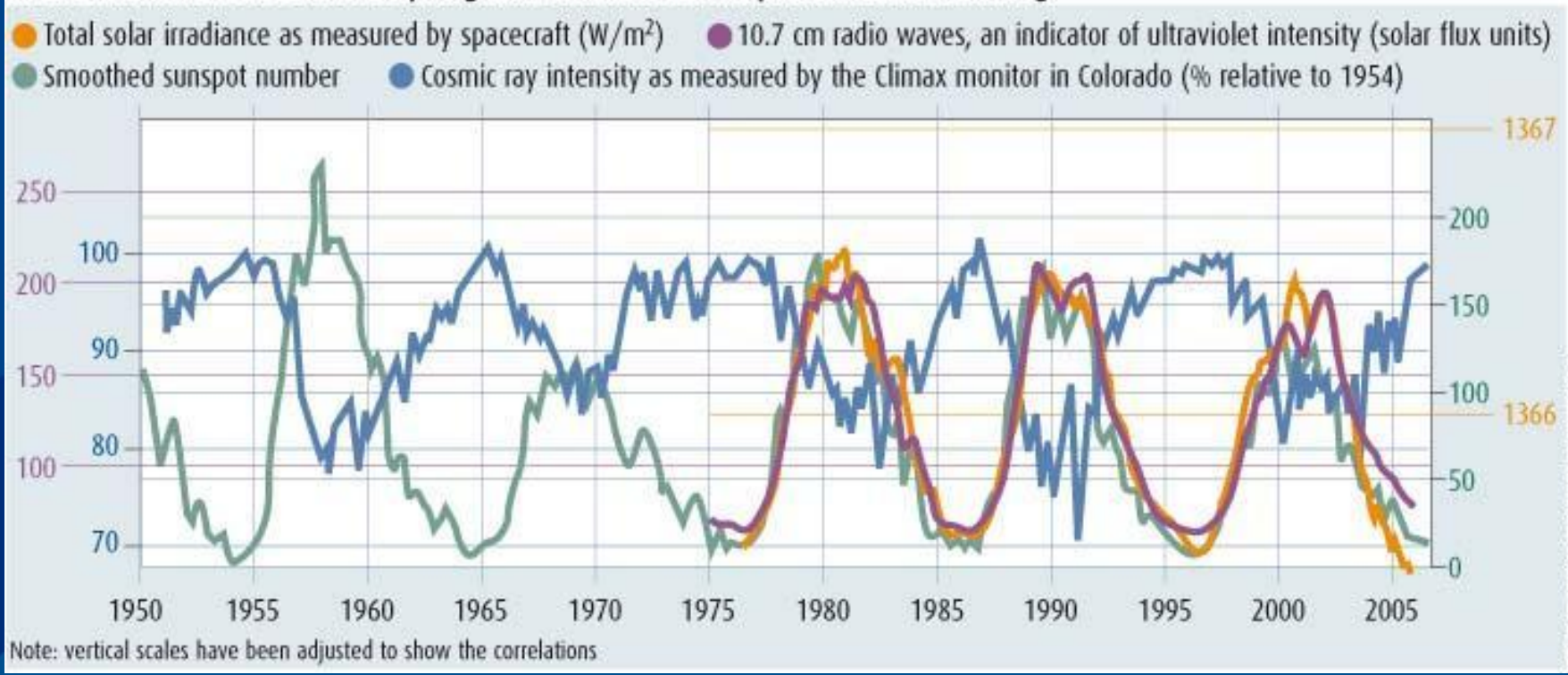
RECENT CHANGES IN SOLAR ACTIVITY AND COSMIC RAYS

Direct, accurate measurements of cosmic ray intensity and various forms of solar activity began only in the late 20th century. None of these measures shows any long-term trends that can explain the recent warming



Note: vertical scales have been adjusted to show the correlations

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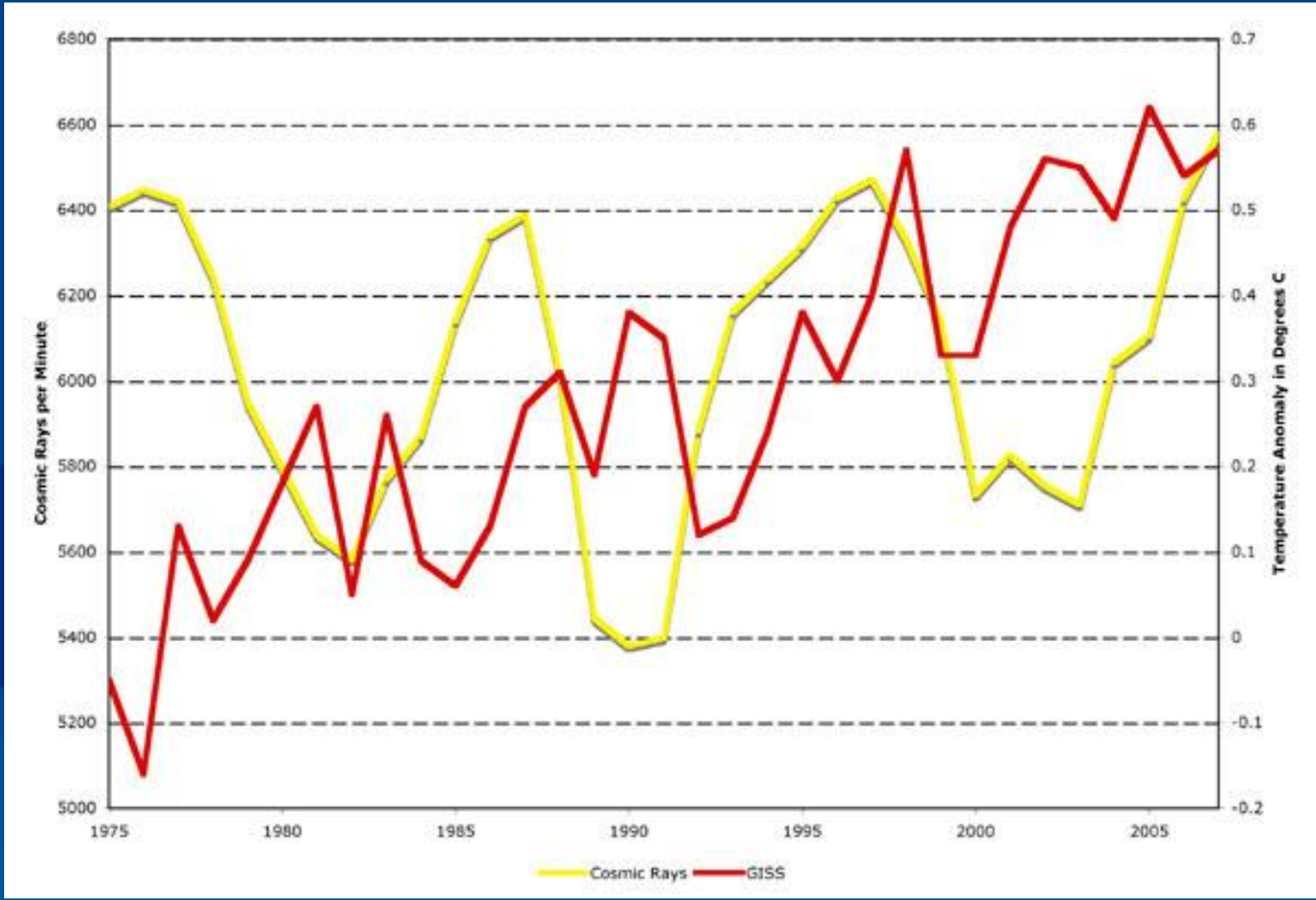
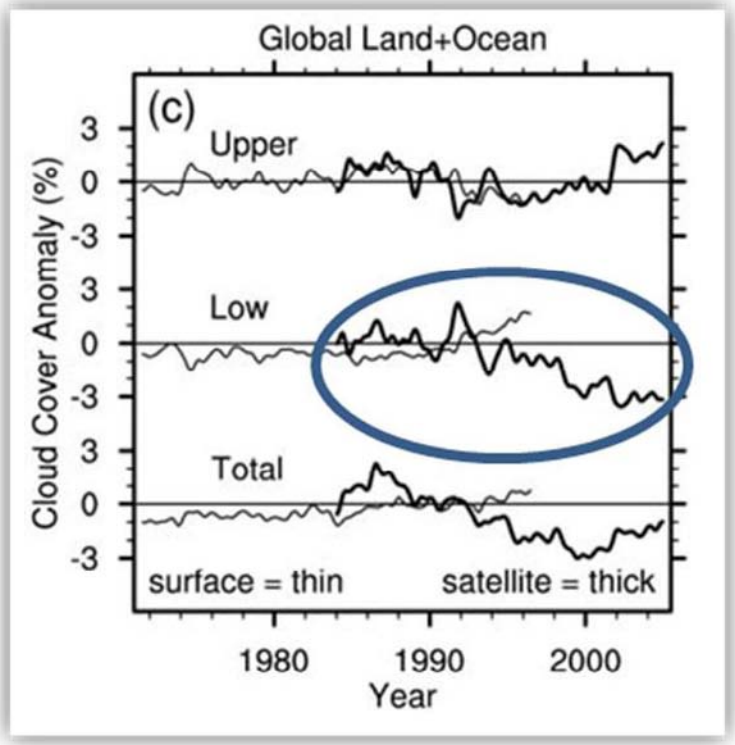
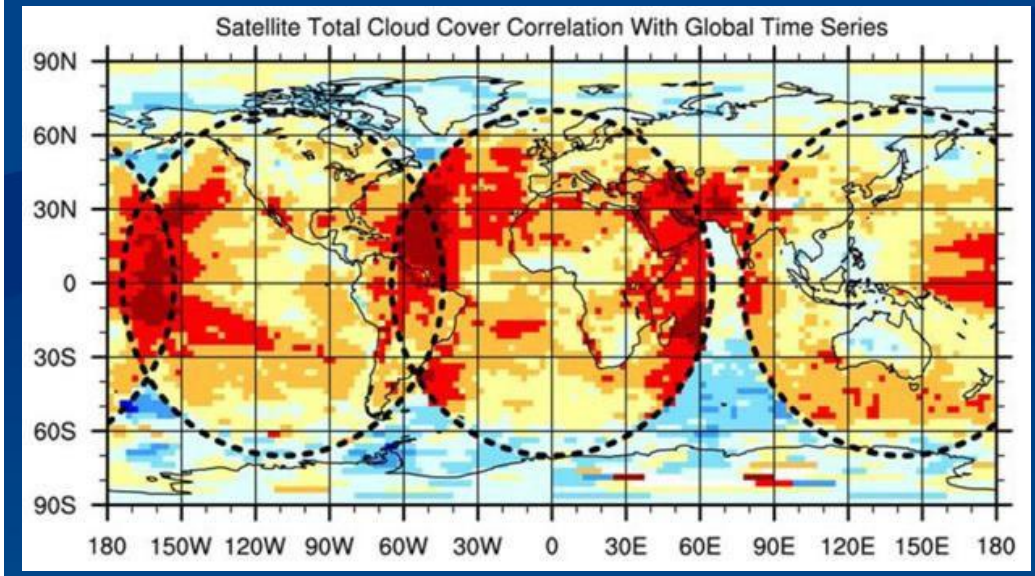



Global Land+Ocean
(c)
Upper
Low
Total
Cloud Cover Anomaly (%)
3
0
-3
surface = thin
satellite = thick
1980
1990
2000
Year


Satellite Total Cloud Cover Correlation With Global Time Series
90N
60N
30N
0
30S
60S
90S
180
150W
120W
90W
60W
30W
0
30E
60E
90E
120E
150E
180

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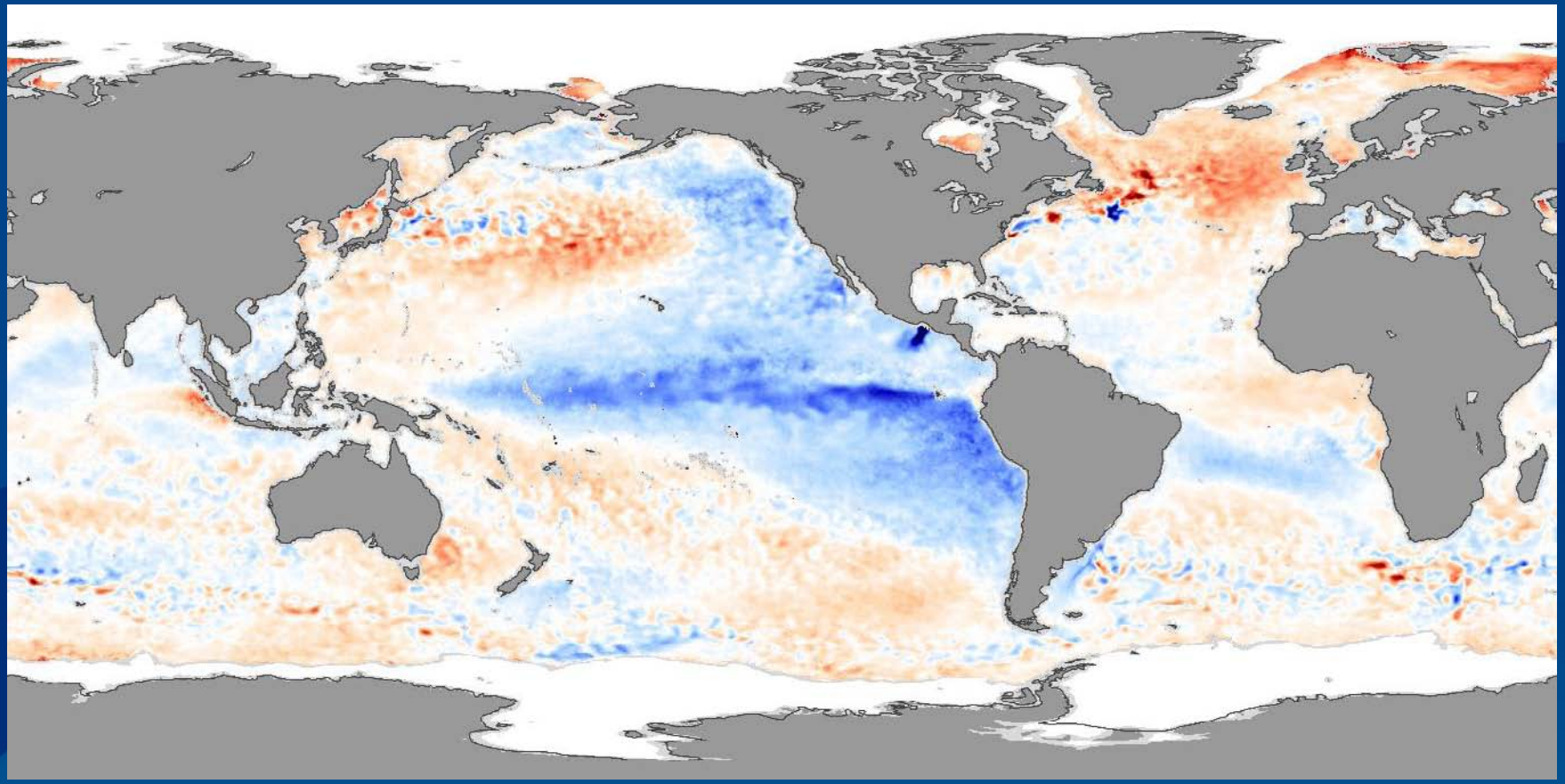

