Anthropogenic Global Warming

Is Earth at the tipping point?

By: Geoffrey Pohanka

Updated 5/13

Objectives

Examine in a thorough, yet understandable way, the theory of man made global warming

Analyze its plausibility

Review other factors, besides CO2, that may impact the climate.

Give a prediction of the global climate for the next 20-30 years

Observation

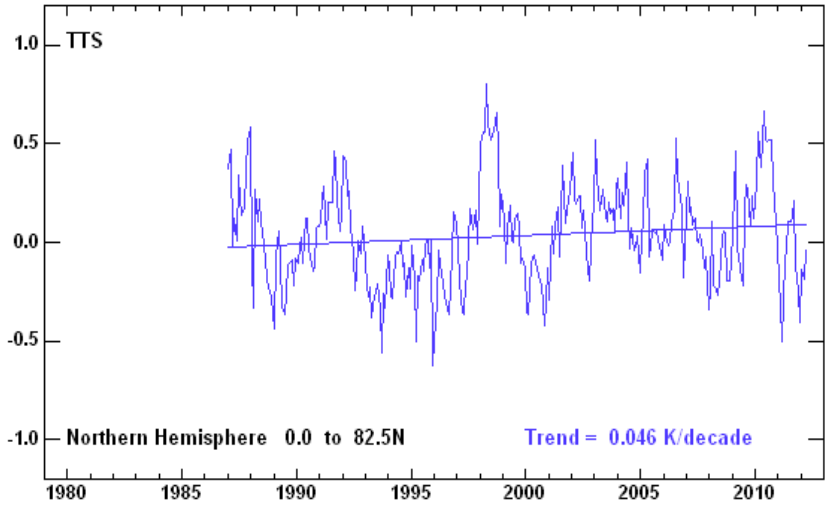
- According to the U.N. Intergovernmental Panel on Climate Change (IPCC), global temperatures increased **+0.74 deg C** in the last century (1906-2005).

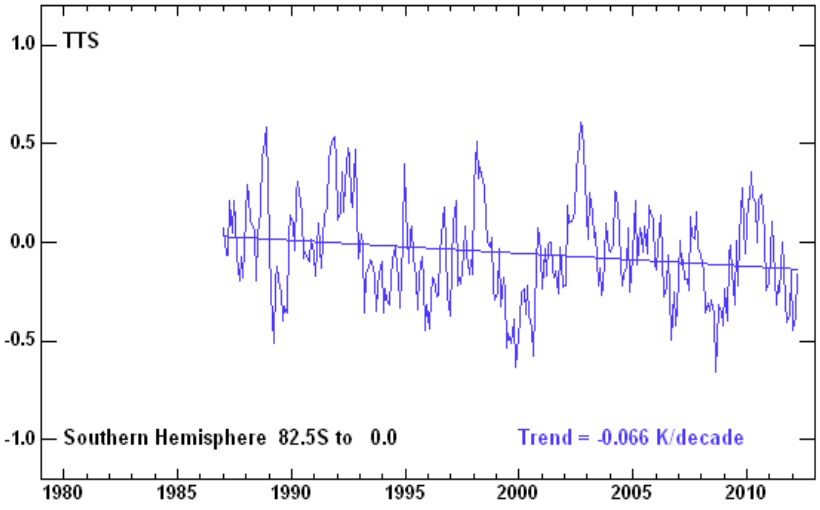
- There is general agreement that there has been some minor warming during the last century…….from whatever cause.

Since 1987 temperature change has not been consistent globally. While temperatures in the northern hemisphere have been warming, in the southern hemisphere they have been cooling.

Source: RSS

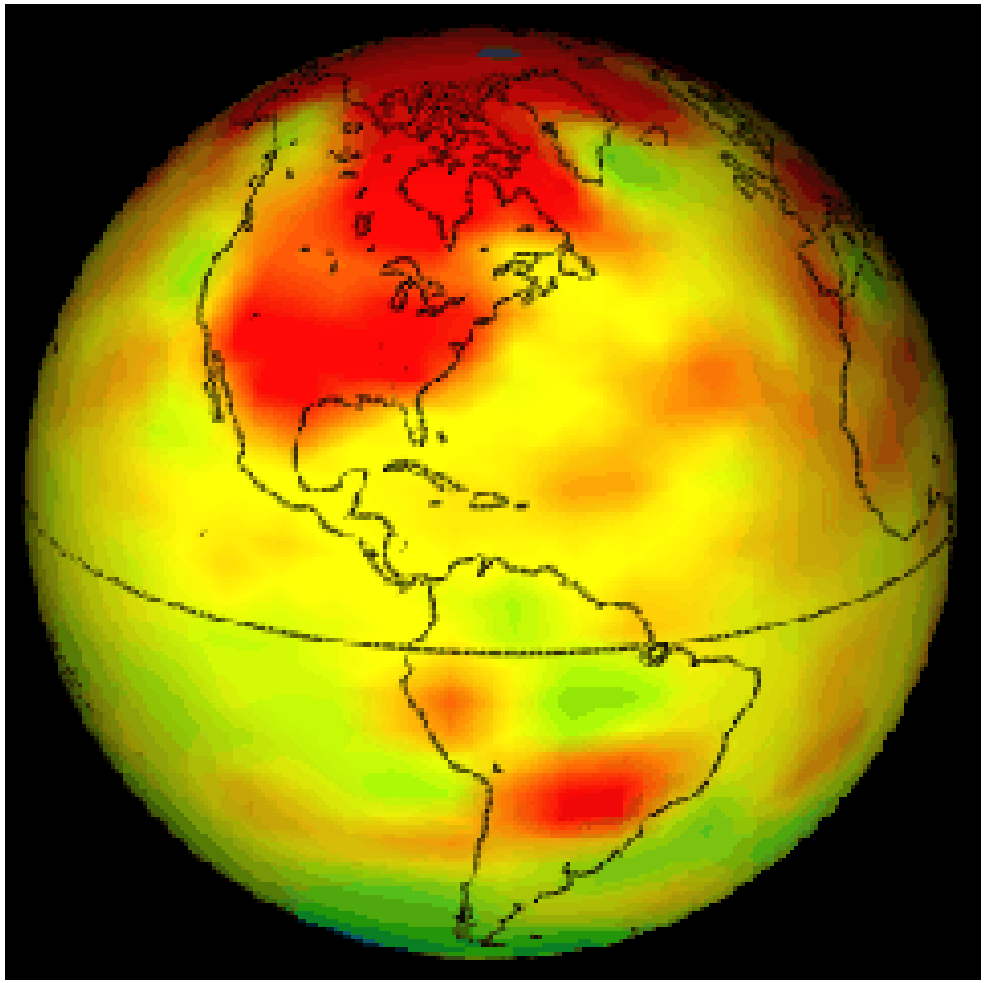
Global temperatures have only been tracked accurately from satellites since 1979.





- Despite the minor warming in the last century, (+0.74 deg C), what do the supporters of the man made global warming theory (AGW) predict for the remaining years of the 21st Century?

Supporters of AGW predict temperatures will rise as much as 11.5 degrees Fahrenheit by 2100



Polar ice and glaciers will melt. The Arctic sea ice could disappear completely within five years

Sea level will rise up to 20 feet by 2100

Hurricanes and their intensity will increase.

The rapidly changing climate will threaten species with extinction

Resulting in millions of climate refugees

But will this happen?

Words of wisdom/Rules of the road

- Scientific Method……

Consists of theories and concepts that must be **proven through observation.**

"Principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses."

(Wikipedia)

“No amount of experimentation can prove me right, but a single experiment can prove me wrong.”

Einstein

President Dwight D. Eisenhower gave two warnings in his farewell address to the nation, regarding:

"The military industrial complex" (and also…..)

The " domination of the nation's scholars by Federal employment, project allocations, and the power of money is ever present – and is to be greatly regarded"…

➡ "…we must be alert to….the danger that public policy itself become captive of the scientific-technological elite"

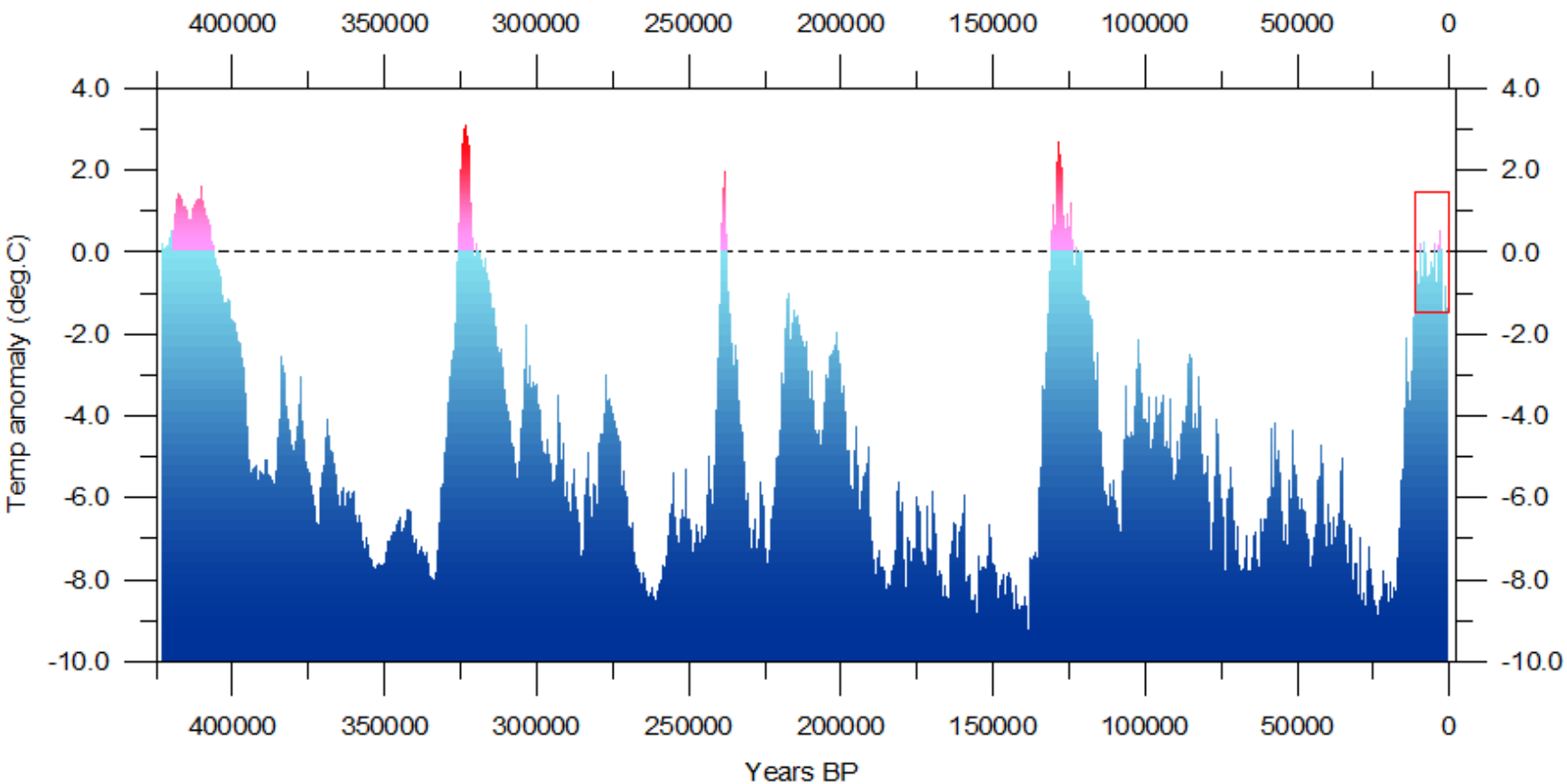
Question: Is it warmer than it has ever been?

With the exception of the Ice Ages, the Earth's temperature today is cooler than most of the last sixty-seven million years.
(chart reads right to left)

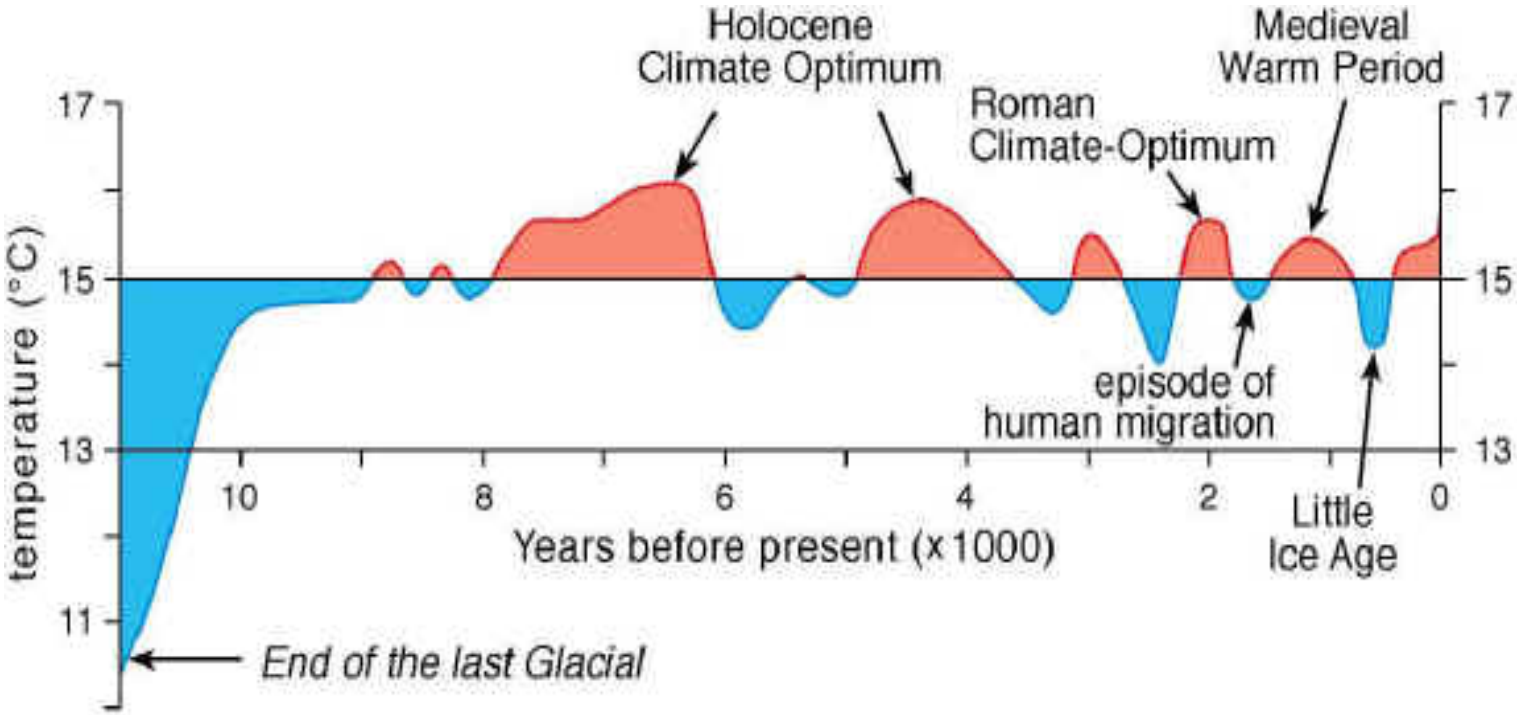
(source: James Zachos)

The Earth has been in an ice age most of the last 400,000 years. The earth's temperature in each of the last four interglacial periods was several degrees warmer than today. (chart reads left to right)

Reconstructed global temperature over the past 420,000 years based on the Vostok ice core from the Antarctica (Petit et al. 2001

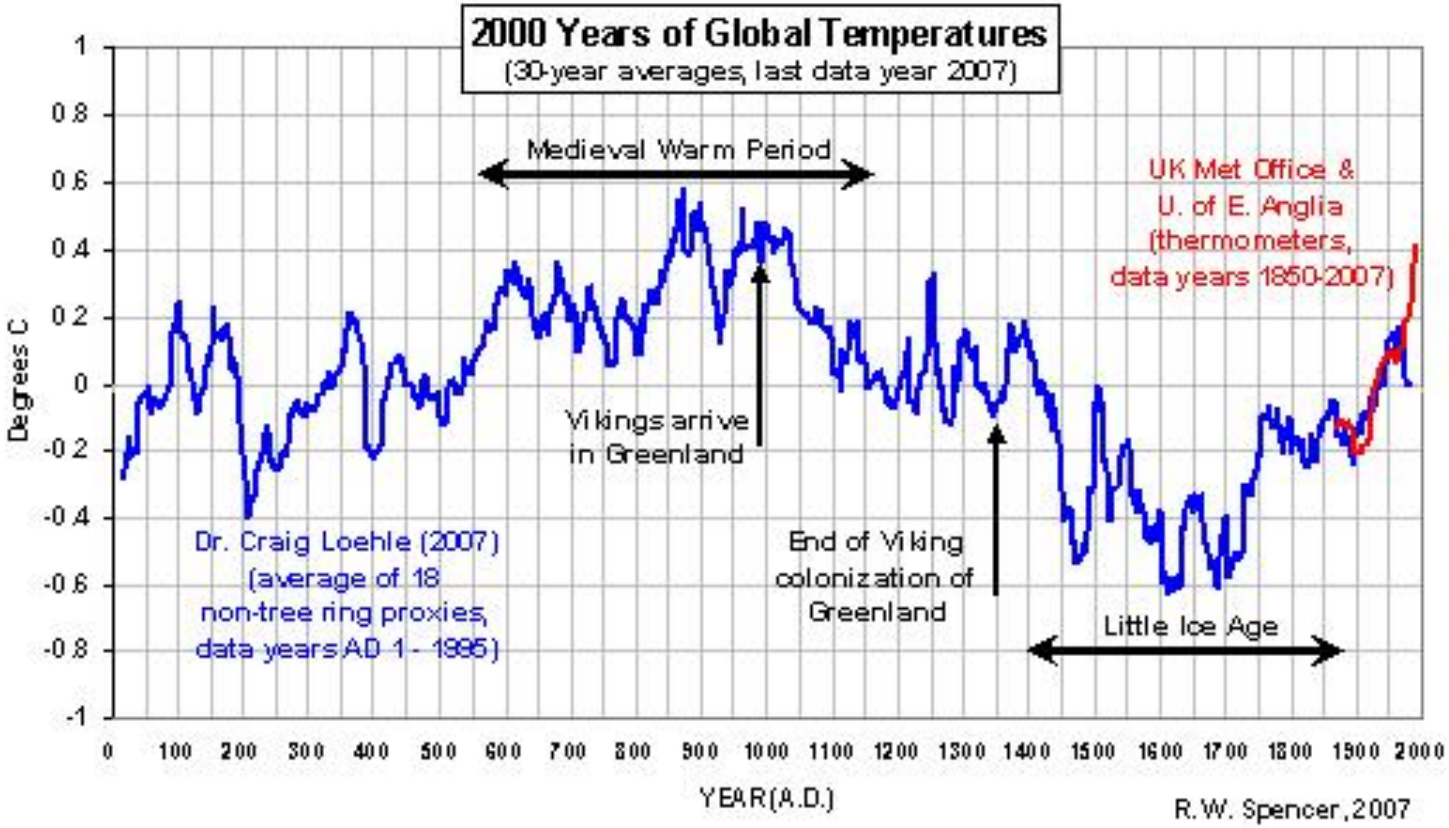


We are in an 11,000 year interglacial period called the Holocene.
It has been warmer than today quite a few times in this period.
This warming is from *natural causes* and not man.



