Space & Atmospheric Physics

Space & Atmospheric Physics
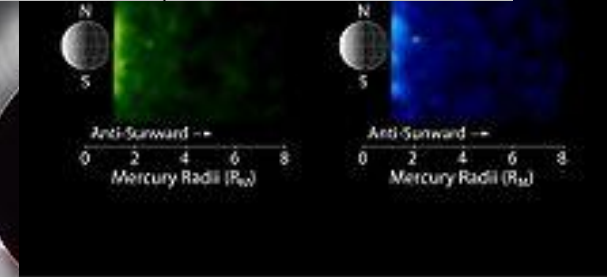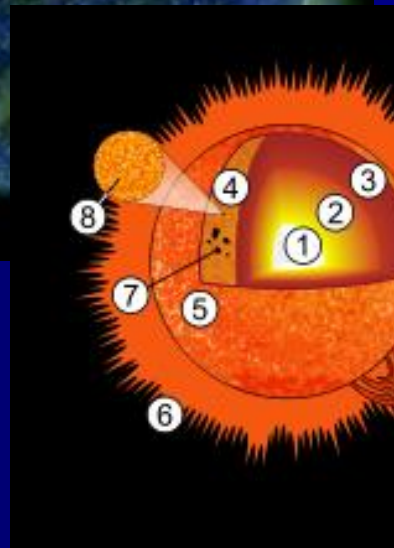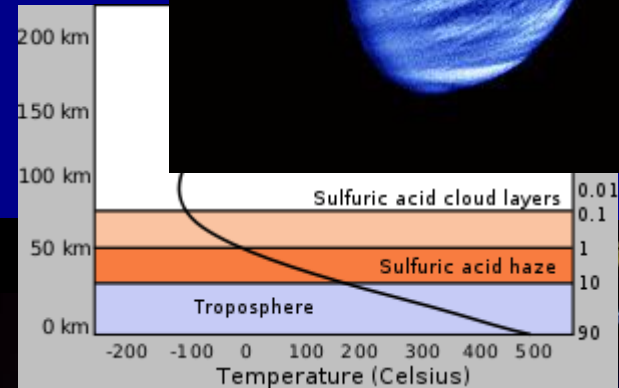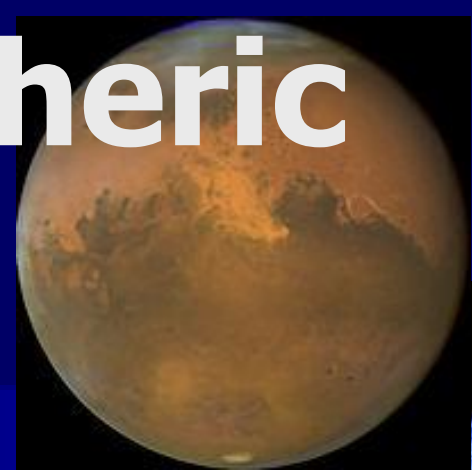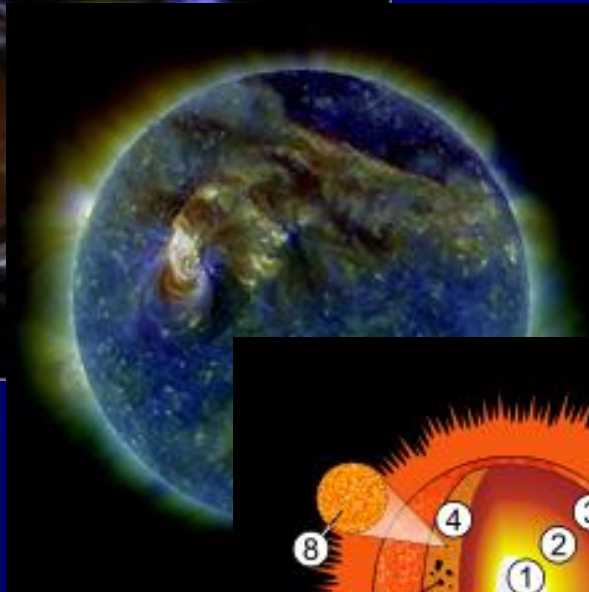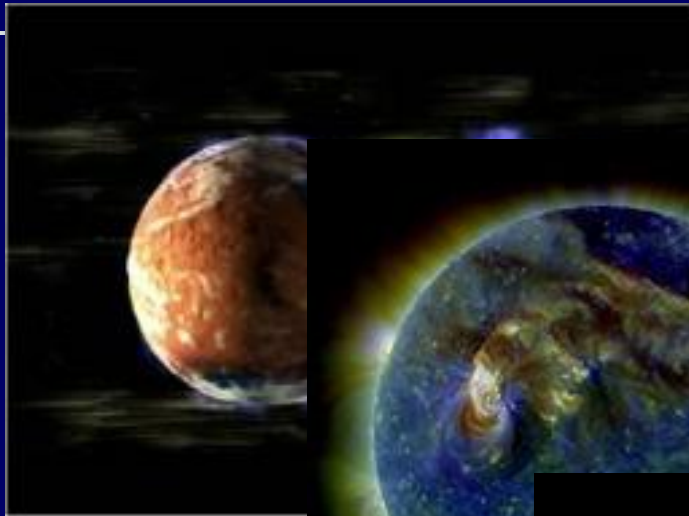
Lecture – 5 A

Earth Atmosphere

Retaining of Gases in the Earth
Major / Minor constituents
Barometric Equation
Scale Height
Atmospheric Regions
Temperature Profiles
Retaining of Gases
Number Density Profiles
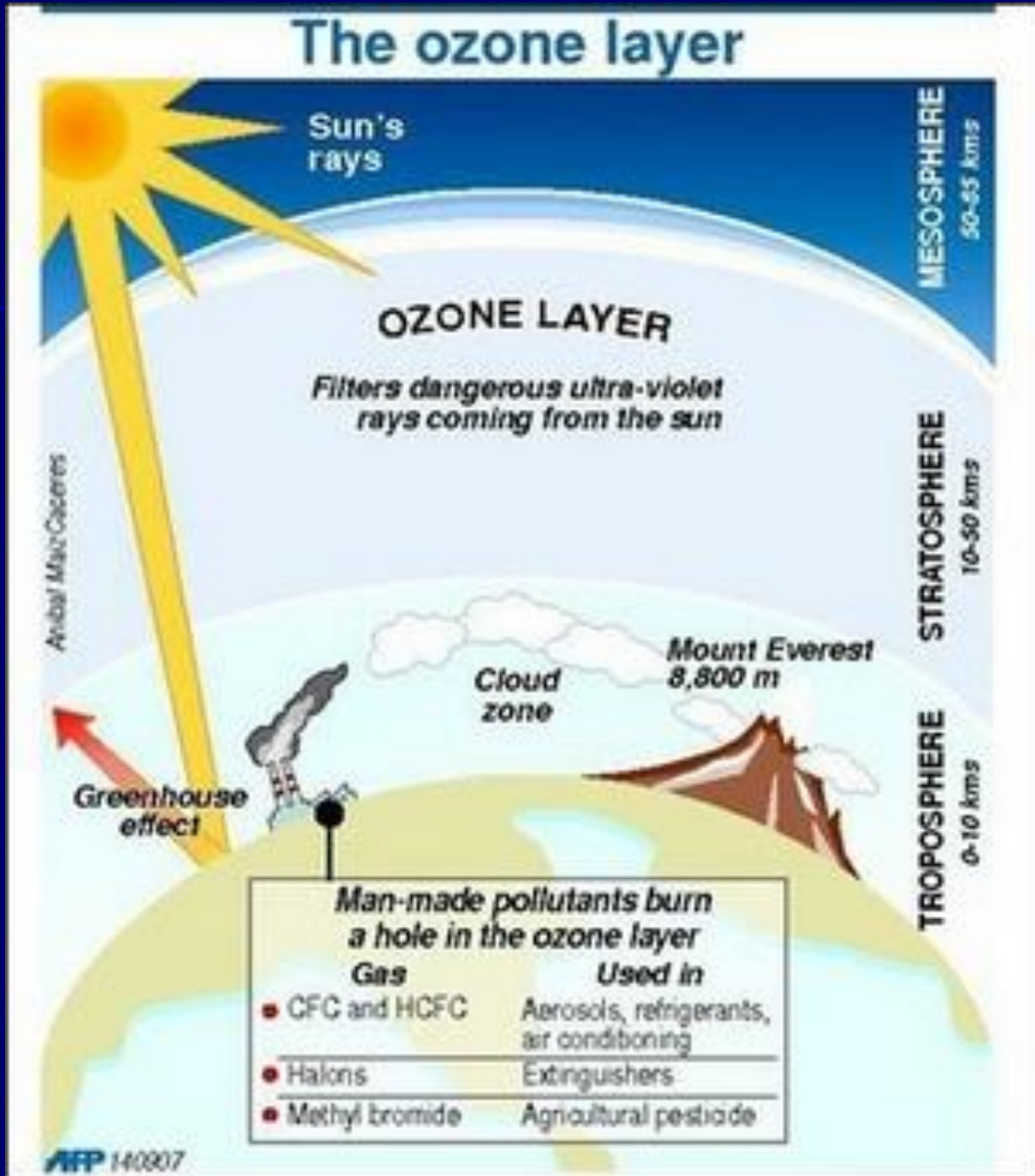
PHY 497 2.0 – Space & Atmospheric Physics
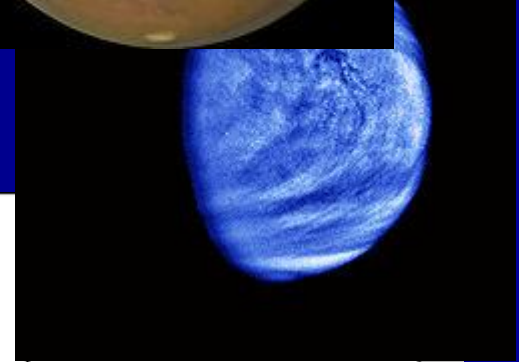## Continuous Assignment – 05

