By far the most terrifying film you will ever see.
The Movie’s/Media’s Premise

- Global warming no longer in question but action to remedy it is being undermined by political inertia and because of doubt created by big oil and a few remaining ‘skeptics’

- The warming is unprecedented and is already having major effects on our weather and climate and the environment, and we are nearing a ‘tipping point’ which could trigger catastrophic consequences
Measuring Carbon Dioxide

- Since late 1950s has been measured at Mauna Loa, a volcano (which emits CO2)
- Prior estimates done by Callendar from many world-wide measurements from varying methods. He cherry picked values that showed a smooth curve and the increase that Arrhenius had projected
- He ignored spike in 1940s
Callendar cherry-picked past data points. Actual average 1800s early 1900s was 345. Spike in 1940s was ignored.

Fig. 1. The mean values of the CO$_2$ measurements from the beginning of 1800 up to present time taken from the literature. Encircled the values used by Callendar and the results from the Scandinavian network 1955.
Measuring Carbon Dioxide

- Prior estimates were supported by Vostok ice cores but Joworowski, Segalstad and Beck have shown that these ice cores cannot accurately measure old CO2 values due to chemical changes from great pressure and associated with liquid water in ice and chemicals from drilling equipment.

- Ice core data was arbitrarily adjusted by Siple to align with the Mauna Loa data.

- Direct chemical measurements are considered by geologists and chemist to be the most accurate measures.
Siple curve after arbitrary adjustment
By IPCC
Figure 11: Local CO₂ concentration for the northern hemisphere, determined through chemical analysis between 1812 and 1861. Data plotted as an 11 year average. Data coverage and important scientists indicated in dark grey/black. The curve delineates three major maxima in CO₂ content, though the one situated around 1820 must be treated as provisional only. Data series used: time window 1857–1873: 13 yearly averages, 83 until 1927 and up to 1961 41 data records (eleven interpolated).
CO₂ concentration in air

Parts per million (ppm)

direct chemical measurement (Beck 2007)

Pettenkofer, Schulze, Spring, Krogh, Warburg, Lundegardh, Kreutz and hundreds more

©egb2007
Greenhouse Effect

- Carbon dioxide is in fact a ‘minor’ greenhouse gas. Man contributes only 4% through fossil fuel burning. Climate models assume increase of 1% per year when average since 1958 has been 0.43%.

- Climate models consider the oceans to be distilled water and greatly underestimate the buffer capacity of the oceans (said to be infinite – Segalstad). According to his estimates, burning all the fossil fuels could only increase CO2 by 20%. It could never double.

- Methane is a far more powerful greenhouse gas and although it has increase 150% since 1750, according to Portland State University and Oregon Graduate Institute it has slowed and leveled off with no changes since 2000.
Atmospheric Methane
By far the most important greenhouse gas (95%) 
Most of the climate models with the greatest warming have this as a strong positive feedback. 
There is empirical evidence that that is not to be case. 
Both water vapor and clouds are listed as having a high degree of uncertainty by IPCC and could have a huge impact on the changes
Only Constant in Nature is Change

Until 1998, the accepted historical record. Made recent warming look insignificant.
Medieval Warming Dilemma

- Dr. David Deming (University of Oklahoma)

“Around 1996, I became aware of how corrupt and ideologically driven current climate research can be. A major researcher working in the area of climate change confided in me that the factual record needed to be altered so that people would become alarmed over global warming. He said, "We have to get rid of the Medieval Warm Period."
Many flaws in the MBH work (data and algorithm) were found by McKitrick and McIntyre and then Wegman et al and others which when corrected, restored earlier warmth
See www.climateaudit.org

Solution: Mann et al. ’98 paper did away with prior warm period. The so-called Hockey Stick was published everywhere as proof of Global warming. It was shown prominently in IPPC 3rd Assessment and in the movie An Inconvenient Truth

Many flaws in the MBH work (data and algorithm) were found by McKitrick and McIntyre and then Wegman et al and others which when corrected, restored earlier warmth
See www.climateaudit.org
Still the government graphs are alarming…but are they right?