Average near-surface temperatures of the northern hemispere during the past 11.000 years (after Dansgaard et al., 1969, and Schönwiese, 1995)

Temperatures were several degrees warmer than today in the Roman and the Medieval Period. The earth cooled several degrees from 1400 to 1800, this period is called “The Little Ice Age”.
Earth’s latest warming started in the early 1700s, *long before CO2 was a factor*.



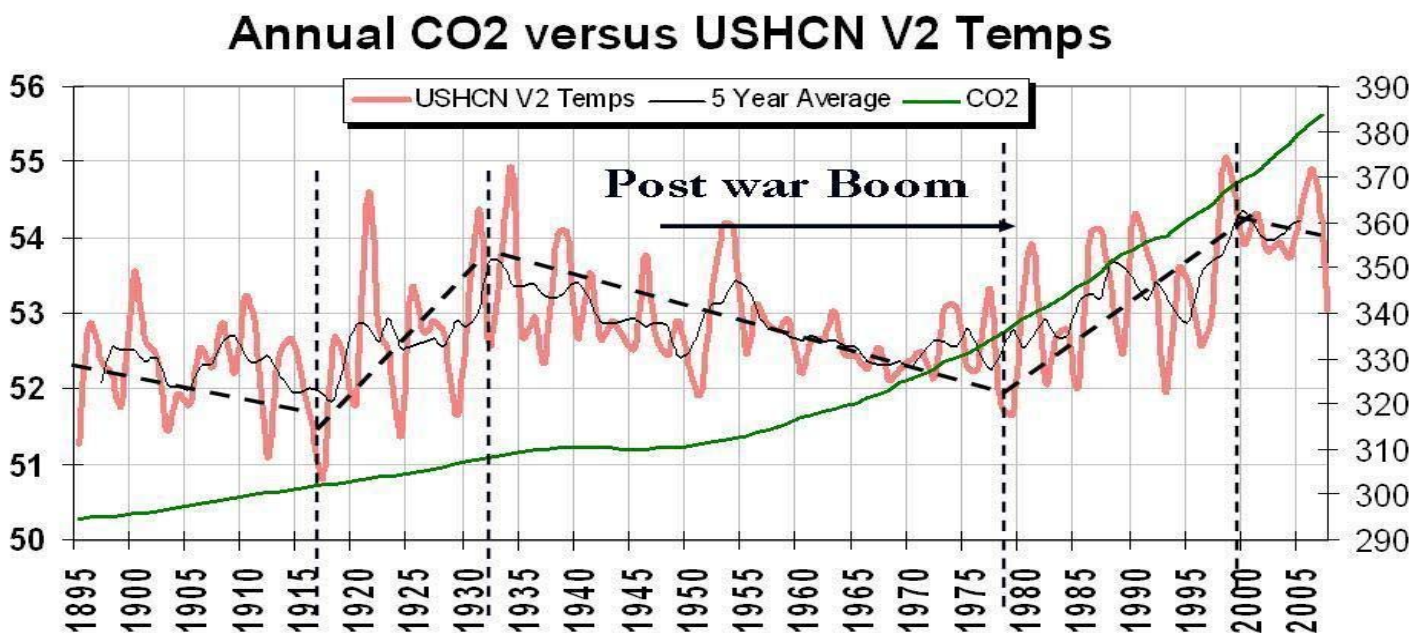
How do we know the temperatures in the past?

- Boreholes in ice, lakes, rivers, and oceans.
- Glacial and flood deposits
- Sea level data, volcanoes, wind blown sand
- Soils, isotopes, pollen, peat
- Fossils, cave deposits
- Agriculture and contemporary records

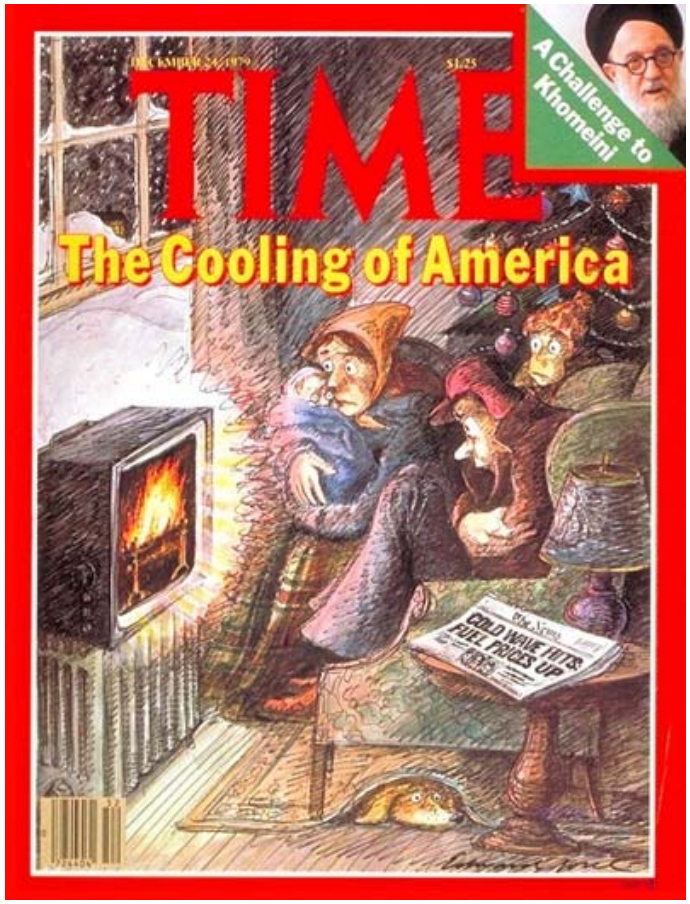
U.S. has tracked continental temperatures since 1895 with land based thermometors

U.S. temperatures have been cooler in six of the last eight decades even though CO2 levels increased in this period.

The forty year cooling period from the 1930s to 1970s caused some to fear the return of an ice age.



The 1970s cooling scare



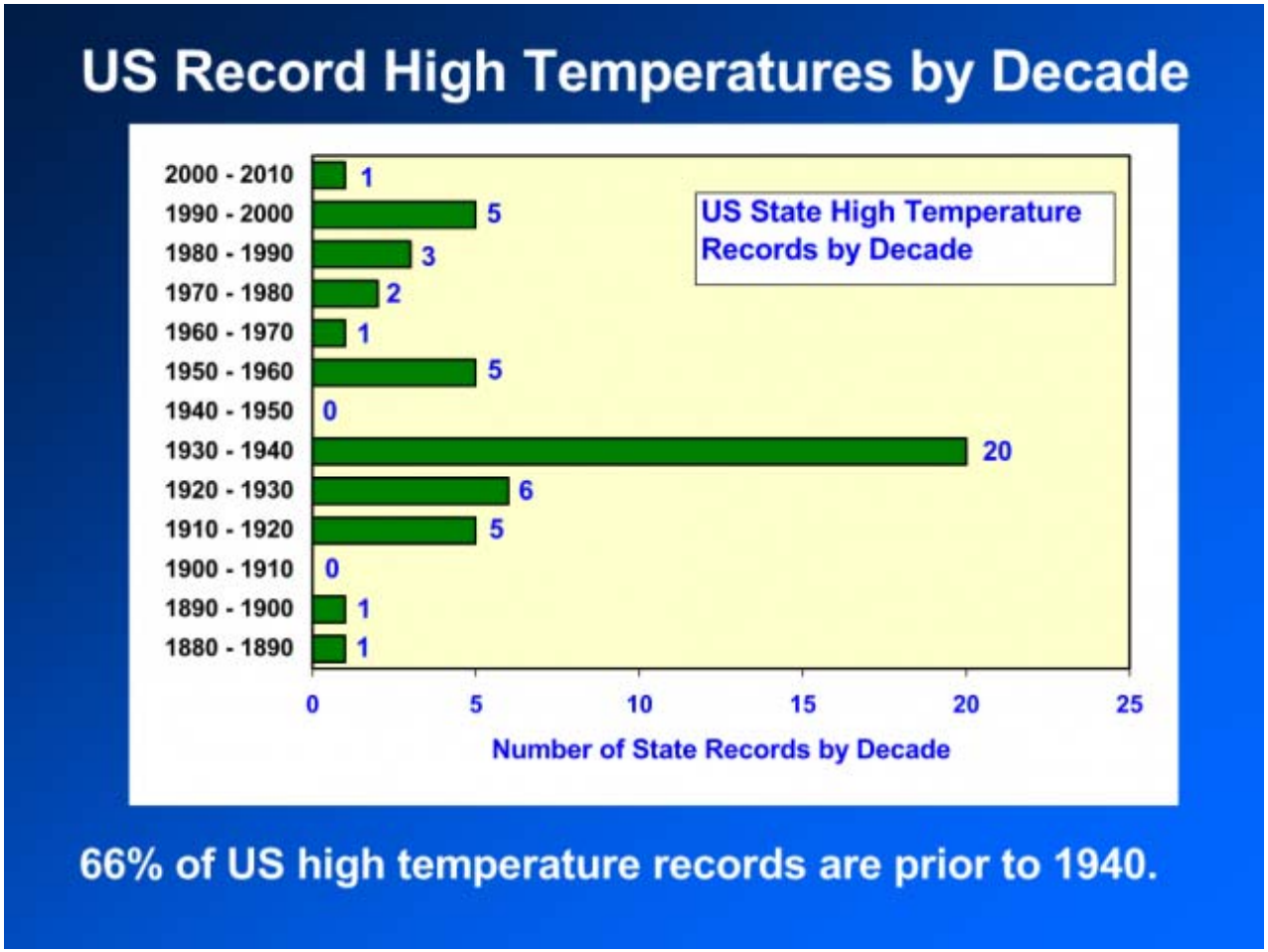
Headline: January 1977

The ten warmest years in the U.S.

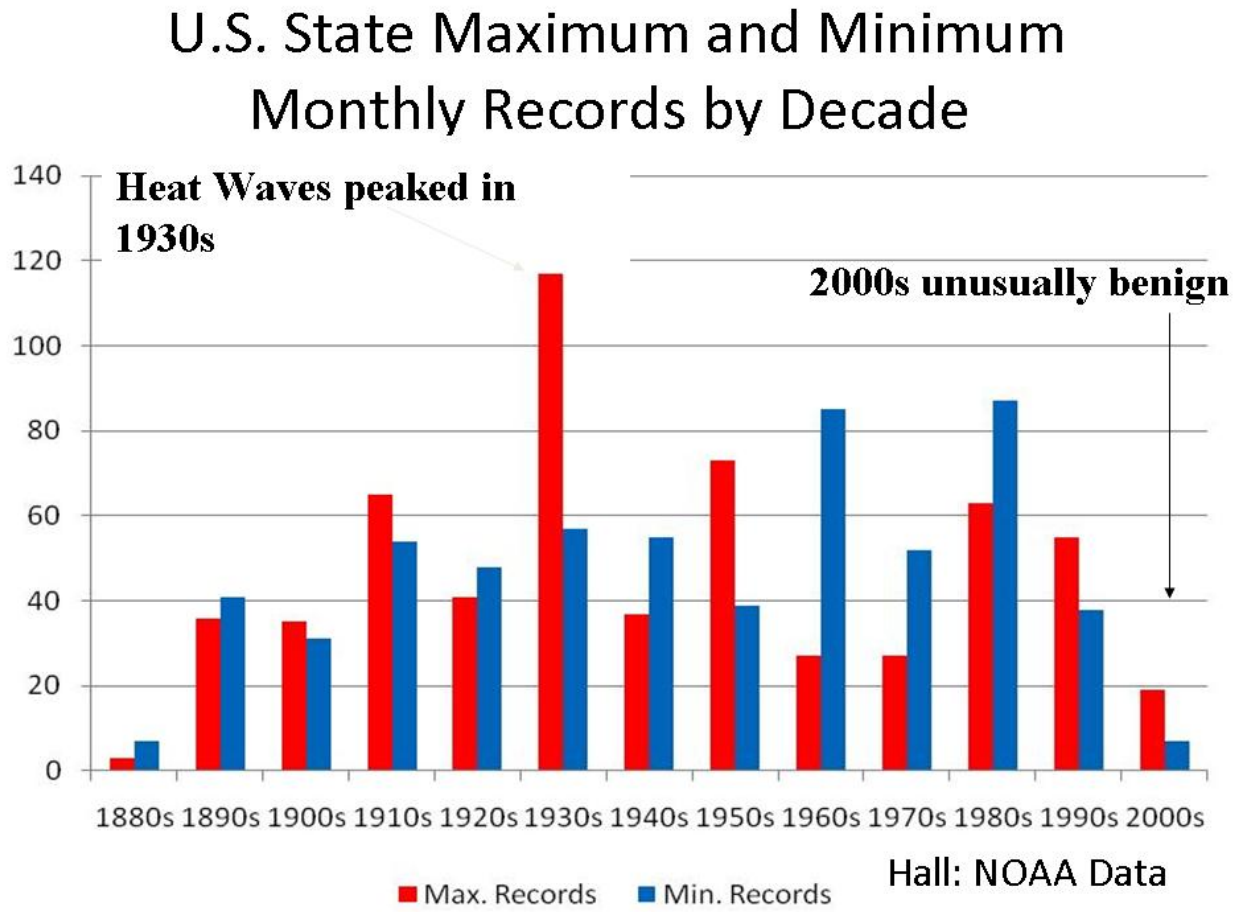
- 1934
- 1998
- 1921
- 1906
- 1931
- 1999
- 1953
- 1990
- 1938
- 1939
- Five of the ten warmest years in the USA were <u>before</u> 1940
- The warmest decade in the USA was the ***1930s***

(Source: NASA GISS)

1880-2010 U.S. 50-State record high temperatures. Most were before 1950 (source David Archibald)

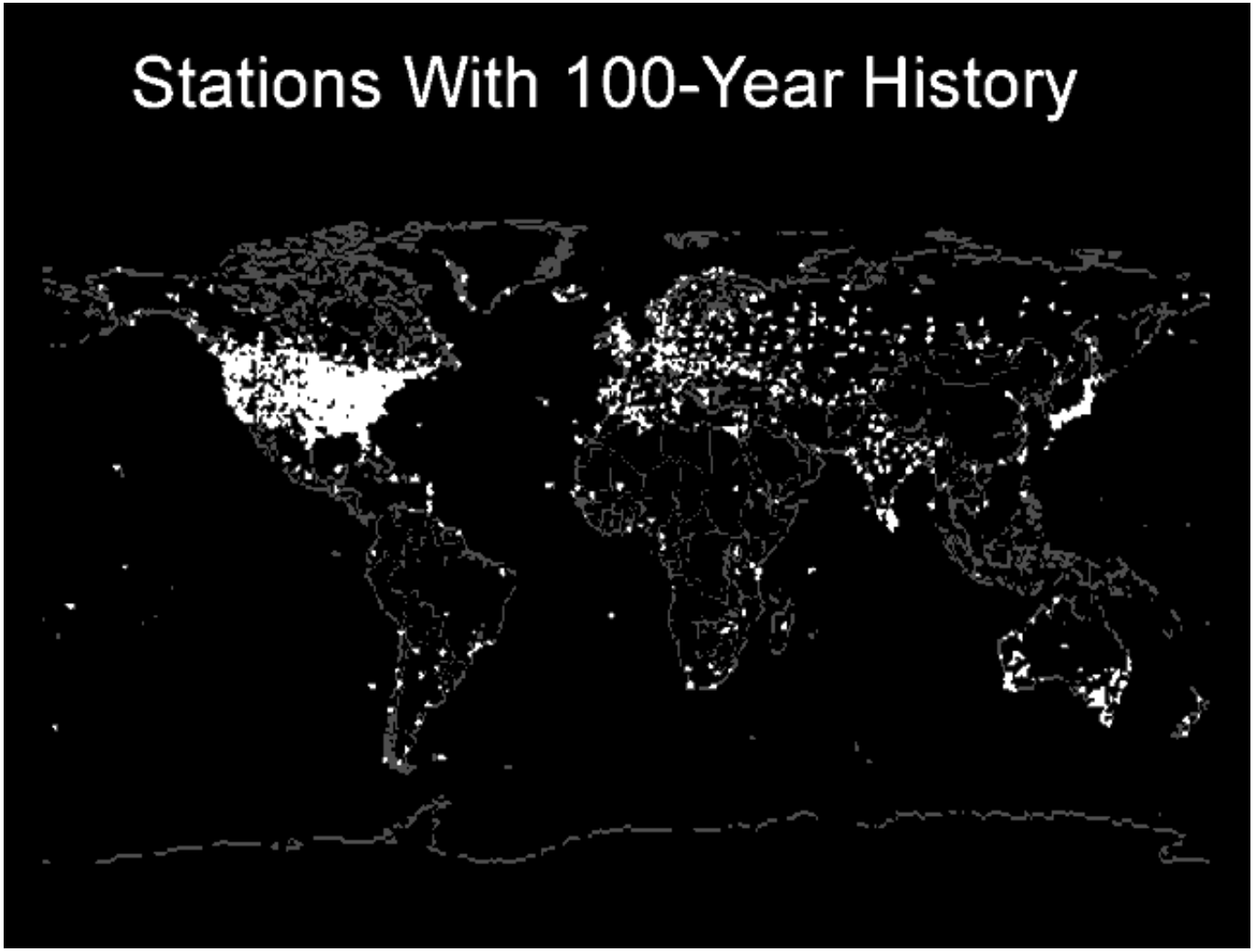


In the past 50 years in the U.S., there have been more record low temperatures than record high temperatures.



