Climate Science **© Robert H. Black June 2017**

Introduction:

This pamphlet is written so that the real science is known and it is also to put all of the debate in context. It is for the non-scientist and those scientists with an interest in becoming knowledgeable in climate in order to be reasonably conversant in the subject. We do not need to be rushing around and spend resources on non-existent problems when we should direct our efforts to real problems. Real problems will come along in due time. We do not need to be rushing for fire extinguishers in a flood or looking for dehumidifiers in a drought. This is not Rush Limbaugh there is nothing happening or Al Gore we are about to have a run away greenhouse effect and we will all cook. This is real science, which is not simplistic, as we shall see.

When looking at the data to be presented we need to consider that an Ice age would be devastating. Even a short period of significant cooling would disrupt food production and would likely destabilize civilization. Modest increases in global temperature would have more good effects than bad. There would be more productive cropland in Canada and Russia.

Due to the expansion of water the ocean will rise even if the temperature stays the same. For every degree Fahrenheit in average sea temperature the ocean will rise 19 inches. Water is most dense at 40 degrees F. The surface water migrates to the poles, cools to 40 degrees and sinks. Water closer to the equator warms at the surface. This warm surface layer is mixed with water from below by ocean currents and wind and wave action. The cycle continues. The net effect with the current climate is to slowly build a mixed thicker warmer layer. This process as been going on for the last 20 thousand years. A climate cool enough to stop this warming would be too cold to grow enough crops to feed the planet. The process is slow so we should be able to adapt. Places like New Orleans, Venice and Bangladesh are sinking because they are on silt deposits that slowly compact. This process is not related to climate or sea level and is not further discussed here.

Ancient History:

The first Chart shows the climate for the last 450,000 years. This is based on studies of sediment. This graph is read from right to left with now on the left and 450,000 years ago on the right. The earth temperature is in blue; the level of Carbon Dioxide in green and dust is in red. This chart shows long periods of cold, usually called ice ages, followed by short periods of warm that are usually called interglacial periods. There have been several studies using various methods that show the same pattern for the last 4 million years. This chart is only the last 450,000 years. Without human intervention, this pattern will likely repeat. There are several things to note about the pattern:

The climate can change fast. There is a study that shows in the start of the last ice age the snow started to fall in England one year and did not stop for over 100,000 years.

It looks like we are overdue for an ice age. For what ever the reason the start of the next ice age has been delayed.

The pattern repeats but not on a perfect schedule. I have tried to fit the patterns of the periodic factors that effect the climate to the actual pattern. I am sure that I have not been the first to try this. I will not be the last. As far as I can determine all have failed. The Nobel Prize should go to anyone that succeeds and can accurately predict the future pattern.

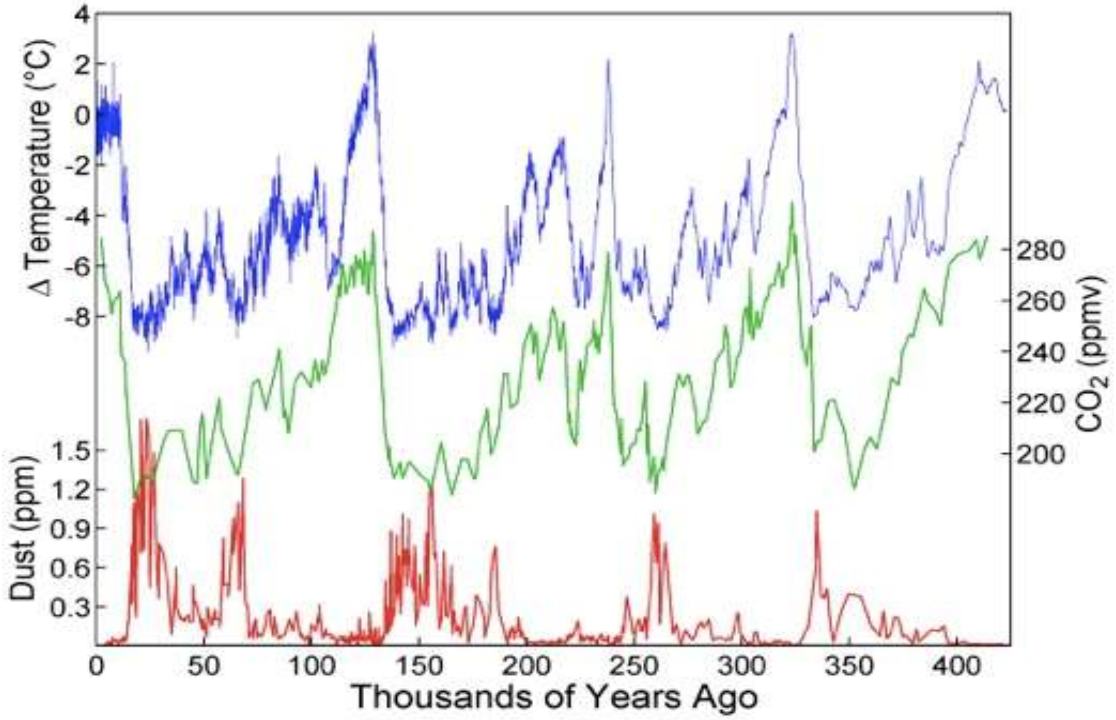
The Carbon Dioxide level follows the temperature. That is; the temperature increases and then the level of carbon Dioxide increases later. We are still coming out of the last ice age so that we should expect that the level of Carbon Dioxide should continue to increase. The current level however is higher than any time in the last 400,000 years.