Global Temperature: Land-Ocean Index

NASA GISS

Temperature Anomaly (°C)

-4 -2 0 .2 .4 .6

1880 1900 1920 1940 1960 1980 2000

Annual Mean

5-year Mean
Issues with the Global Station Data

- Station dropout (6000 to 2000, most significant since 1990). The dropout is shown in a visually striking animation here: http://climate.geog.udel.edu/~climate/html_pages/Ghcn2_images/air_loc.mpg.

- Large increases in missing monthly data in Asia and especially the FSU after 1990

- Questions about sufficient urban and site adjustment
Most were rural stations

A discontinuity in both at the same time
For the 110 Russian weather stations reporting weather data continuously from 1971 to 2001, the total number of missing monthly observations each year (McKitrick and Michaels)
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Station Dropout and Missing Data

- Since many of the stations that dropped out were the smaller stations, the bias in the remaining stations is towards larger metro area stations where there is more warmth.

- Infilling of data is very difficult. Some of the methods used (NASA GISS substitutes annual average anomaly) can introduce a warm bias.
Urban Heat Island Effect
Urban Heat Island Effect

- In cities, vertical walls, steel and concrete absorb the sun’s heat and are slow to cool at night, which can be 10 or more degrees warmer in cities than in rural areas.
- More and more of the world is urbanized.
- Cities grow around airports where we measure temperatures.
- Urban areas with population >10,000 are adjusted in global data.
- Oke (1973) and Hoyt (2002) have shown towns with much smaller populations can have warming (town of 1000 up to 2C or 3F) especially in winter.
- Hinkel et al (2003) showed even the village of Barrow, Alaska with a population of 4600 has shown a warming of 2.2C (3.4F) in winter over surrounding rural areas.
- Insufficient adjustments introduces a warm bias in data.
Counties in CA with >1 million Population (+4°F since 1910)

Counties in CA with between 100,000 and 1 million population (+1°F since 1910)

Counties in CA with less than 100,000 Population (0°F since 1910)
Update: Here are a couple of graphics showing gridded and station data for Ulan-Ude and its gridcell. Several versions of station data are shown here. The station data shows a rather remarkable increase since the 19th century in the GHCN adjusted version (which does not incorporate recent Russian data.) McIntyre
Pielke and Davey have found a majority of stations including climate stations in eastern Colorado did not meet WMO requirements for proper siting.

State climatologist teams found siting issues in surveys in Georgia, Alabama, Kentucky, Oregon and New England.

Even in Oklahoma where the Oklahoma Mesonet is the gold standard for observation networks, issues developed with time (growth of vegetation that changed wind and temperature profiles).

All these siting issues introduce a warm bias.
Contamination of the Data Bases

- A number of peer-reviewed papers ignored by the IPCC have estimated that these problems with the observing networks may account for up to one half the warming since 1880 (Michaels and Balling, Michaels and McKitrick, Kalney and Cai, de laat and Maurellis, Pielke and Davey)
NCDC USHCN Data

- National Climate Data Center maintains a database of 1221 stations across the contiguous 48 United States. Adjustments have been made to account for changes over time in the time of observations, missing data, type of instrumentation, changes in station siting, and urban warming (Karl, 1988).

- It WAS the ‘best’ available station data set for assessing change as unlike the global data bases, there is not a big station dropout, less missing data and there was a better urbanization adjustment (although some siting adjustment issues may remain (Pielke et al 2005, 2006)).
| USHCN Station Hopkinsville, KY (Pielke et al 2006) | Max/Min sensor near John Martin Reservoir, CO (Davey 2005, |
USA Annual Mean Temperatures

NCDC US HCN (1221 STATIONS)

Starts near a min

Great Depression

Post war boom

Ends near a max

Year

Anomaly °C


-1.50 -1.00 -0.50 0.00 0.50 1.00 1.50
USA Annual Mean Temperatures

-1.50
-1.00
-0.50
0.00
0.50
1.00
1.50

Year

-1.50
-1.00
-0.50
0.00
0.50
1.00
1.50

NCDC US HCN (1221 STATIONS)

More accurate trends?
NCDC Annual Mean Temperatures

Warming of 0.25°F in 75 years
NCDC Annual Mean Temperatures

Warming of 0.25F in 75 years

For 112 years of record keeping total is 0.37F
In order to reconcile some of the differences between the US and global data, the GISS US data was adjusted in 2007.