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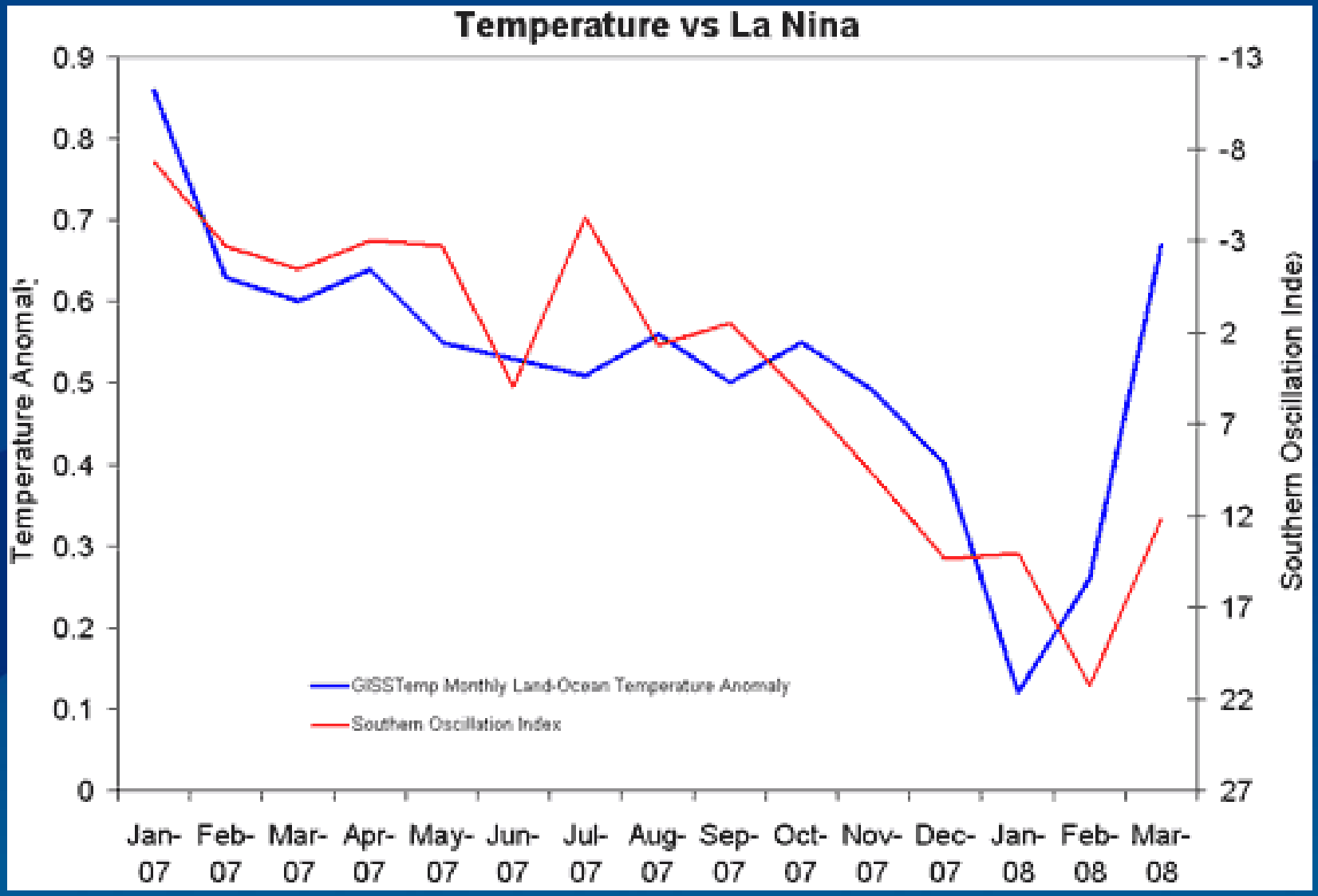

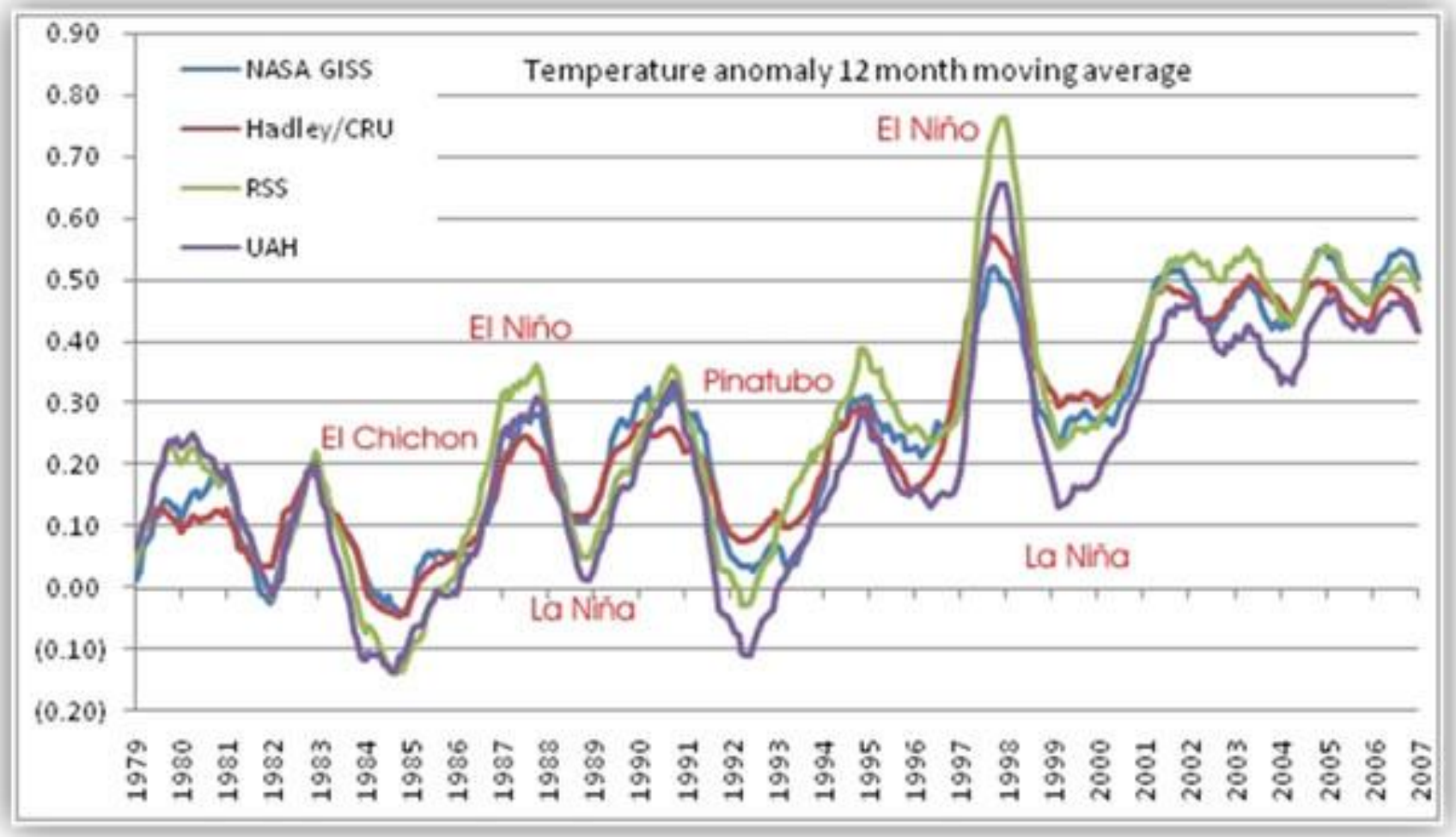
Temperature anomaly 12 month moving average
NASA GISS
Hadley/CRU
RSS
UAH
El Niño
El Niño
Pinatubo
El Chichon
La Niña
La Niña
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
(0.10)
(0.20)
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007

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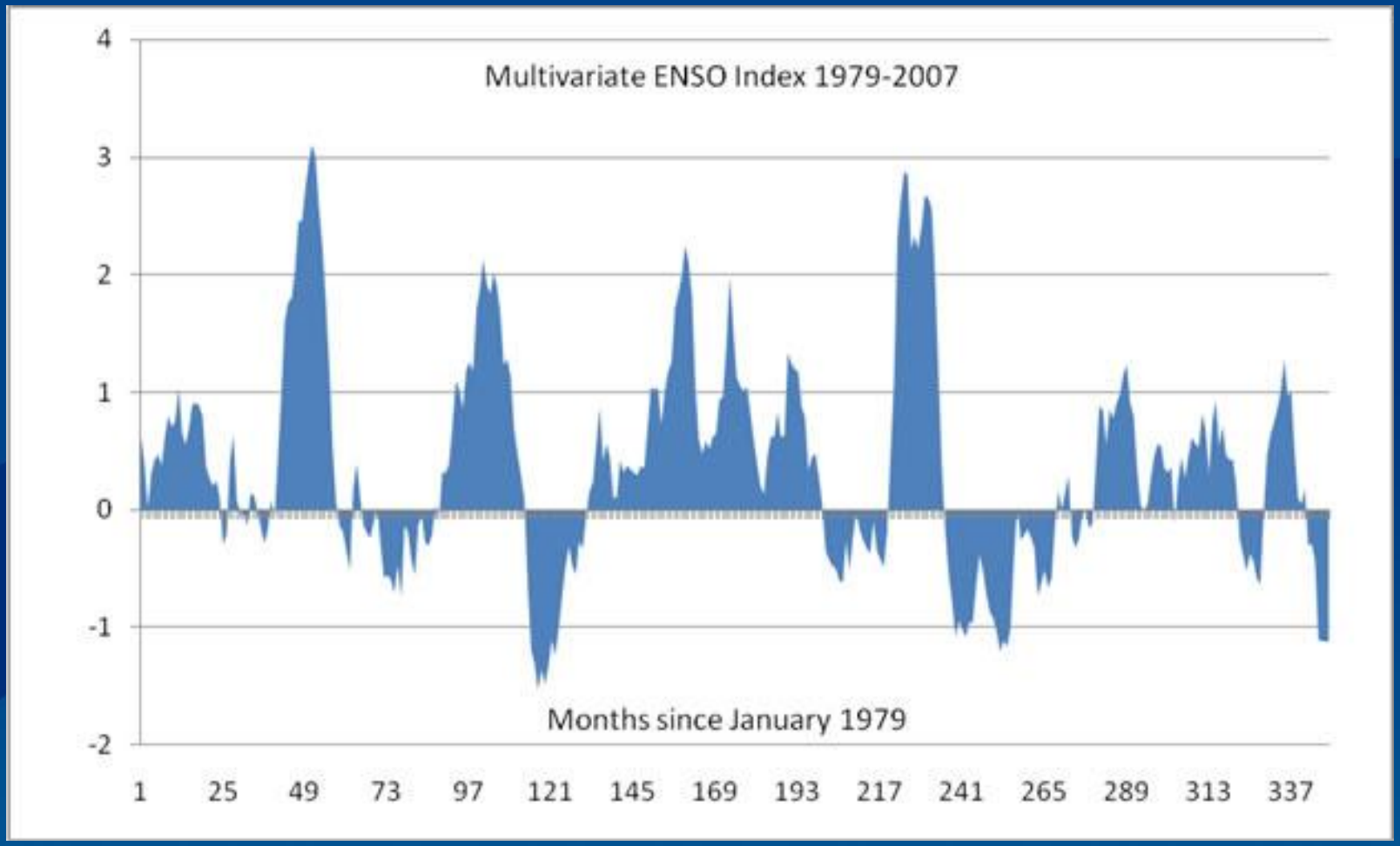
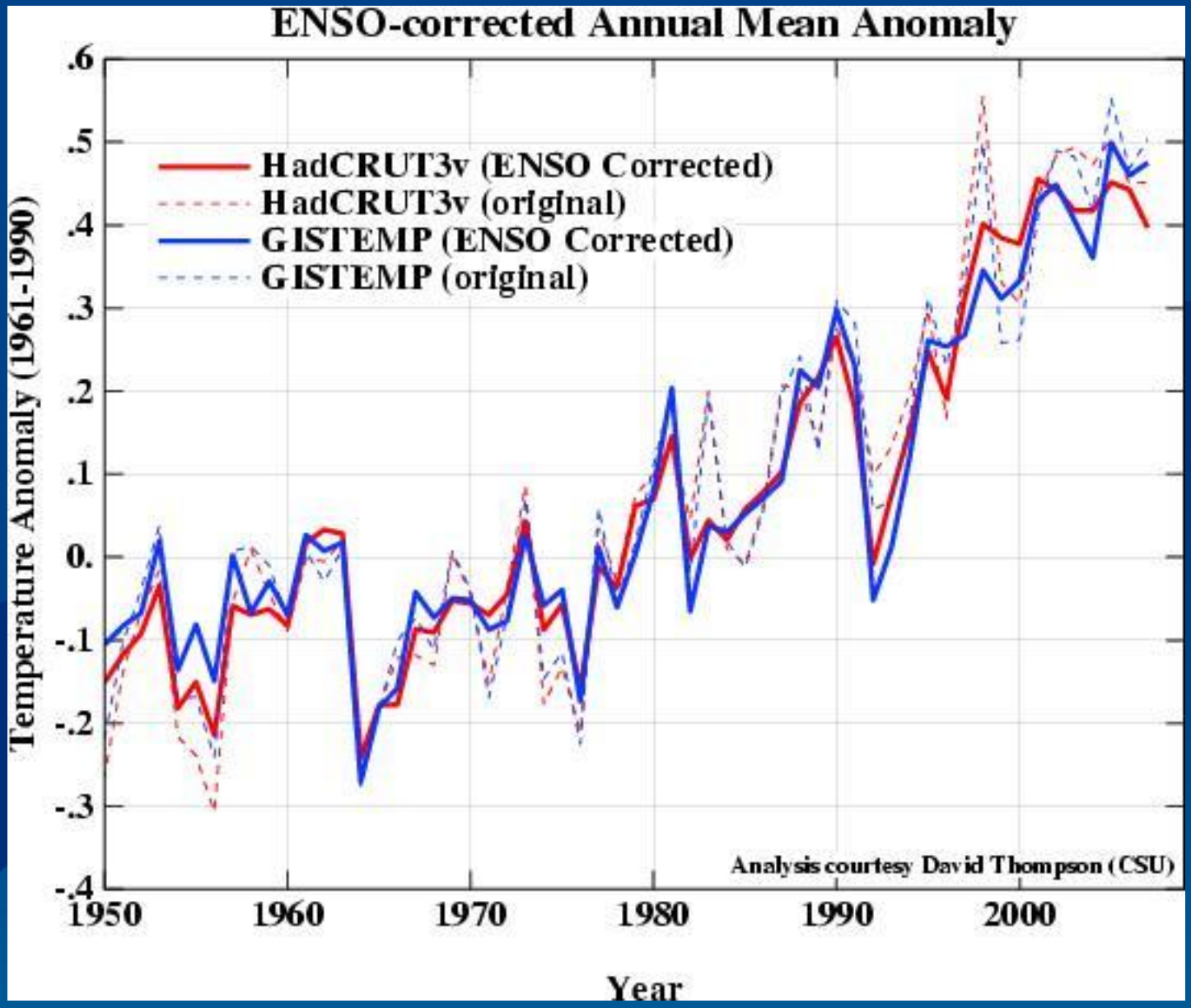
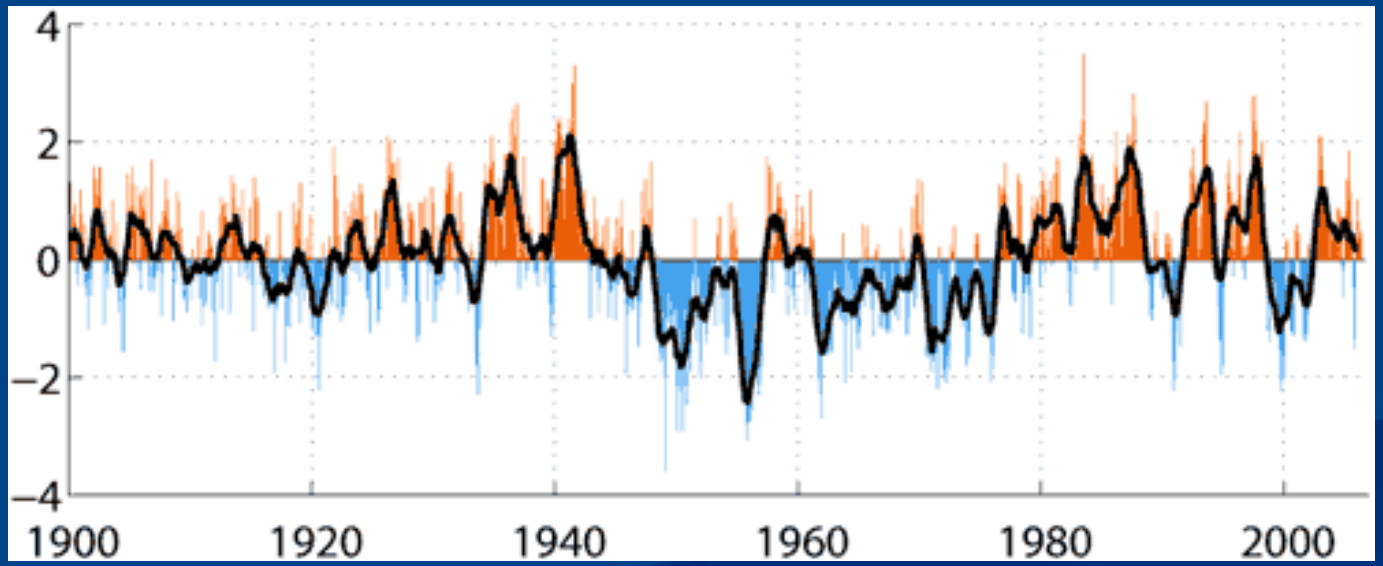
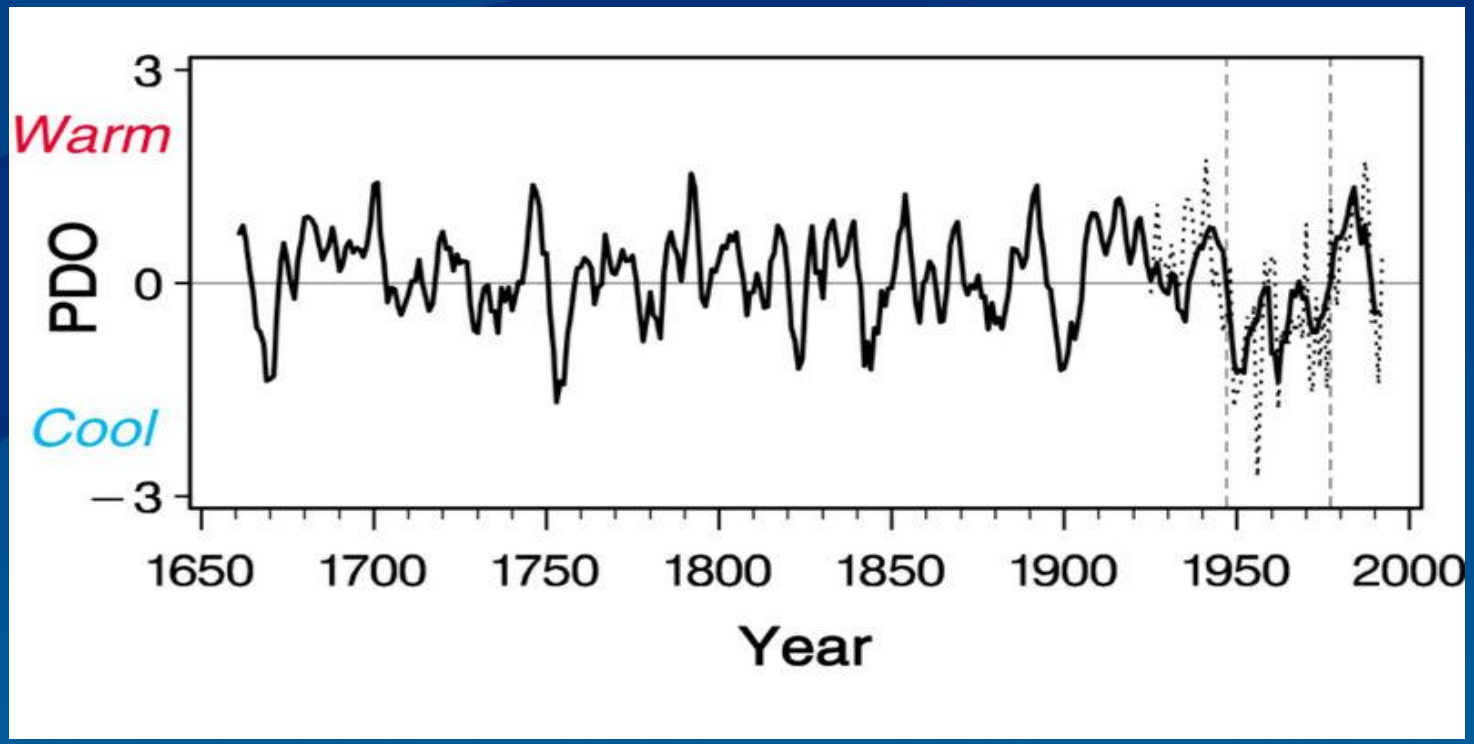