1. Explain the importance of Ozone layer in terms of maintaining a life form comprehensively on Earth.

2. How far gases such as "**CFC**" can damage the Ozone layer and explain it?

3. What are the steps that you can take to protect the Ozone layer?

Global Warming

Global Warming

Global warming is the rise in the average temperature of Earth's atmosphere and oceans since the late 19th century and its projected continuation.

Since the early 20th century, Earth's mean surface temperature has increased by about 0.8 °C, with about two-thirds of the increase occurring since 1980.

Global Warming

Global mean land-ocean temperature change from 1880–2011, relative to the 1951–1980 mean. The black line is the annual mean and the red line is the 5-year running mean. The green bars show uncertainty estimates. (Source: NASA GISS)

Global Land–Ocean Temperature Index

- Annual Mean
- 5-year Running Mean
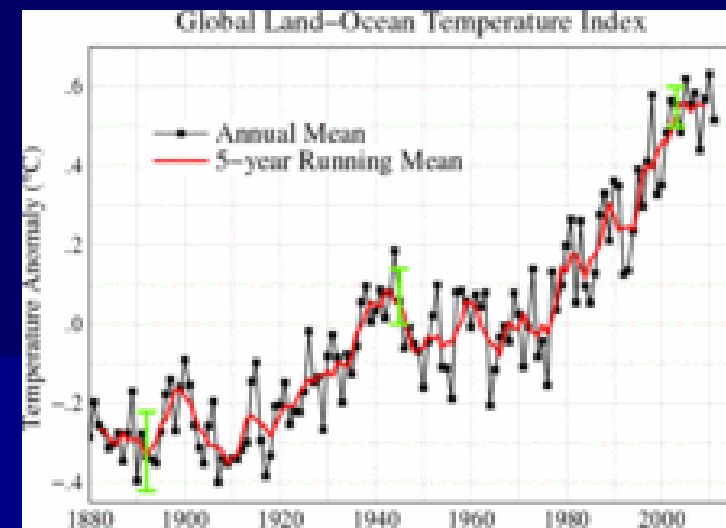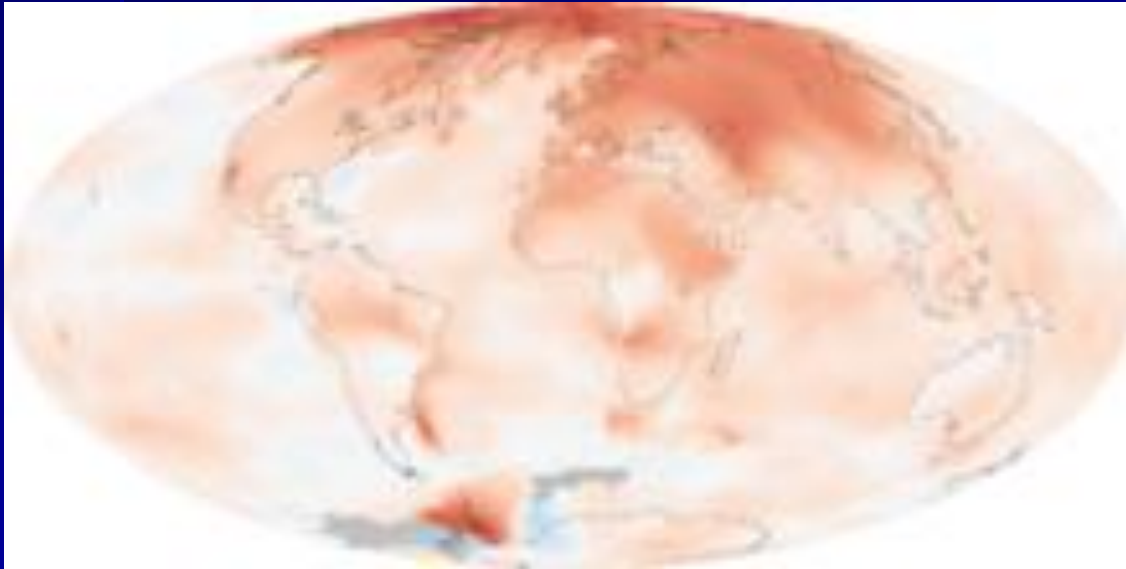
The map shows the 10-year average (2000–2009) global mean **temperature anomaly** relative to the 1951–1980 mean.

The largest **temperature increases** are in the Arctic and the Antarctic Peninsula. Source: **NASA Earth Observatory**

Initial causes of temperature changes

Greenhouse gases :