There is more dust when the climate is cooler. There isn't enough data to say anything about this other than it doesn't indicate desert expansion when the climate is warmer. From this one sample it would seem that deserts shrink when it is warmer.

Up until about 2,000 years ago people had nothing to do with this pattern. Burning significant quantities of fossil fuels did not happen until the last 100 years.

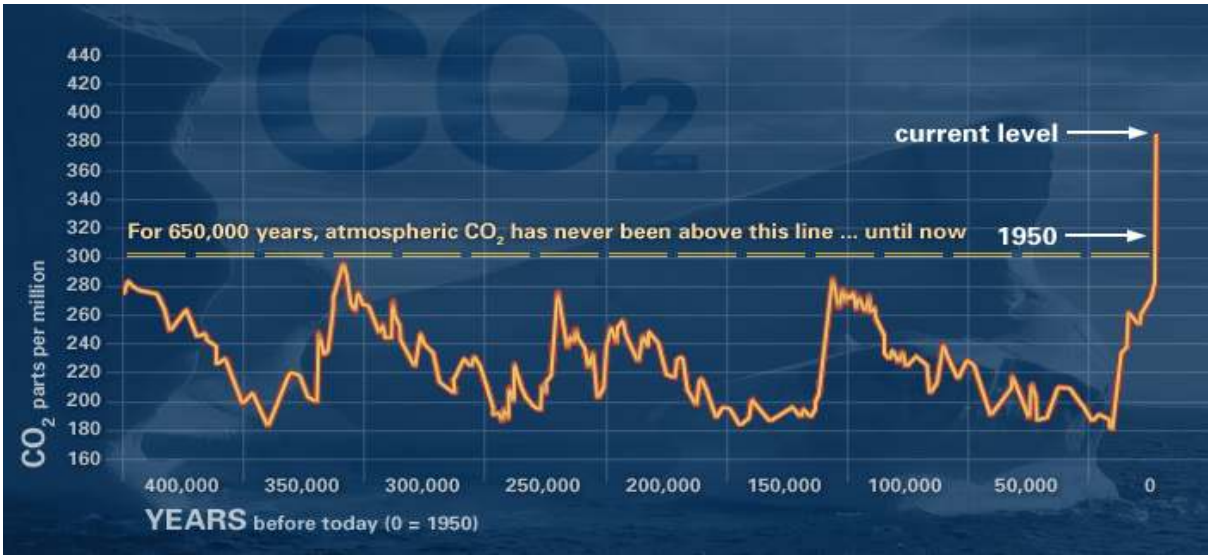
When this pattern was first discovered Scientists were concerned. Papers were written describing the coming ice age. There were articles in respected journals by respected scientists describing how quickly this could be expected. *News Week* and *Time* had articles describing the coming ice age. If there ever was a scientific consensus, the consensus was we are heading for an ice age.