ENSO-corrected Annual Mean Anomaly
HadCRUT3v (ENSO Corrected)
HadCRUT3v (original)
GISTEMP (ENSO Corrected)
GISTEMP (original)
Temperature Anomaly (1961-1990)
.6
.5
.4
.3
.2
.1
0.
-.1
-.2
-.3
-.4
1950
1960
1970
1980
1990
2000
Year
Analysis courtesy David Thompson (CSU)





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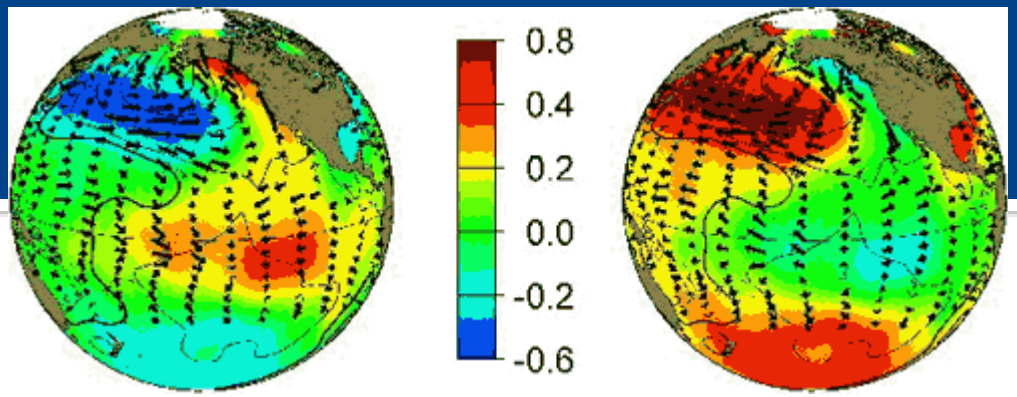
0.8
0.4
0.2
0.0
-0.2
-0.6

Global Temperature Anomaly
PDO Index
PDO Index
Temperature Anomaly
12
10
8
6
4
2
0
-2
-4
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000

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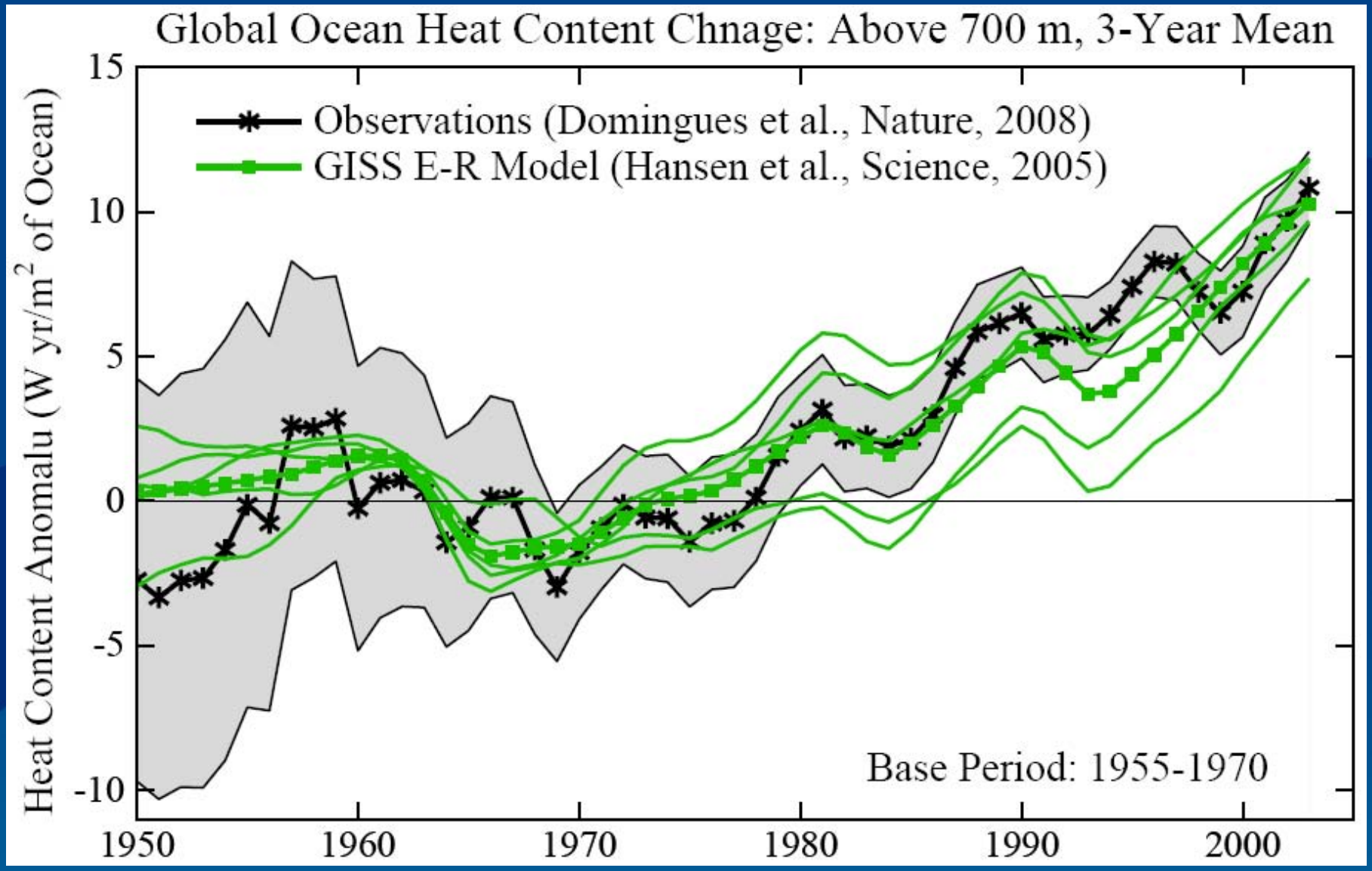

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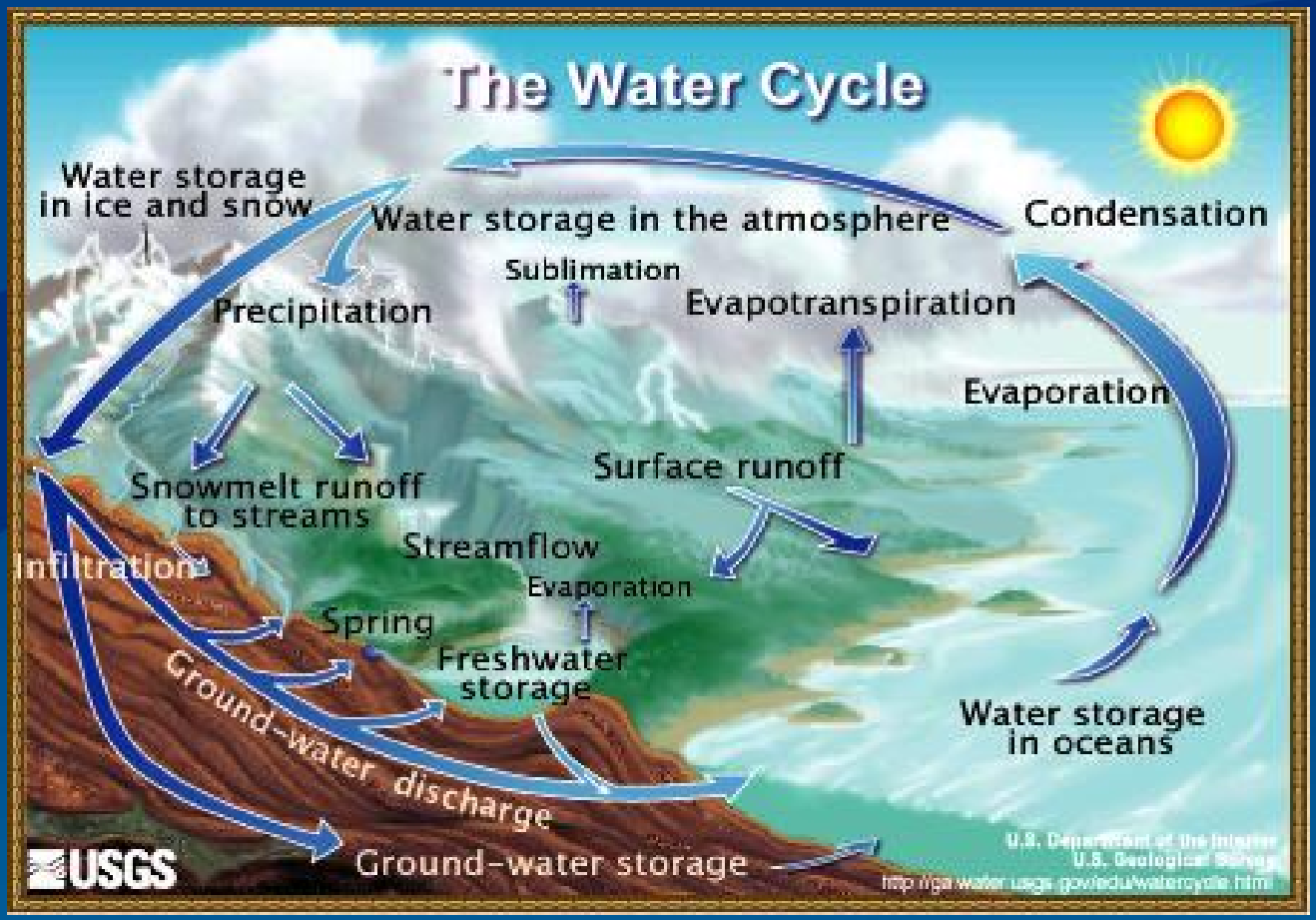
It's water vapour