The greenhouse effect is the process by which absorption and emission of infrared radiation by gases in the atmosphere warm a planet's lower atmosphere and surface.
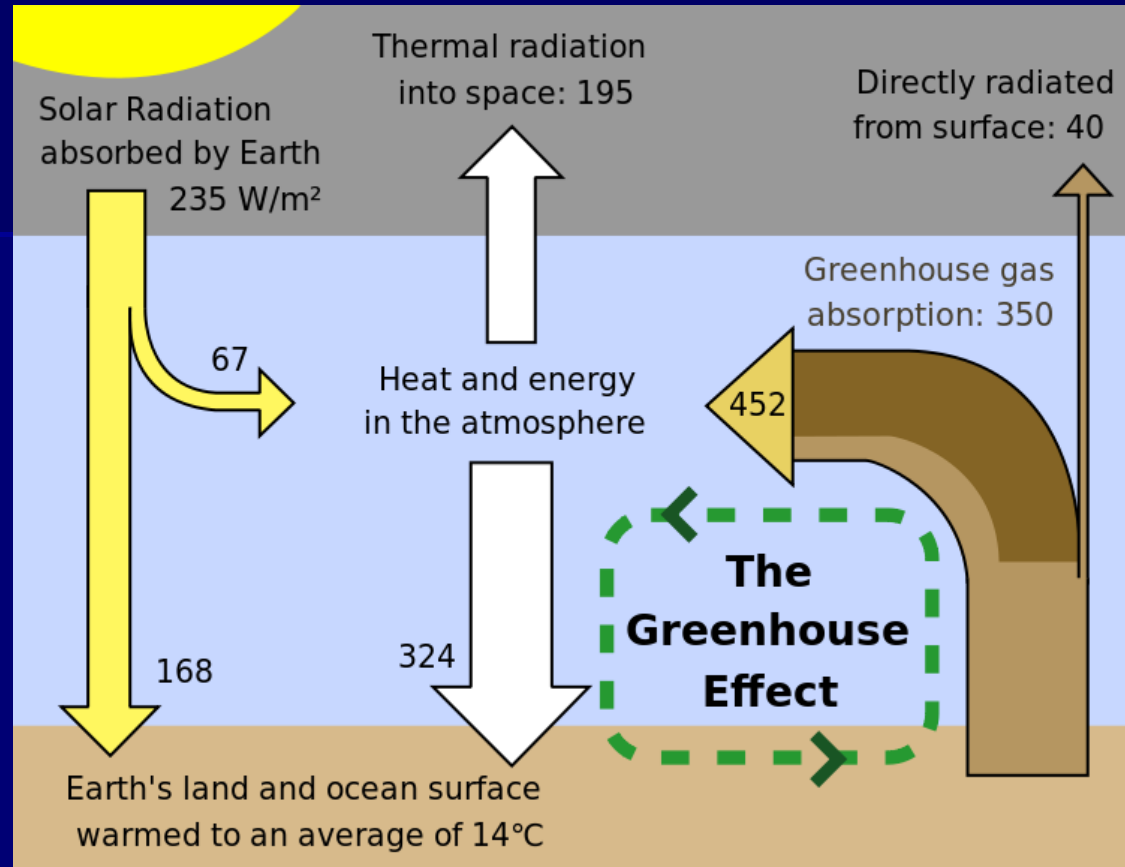
Naturally occurring amounts of greenhouse gases have a mean warming effect of about 33 °C (59 °F). The major greenhouse gases are **water vapor, which causes about 36–70% of the greenhouse effect; carbon dioxide (CO2), which causes 9–26%; methane (CH4), which causes 4–9%; and ozone (O3), which causes 3–7%. Clouds also affect the radiation balance through cloud forcing similar to greenhouse gases.**

Initial causes of temperature changes

Particulates (ပါ၀င်) and soot (ဖိုးခိုး)

Global dimming, a gradual reduction in the amount of global direct irradiance at the Earth's surface, was observed from 1961 until at least 1990. The main cause of this dimming is particulates (ပါ၀င်) produced by volcanoes and human made pollutants, which exerts a cooling effect by increasing the reflection of incoming sunlight.

100 km

Soot (ဖိုးခိုး) may cool or warm the surface, depending on whether it is airborne or deposited. Atmospheric soot directly absorb solar radiation, which heats the atmosphere and cools the surface. In isolated areas with high soot production, such as rural India, as much as 50% of surface warming due to greenhouse gases may be masked by atmospheric brown cloud.

Initial causes of temperature changes

Solar activity

Solar variations causing changes in solar radiation energy reaching the Earth have been the cause of past climate changes. The effect of changes in solar forcing in recent decades is uncertain, but small, with some studies showing a slight cooling effect, while others studies suggest a slight warming effect.

Solar Cycle Variations
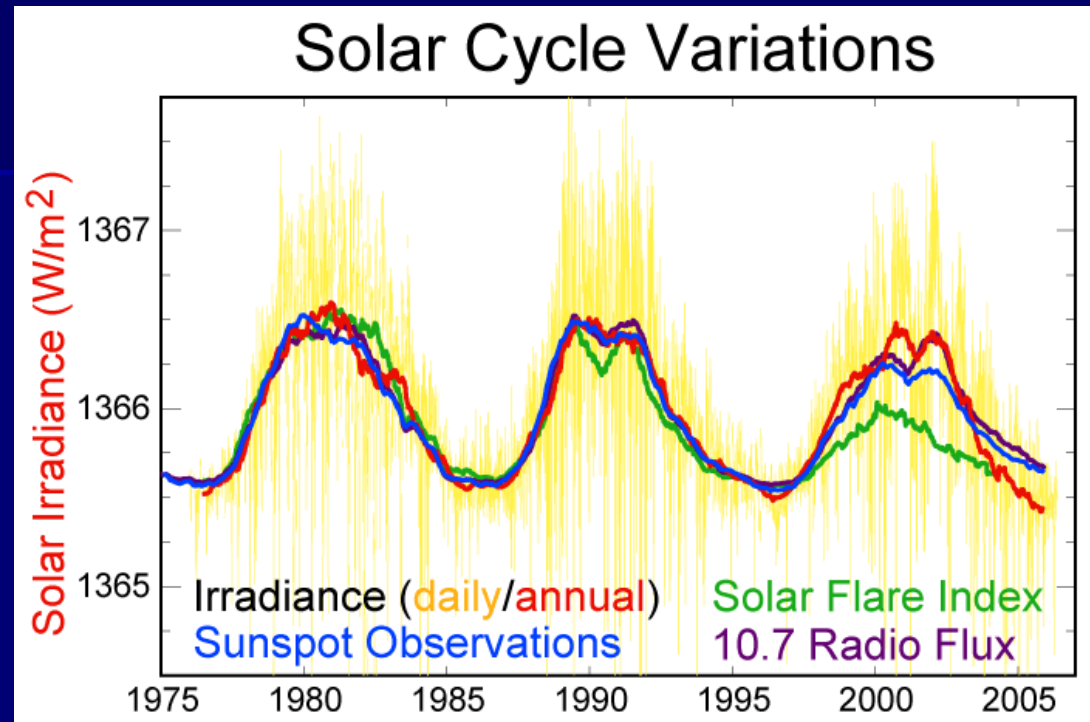
Studies in 2011 have indicated that solar activity may be slowing, and that the next solar cycle could be delayed. To what extent is not yet clear; Solar Cycle 25 is due to start in 2020, but may be delayed to 2022 or even longer.

Global Warming

U.S. National Surface Temperature (48 states)-- 1880 to 2006
Annual Temperature Deviation from Period 1951-1980 (NASA)
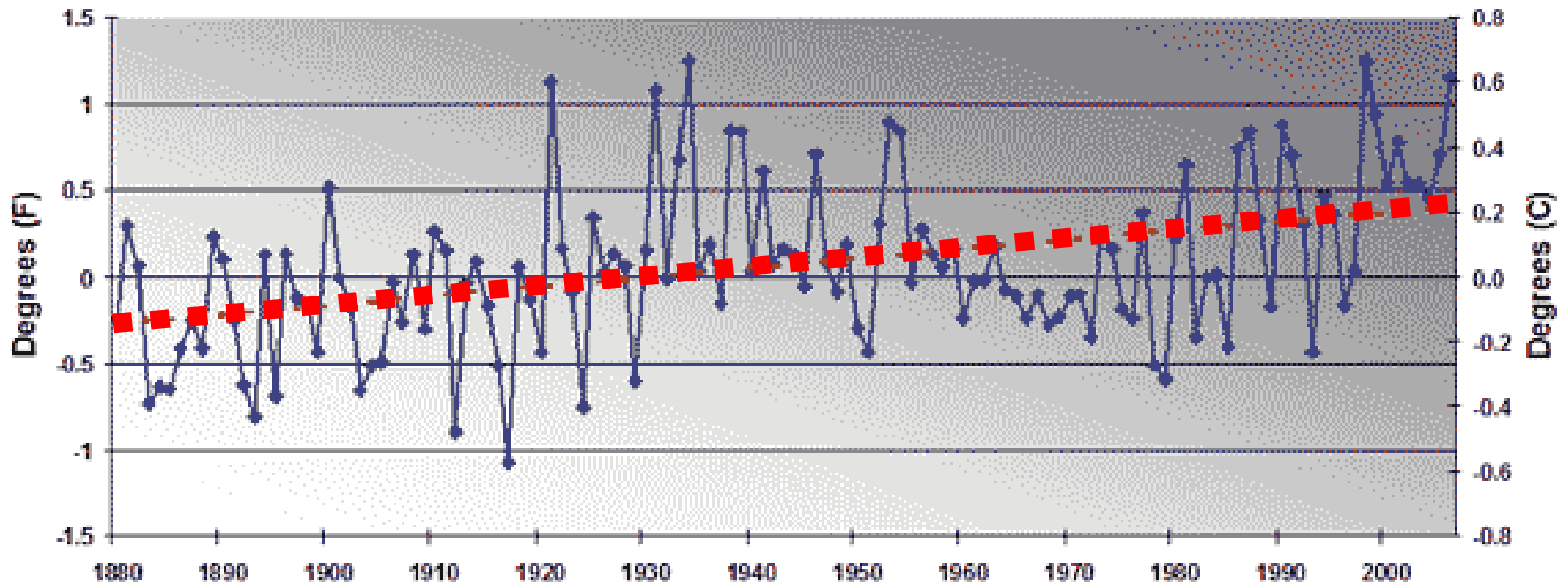
- **There is a future threat of melting the glaciers in the polar regions of the Earth as a consequence of global warming. Ecologists have predicted that before the end of year 2050, the glaciers in the Polar Regions will melt entirely. The following table depicts the variation of the temperature and the prevailed carbon dioxide percentage of the environment with time for the last 27 years in the Arctic region of the earth. Values given here are the annual averages of daily records.**