The U.S. has the longest and most comprehensive record of temperature data from ground weather stations

(source: Climateskeptic.com)



Most parts of the globe do not keep consistent track of the temperatures. This map shows weather stations reporting data at least 67% of the time from 1978-2007

(Source: GHCN)

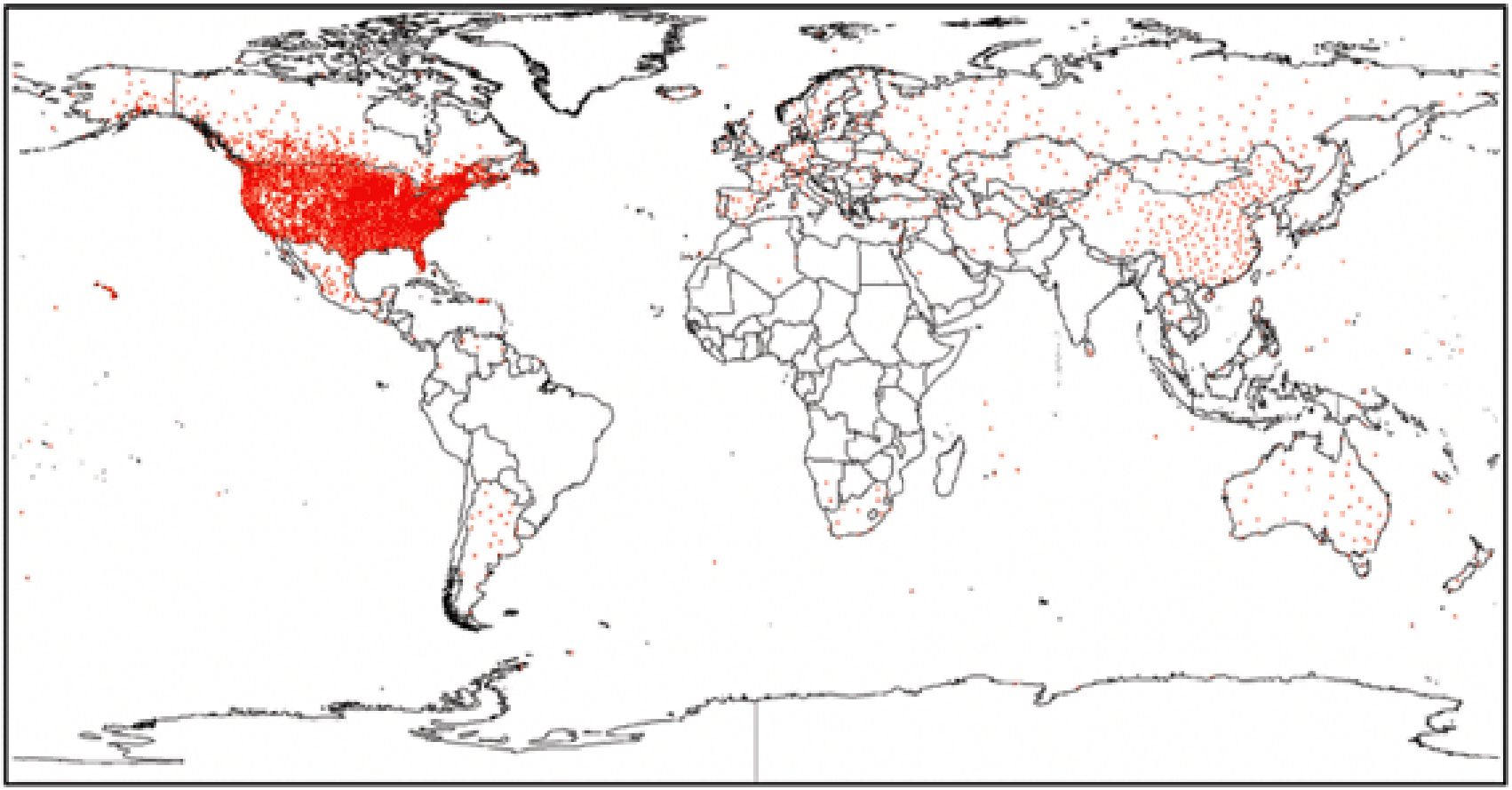
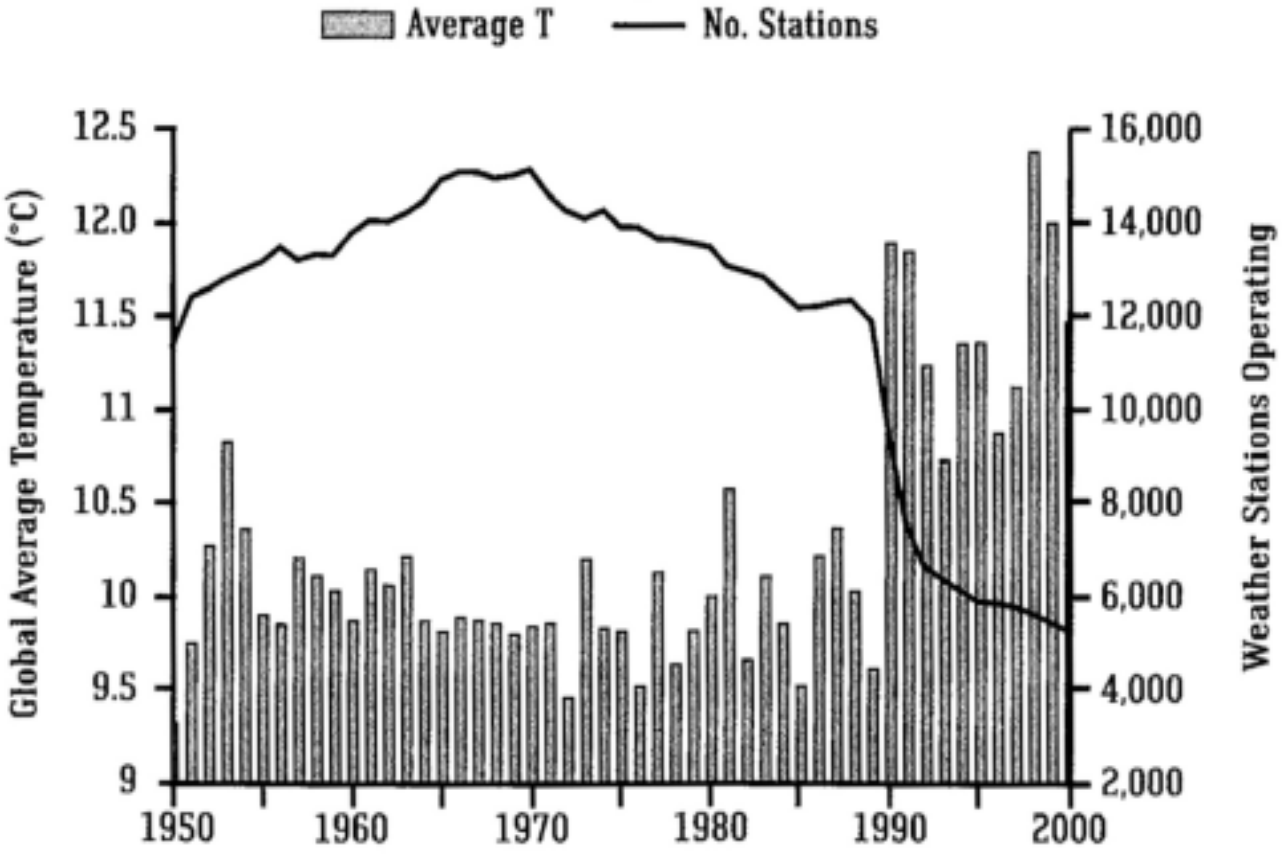


Figure 1 - Locations of Daily Global Historical Climatology Network (GHCN) stations reporting at least 67 percent of the time (at least 20 years for the 1978–2007).

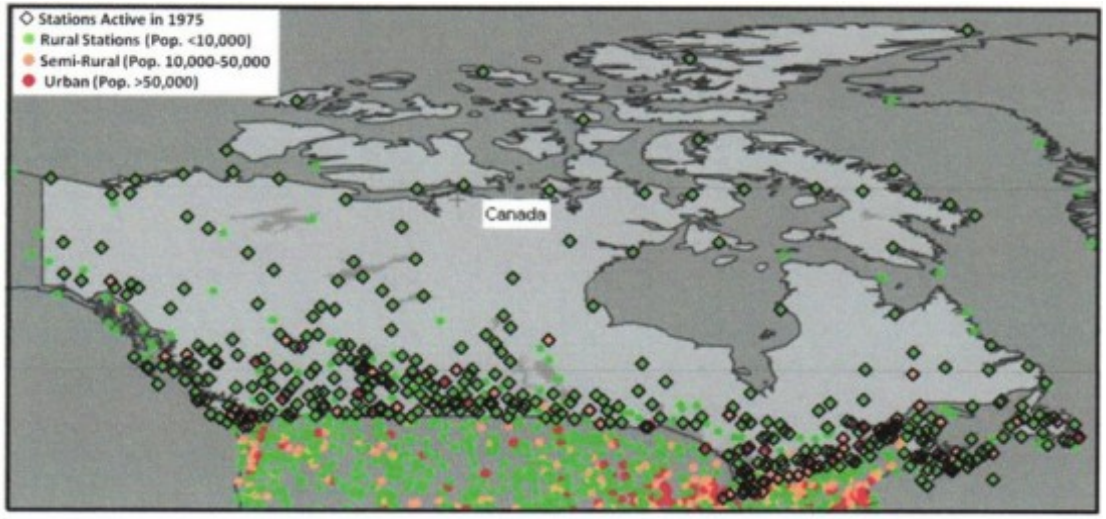
In the early 1990s climate data stopped being collected from thousands of global weather stations. Many of these stations were in cooler rural areas such as Siberia. Temperatures appeared to rise as the stations were dropped. How temperature is collected impacts the data.

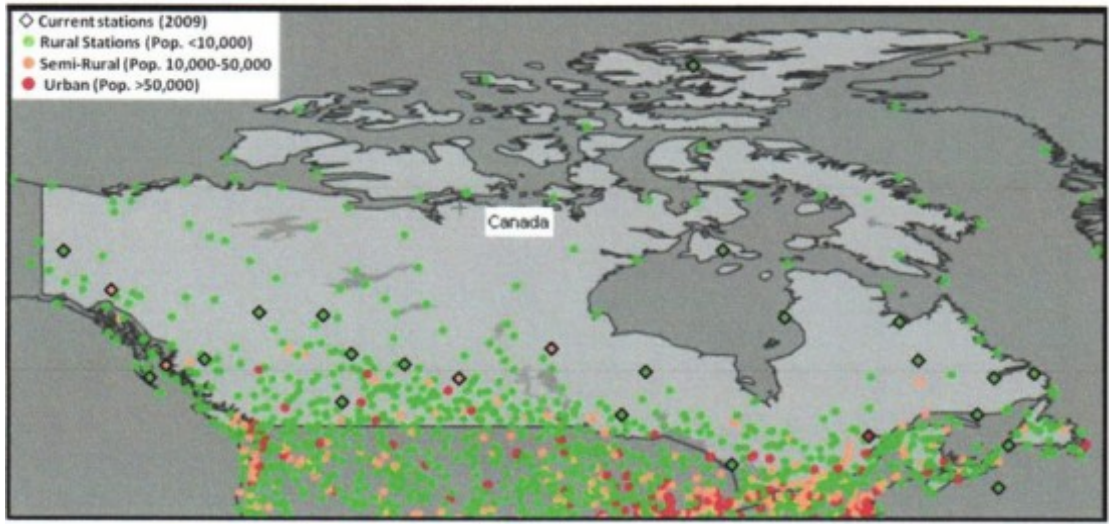
(source: Joe D'Aleo)



Canada had over 600 climate stations in 1975. By 2009 they were down to less than 50. Most stations today are located near the warmer southern border. There are only 4 stations today in the Polar north.

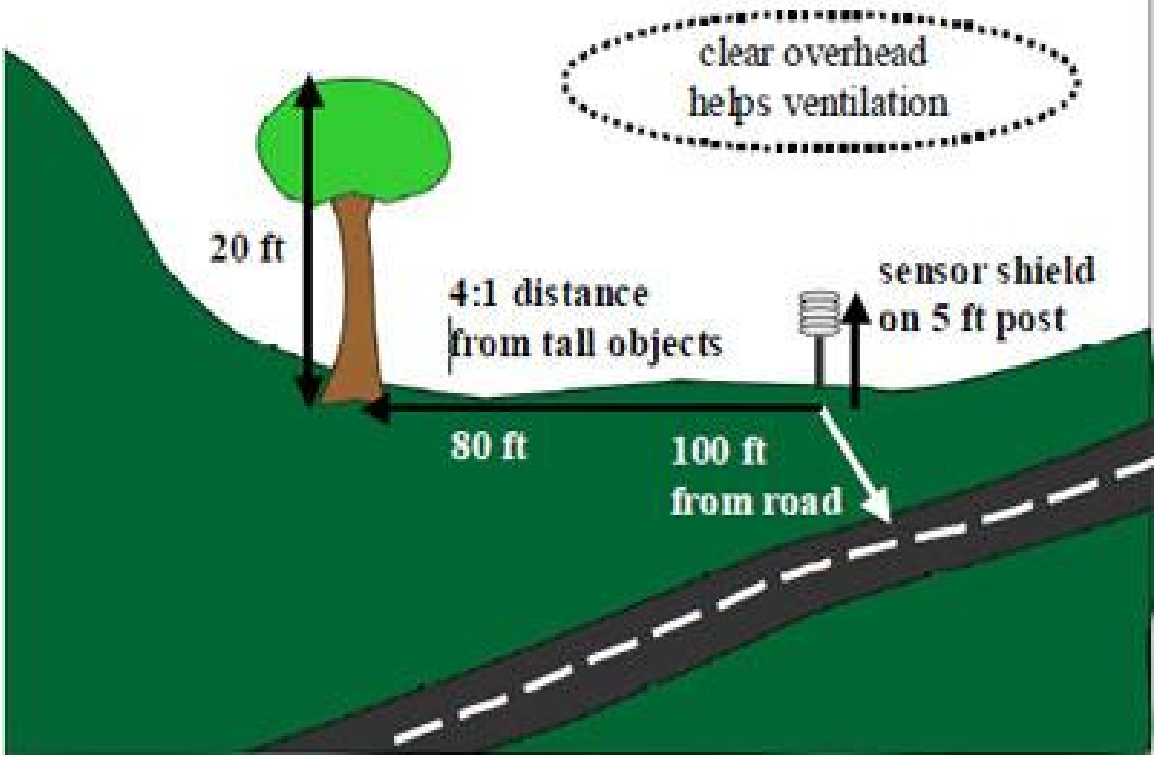
Source icecap.us





One way the U.S. tracks temperature is from 1,221 ground weather stations.
These stations are supposed to be kept at a distance from buildings, roadways, and trees

(Source: Anthony Watts)



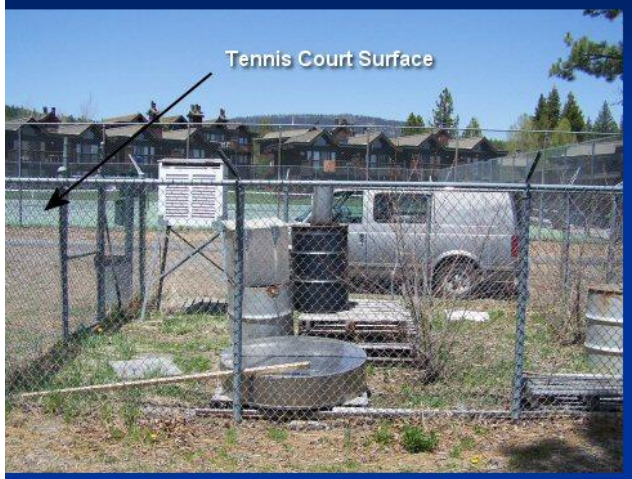
Observation shows that many stations are poorly located next to buildings and gravel roadways

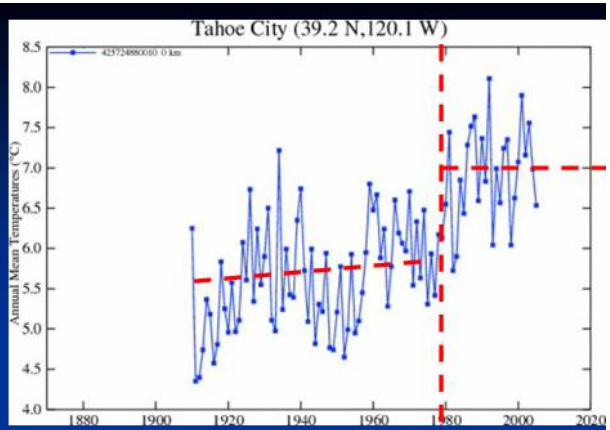
Adjacent to buildings, cars, parking lots, satellite dishes, and air conditioners