The difference (2000-2007) is not small.
Other data suggests heat was worse in the 1930s.
Oceans Also Not Warming

- Hoyt reports in “The Collapse of Arguments for High Climate Sensitivity”* [http://www.warwickhughes.com/blog/?p=87](http://www.warwickhughes.com/blog/?p=87) that because of
  - Gouretski and Koltermann’s (2007) finding “the ocean heat content increase since the 1950s must be reduced by a factor of 0.62" due to instrumental errors
  - Lyman et al (2006) finding that “20% of the original warming since the 1950’s disappeared in 2003-2005”

that the total net warming of the ocean surface to 3000 meters depth is **just 0.03 C since 1948!**

- Hoyt believes the works of Gouretski and Koltermann and Lyman are very important and *have essentially invalidated all the climate models.*

- This suggests a sensitivity to CO2 doubling of just 0.4C. Most of that may have already occurred!
Adjusting sea surface temperatures for slower transition from bucket to ship intake. Global Temperatures assumed abrupt transition WWII 1941 (Folland)
Satellite derived lower atmospheric temperatures since 1979 also rising much less.

But again we are not denying any recent warming only the amount and the causes.
Cyclical Factors
11 year solar cycles themselves vary in their strength on a longer term with cycles of 80 to 100 years.
The Solar Connection

**DIRECT EFFECTS**
- Direct effects of changes in solar brightness or irradiance are likely relatively small.

**INDIRECT EFFECTS**
- UV warming through ozone chemistry high up in low and mid latitudes.
- Geomagnetic activity /solar wind effects that warm higher latitudes and may reduce low clouds through reduction of cosmic rays.
Scafetta and West (GRL 2006) assumed that the Total Solar Irradiance (Lean) was a proxy for the total solar effect (direct and indirect). They estimated the changes in the sun could account for 50% of the Northern Hemispheric changes since 1900.

Shaviv (2005) estimated that the combination of cosmic ray cloud effects and brightness related increases in irradiance since 1900 could account for 77% of the changes in global temperatures. He found relationship held going back 600 million years.
NCDC Annual Mean US Temperature vs Hoyt Schatten TSI

$R^2 = 0.59$

$R^2 = 0.64$ for 3 year lag temp vs TSI
Fit is much better of solar irradiance with arctic temperatures (Polyakov) than with CO$_2$

$$r^2 = 0.79$$

$$r^2 = 0.22$$
Ultraviolet Radiation and Ozone

- Though solar irradiance varies only 0.1% over the 11 year cycle, radiation at longer UV wavelengths are known to increase by several percent with still larger changes (factor of two or more) at extremely short UV and X-ray wavelengths (Baldwin and Dunkerton, JAS 2004).

- Labitzke has shown statistically significant differences of heights and temperatures in the lower stratosphere into the middle troposphere with the 11 year solar cycle (using solar flux which correlates well with UV radiation).

- Shindell et al NASS GISS (1999) showed results from a global climate model including a parameterization of stratospheric chemistry, how UV induced stratospheric ozone changes may amplify observed irradiance effects and have them penetrate into the troposphere, in effect confirming Labitzke’s findings.
Pattern fit the findings of Labitzke and Shindell’s models

Correlation high atmosphere heights with solar flux (Labitzke)

Actual anomalies 500mb heights during high flux Jan/Feb 2002
Cosmic Rays and Low Clouds

- Also an active sun leads to less cosmic rays and a reduction in the amount of low level (water droplet) cloudiness. Low clouds have a cooling effect by reflecting energy back to space.

- This was first proposed by Svensmark (1997), Bago and Butler (Astronomy and Geophysics 2000), and Yu and Tinsley (AGU 2002).