Year	1983	1984	1985	1986	1987	1988	1989	1990	1991
Average Temperature (°C)	-40.0	-38.1	-38.0	-37.0	-36.4	-35.7	-35.2	-34.3	-33.9
Environment CO_2 percentage	0.5	1.0	1.9	2.0	3.0	3.9	4.2	5.0	5.2

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000
Average Temperature (°C)	-33.0	-32.2	-31.0	-29.7	-30.5	-30.1	-28.6	-28.0	-27.8
Environment CO_2 percentage	6.0	7.1	7.9	8.9	9.1	10.1	11.3	11.1	12.0

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009
Average Temperature (°C)	-27.0	-26.1	-25.6	-24.9	-24.0	-23.6	-22.9	-22.0	-21.5
Environment CO_2 percentage	12.9	13.1	14.1	15.2	15.3	16.5	16.9	18.0	18.9

```mathematica
yr = Table[i, {i, 1983, 2009}];
temp = {-40.0, -38.1, -38.0, -37.0, -36.4, -35.7, -35.2, -34.3, -33.9, -33.0, -32.2, -31.0,
    -29.7, -30.5, -30.1, -28.6, -28.0, -27.8, -27.0, -26.1, -25.6, -24.9, -24.0, -23.6, -22.9, -22.0, -21.5};
co2 = {0.5, 1.0, 1.9, 2.0, 3.0, 3.9, 4.2, 5.0, 5.2, 6.0, 7.1, 7.9, 8.9, 9.1, 10.1, 11.3, 11.1,
    12.0, 12.9, 13.1, 14.1, 15.2, 15.3, 16.5, 16.9, 18.0, 18.9};
tdata = Transpose[{yr, temp}];
g1 = ListPlot[tdata, PlotStyle → {RGBColor[1, 0, 0], PointSize[0.02]}];
f = Fit[tdata, {t, 1}, t];
g2 = Plot[f, {t, tdata[[1, 1]], Last[tdata][[1]]}, PlotStyle → RGBColor[0, 0, 1]];
Show[g1, g2]
Print["The Temperature w.r.t time : ", f]
Print["The Temperature will be zero on : ", Solve[f == 0, t]]


codata = Transpose[{yr, co2}];
g3 = ListPlot[codata, PlotStyle → {RGBColor[0.5, 0.5, 0], PointSize[0.02]}];
ff = Fit[codata, {t, 1}, t];
g4 = Plot[ff, {t, codata[[1, 1]], Last[codata][[1]]}, PlotStyle → RGBColor[0, 0.5, 0.5]];
Show[g3, g4]
Print["The CO2 % w.r.t time : ", ff]
Print["The CO2 % on year 2040: ", ff /. t → 2040, " %"]


cotdata = Transpose[{co2, temp}];
g5 = ListPlot[cotdata, PlotStyle → {RGBColor[0.25, 0.25, 0], PointSize[0.02]}];
Print["The Temperature % w.r.t CO2 % : ", fff]
fff = Fit[cotdata, {x, 1}, x];
g6 = Plot[fff, {x, cotdata[[1, 1]], Last[cotdata][[1]]}, PlotStyle → RGBColor[0, 0.25, 0.25]];
Show[g5, g6]
Print["The Temperature and w.r.t CO2 has a LINEAR RELATIONSHIP ! "]
```
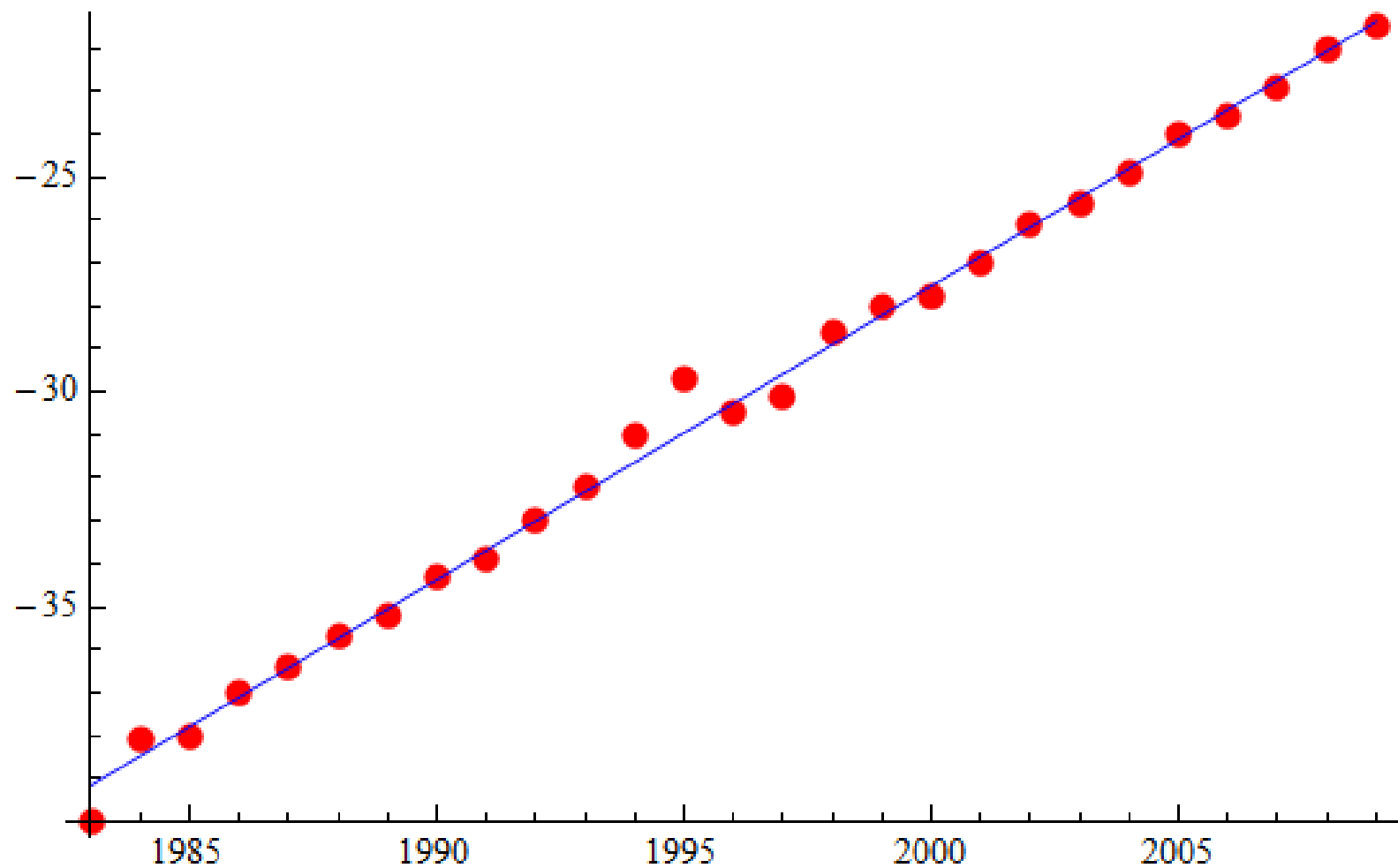
The Temperature w.r.t time : $-1395.66 + 0.684066\,t$