On hot rooftops

Next to trash burn barrels and tennis courts

Temperatures rose at this station when the nearby tennis court was built





Tahoe City, CA
Tennis court added in early 1980s

Adjacent to transformers, buildings, dumpsters and gravel roadways

Next to A/C condensors

Many climate stations are located close to artificial heat sources

Such as sewage treatment plants

Or buildings with A/C units

Next to man made objects that absorb and radiate heat

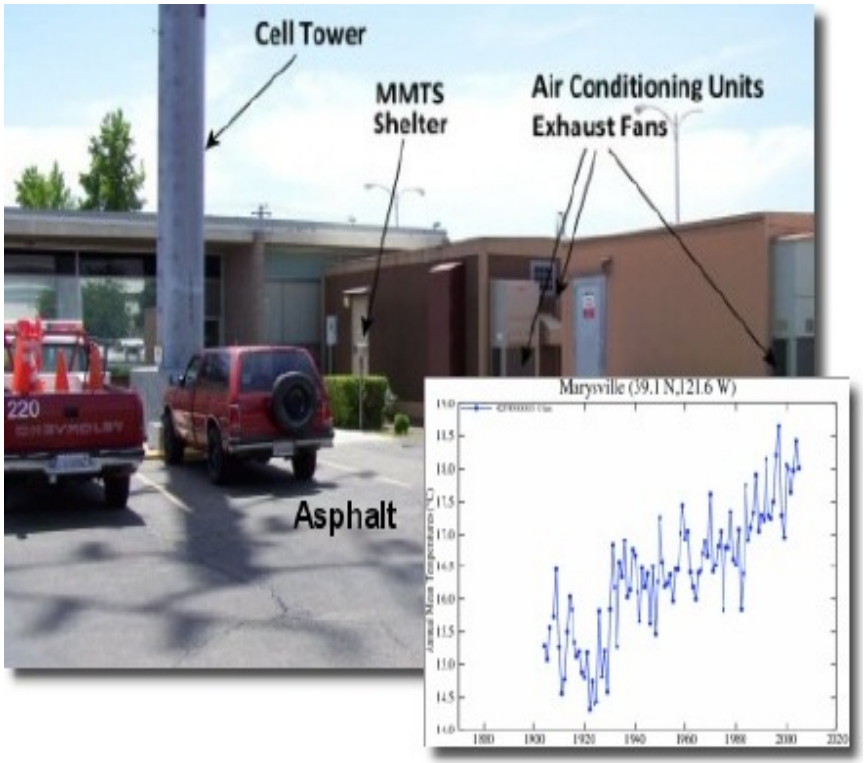
Many climate stations are located at airports. Global air traffic is growing and effects local temperatures.

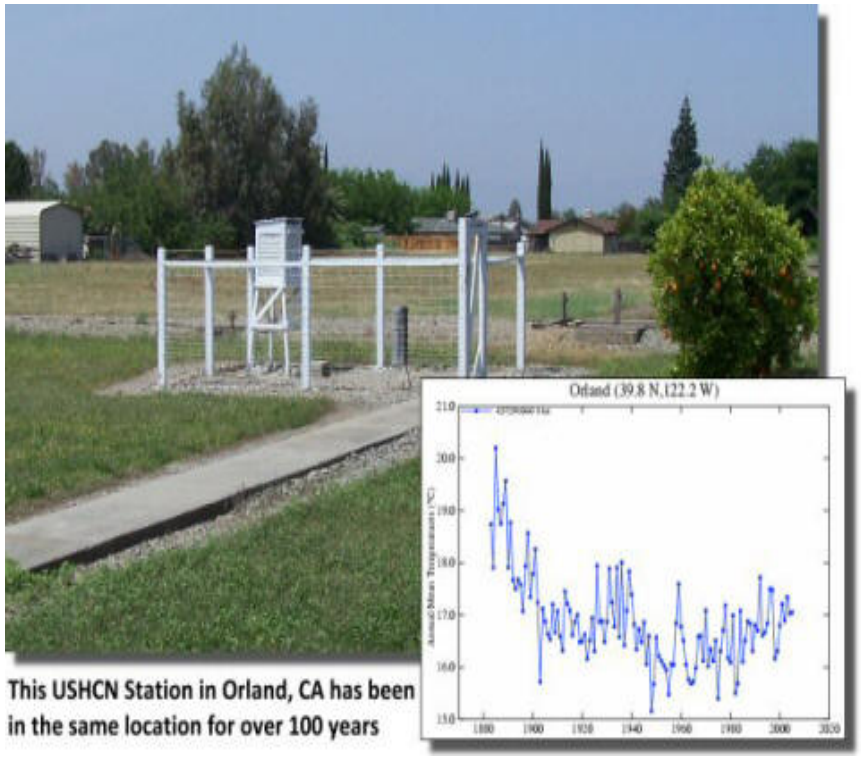
Some are in backyards and near people's "stuff"
Changes within close proximity to climate stations impacts the temperatures that are recorded.

Some weather stations are near barbeque grills.
Burgers anyone?

In junkyards

These two stations are forty miles apart and show different temperature trends due to the proximity of development. This demonstrates the impact of land use changes on 'local' temperatures and the importance of sensor placement.





This USHCN Station in Orland, CA has been in the same location for over 100 years

- Of the 1,221 U.S. ground weather stations 82% have been independently surveyed.

- Anthony Watts has found that 89% of the stations checked are poorly located and are within 100 feet of an artificial heat source that causes a heat bias of **1 degree C to 5 degrees C**

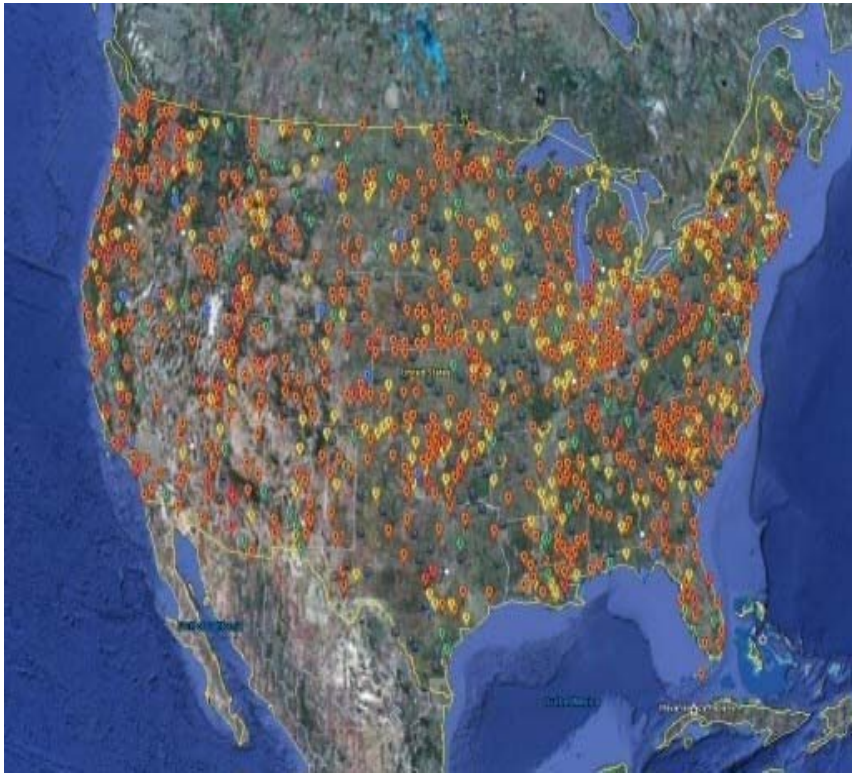
- These ground weather stations have been encroached by development and thus show higher temperatures due to the "**heat island effect**".

- Attempts are made to correct temperature readings as a result of land use changes but…….by whom? And how?

Results of the 1,221 USCHN surface weather station quality ratings. Using NOAA's own standards for the quality of climate station location, data from 89% of the stations surveyed would be classified as 'unreliable'.

Location of U.S. climate stations and their ratings

(Source: Anthony Watts)

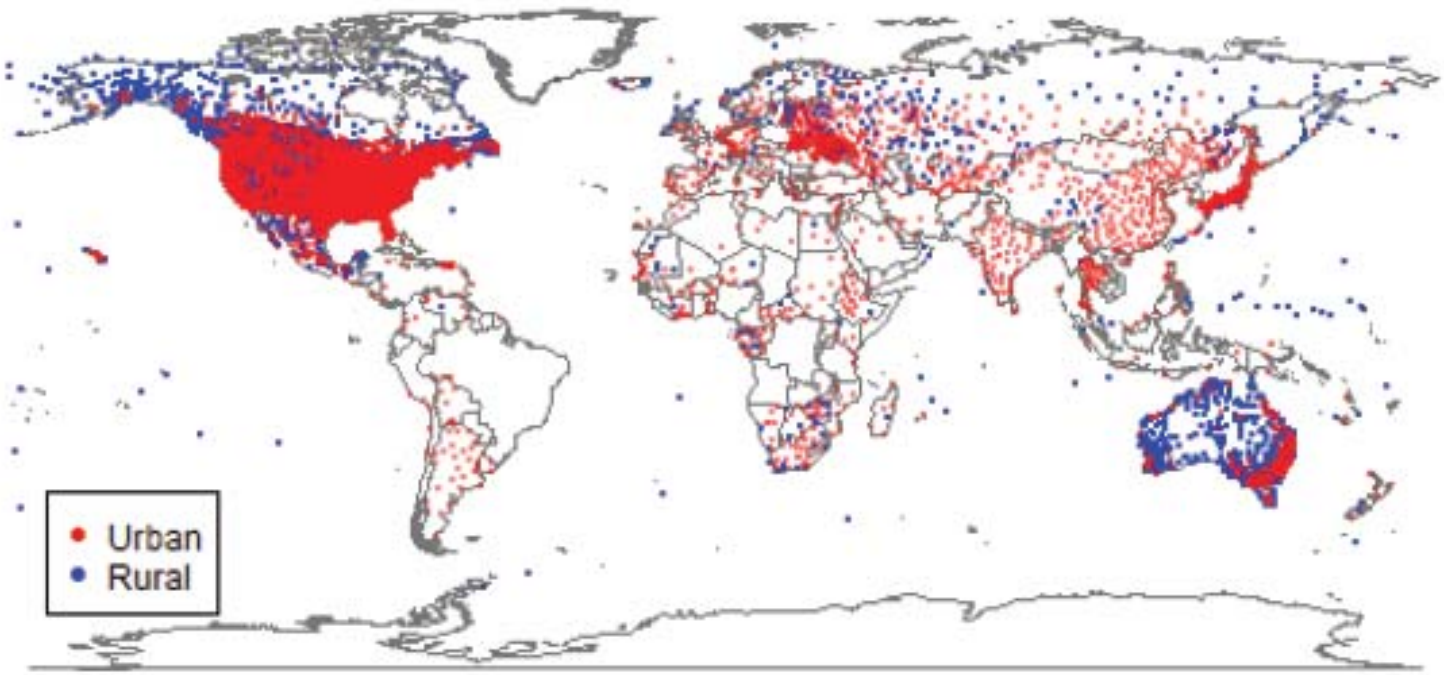


Bias rating factor

CRN Rating key	1	2	3	4	5	
Estimated Error in °C (per NOAA)	Error ≤1°C	Error ≤1°C	Error ≥1°C	Error ≥2°C	Error ≥5°C	Unrated
Quality	Best	Good	Fair	Poor	Worst	Closed

Most global climate stations are located in or near urban areas. The temperature in cities is warmer than the surrounding countryside. Local warming is not the same as global warming.

Source: *Zeke Hausfather , Steven Mosher, Matthew Menne , Claude Williams , and Nick Stokes*

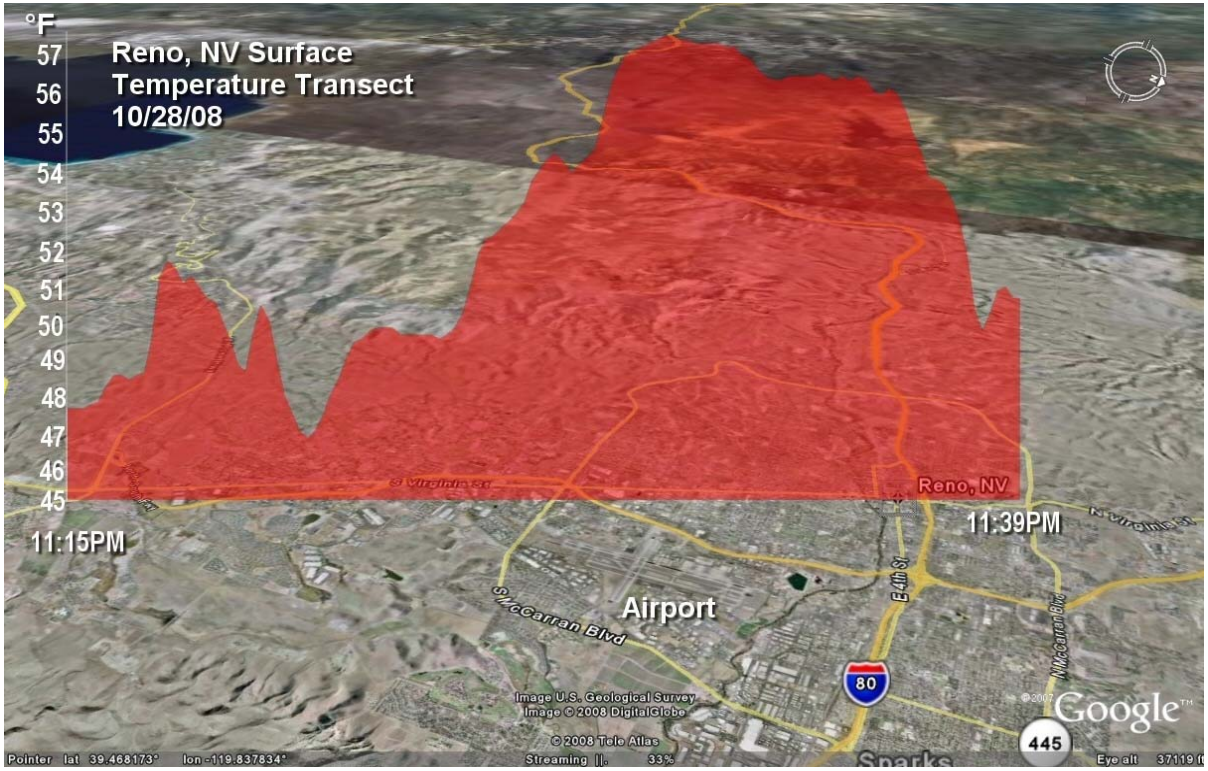


Map of Urban and Rural Stations

URBAN HEAT ISLAND EFFECT

The world's population has increased six-fold in the last 100 years.
The growing urbanization has caused "local" temperatures to rise.
(heat from the day is slower to dissipate at night in urban areas)
The chart below shows how the city of Reno Nevada
retains the heat of the day as one drives from the suburbs and into the city.

(source: Anthony Watts)



The official EPA description of ‘heat islands’

(source: http://www.epa.gov/heatislands/index.htm)

- “the term "heat island describes built up areas that are hotter than nearby rural areas. The annual mean air temperature of a city with 1 million people or more can be 1.8–5.4°F (1–3°C) warmer than its surroundings. In the evening, the difference can be as high as 22°F (12°C)”

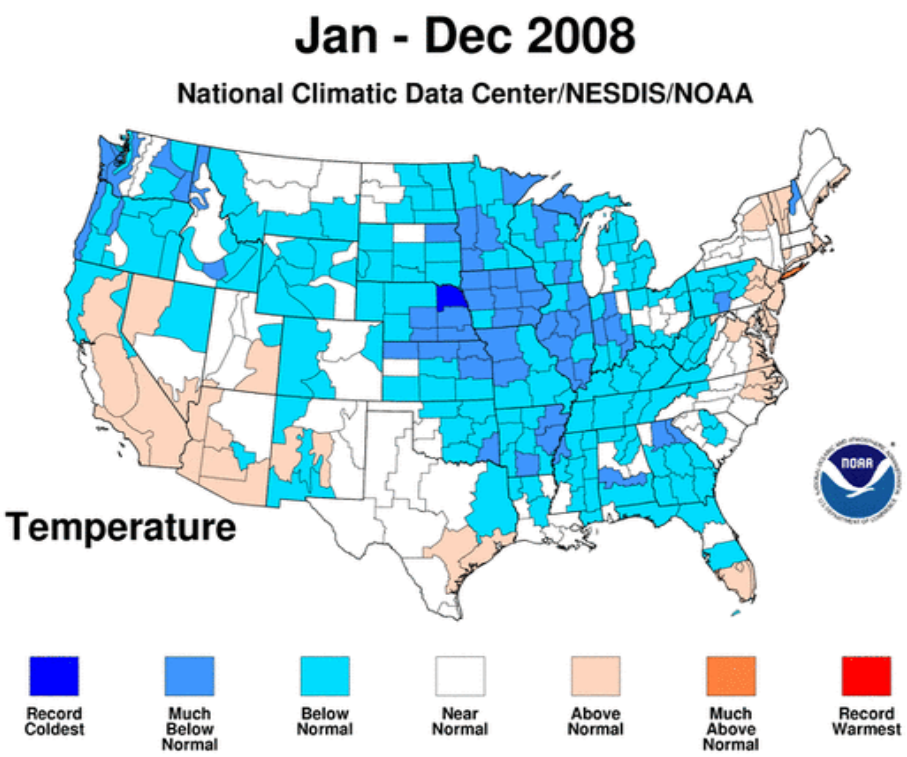
As atmospheric CO2 levels increase, how are temperatures reacting ?