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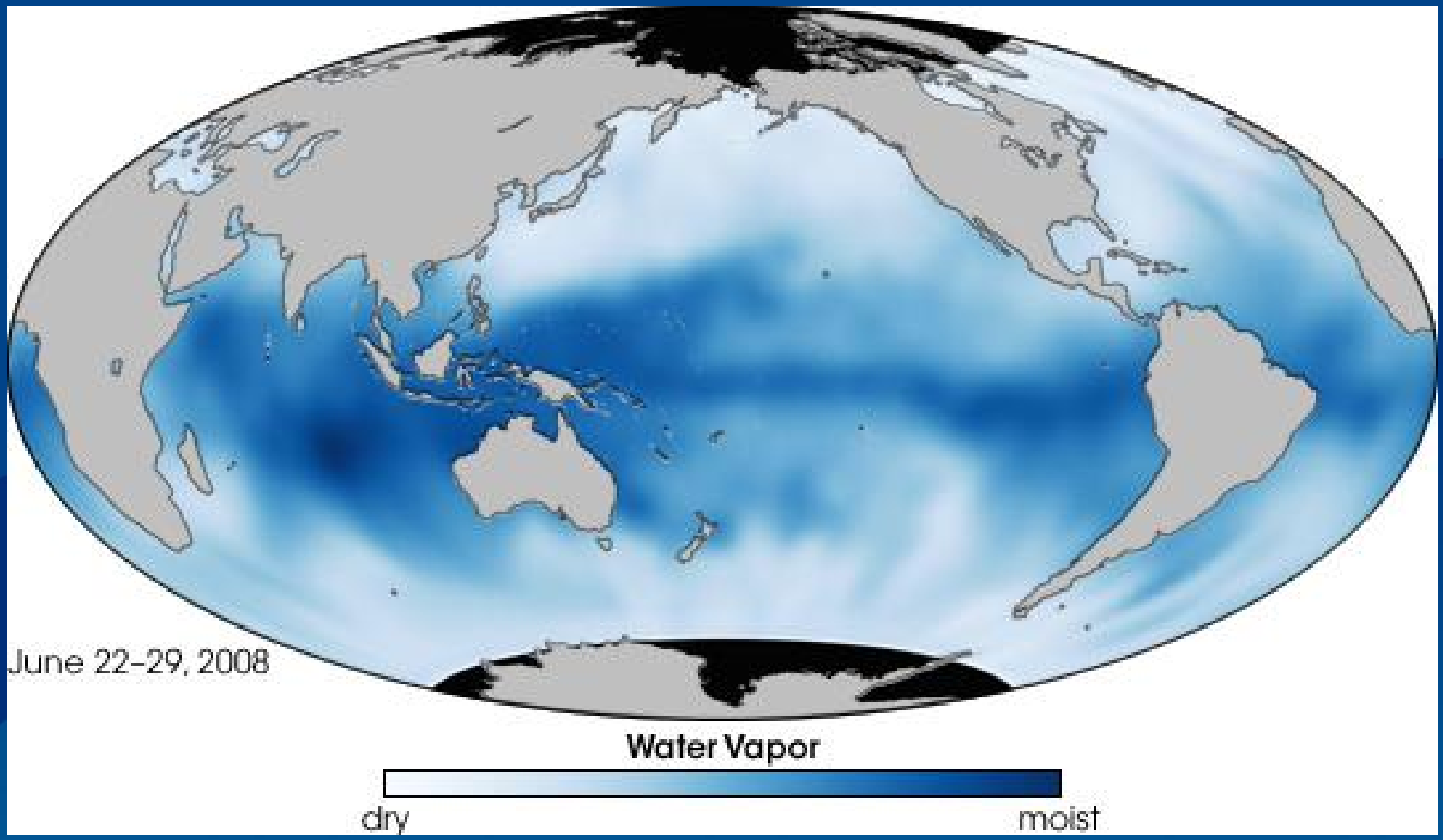
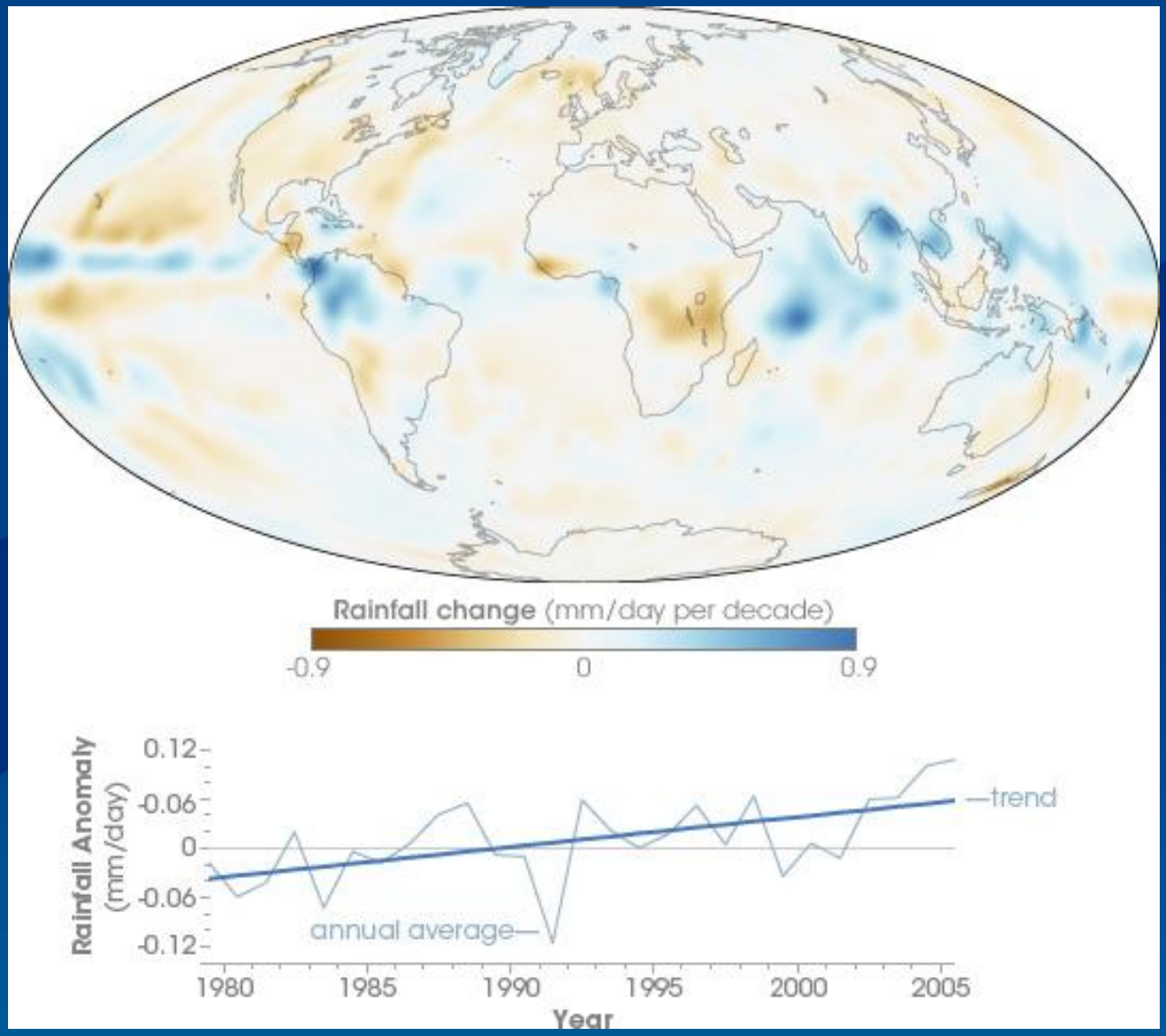
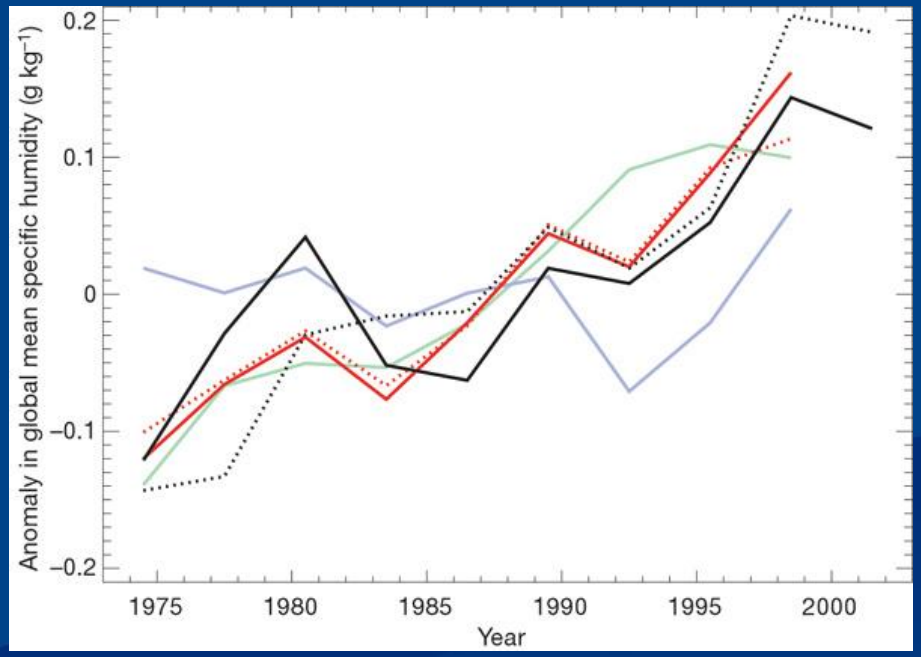
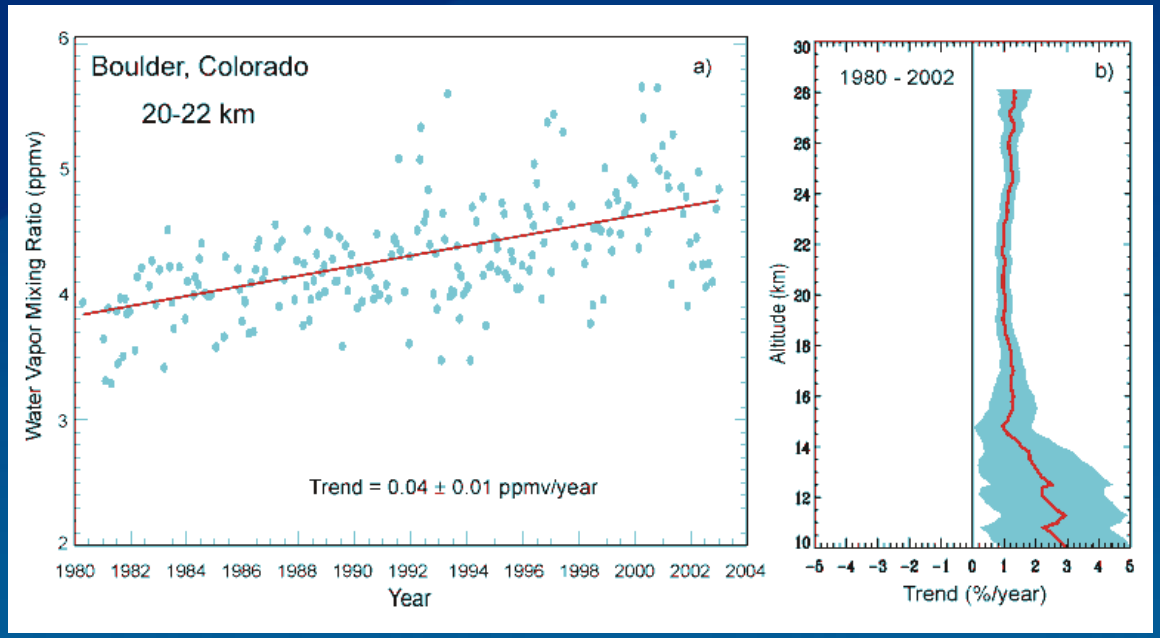
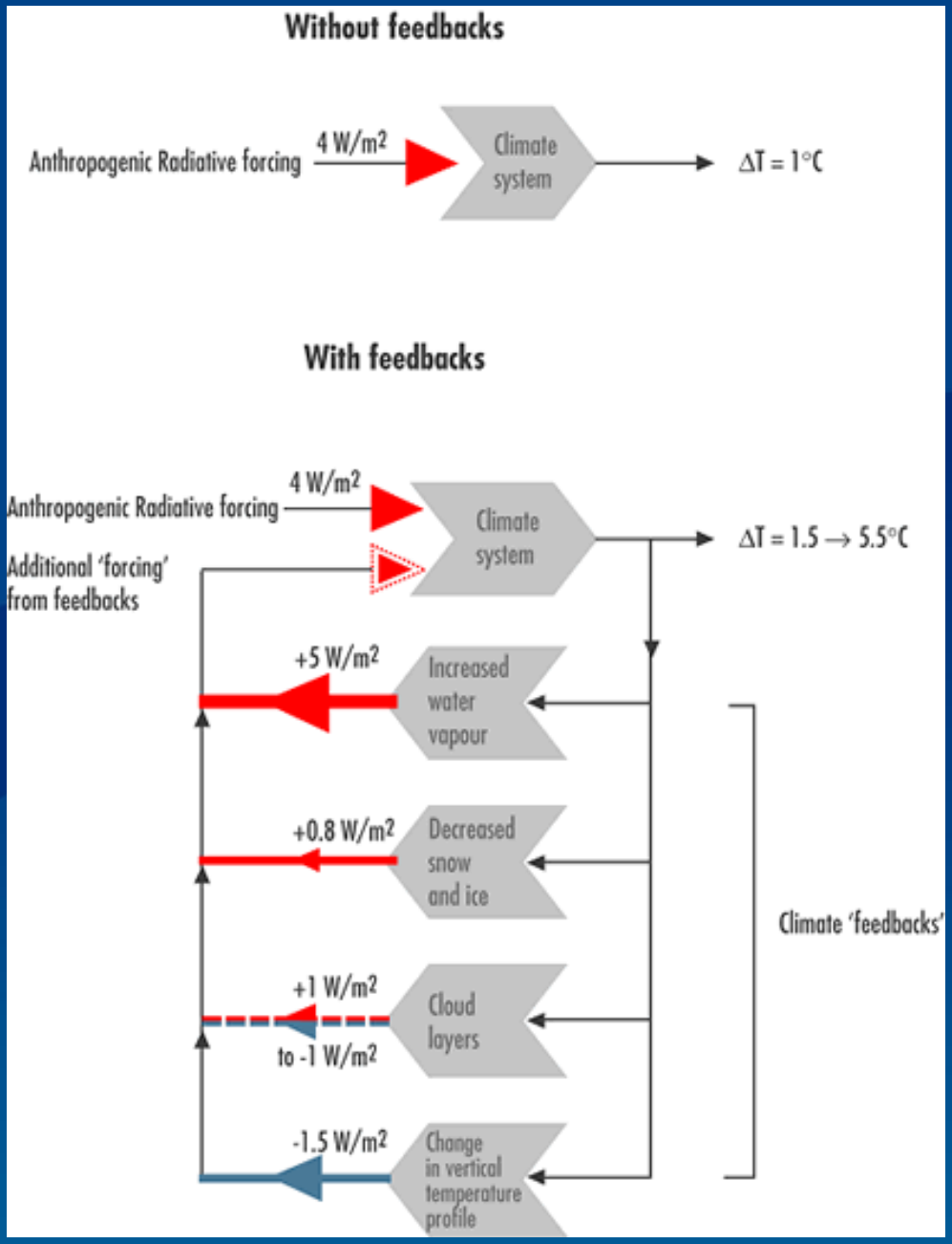



Rainfall change (mm/day per decade)
-0.9
0
0.9
Rainfall Anomaly (mm/day)
0.12
0.06
0
-0.06
-0.12
annual average
trend
1980
1985
1990
1995
2000
2005
Year


Anomaly in global mean specific humidity (g kg⁻¹)
0.2
0.1
0
−0.1
−0.2
1975
1980
1985
1990
1995
2000
Year