The Temperature will be zero on : $\{\{t \to 2040.24\}\}$
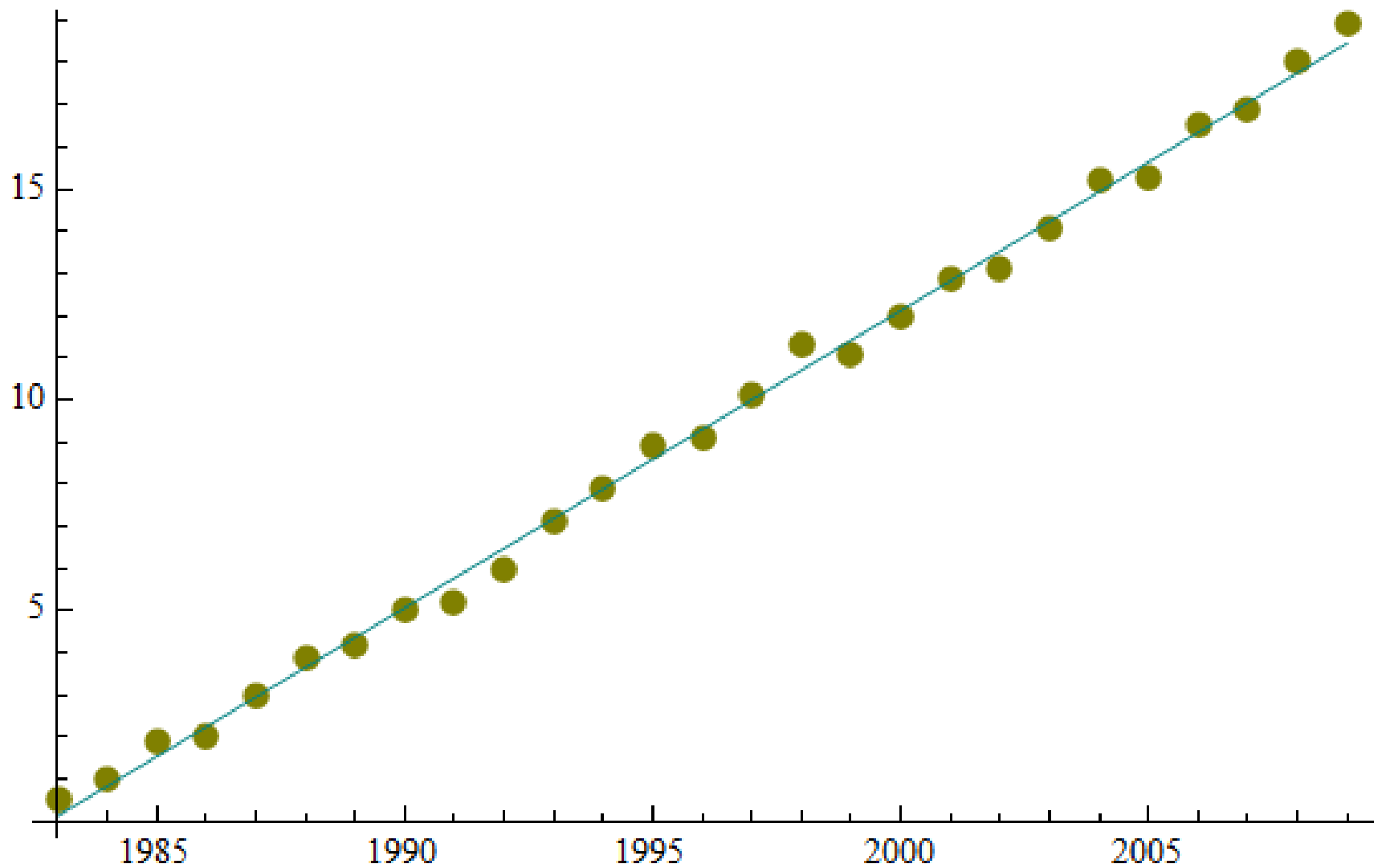
The CO2 % w.r.t time : $-1397.77 + 0.704945\,t$

The CO2 % on year 2040: 40.3176 %

The Temperature % w.r.t CO2 % : $-39.2642 + 0.967879\,x$
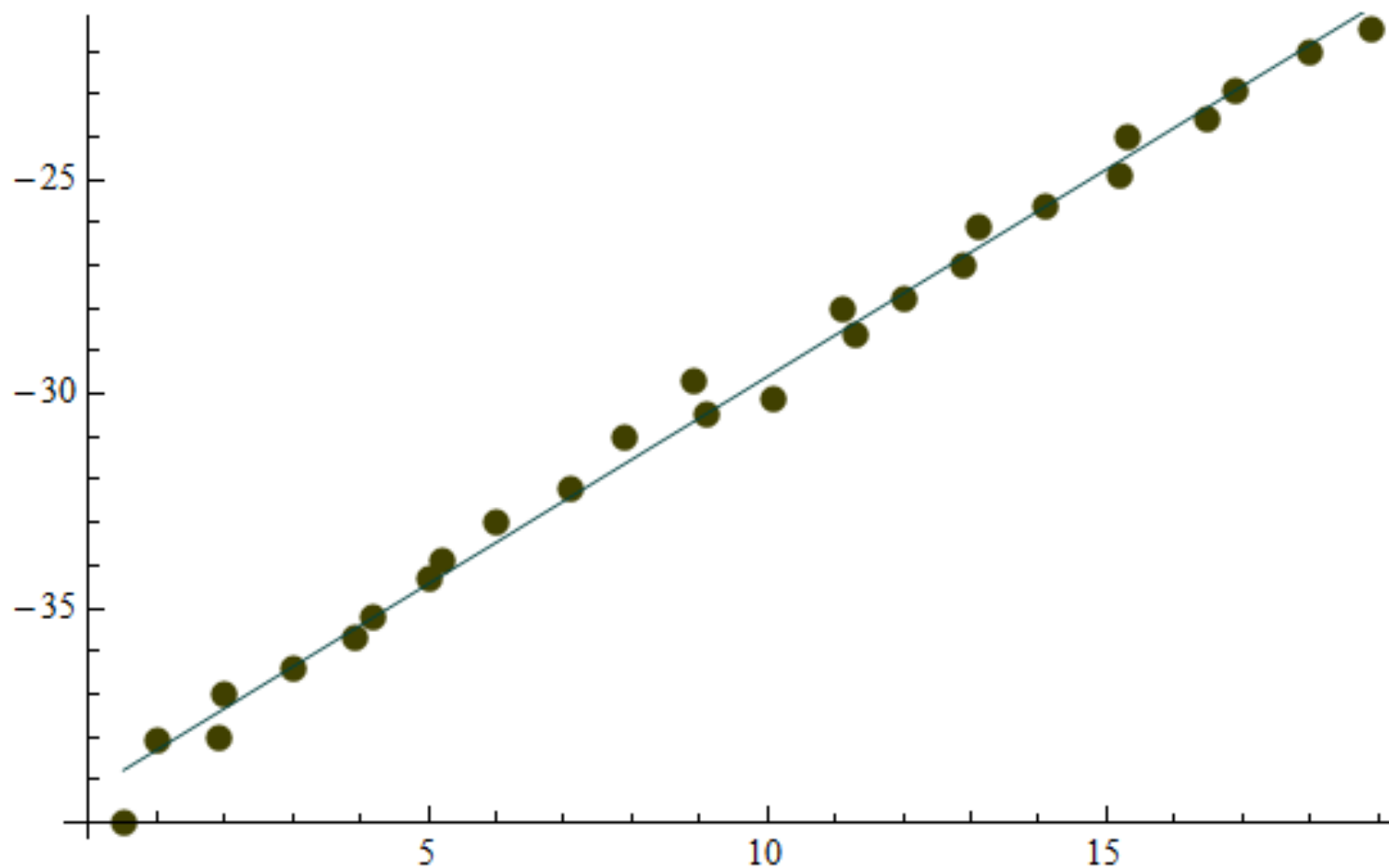
The Temperature and w.r.t CO2 has a LINEAR RELATIONSHIP !