U.S. temperatures in 2008 were below the 115 year average

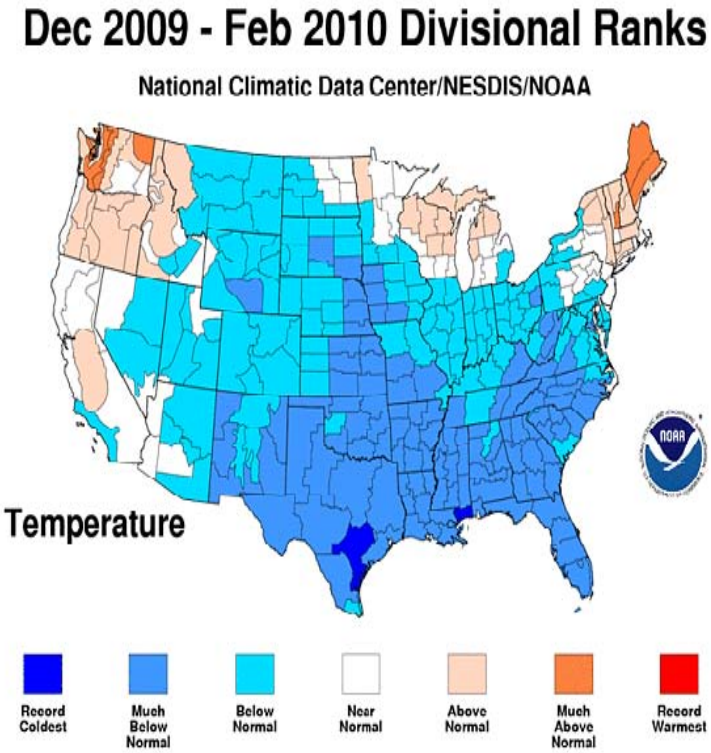
U.S. 2009 Summer temperatures were the 34th coldest in 115 years.

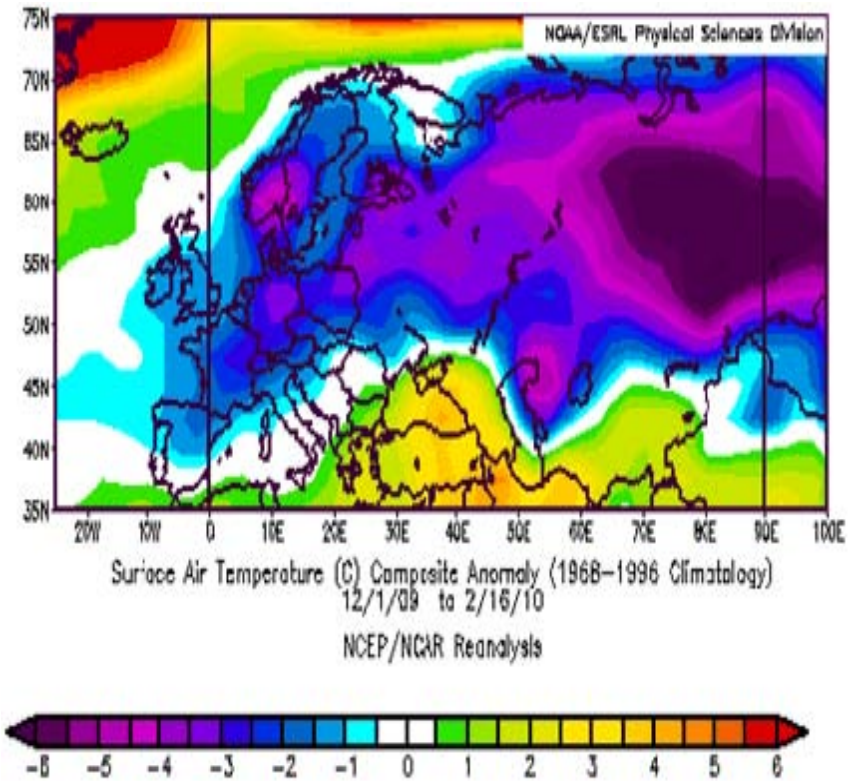
U.S. October 2009 temperatures were the 3rd coldest *ever* for that month, 4 degrees below normal. December 2009 temps were the 4th coldest *ever* for that month.

(Source: U.S. National Climate Data Center)



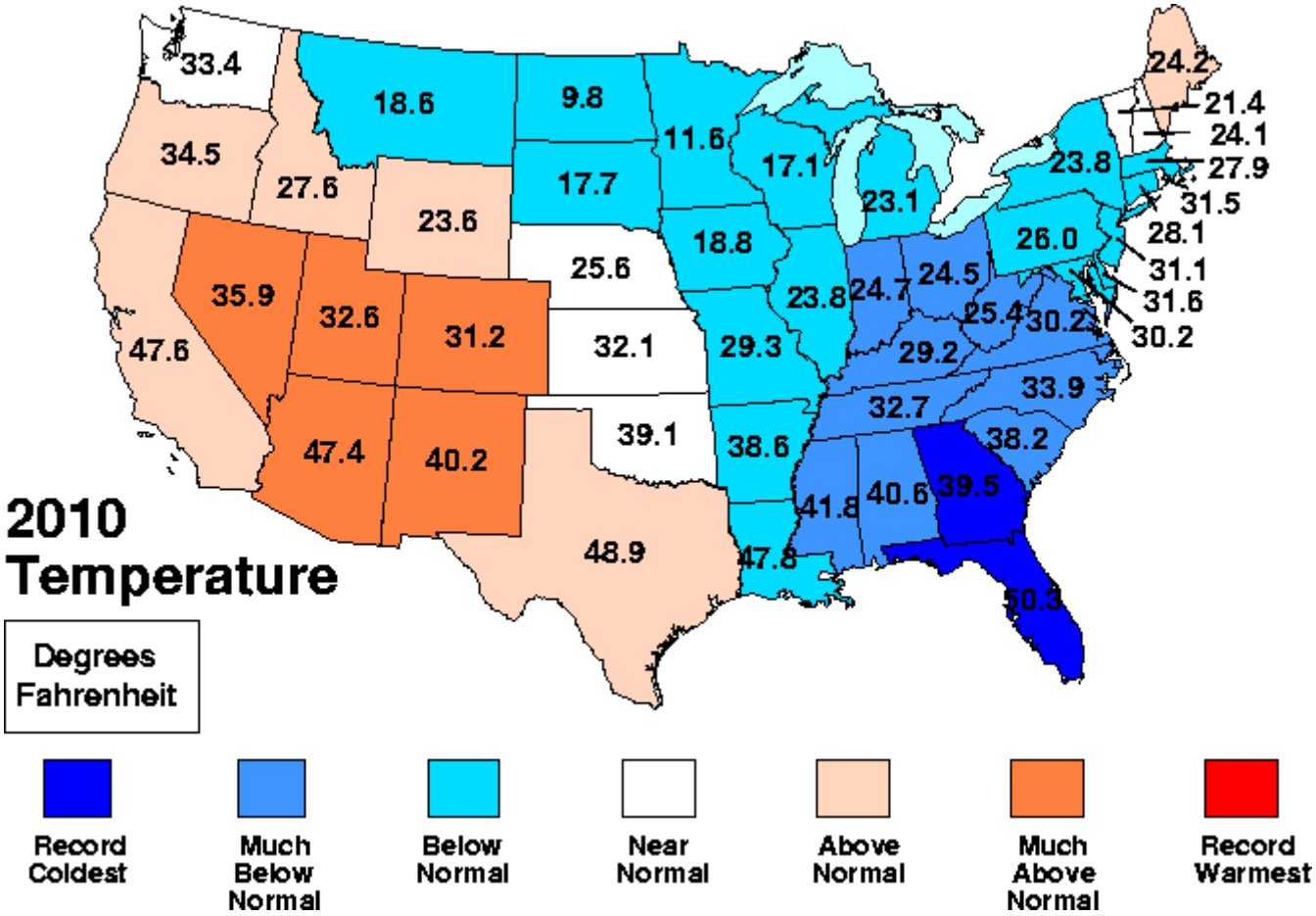
These cold temperatures were not limited to North America.
They could also be found in Europe and Asia.
The Russian winter of 2009-2010 was one of the coldest ever.





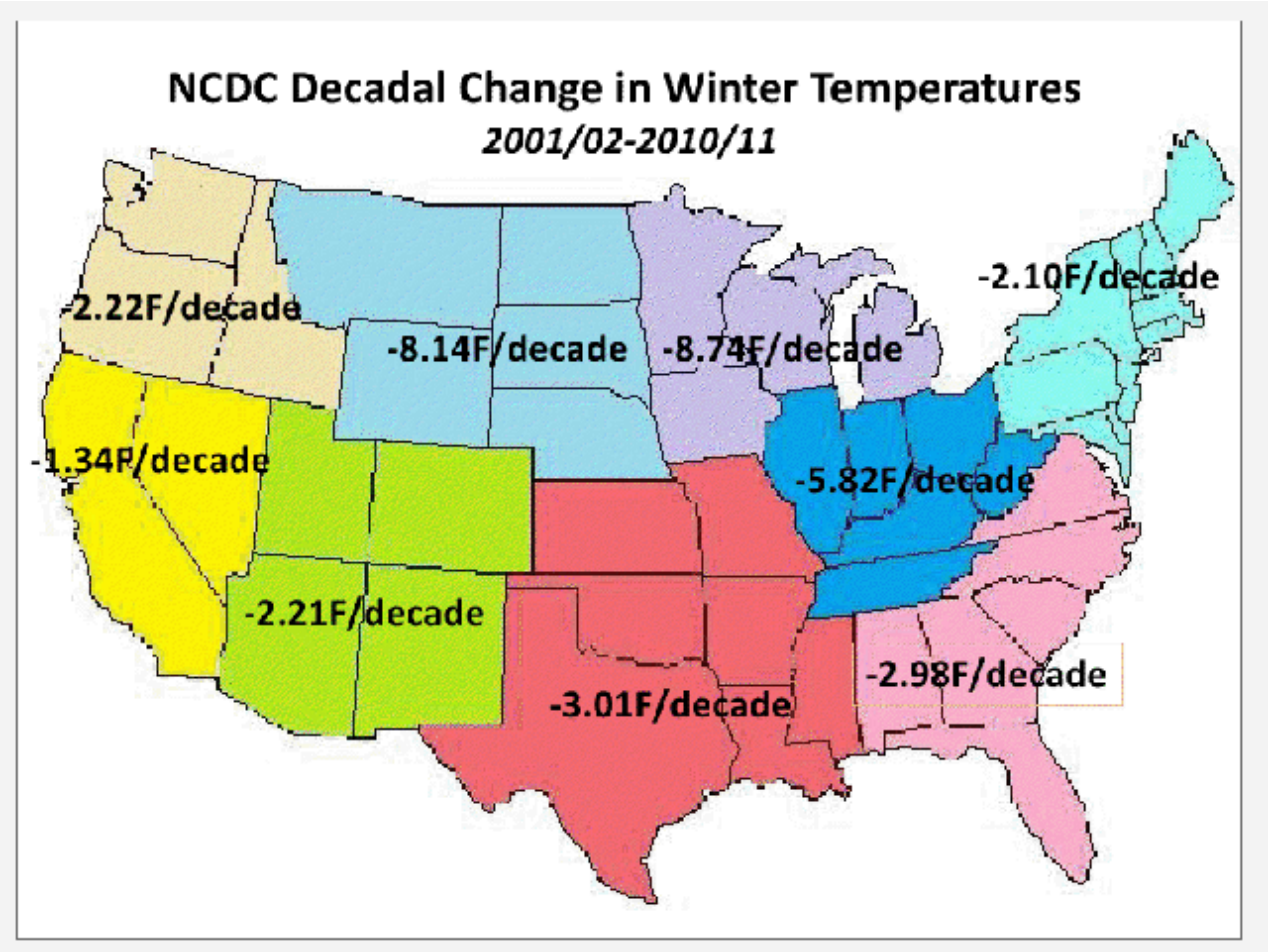
Despite a very strong El Nino in 2010 , much of the nation experienced colder than average temperatures that year.

(source NOAA)



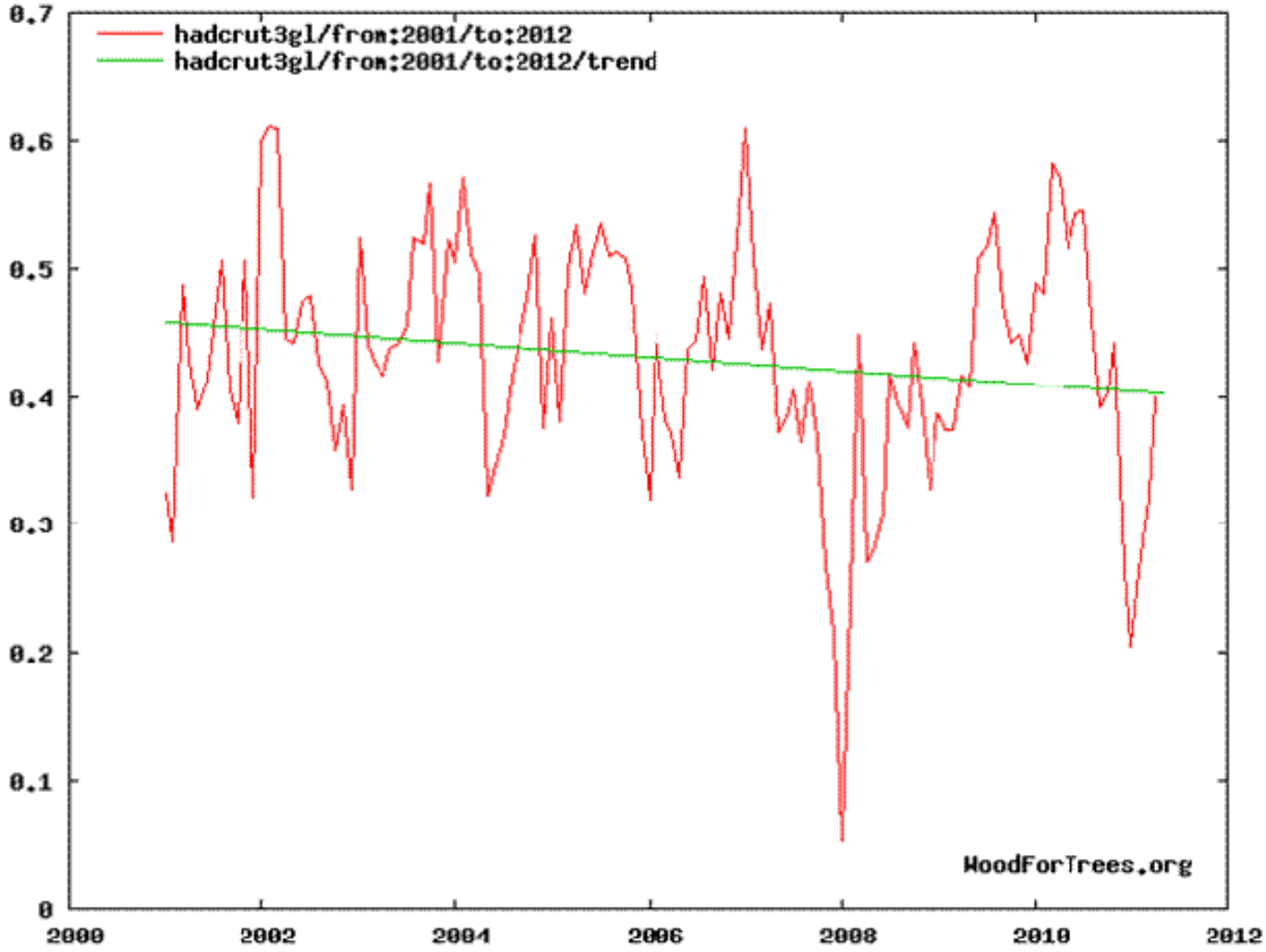
U.S. Winter temperatures were trending dramatically cooler in the past ten years. (source NOAA)

2013 U.S. Spring temperatures are also near record low levels.



Global temperatures also have been slightly cooling, on average, for the last decade.

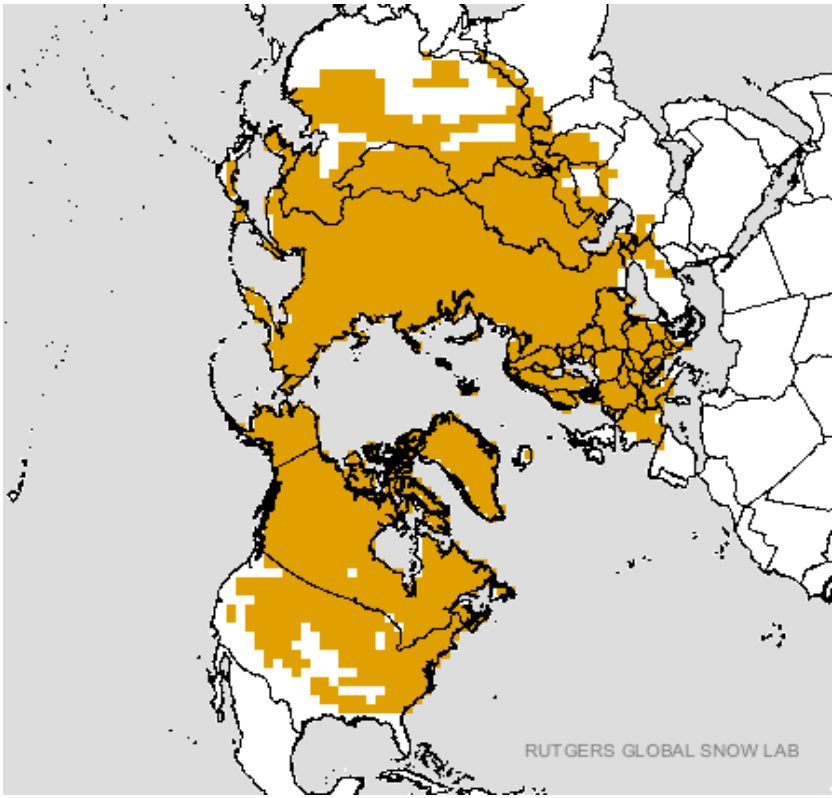
Source: Hadley Centre UK Met Office



In February 2010 North America had the largest area of snow cover ever recorded.