Boulder, Colorado
20-22 km
a)
Water Vapor Mixing Ratio (ppmv)
Trend = 0.04 ± 0.01 ppmv/year
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004
Year
1980 - 2002
b)
Altitude (km)
Trend (%/year)


Without feedbacks
Anthropogenic Radiative forcing
4 W/m²
Climate system
ΔT = 1°C
With feedbacks
Anthropogenic Radiative forcing
4 W/m²
Additional 'forcing' from feedbacks
Climate system
ΔT = 1.5 → 5.5°C
+5 W/m²
Increased water vapour
+0.8 W/m²
Decreased snow and ice
+1 W/m²
to -1 W/m²
Cloud layers
-1.5 W/m²
Change in vertical temperature profile
Climate 'feedbacks'

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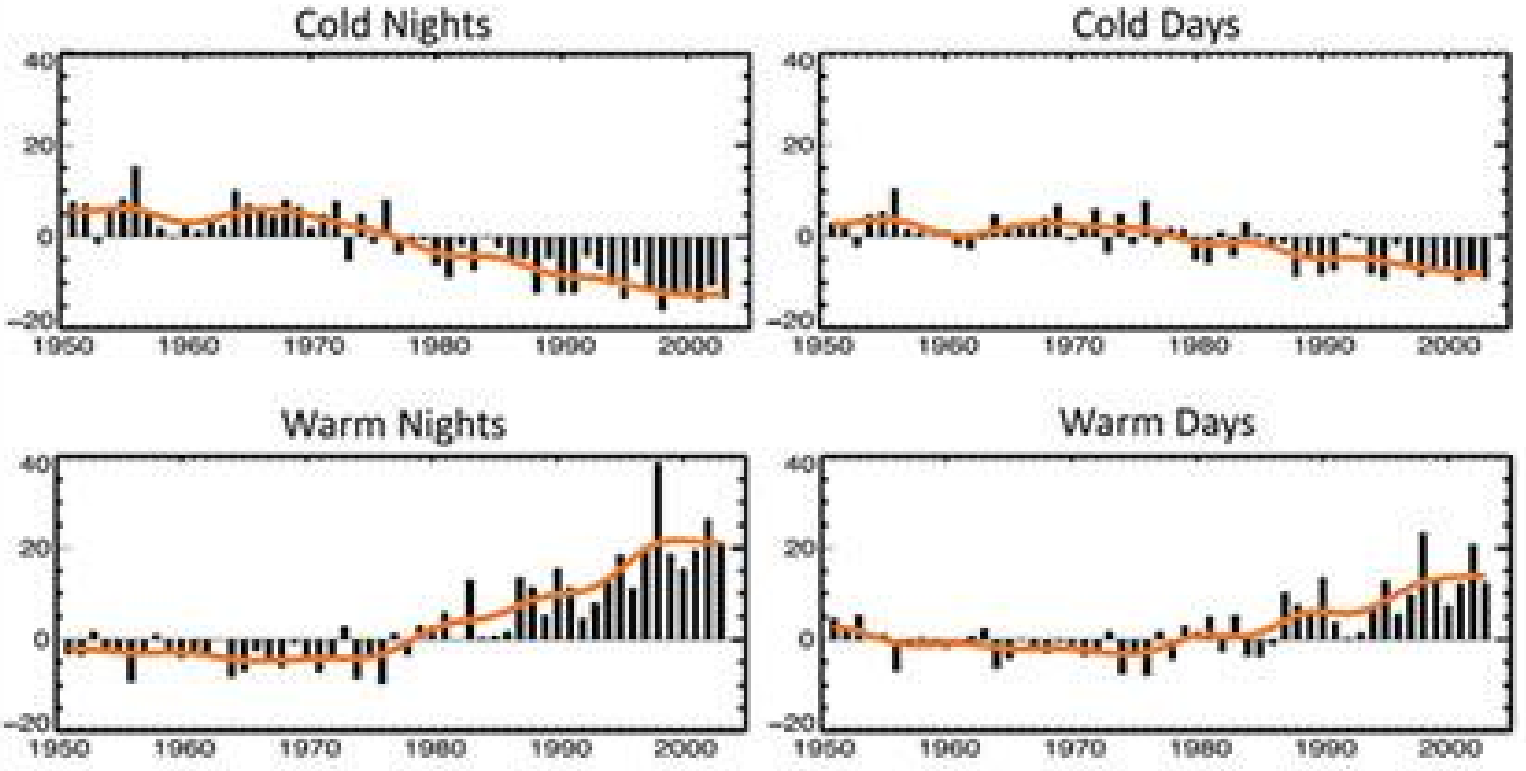
‘Fingerprint’ attributions

Frequency of cold and warm days and nights

cold = bottom 10th percentile, warm = top 10th percentile
1961 - 1990 base period



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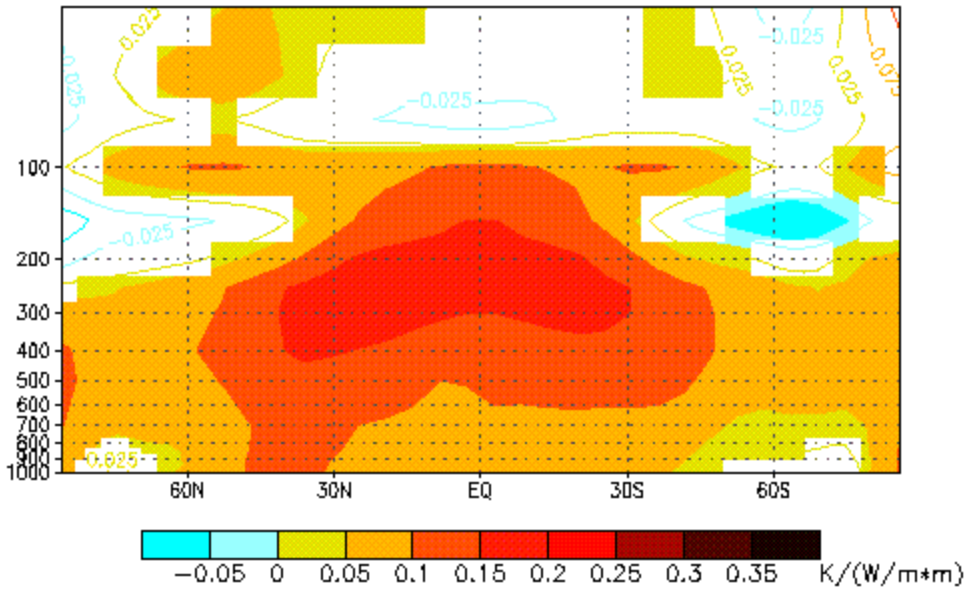
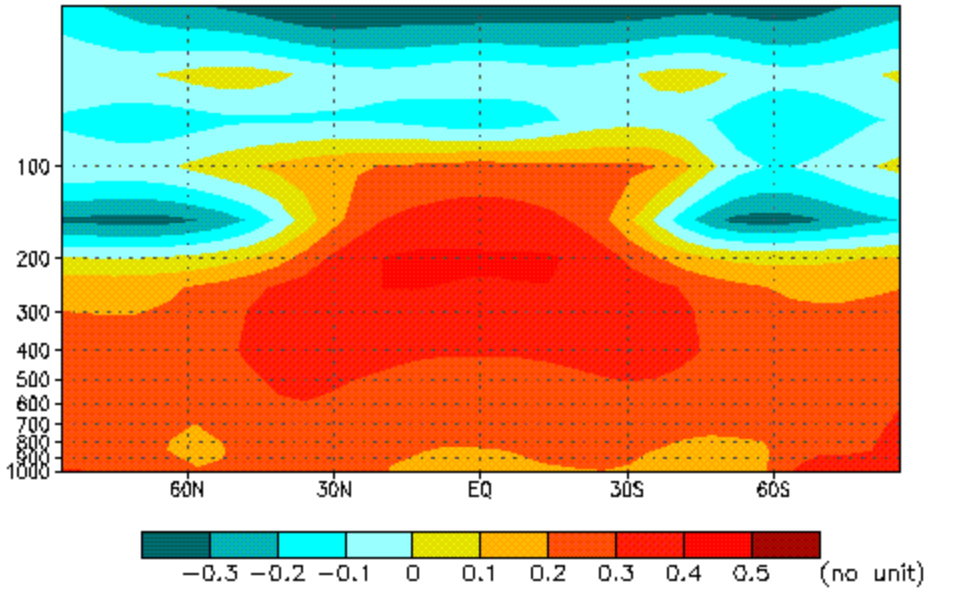
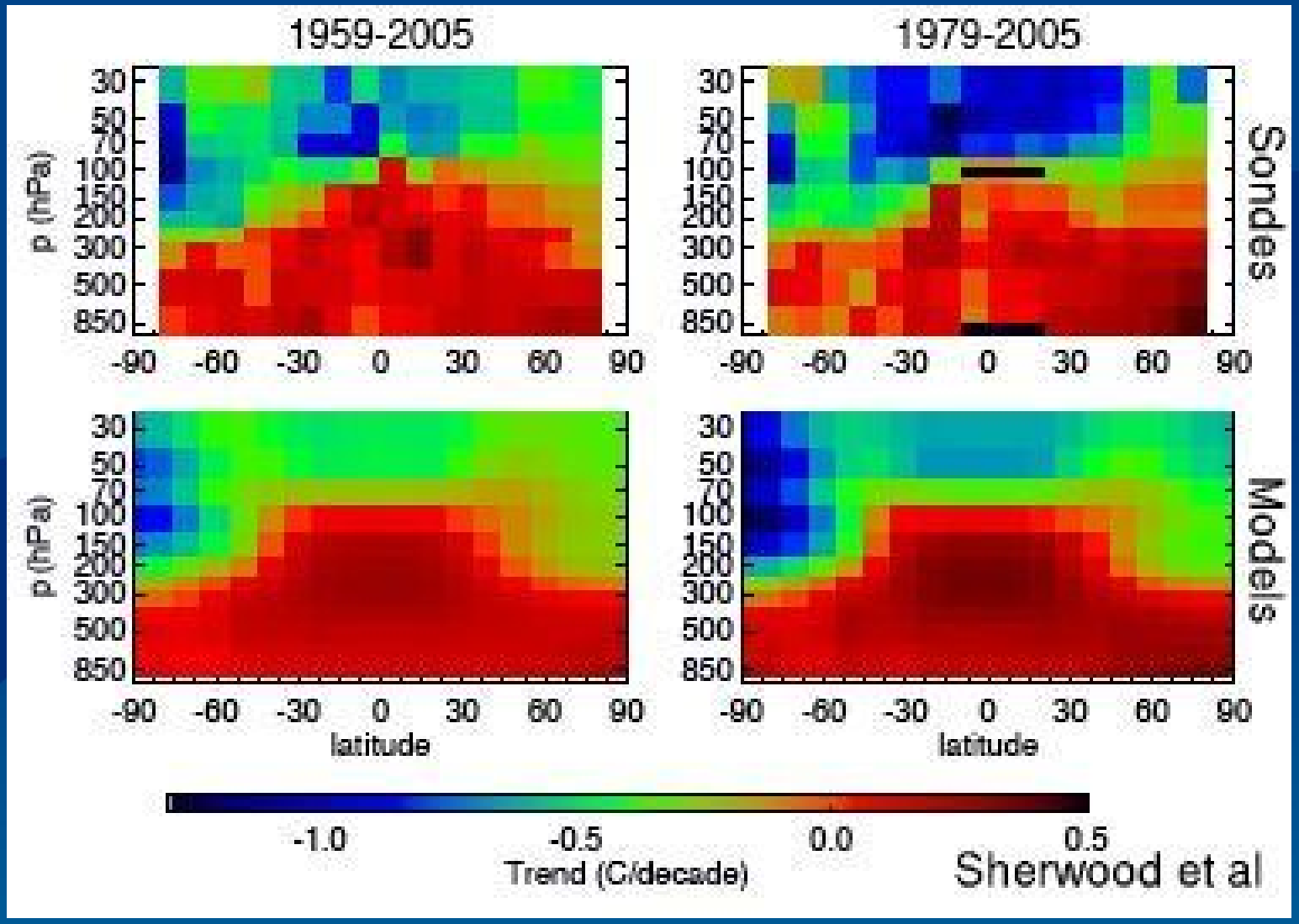
a) Solar Variability Experiments



b) CO2 Experiment




1959-2005
1979-2005
p (hPa)
30
50
70
100
150
200
300
500
850
-90
-60
-30
0
30
60
90
Sondes
Models
latitude
-1.0
-0.5
0.0
0.5
Trend (C/decade)
Sherwood et al

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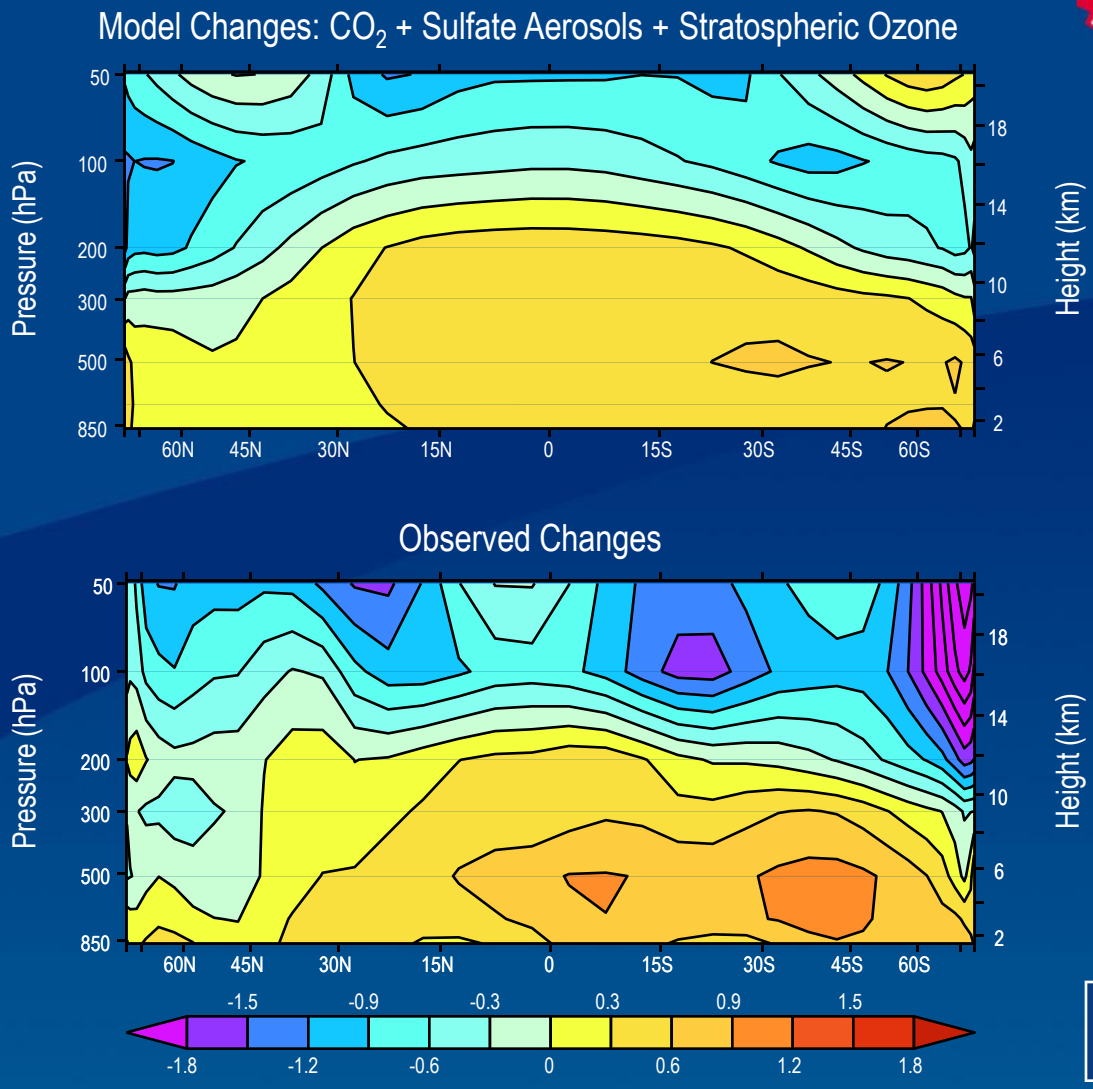