The Nobel Peace Prize 2007

Intergovernmental Panel on Climate Change, Al Gore

The Nobel Peace Prize 2007 was awarded jointly to Intergovernmental Panel on Climate Change (IPCC) and Albert Arnold (Al) Gore Jr. *"for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change"*

IPCC

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

WMO   UNEP

An Inconvenient Truth

An Inconvenient Truth is a 2006 documentary film directed by Davis Guggenheim about former United States Vice President Al Gore's campaign to educate citizens about global warming via a comprehensive ... Wikipedia

en.wikipedia.org

Release date: January 24, 2006 (initial release)

Director: Davis Guggenheim

DVD release date: November 21, 2006

Awards: NAACP Image Award for Outstanding Foreign Motion Picture, More

Producers: Lawrence Bender, Laurie David, Al Gore

Cast: Al Gore, Billy West

A documentary on Al Gore's campaign to make the issue of global warming a recognized problem worldwide.

"It is now clear that we face a deepening global climate crisis that requires us to act boldly, quickly, and wisely," said Gore.

Two narratives -- the life cycle of a mother walrus and her calf, and the life of a polar bear and her cubs -- are used to illustrate the harsh realities of existence in the Arctic.

Global Warming

U.S. National Surface Temperature (48 states)-- 1880 to 2006
Annual Temperature Deviation from Period 1951-1980 (NASA)
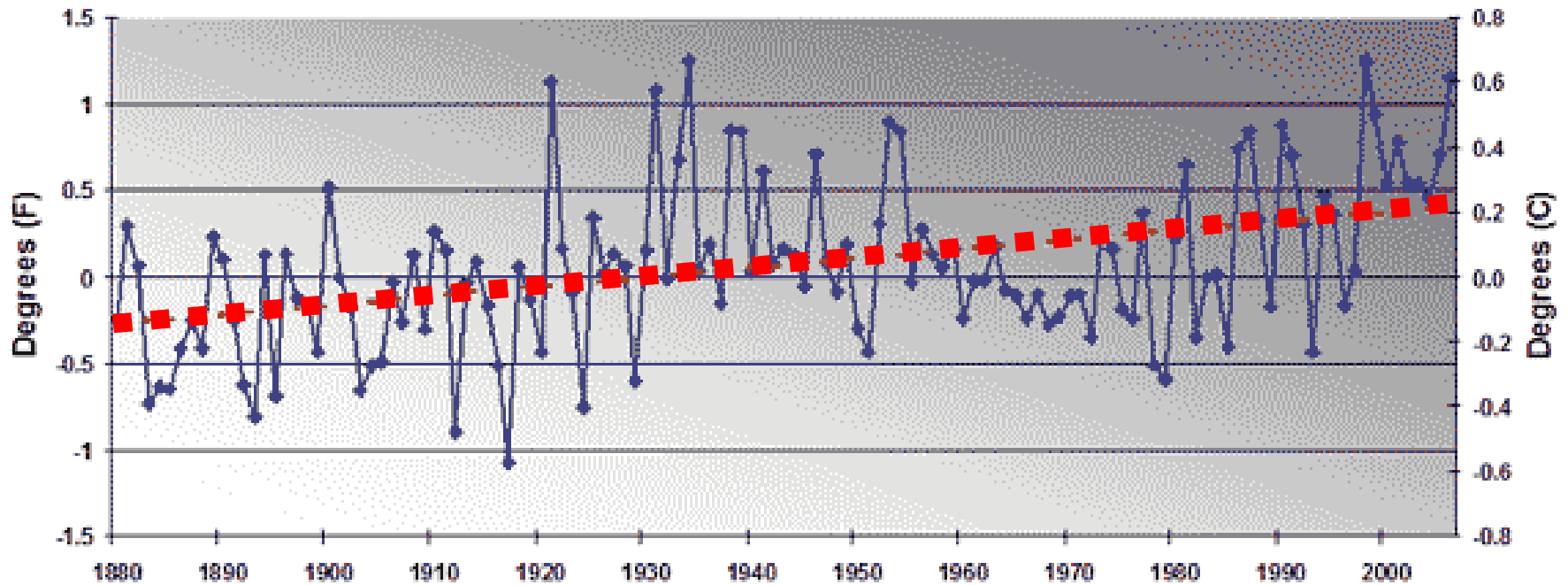
GLOBAL TEMPERATURES (2500 B.C. TO 2040 A.D.)

MAJOR GLOBAL COOLING SINCE LATE 2007
A 0.9 Degree Fahrenheit drop in global temperatures from late 2007 to February 2009.

MOUNT PINATUBO ERUPTION (Philippines)
1.1 Degree F. Rapid Cool Down (June 1991 to March 1992)
Global Temperature Went From 0.6 Degrees Above Normal To 0.5 Degrees Below Normal.

1100 B.C.

Hebrew Exodus From Egypt

Only Scattered Volcanic Eruptions

VERY WARM

2200 B.C.

Sudden Cool Down

Sudden Cool Down

WARM

At Least 10 Eruptions in Italy, Pacific and Alaska

Nomanic Time (Era of Great Migration)

25 Eruptions Pacific, Columbia, Italy & Iceland

79 A.D. Vesuvius Erupts Pompeii Destroyed in Italy

4 B.C. Birth of Christ

Vesuvius Etna Italy **250 B.C.**

Grecian Empire COLD

Roman Empire

WARM

35 Volcanic Eruptions

535-550 Krakatoa, Indonesia and at least 10 other eruptions

DARK AGES COLD

55 Eruptions

Viking Explorations (Reached NE Canada)

Few Eruptions

Sudden Cool Down

1300 A.D.

WARM Medieval Warm Period

1335-1360 24 Eruptions (Italy, Pacific, Alaska and Iceland)

1982 El Chichon Mexico

1991 **Mt. Pinatubo** Philippines

1883 Krakatoa Indonesia

1851 Mt. Pelee Martinique

1845 Nevado del Ruiz Columbia

Hot/Dry Cycle

2038

1998 58.3°F

?

2005

57°F **Normal**

Now 2011

2019 **Colder**

"LITTLE ICE AGE"

VERY COLD

At Least 90 Major Eruptions (4 in 1660 alone)

1586 Kelut Indonesia

1607 Jamestown Founded (SE Virginia) 54.3°F?

1815 Mt. Tambora Indonesia

1792 Mt. Unzen Japan

1783 Lakagigar Iceland

1772 Papadanyan Indonesia

1741 Vesuvius Italy

Whenever SOLAR RADIATION has DECREASED and VOLCANIC ACTIVITY has INCREASED, global temperatures SUDDENLY PLUMMET, often within weeks or months.