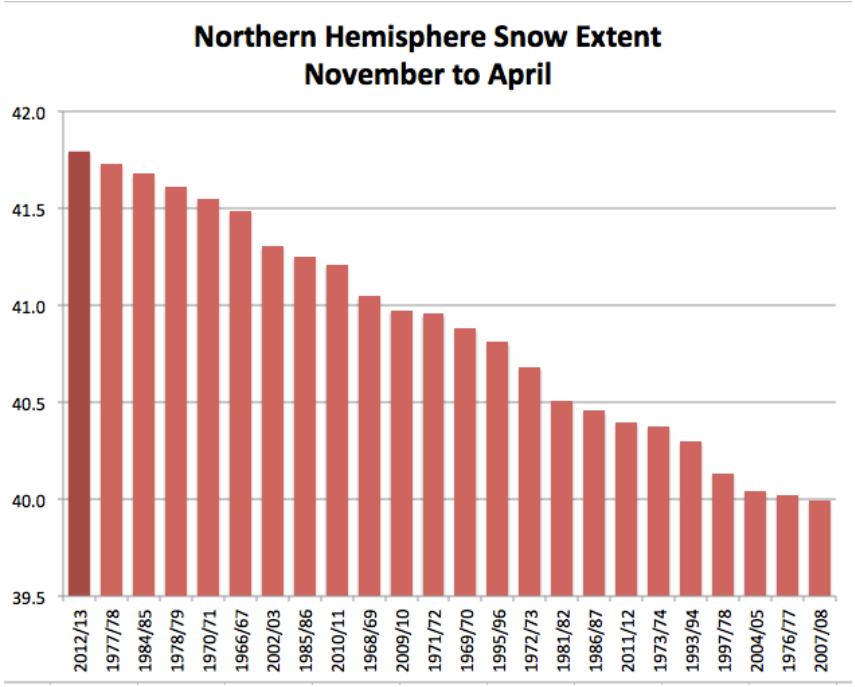
The Northern Hemisphere had the second largest ever.

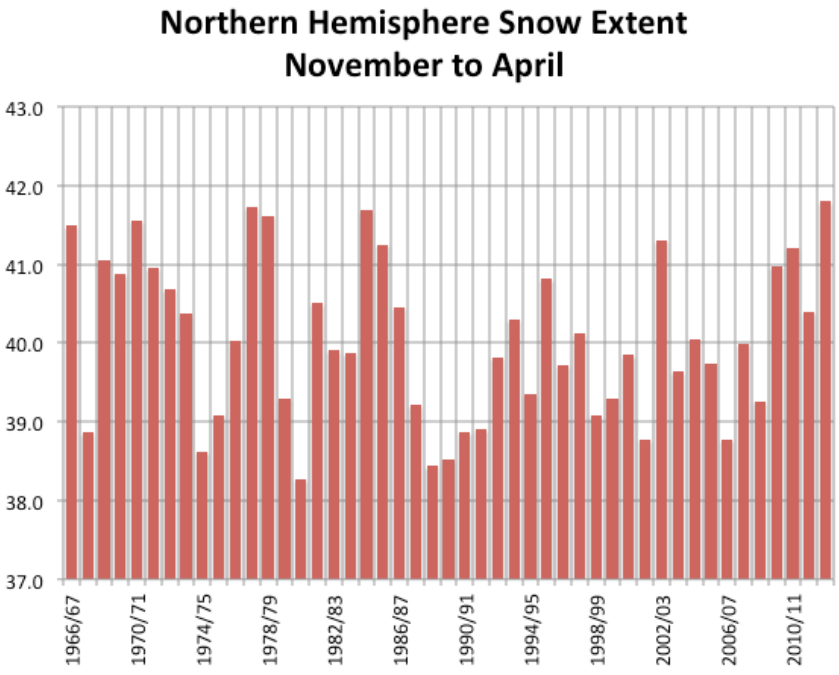
(Source: Rutgers University Global Snow Lab)



The northern hemisphere winter snow cover extent during the latest winter, (November '12 to April '13) was the largest ever recorded

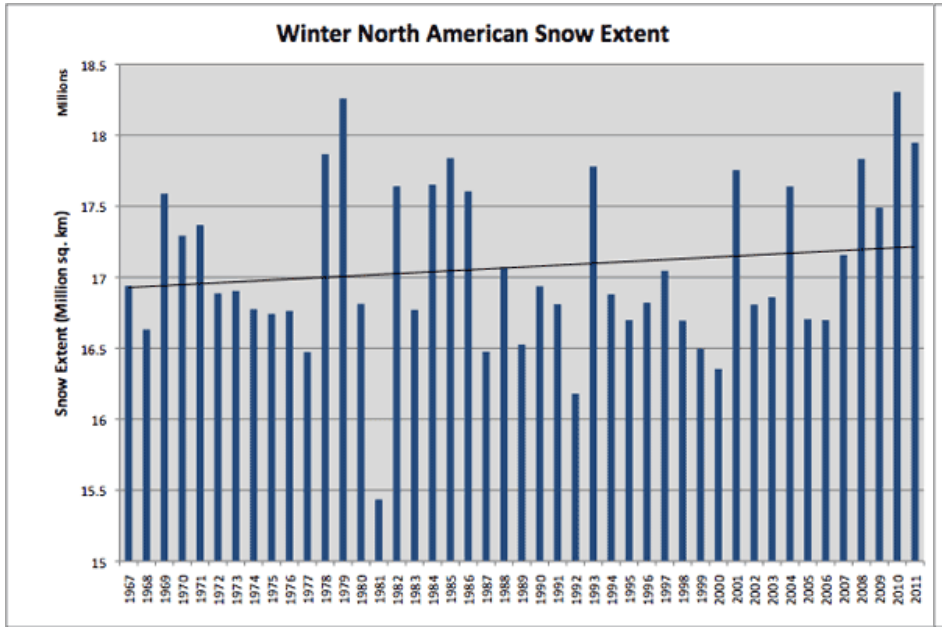
Source: Rutgers University Global Snow Lab

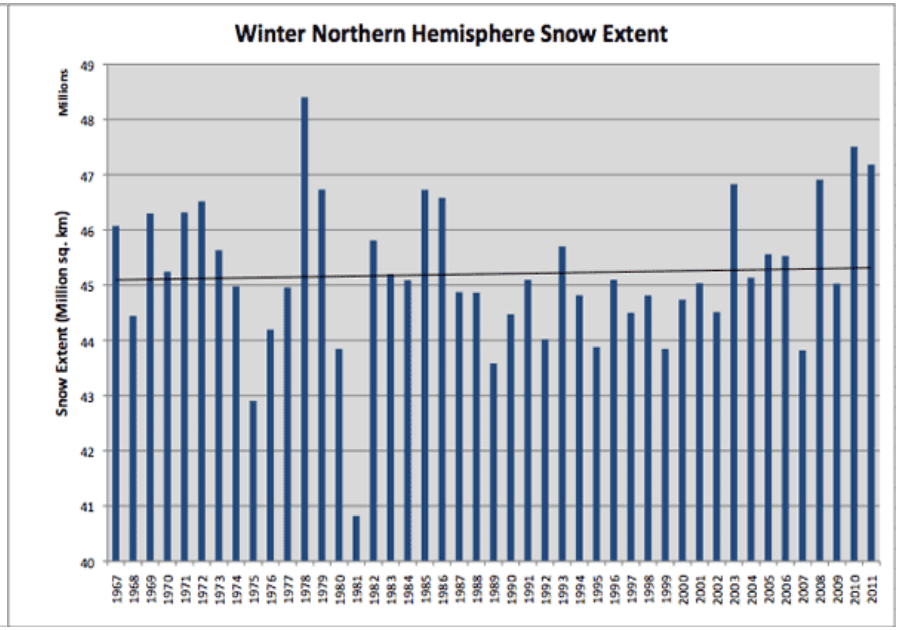




Since 1967 the snow extent in North America and the Northern Hemisphere have been increasing.

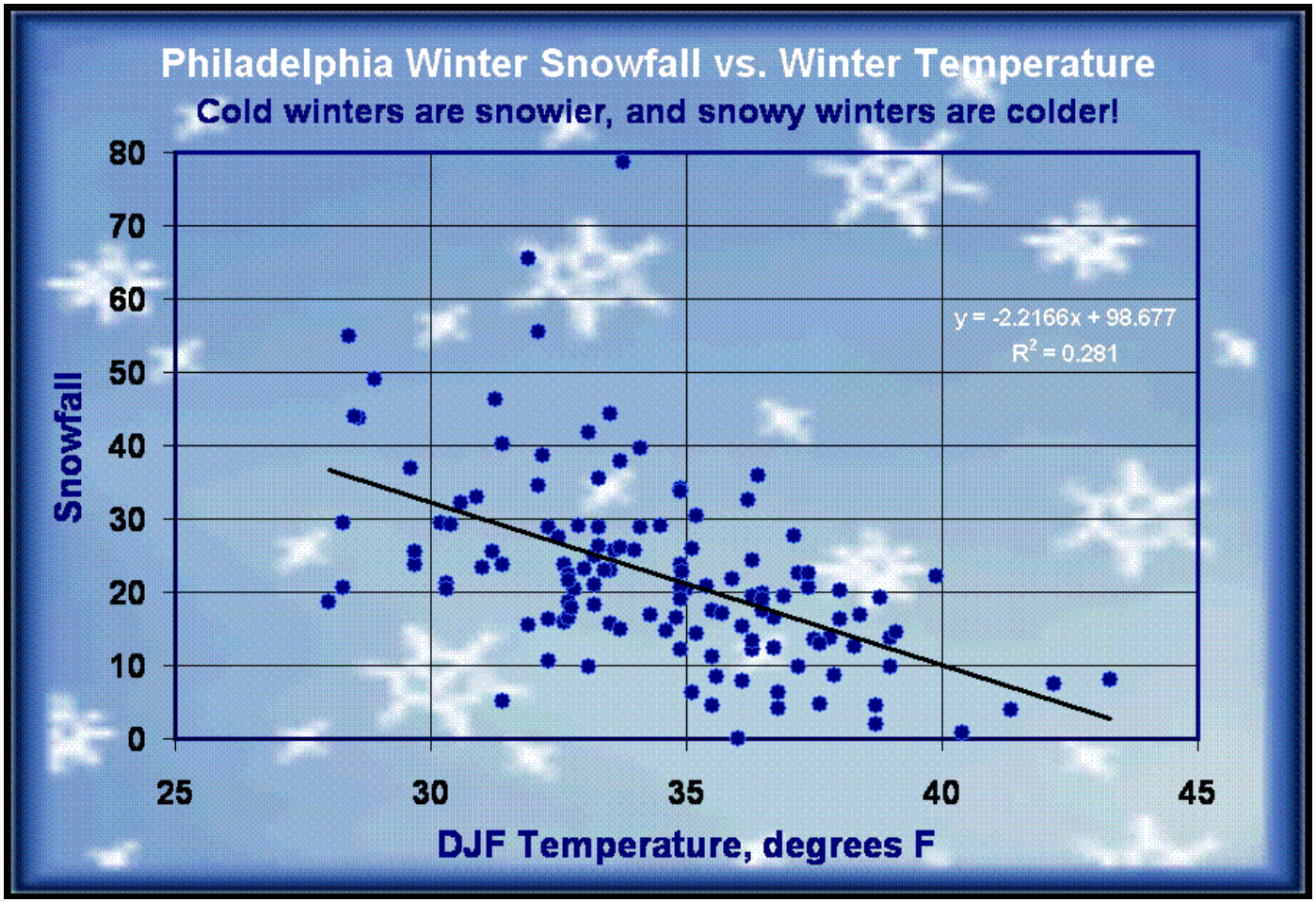
Source: Rutgers University Global Snow Lab.



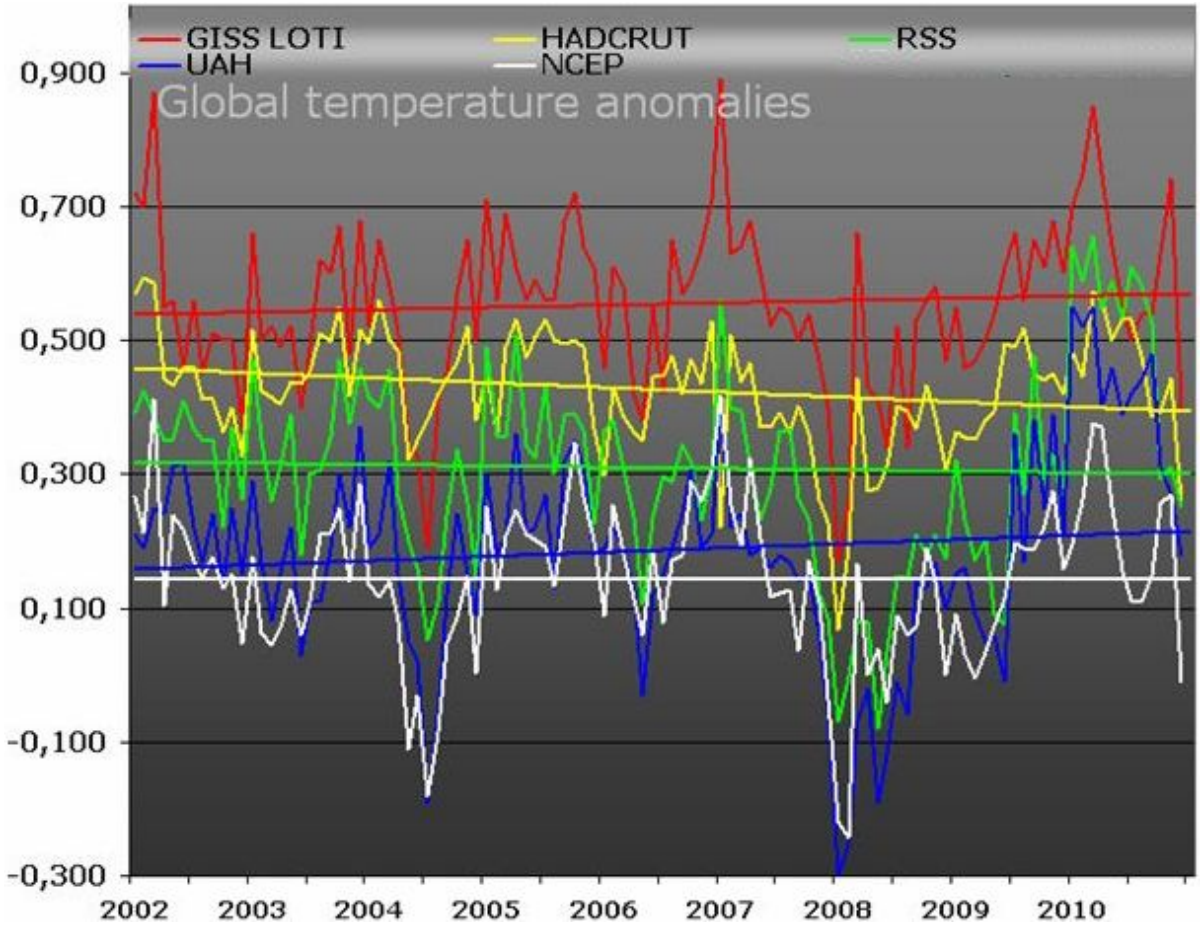


Observation shows that as temperatures fall, snowfall increases. Instead of rain, there is snow.