- Recently Svensmark was able to replicate water cloud droplet nucleation in a laboratory (Royal Society Proceedings A 2006)

- Shaviv (2005) estimated that the combination of cosmic ray cloud effects and brightness related increases in irradiance since 1900 could account for 77% of the changes in global temperatures.
An inverse relationship

Cosmic Rays and the Solar Cycle

Bago and Butler

McMurdo, Antarctica, Neutron Monitor
Bartol Research Institute, University of Delaware
27-Day Averages - data through 1 August 2000
The cosmic ray flux (upper diagram) and tropical ocean temperature anomaly variations over the past 500 million years (Shaviv and Veizer, 2003). Upper curve based meteorite exposure ages (Shaviv, 2002), lower curves shows fit of cosmic rays with temperature anomaly reconstruction (Veizer et al., 2000).
Warming on Other Planets

- MIT astronomers in a report in Nature found Neptune’s moon Triton seems to have warmed significantly since 1989.
- A UC Berkeley study showed Jupiter has a new red spot and may be in midst of a climate change with a warming of 10F or more.
- NASA using Mauna Loa Observatory telescope has shown Pluto may have warmed 3.5 degrees over the past 14 years.
- National Geographic story showed how NASA Mars Global surveyor discovered the Mars polar ice caps have been diminishing in the last several years.

All these point to the role of the sun!!!!
Solar in Climate Models

- Only the small direct brightness changes have been used for historical
- For the future, the small direct average solar irradiance is the only forcing factor and it is assumed constant
Cyclical Factors - Oceans

- Multi-decadal cycles in the ocean temperature patterns in both Pacific and Atlantic
  - Pacific Decadal Oscillation
  - Atlantic Multidecadal Oscillation
- These are due to multi-decadal changes in the thermohaline circulation
- They have a major influence on temperatures over adjacent land areas
Pacific Decadal Oscillation

Annual Temperature Anomaly

Warm Mode (+)

Great Pacific Climate Shift
El Ninos lead to global warming and La Ninas to cooling

MSU data Spencer Christy
What about the minor warming then cooling after of the super El Nino of 1982/83 and the cooling with and following the El Nino of 1992/93?
What about these extensive global cooling events then recent warming from variations in volcanic activity (a measure of level of sulfate aerosols)?

**El Nino**

**La Nina**

**Super El Nino**

**Mt. St. Helens, El Chichon, Pinatubo, Cerro Hudson**

(NASA GISS)
Volcanic aerosols in the high atmosphere block solar radiation and increase cloud cover leading to widespread cooling, especially significant in summer.
Years with more than $\frac{1}{2}$ STD departures stratospheric aerosols

More than 1/2 STD Above

More than ½ STD Below

January to December Annual Temperature Anomalies

Data NASA GISS, CDC
Mean ocean temperature anomalies in the Atlantic from 0 to 70N
Atlantic Multidecadal Oscillation

Correlates with general warmth, statistically significant in places
PDO, AMO and Global Warming

- If + PDO relates to more El Ninos which lead to global warming and if +AMO relates to general global warmth, the sum of the two may be useful in identifying warm periods (and when negative cold periods)
USA Annual Mean Temperatures

Anomaly de\textgreek{d}\_\textgreek{d}e

USA

10 year Running Mean

Year

Mid 1920s to late 1950s

Late 1950s to late 1970s

Late 1800s to early 1920s

1980 to current

$r^2 = 0.86$
Oceans and Climate Models

- Though there are coupled ocean and atmospheric models used, they do not fully capture all the important processes involved (salinity changes) that result in multi-decadal shifts.
- Indeed they are not able to replicate the warm and cold modes in the Pacific and Atlantic.
- So looking forward we see no cyclical behavior in temperatures in the models only a warming.
Iceaps and Glaciers

95% of the world’s ice is found in the Antarctic and Greenland Icecaps
Antarctica
Summer 2002
Larsen Ice Sheet
Break-up
Total Antarctic ice anomalies
NASA National Snow and Ice Data Center (NSIDC)
Amundsen-Scot, South Pole Winter (JJA) Mean Temp

Note 2004 winter was the coldest of the entire record

NASA GISS
Greenland Icecap and Global Warming
Greenland Annual Mean Temperatures

Annual Atlantic MultiDecadal Oscillation (AMO)
Sea Level Rises

- The lack of convincing melting of the Antarctic ice cap (+100 to -200Gt/yr) and the uncertainty about Greenland (+25 to -60Gt/yr) has led the IPCC to reduce sea level rises this century to a range from 8 to 17 inches.