2500 B.C. To 1 B.C. | 1 A.D. To 2040

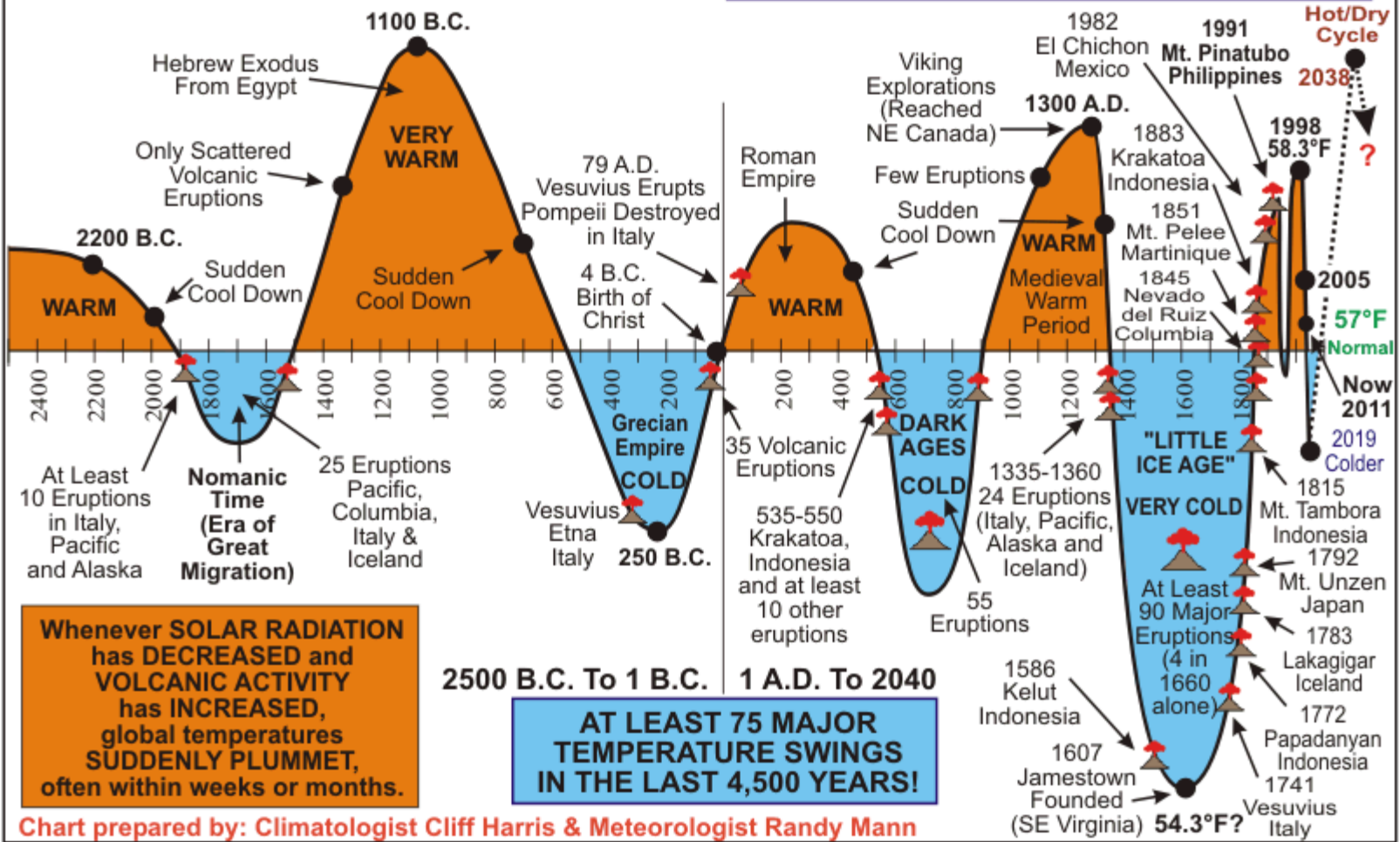**AT LEAST 75 MAJOR TEMPERATURE SWINGS IN THE LAST 4,500 YEARS!**

Chart prepared by: Climatologist Cliff Harris & Meteorologist Randy Mann

Global temperature chart was complied by Climatologist Cliff Harris that combined the following resources:
"Climate and the Affairs of Men" *by Dr. Iben Browing.*
"Climate...The Key to Understanding Business Cycles...The Raymond H. Wheeler Papers. *By Michael Zahorchak*
Weather Science Foundation Papers in Crystal Lake, Illinois.

Top 10 Things You Can Do to Reduce Global Warming

1. **Reduce, Reuse, Recycle**
2. **Use Less Heat and Air Conditioning**
3. **Change a Light Bulb** (CFL, most suitable LED Bulbs)
4. **Drive Less and Drive Smart**
5. **Buy Energy-Efficient Products** (Plasma Displsy, CRT Displsy, LCD, LED , **OLED**)
6. **Use Less Hot Water**
7. **Use the "Off" Switch**
8. **Plant a Tree**
9. **Get a Report Card from your Utility Company**
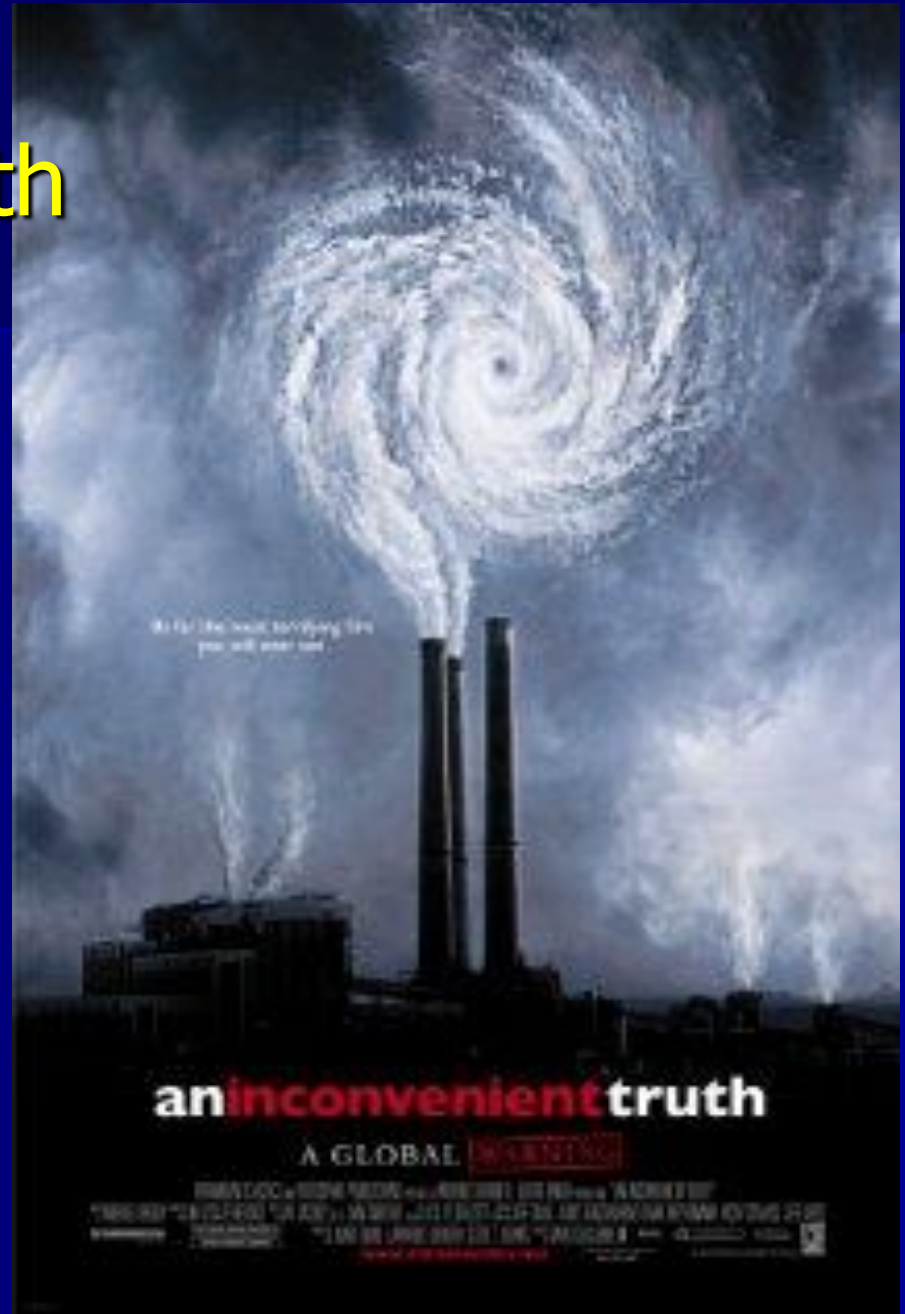10. **Encourage Others to Conserve**