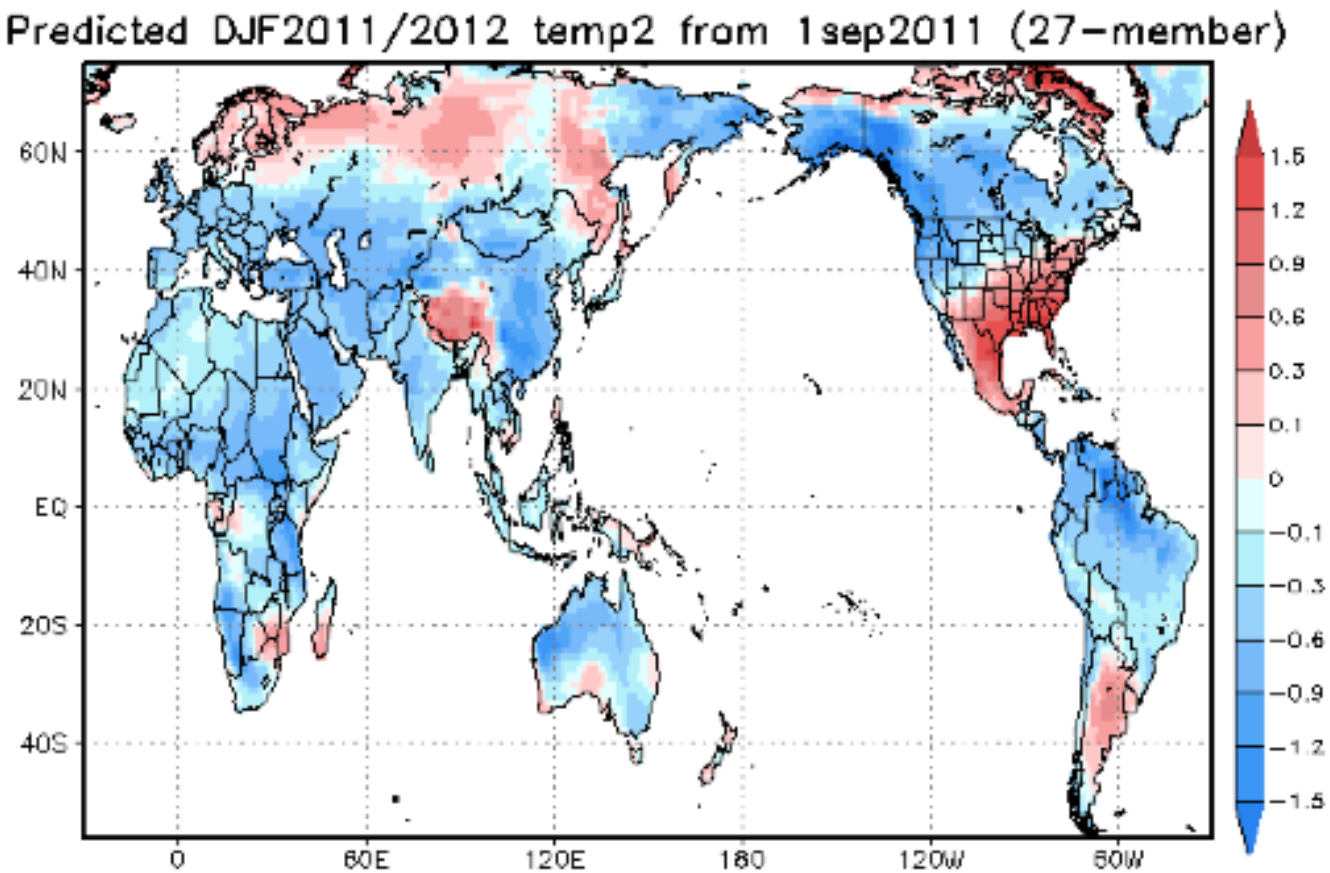
Source: *National Weather Service* Forecast Office in *Philadelphia*



Upper atmospheric temperatures do not have a bias from land use changes. They show no warming since 2002 in spite of a strong La Nina in 2010. (satellite measurement of atmospheric temps began in 1979)



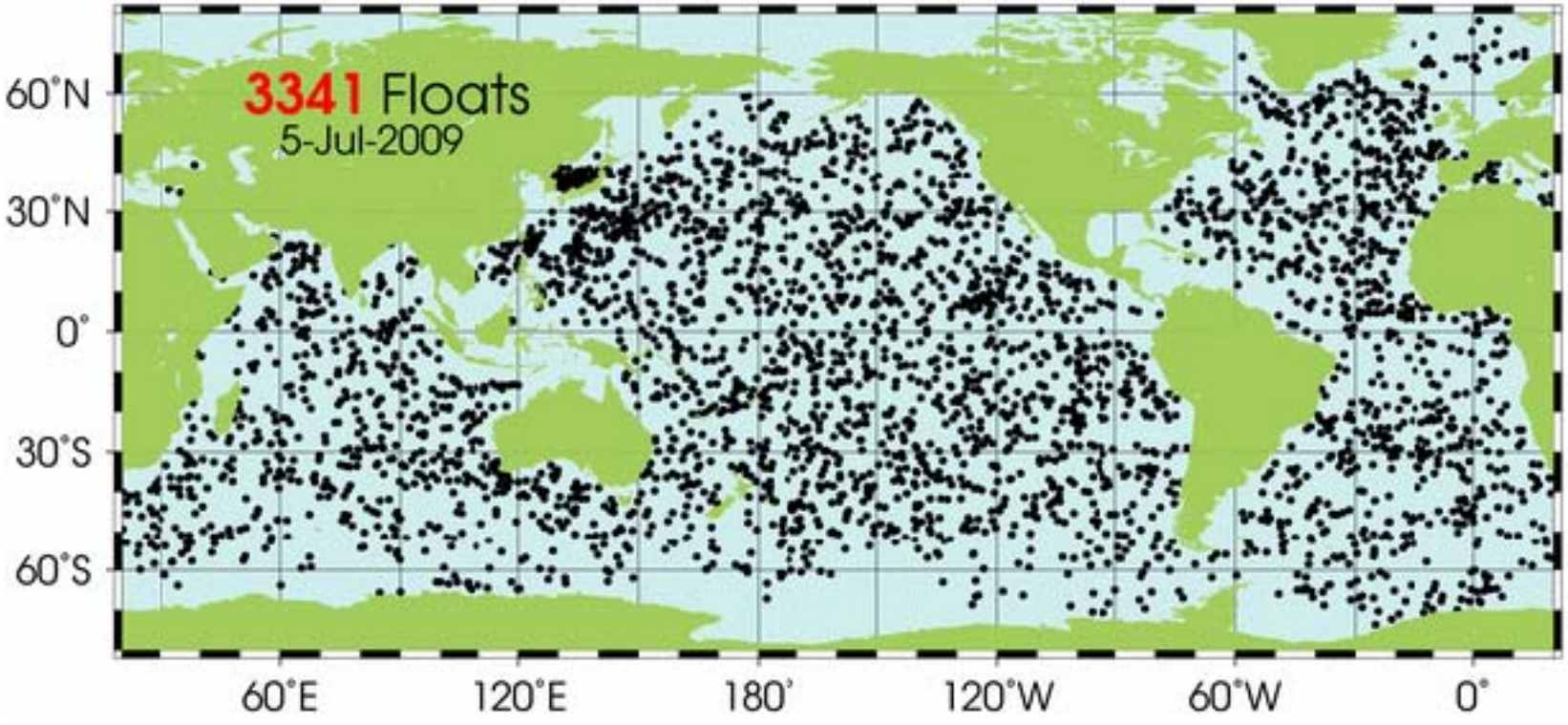
The U.S. had a warm winter in 2011-2012 but globally it was the tenth coldest winter in thirty-two years. Source European Weather Service



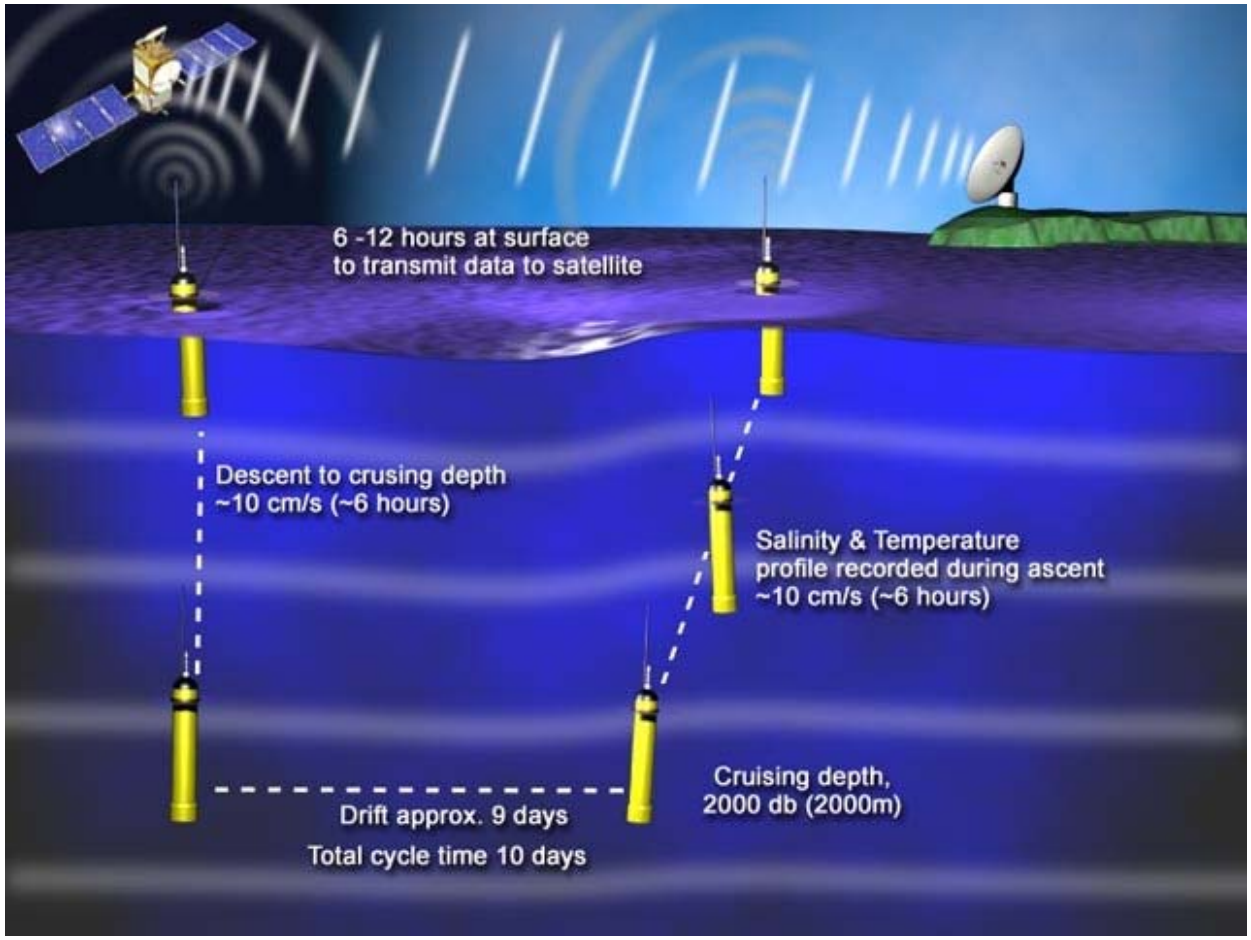
70% of the earth is ocean.

Argo (part of the inter global observation strategy) measures the earth's ocean temperature with over 3,000 buoys

(Source: ARGO)

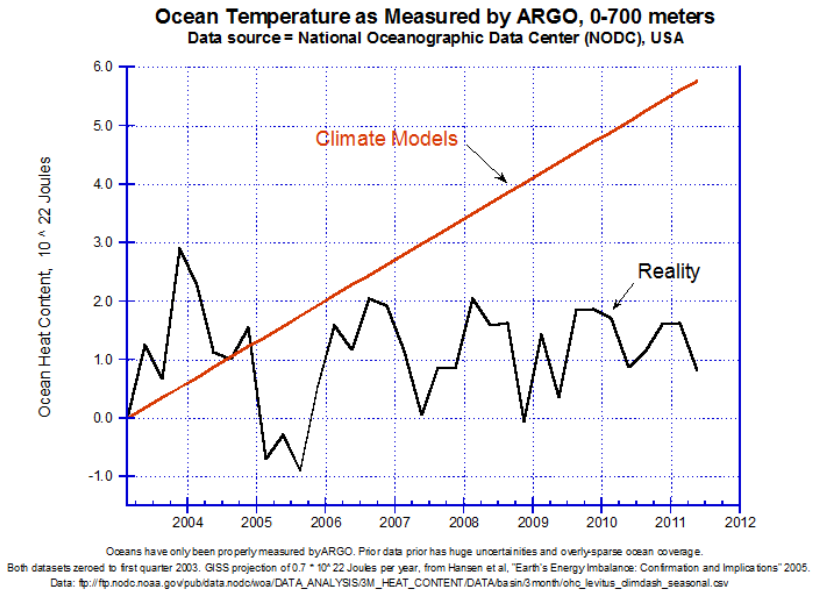


Argo buoys dive 700 meters deep, surface, and then send their temperature data to satellites

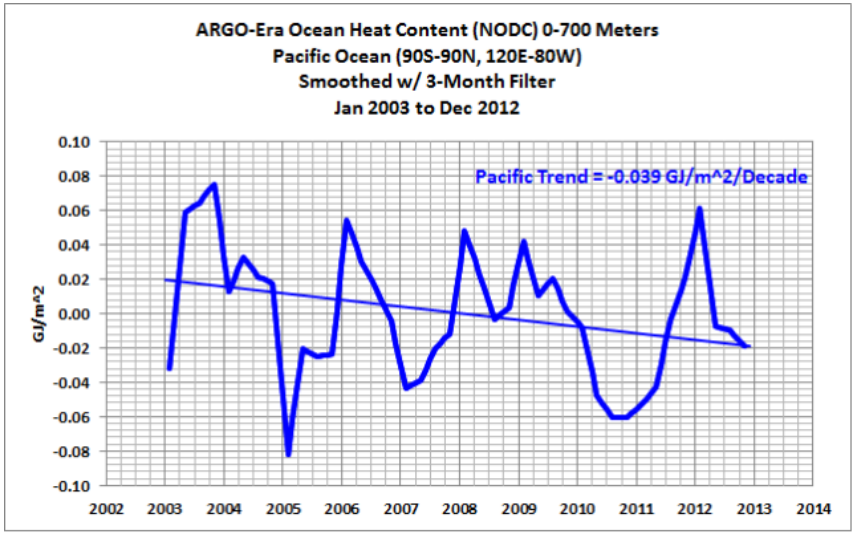


Argo has discovered that ocean temperatures have <u>not</u> been warming. Some are actually cooling.

Overall sea temperatures are not warming

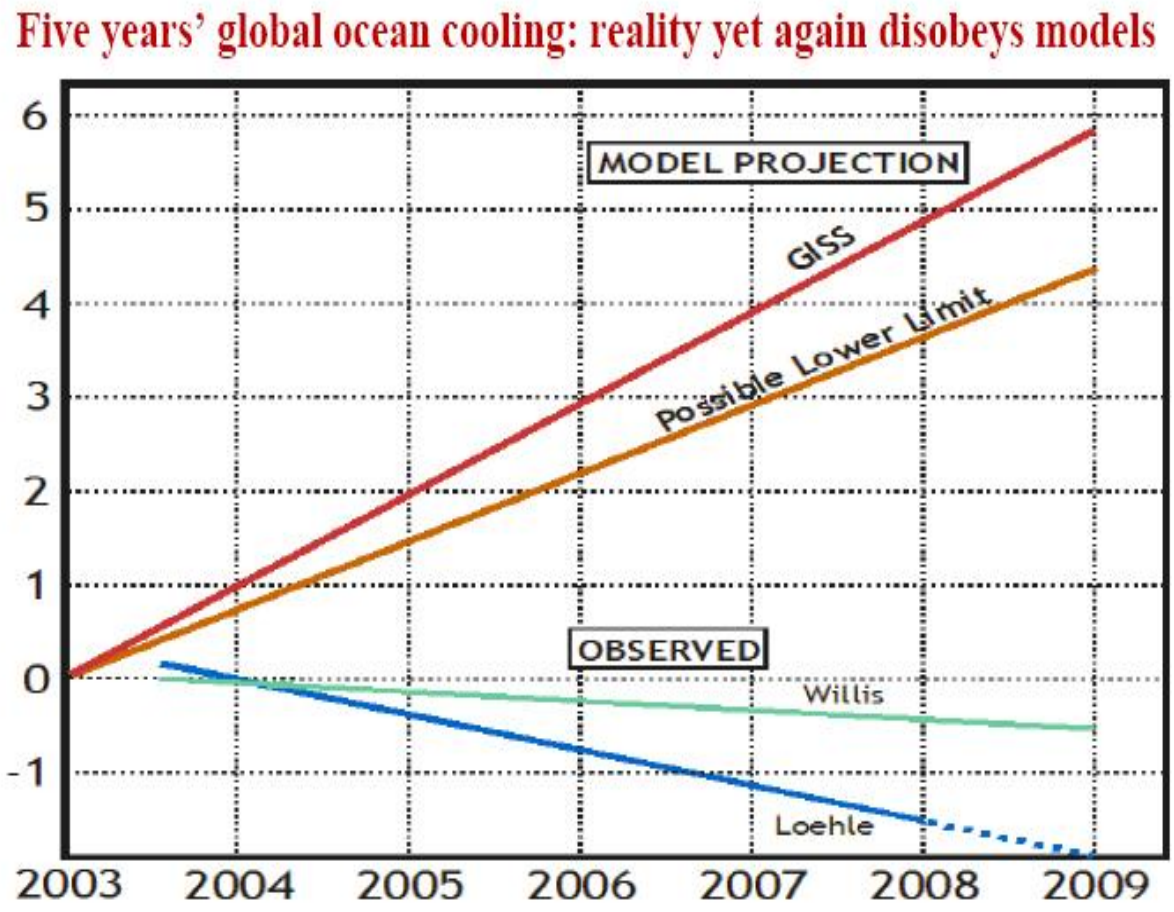


Pacific Ocean cooling 2003-2013

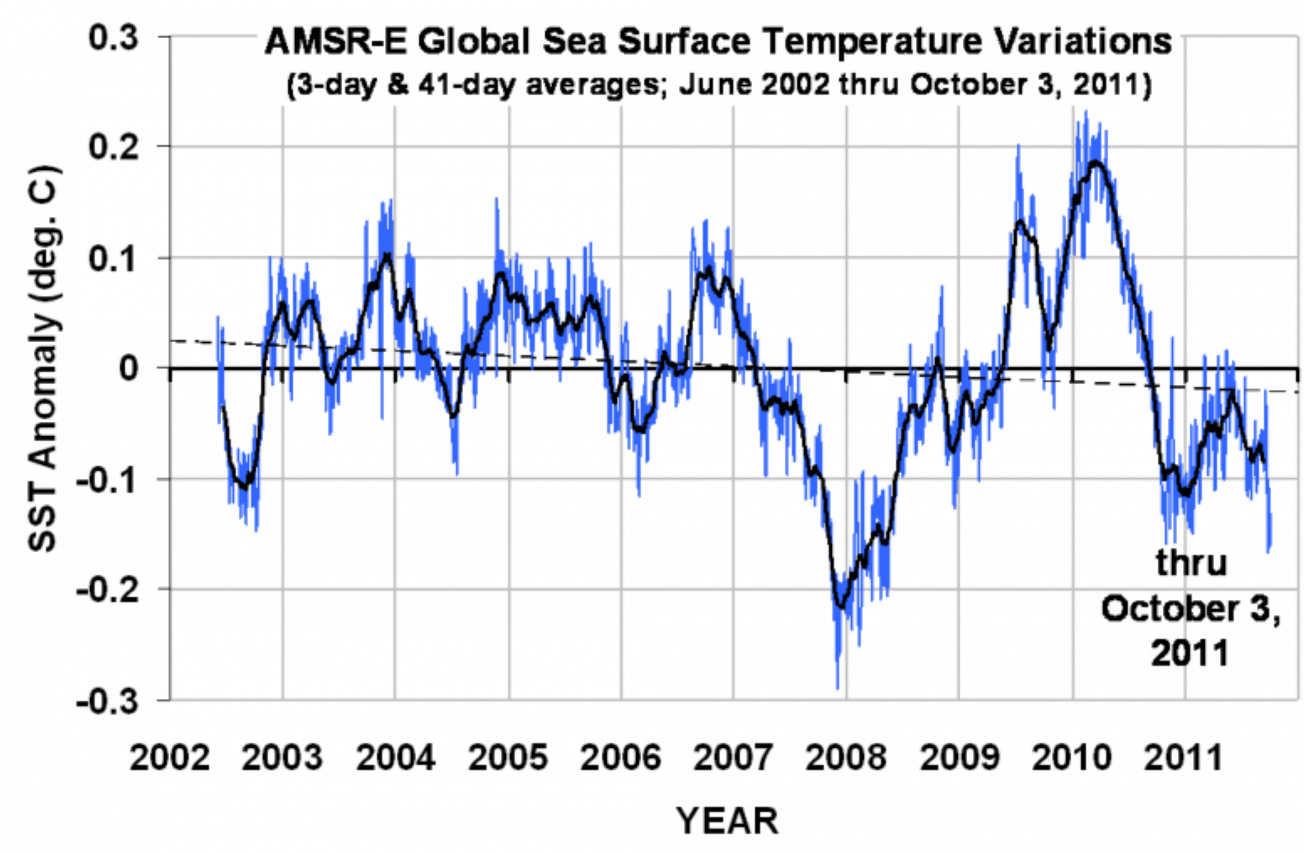


This ocean cooling is contrary to climate model predictions

(source: John Willis, NASA, Craig Loehle, PhD)