Temperature changes in ^{o}C

Santer *et al*., *Nature* (1996)

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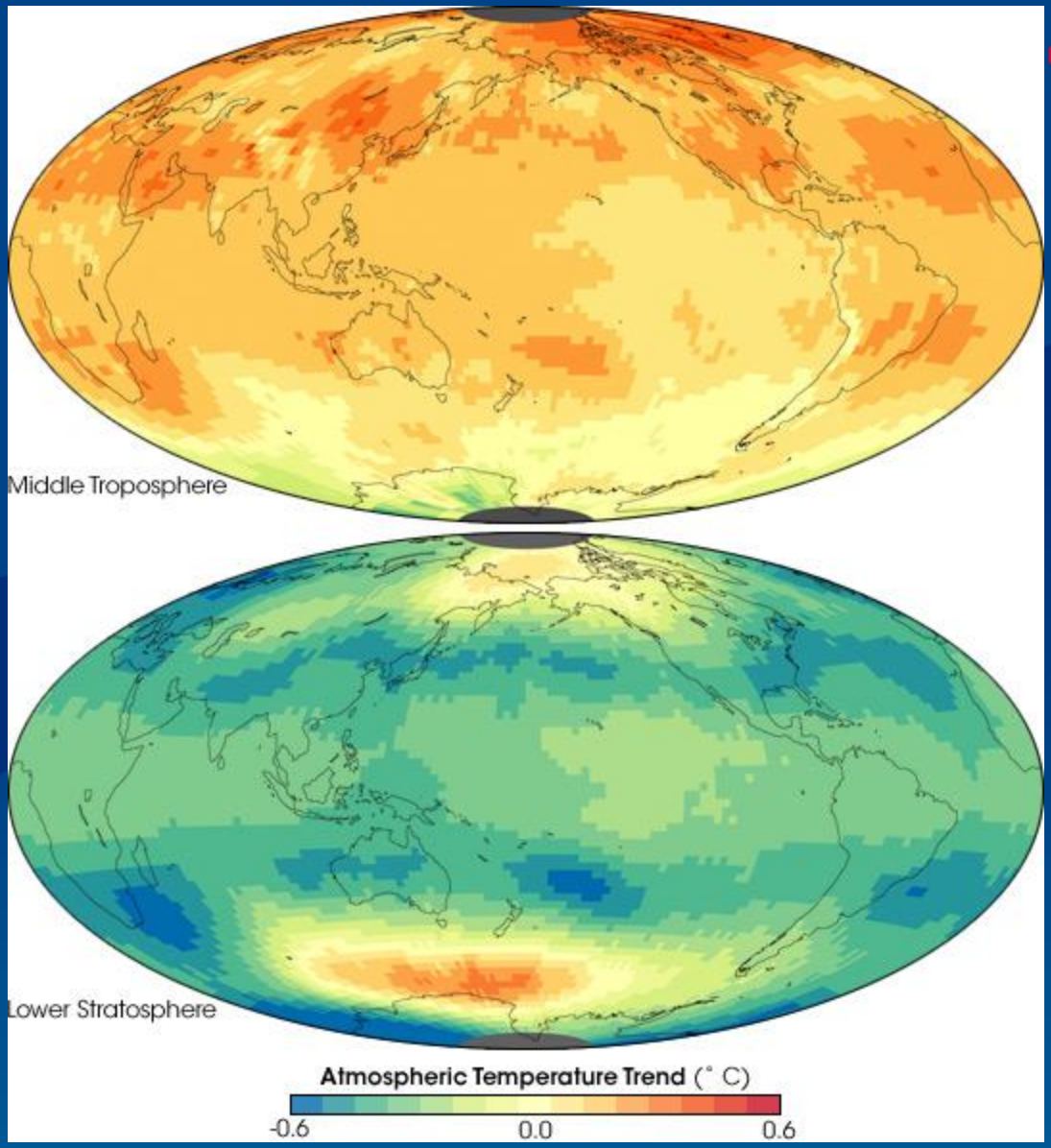

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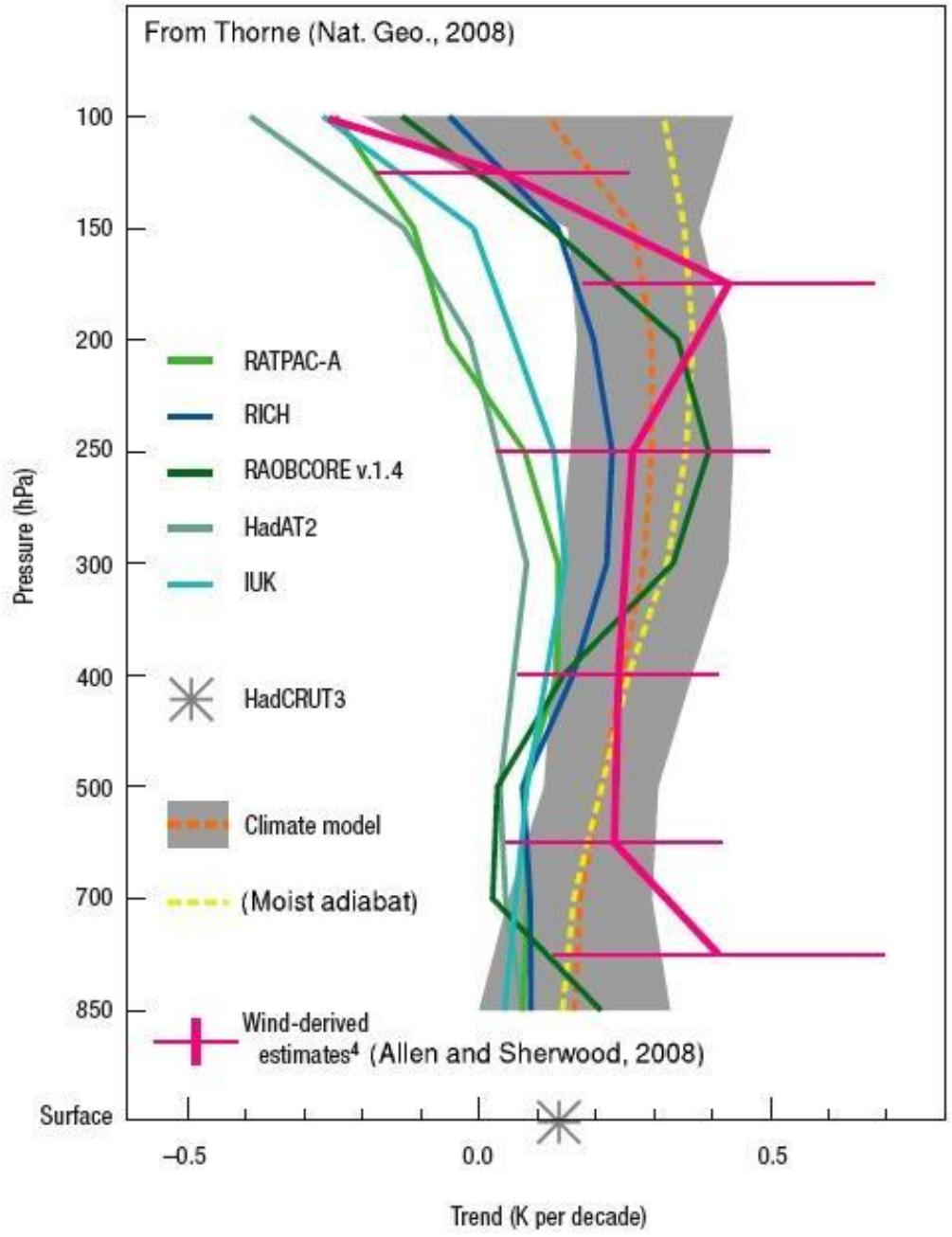

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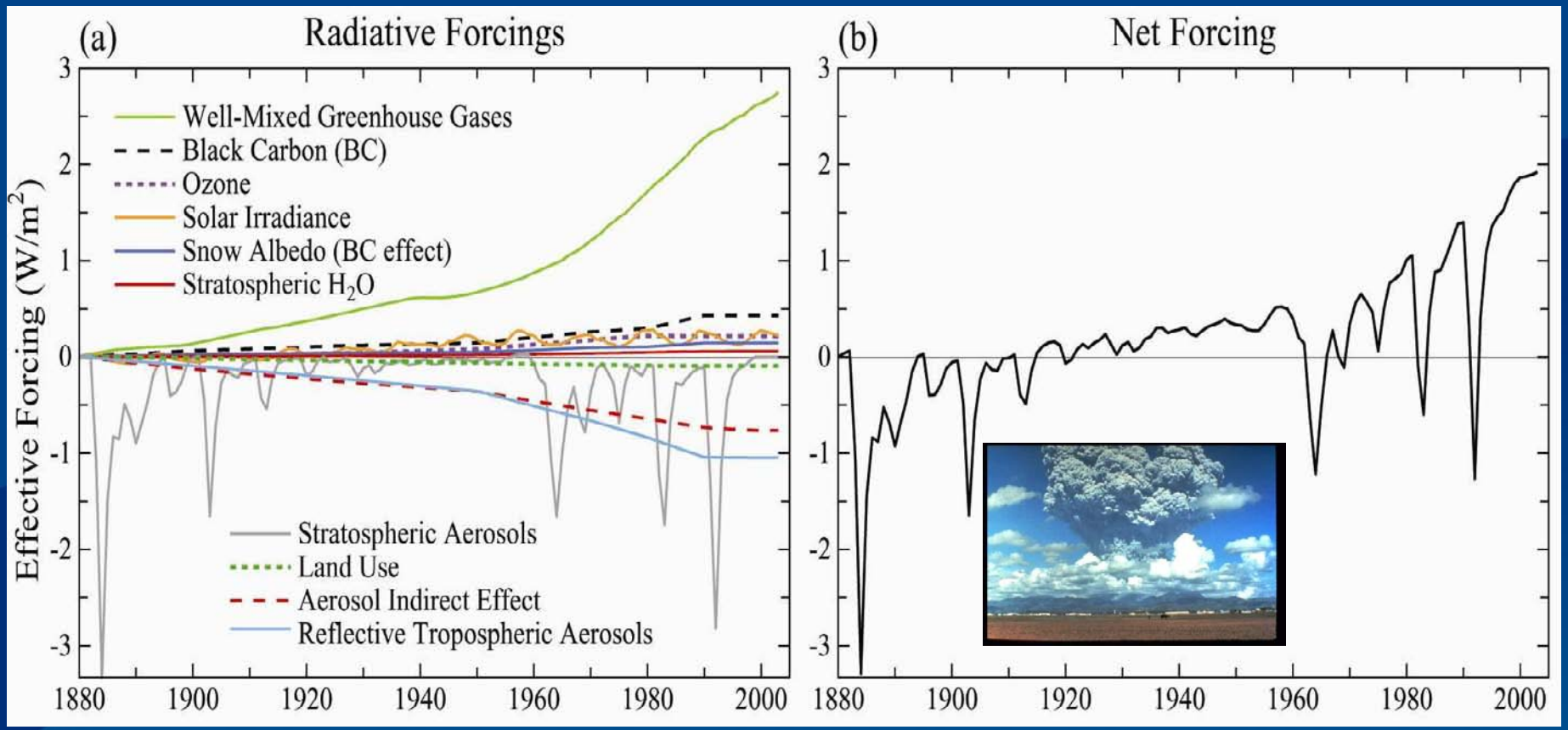