Share information about recycling and energy conservation with your friends, neighbors and co-workers, and take opportunities to encourage public officials to establish programs and policies that are good for the environment.
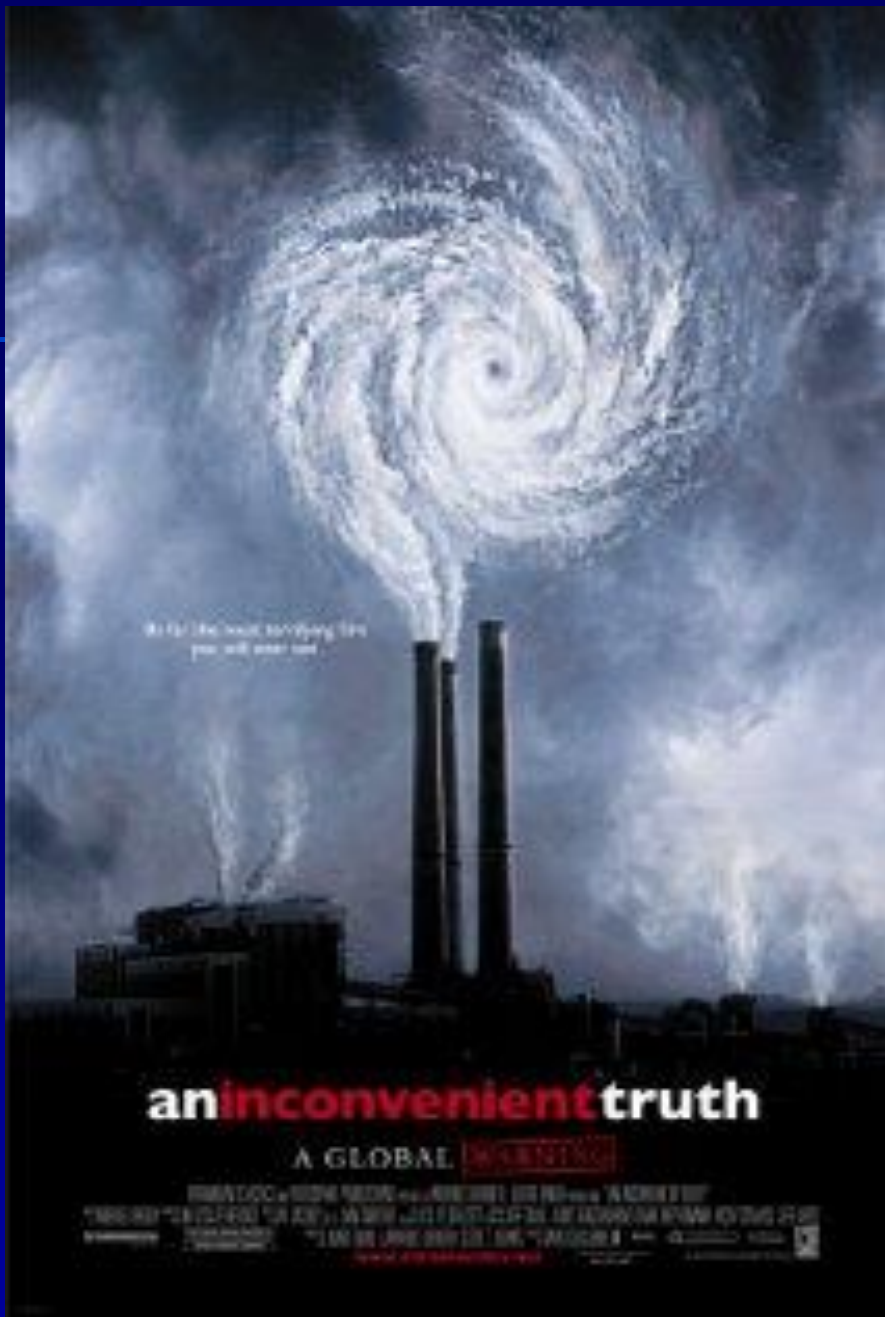
These 10 steps will take you a long way toward reducing your energy use and your monthly budget. And less energy use means less dependence on the fossil fuels that create greenhouse gases and contribute to global warming.

An Inconvenient Truth

Documentary Film
based on the
Global Warming...

(~ 100 min)

An Inconvenient Truth

An Inconvenient Truth is a 2006 documentary film directed by Davis Guggenheim about former United States Vice President Al Gore's campaign to educate citizens about global warming via a comprehensive ... Wikipedia

en.wikipedia.org

Release date: January 24, 2006 (initial release)

Director: Davis Guggenheim

DVD release date: November 21, 2006

Awards: NAACP Image Award for Outstanding Foreign Motion Picture, More

Producers: Lawrence Bender, Laurie David, Al Gore

Cast: Al Gore, Billy West

A documentary on Al Gore's campaign to make the issue of global warming a recognized problem worldwide.

"It is now clear that we face a deepening global climate crisis that requires us to act boldly, quickly, and wisely," said Gore.

An Inconvenient Truth (2006)

Oscar-winning documentary about the environment featuring the unlikeliest of movie stars. Former presidential candidate Al Gore holds this film together as, in front of an audience and with few aids beyond photo slides, he explains how humans have messed up the planet. Gore issues an urgent warning on what must be done, and done quickly, to save the earth.

An Inconvenient Truth

Theatrical release poster

Directed by	Davis Guggenheim
Produced by	Laurie David
	Lawrence Bender
	Scott Z. Burns
Written by	Al Gore
Starring	Al Gore
Music by	Michael Brook
Cinematography	Bob Richman
	Davis Guggenheim
Edited by	Jay Cassidy
	Dan Swietlik
Production company	Lawrence Bender Productions
	Participant Productions
Distributed by	Paramount Classics
Release date	May 24, 2006
Running time	97 minutes[1]
Country	United States
Language	English
Budget	$1.5 million[2]
Box office	$49.8 million[3]

Further More…

An Inconvenient Sequel: Truth to Power (2017)

★ 6.3/10
5,795

☆ Rate This

+

PG | 1h 38min | Documentary | 4 August 2017 (USA)

FIGHT LIKE YOUR WORLD DEPENDS ON IT

an inconvenient sequel
TRUTH TO POWER

STAY IN LANE
SPEED LIMIT 23

BREAKING NEWS
HURRICANE SANDY FLOODS 9/11 MEMORIAL

2:32 | Trailer
3 VIDEOS | 13 IMAGES

A decade after An Inconvenient Truth (2006) brought climate change to the heart of popular culture, the follow-up shows just how close we are to a real energy revolution.

Directors: Bonni Cohen, Jon Shenk
Writer: Al Gore
Stars: Al Gore, George W. Bush, Bill Clinton | See full cast & crew »

68 Metascore
From metacritic.com

Reviews
56 user | 99 critic

Nominated for 1 BAFTA Film Award. Another 3 wins & 12 nominations. See more awards »

Further More…

FULL CAST AND CREW | TRIVIA | USER REVIEWS | IMDbPro | MORE ≫   SHARE

+ **Not Evil Just Wrong** (2009) ★ 5.8/10 227   ☆ Rate This

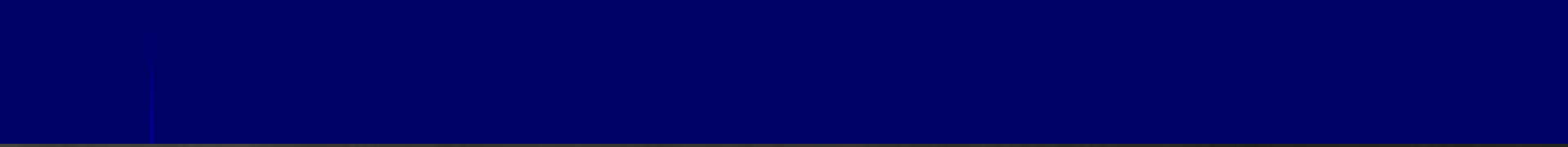PG | 1h 30min | Documentary | 18 October 2009 (USA)

Examines how extreme environmentalism is damaging lives of vulnerable populations in the developed and developing world, from the ban on DDT to the current campaigns on global warming.

Directors: Phelim McAleer, Ann McElhinney
Writers: Phelim McAleer, Ann McElhinney

Not Evil Just Wrong
THE TRUE COST OF GLOBAL WARMING **HYSTERIA**
www.noteviljustwrong.com

Reviews
4 user | 1 critic

Thank You !