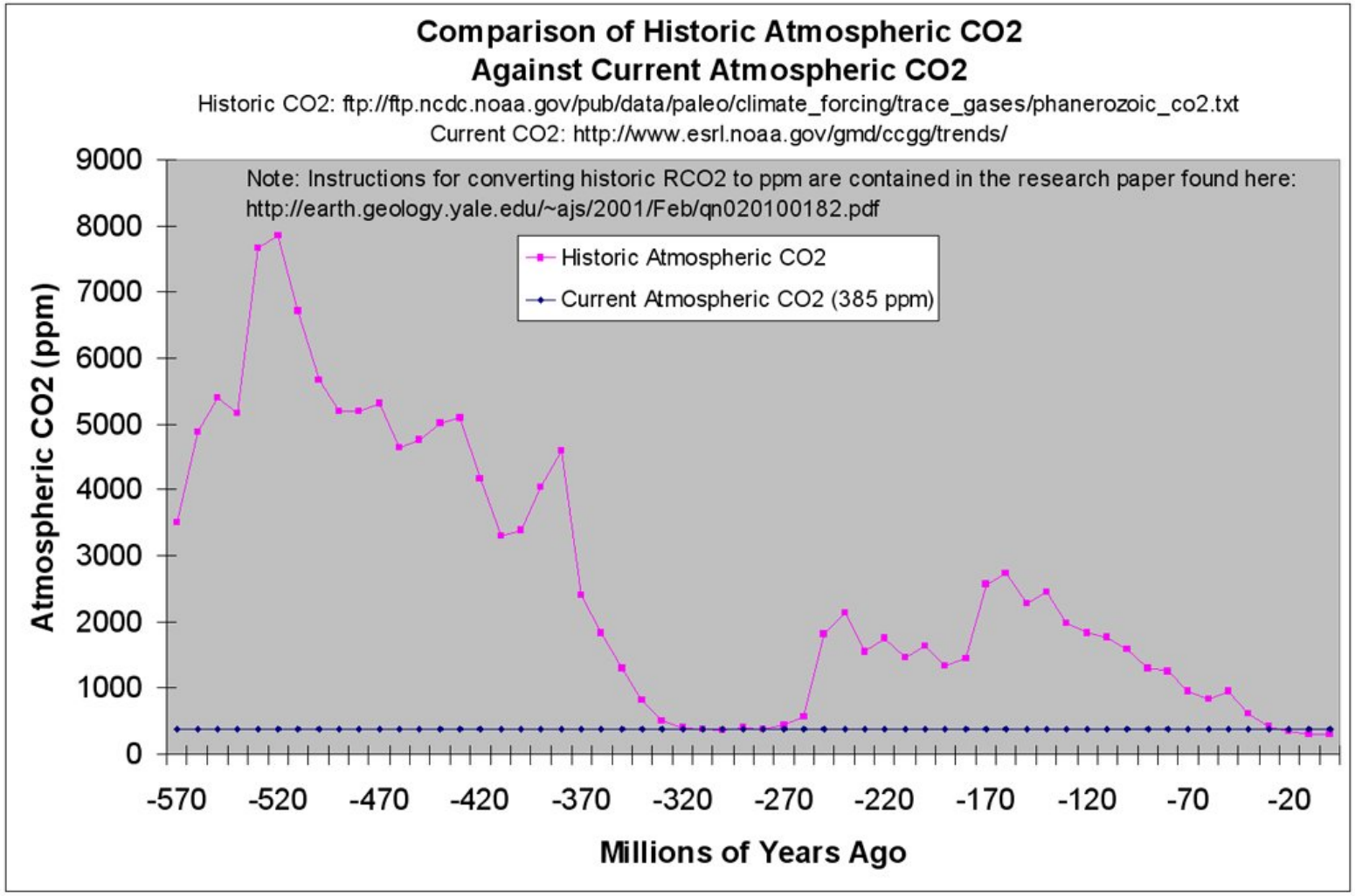


Ocean surface temperatures are influenced by winds (El Nino-La Nina). They, also, show a cooling trend. No heat sinks have been discovered.



Let's explore Carbon Dioxide

Atmospheric CO2 levels today are near the lowest level in the last 570 million years.



Atmospheric CO2 levels during the Dinosaur periods were as much as <u>twelve</u> times <u>higher</u> than today's. The environment supported a diversity of life.

Three ice ages also had more atmospheric CO2 than today's level.

Ordovician-Silurian Ice Age - fifteen times more CO2 than today.

Cretaceous Ice Age - five times more.

Permian-Jurassic Ice Age - more CO2 than today as well.

Either CO2 does not cause much warming……other natural forces are much stronger…..or both.

(source: Ian Plimer)

CO_2 makes up about 4/10,000ths of the atmosphere

- CO_2 is a trace gas, there is not much of it.

- There are 100,000 molecules in front of your face and only 40 of them are CO_2, (400 parts per million)

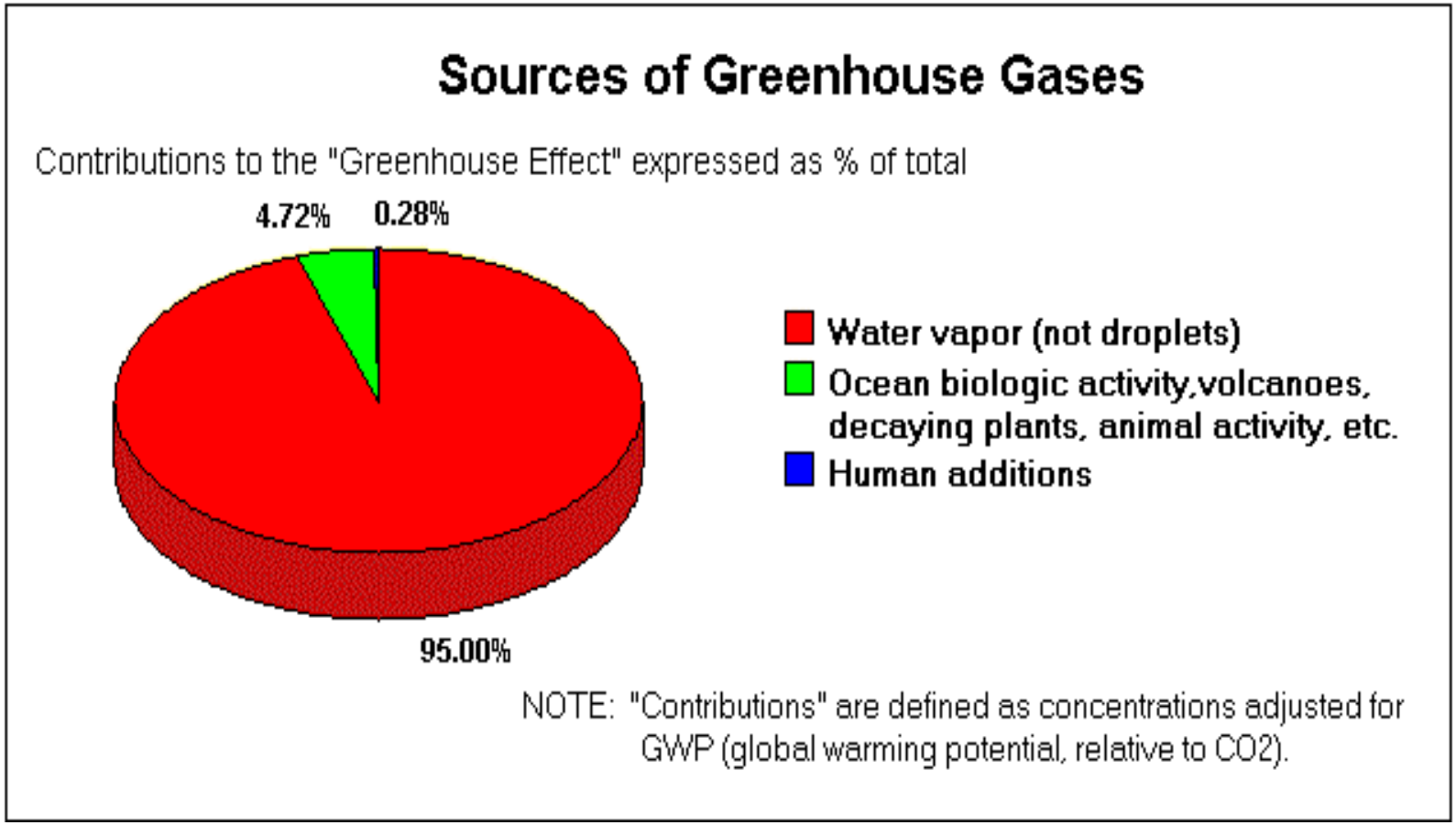
  CO_2 has grown 100ppm since the mid 1700s, an increase of 35%

- But CO_2 as a percent of the atmosphere has grown only about **1/10,000th** since the mid 1700s

(if you had ten cents in your pocket and it increases by 40%, the increase as a percentage is large, but there is still not much of an overall impact caused by it)

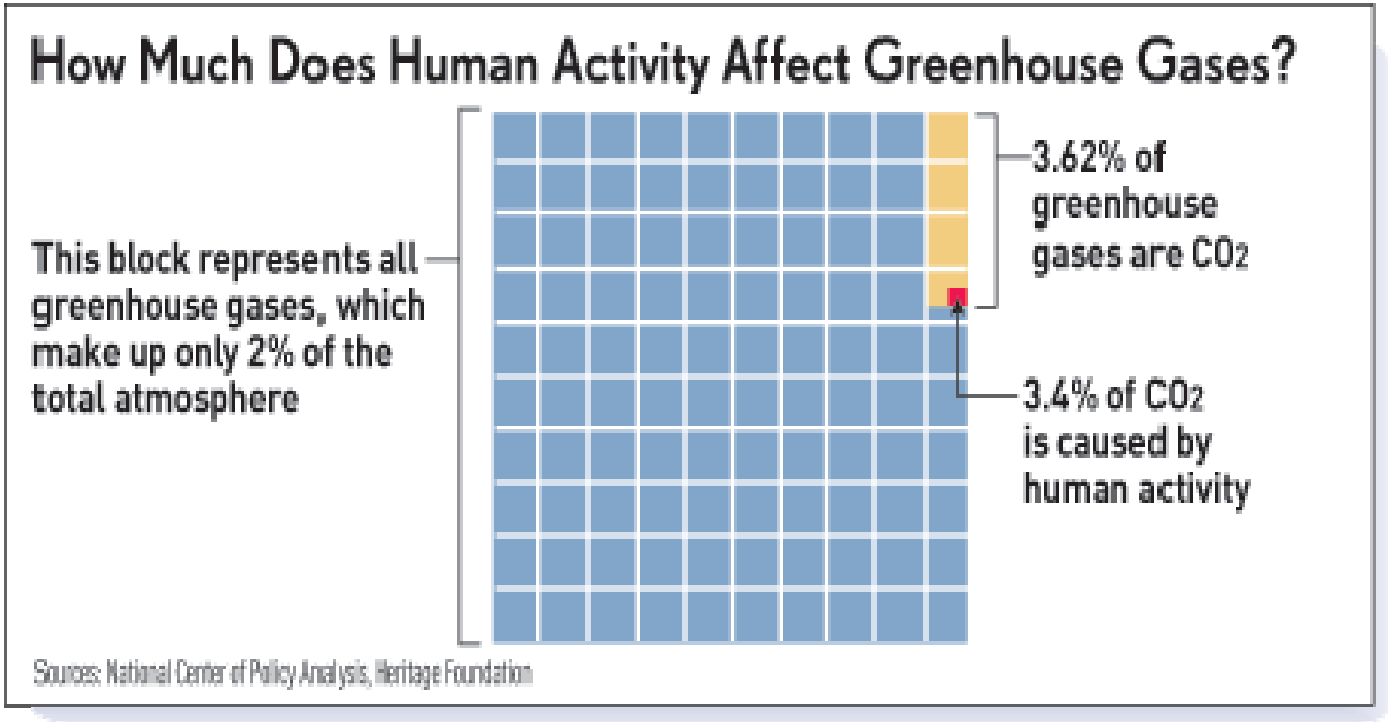
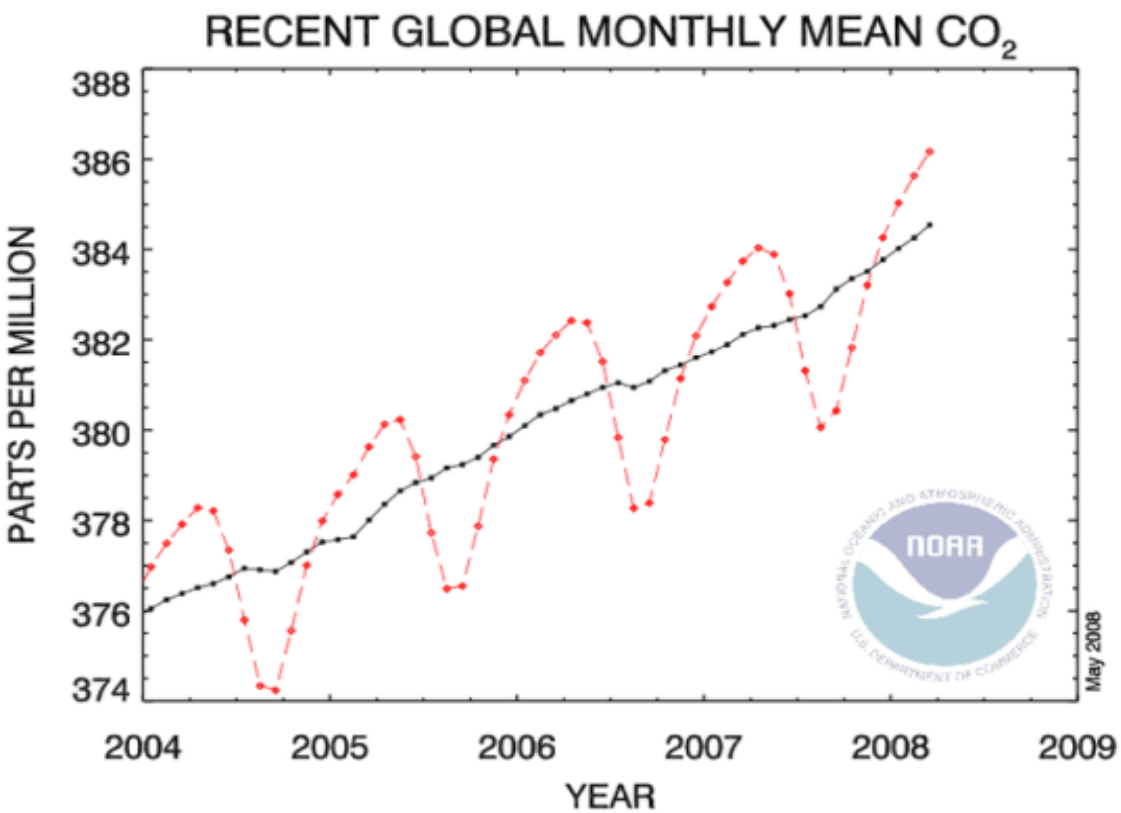
Greenhouse gases slow the release of heat from the atmosphere. This is one reason why the earth's temperature is different from the Moon. Water vapor comprises 95% of greenhouse gases.

(source: www.geocraft.com)



CO_2 makes up 3.62% of greenhouse gases. But only 3.4% of atmospheric CO_2 comes from human sources, the rest is from the oceans, decomposing vegetation and volcanoes. Thus man made sources of CO_2 are only responsible for **<u>0.15%</u>** of all greenhouse gases in the atmosphere.

(source: Heritage Foundation)



Some say that man made CO2 will remain in the atmosphere for hundreds of years or more. The flux of atmospheric CO2 suggests otherwise. As the northern hemisphere enters its summer growing season, CO2 levels decline. Plants and nature begin to absorb the extra CO2