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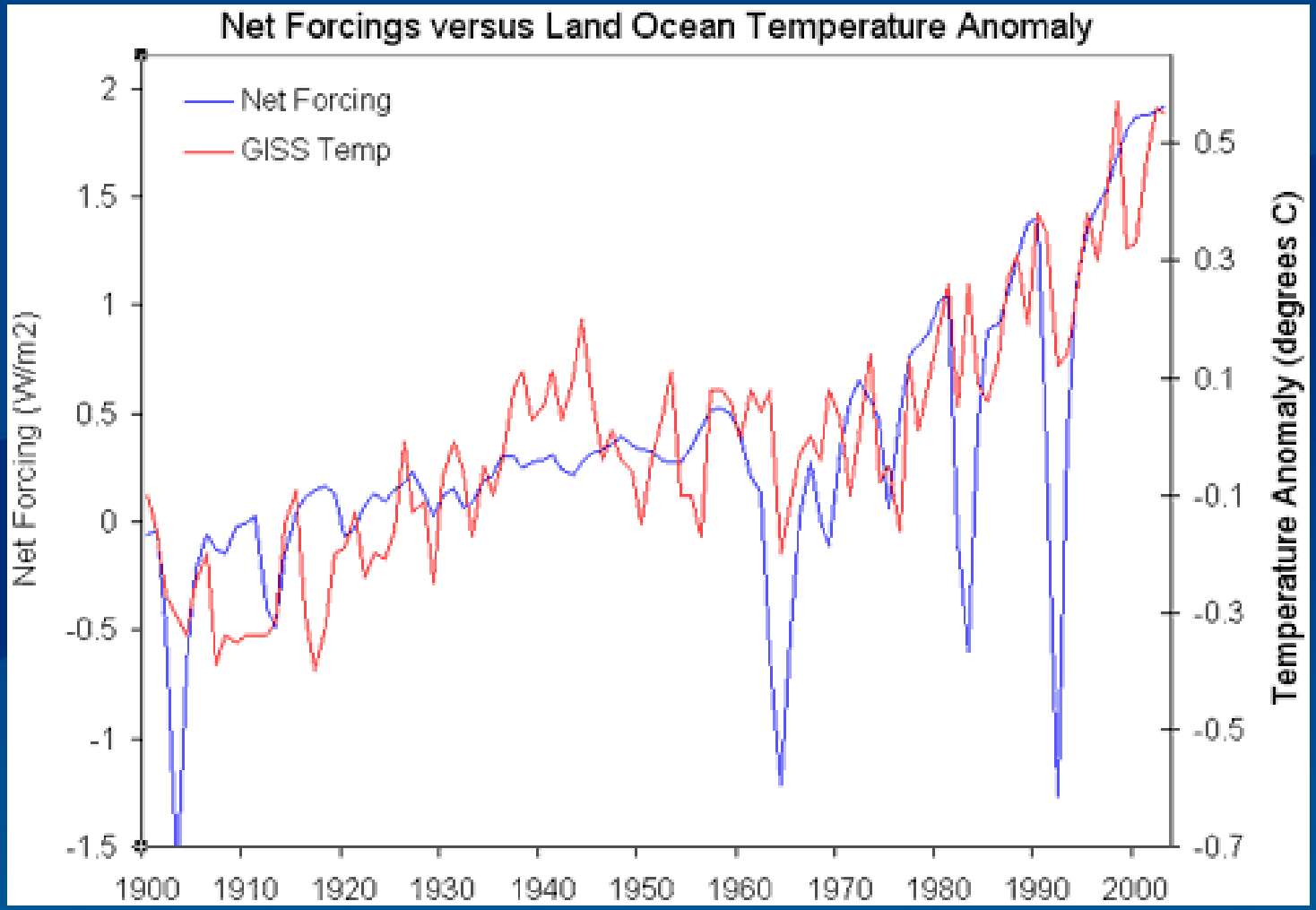
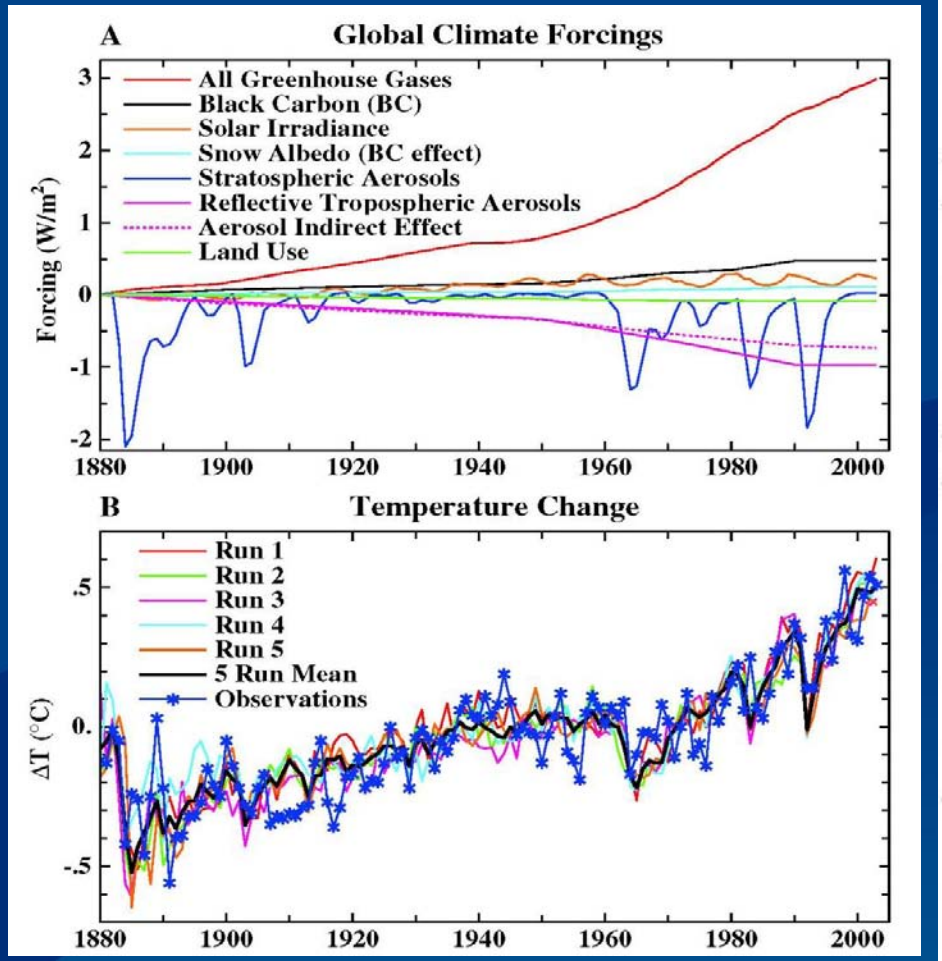
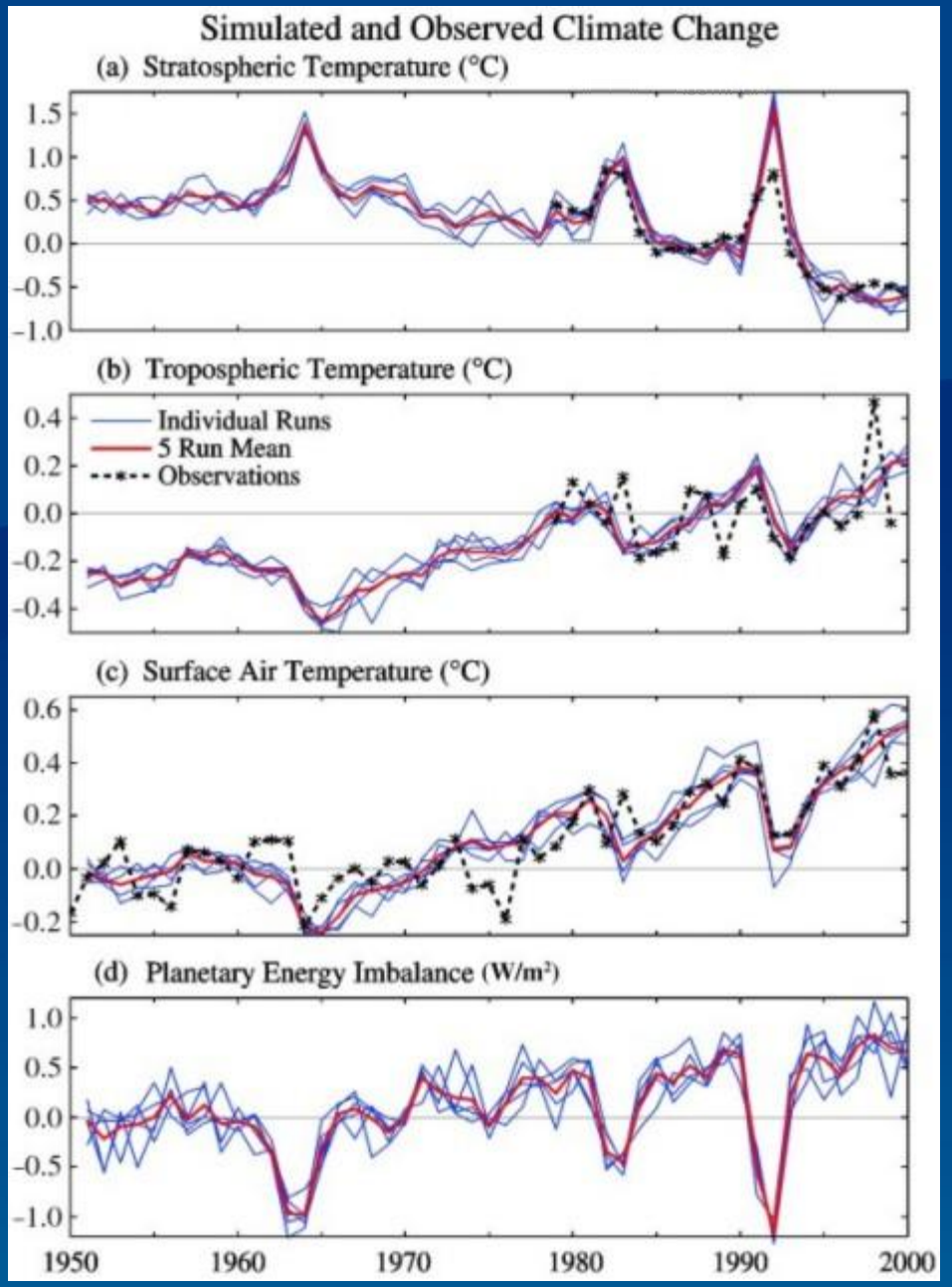



A
Global Climate Forcings
All Greenhouse Gases
Black Carbon (BC)
Solar Irradiance
Snow Albedo (BC effect)
Stratospheric Aerosols
Reflective Tropospheric Aerosols
Aerosol Indirect Effect
Land Use
Forcing (W/m²)
3
2
1
0
-1
-2
1880
1900
1920
1940
1960
1980
2000
B
Temperature Change
Run 1
Run 2
Run 3
Run 4
Run 5
5 Run Mean
Observations
ΔT (°C)
.5
0.
-.5
1880
1900
1920
1940
1960
1980
2000


Simulated and Observed Climate Change
(a) Stratospheric Temperature (°C)
1.5
1.0
0.5
0.0
-0.5
-1.0
(b) Tropospheric Temperature (°C)
Individual Runs
5 Run Mean
Observations
0.4
0.2
0.0
-0.2
-0.4
(c) Surface Air Temperature (°C)
0.6
0.4
0.2
0.0
-0.2
(d) Planetary Energy Imbalance (W/m²)
1.0
0.5
0.0
-0.5
-1.0
1950
1960
1970
1980
1990
2000

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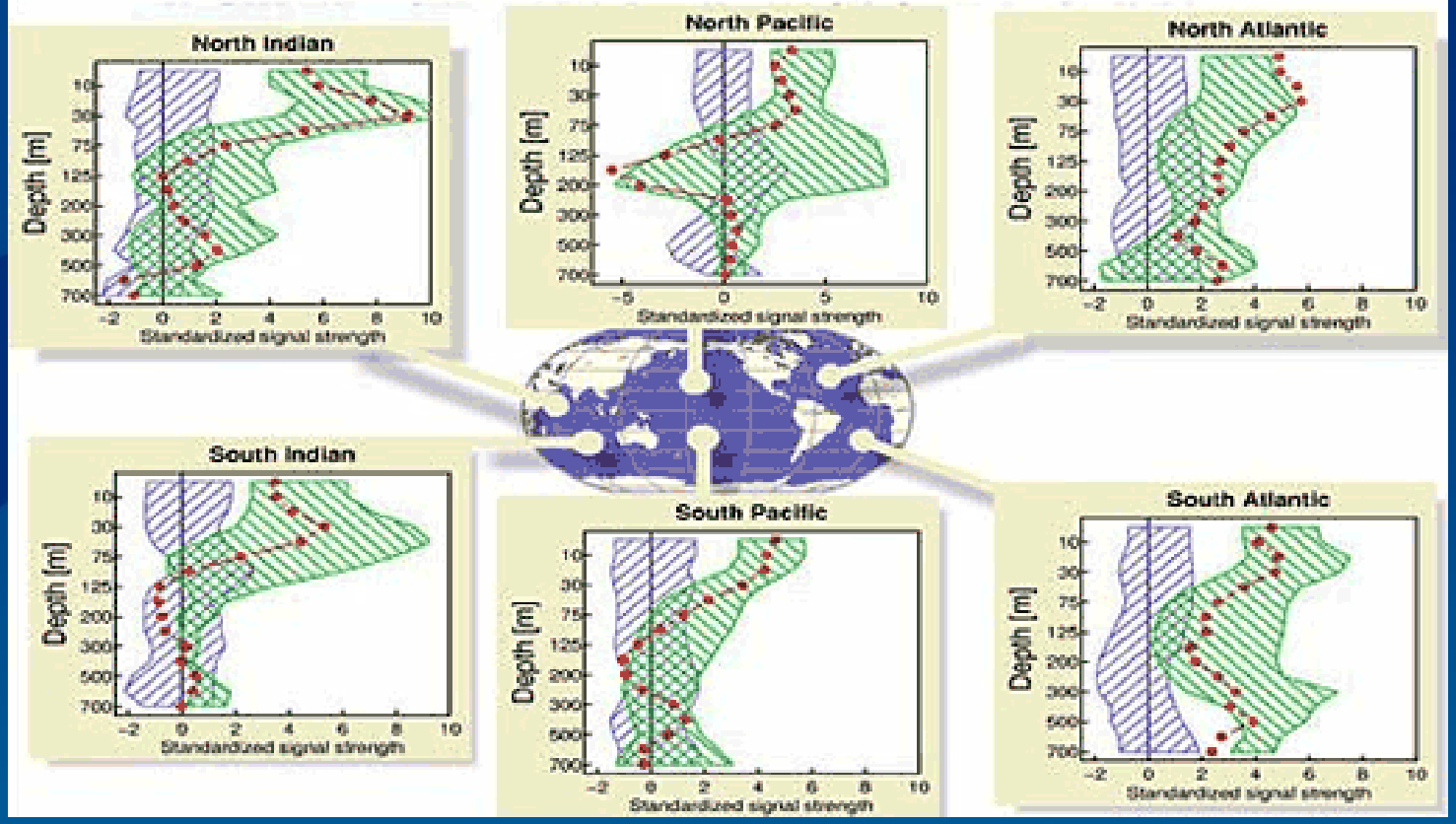
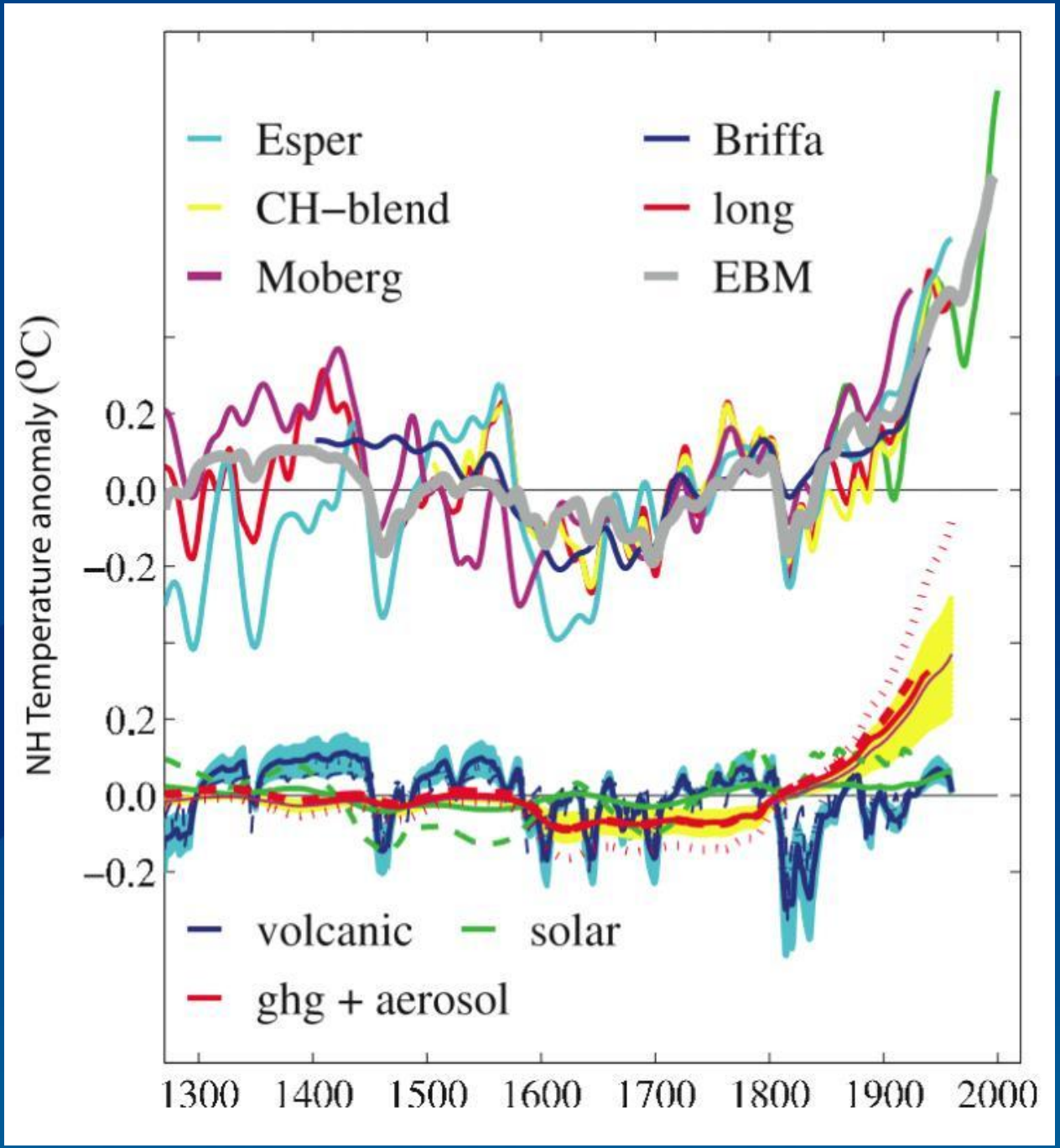
Penetration of Ocean Warming Signal (1960-1999)