- The rate-of-rise of global sea level over the last half of the 20th century was actually less than the rate-of-rise over the first half of the century (Jevrejeva et al., 2006; Holgate, 2007), which is suggestive of a decelerating rate of global sea level rise.

- This is far short of the 18-20 feet Al Gore and others have proposed.
Arctic

- Arctic ice has diminished in thickness and extent in the summer since the Great Pacific Climate shift in 1978 as warming North Pacific water made its way into the arctic through the Bering Straits.


USGRC, June 2000
Dmitrenko and Polyakov tracked warm Atlantic water under arctic ice and noted it is playing a role in ice thinning as it did in 1930s (when thickness decreased by 30% from 1890).

Arctic temperatures correlate well 73% with PDO+AMO.
Kilimanjaro
Africa

1970

2000
Kilimanjaro Snowfield

- Certainly not due to global warming – temperatures have been cooling last 25 years

- Ice retreat has been due to less precipitation
Precipitation anomalies same 25 years

Relates to Atlantic Multidecadal Oscillation and land use changes (deforestation)
Shrubs and trees

Short grasses
Schematic presentation of Alpine climate variations during the last 10,000 years (Holocene), as established by Gernot Patzelt, University of Innsbruck
Consensus on Global Warming

- Most scientists are not climatologists. Most work in other fields and many maybe observing first-hand the effects of climate change. No doubt many have been convinced man is behind it (though 17,200 of them signed petition urging US not to sign Kyoto).

- Many climatologists that work closely with the data see the importance of local factors such as urbanization, land use changes and bad siting and see changes that are cyclical and natural.

- I estimate $\frac{2}{3}$ to $\frac{3}{4}$ of the forecast and broadcast meteorologists and non-modeler climatologists believe natural factors are important.

- Survey of American Association of State Climatologists in 1997 showed 73% felt natural cycles were largely behind climate changes, especially the old-timers who have seen this frenzied overreaction to change before.
Al Gore’s Own Words

“…what is most dangerous for us is not what we don’t know, but that which we know for sure which just ain’t so”

Though meant for the politicians and ‘skeptics’, it really applies to Al Gore and the ‘alarmists’

By focusing solely on greenhouse gases and discouraging efforts to understand other factors, we stand to be blindsided when other factors change and the climate makes its next quick about face
Russian Academy of Science has warned of an imminent recurrence of a minor Ice Age, similar to the one in the 17th century, when temperatures dropped in Europe, North America and Greenland, the Thames and Dutch canals froze in winter, and people fled from Greenland because of unbearable cold. The scientists made the conclusion on the basis of a big decline in solar activity expected the next 50 years or so.

Many solar scientists in Europe, Canada and the US share the same concern but they are not being heard among the shouting and media frenzy about global warming.

The Pacific appears to be heading back into the “cold phase” and Atlantic may follow in a decade.

Warming may have peaked in 1998, still the warmest year in the global data bases (9 years ago).
A Climatologist’s Viewpoint

- Man plays some role in the world’s climate through greenhouse gases and especially urbanization.
- Lack of warming in rural areas suggest the greenhouse component is likely small and overall warming estimates overdone. Global data bases are contaminated by siting, urbanization, station dropout and an increase in missing data.
- Background temperatures are cyclical in nature and correlate better with natural cycles in the sun and oceans than with greenhouse gases.
- The world’s icecap and glacial situation is not exactly as portrayed but where changes are occurring they too can be largely explained by these same cycles in sun and oceans.
- There is clearly not a consensus among meteorologists and climatologists that greenhouse warming is entirely behind recent changes.