SCRIPPS INSTITUTION OF OCEANOGRAPHY

RED: Observed ocean temps
GREEN Climate model with human-made greenhouse gas
BLUE Climate model without human-made greenhouse gas




Esper
Briffa
CH–blend
long
Moberg
EBM
NH Temperature anomaly (°C)
0.2
0.0
–0.2
0.2
0.0
–0.2
volcanic
solar
ghg + aerosol
1300
1400
1500
1600
1700
1800
1900
2000

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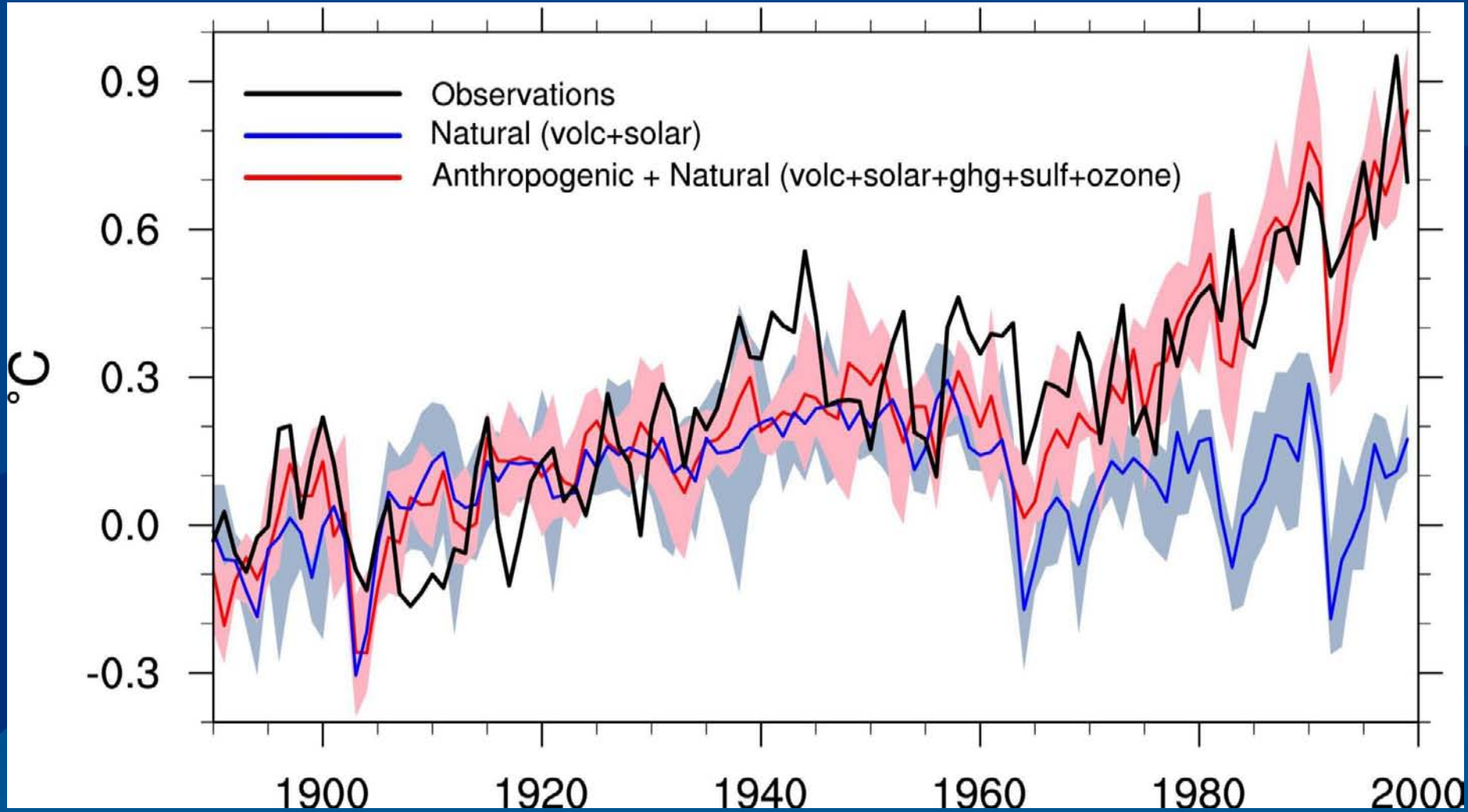
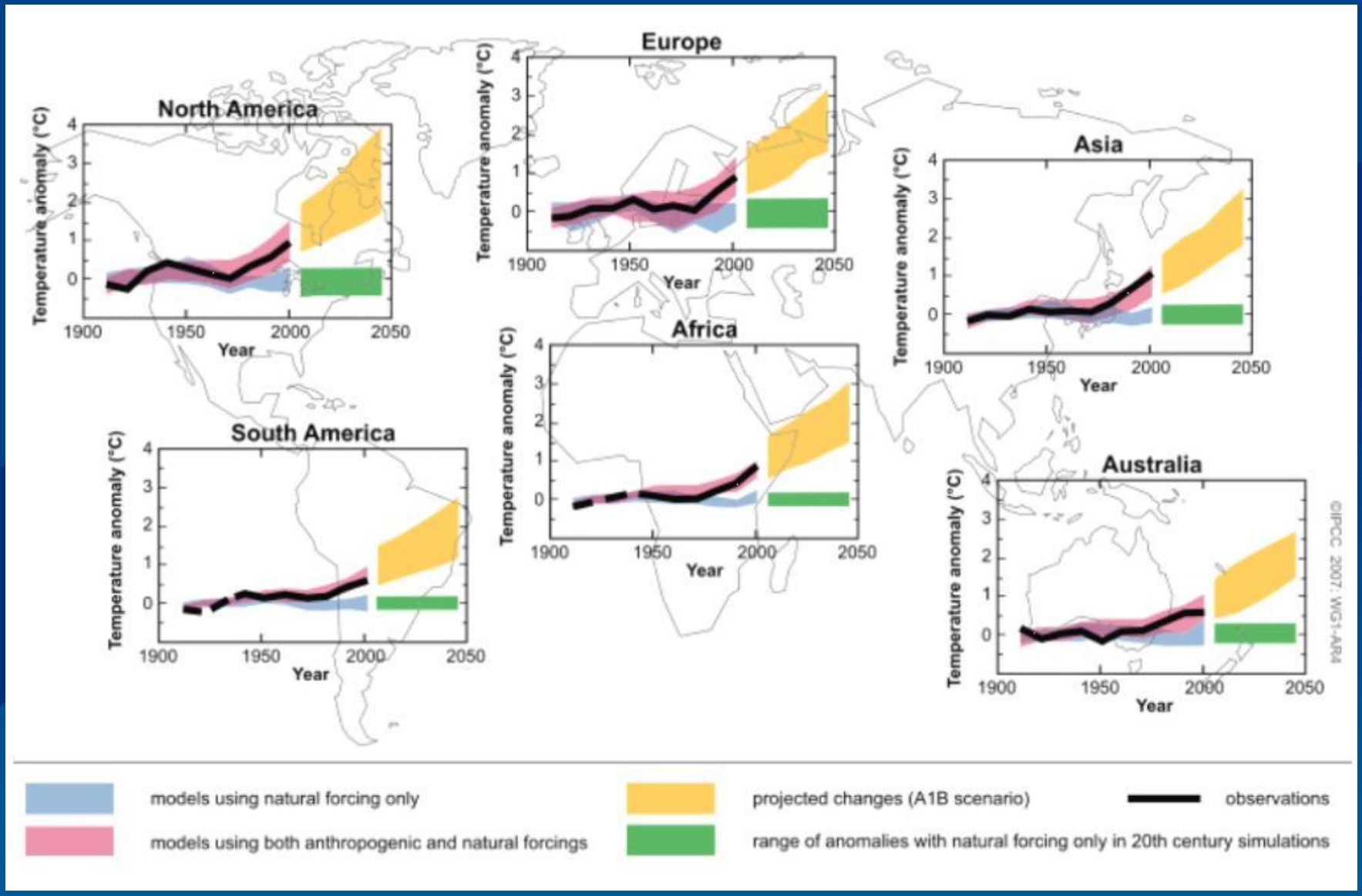
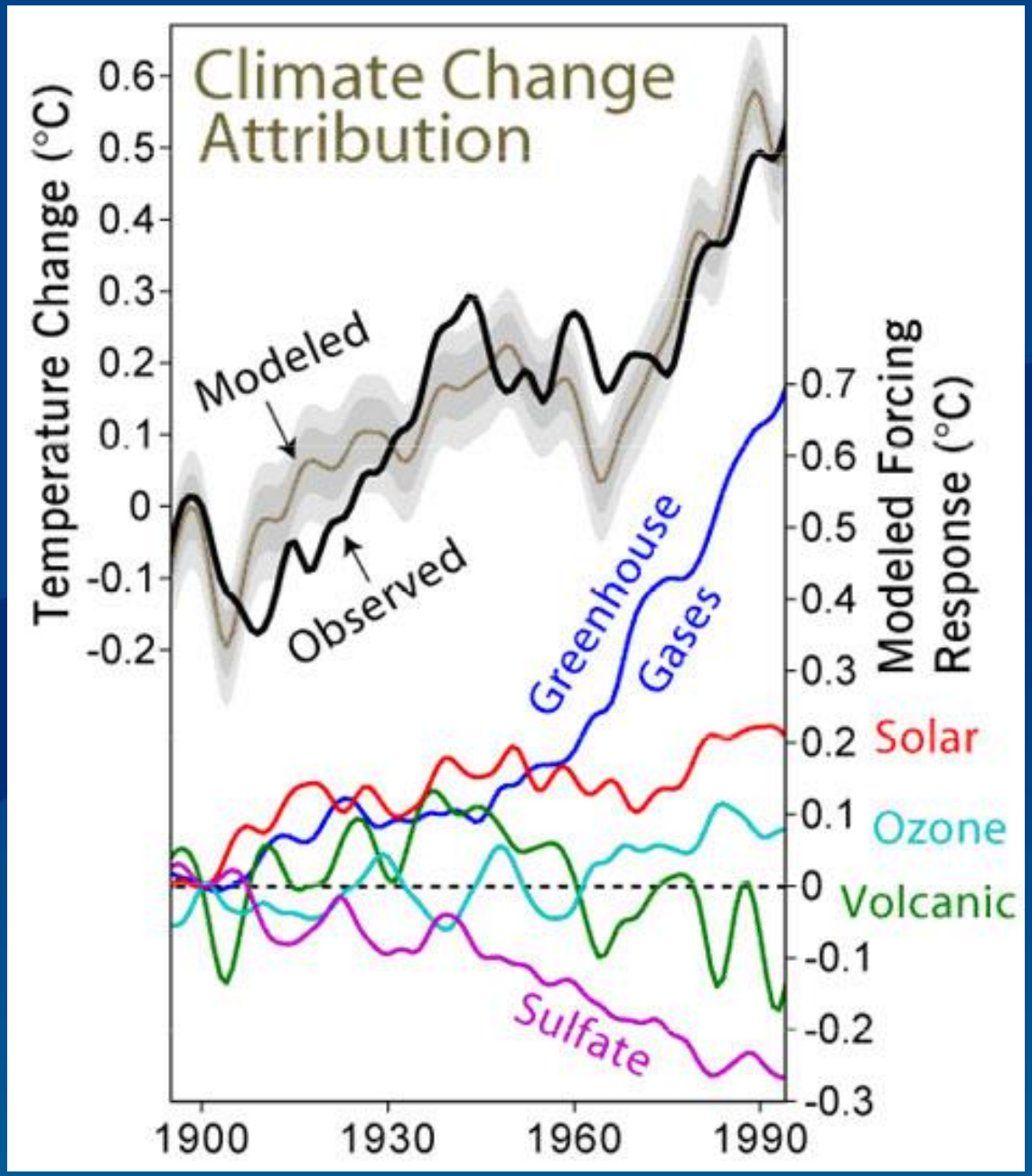



North America
Europe
Asia
Africa
South America
Australia
Temperature anomaly (°C)
Year
1900
1950
2000
2050
models using natural forcing only
models using both anthropogenic and natural forcings
projected changes (A1B scenario)
range of anomalies with natural forcing only in 20th century simulations
observations
©IPCC 2007: WG1-AR4


Climate Change Attribution
Temperature Change (°C)
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
Modeled
Observed
Modeled Forcing Response (°C)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
Greenhouse Gases
Solar
Ozone
Volcanic
Sulfate
1900
1930
1960
1990

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The climate system is telling us a consistent story

- Human fingerprints have been identified in:
  - Surface temperature (1995)
  - Zonal-mean vertical profiles of atmospheric temperature change (1996)
  - Global ocean heat content (2001)
  - Satellite records of stratospheric and tropospheric temperature change (2003)
  - The height of the tropopause (2003, 2004)
  - Vertical structure of upper-ocean temperature changes (2005)
  - Sea-surface temperature changes in hurricane formation regions (2006)
  - Atmospheric water vapor over oceans (2007)
  - Surface specific humidity
  - Hydrologically-relevant climate variables in the western U.S. (2008)

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SUB CRUCE LUMEN

More information and discussion:

www.bravenewclimate.com

Climate Q&A slide sources include:

http://www.grist.org/news
http://n3xus6.blogspot.com
http://tamino.wordpress.com
http://www.realclimate.org
http://www.skepticalscience.com
http://www.aussmc.org
http://www.bom.gov.au/climate
http://arctic.atmos.uiuc.edu/cryosphere
http://sealevel.colorado.edu
http://cce.890m.com
http://www.ipcc.ch
http://data.giss.nasa.gov/gistemp
http://nsidc.org/arcticseaicenews
http://environment.newscientist.com/channel/earth/dn11462
http://www.woodfortrees.org
http://blogs.news.com.au/heraldsun/andrewbolt
http://www.globalwarmingart.com
http://cdiac.esd.ornl.gov
http://nature.com/nature
http://sciencemag.com
http://pnas.org
http://www.unep.org/Themes/climatechange
http://www.columbia.edu/~jeh1
http://www.metoffice.gov.uk
http://www.cru.uea.ac.uk/cru/data/temperature
http://www.woodfortrees.org
http://en.wikipedia.org
http://www.yaleclimatemediaforum.org
http://www.global-greenhouse-warming.com
http://www.remss.com/msu
http://climate.uah.edu
http://atmoz.org/blog
http://climateprogress.org
http://forecast.uchicago.edu
http://geosci.uchicago.edu/~rtp1/ClimateBook
http://www.ccpo.odu.edu/SEES
http://www.eoearth.org
http://www.cpc.noaa.gov
http://earthobservatory.nasa.gov
http://www.climateprediction.net
http://scitizen.com
http://www.desmogblog.com
http://www.climatedenial.org
http://www.psie.psu.edu
http:// www.agu.org/journals
http://www.esa.org
http://www.aps.org
http://publishing.royalsociety.org
http://flood.firetree.net
http://www.climateaudit.org
http://julesandjames.blogspot.com/
http://icecap.us
http://www.abc.net.au/news/tag/climate-change
http://www.aip.org/history/climate/
http://ams.allenpress.com
http://climatespin.blogspot.com
http://wattsupwiththat.wordpress.com
http://hot-topic.co.nz
http://www.ukcip.org.uk
http://climatesci.org
http://blogs.nature.com/climatefeedback
http://stephenschneider.stanford.edu
http://scienceblogs.com
http://www.wmo.int
http://chriscolose.wordpress.com
http://aerosols.blogspot.com
http://moregrumbinescience.blogspot.com
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