http://colli239.fts.educ.msu.edu/1999/07/11/vostok-1999/



The chart below shows Carbon Dioxide for the last 400,000 years and includes the last few. This chart reads from left to right. Now is on the right and 400,000 years ago is on the left. This chart caused a sensation like the first chart only in reverse. Respected scientists predicted that we would soon have run away global heating from the increased Carbon Dioxide. The leading proponents of run away global heating theory were Professor Mann at Penn State University and Professor Phil Jones of the East Angelica Climatic Research Unit. Their papers were the opposite from those written in the 1950s predicting an imminent ice age. To be taken seriously scientists must make predictions and the predictions must match the actual. Einstein predicted the perturbation of the orbit of Mercury, the bending of light passing the sun. the twisting of space/time, the increase of mass related to movement and the slowing of time by both gravity and motion. All of his predictions have proven to be accurate, even those measured to less than one part per billion.

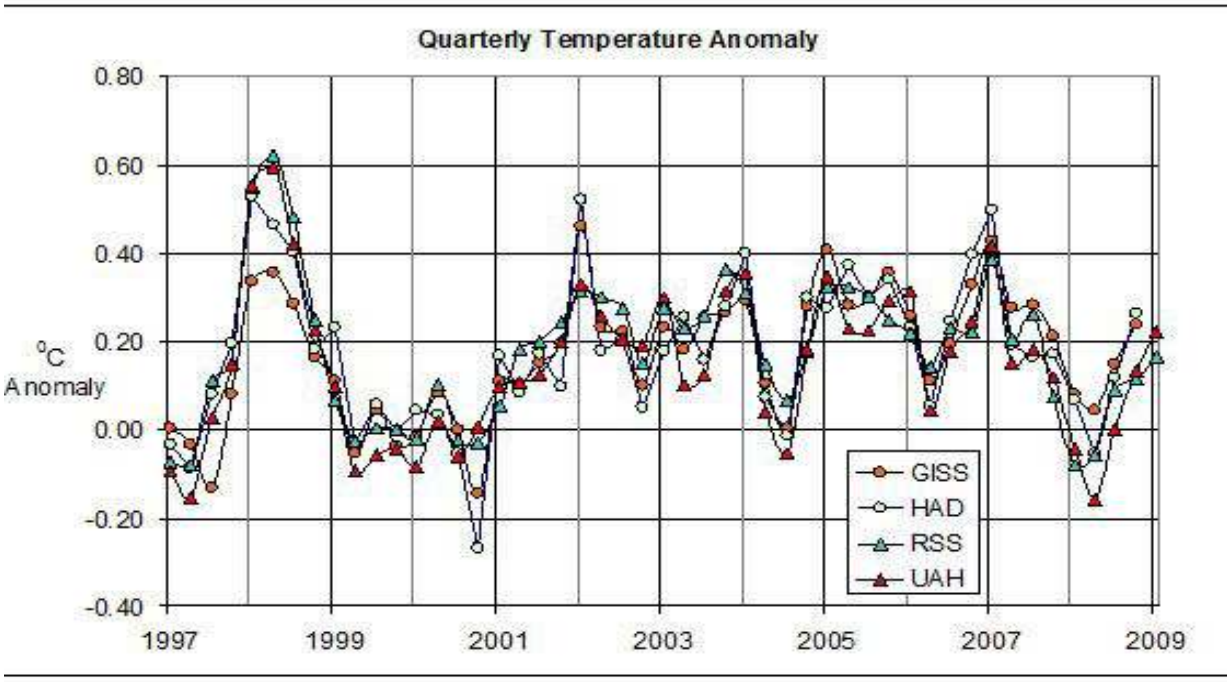
Predictions made by Professor Mann and Professor Jones did not come true. For some combination of wanting to protect their professional reputation and their belief in run away green house warming they did what they could to keep their lack of accuracy from being discovered. They Lied. They altered data, They did things like using October data twice instead of using a particularly cold November data set. They also used their influence to prevent journals from publishing articles contrary to their theory. They permanently damaged recent climate data. Some cannot ever be recovered.



http://climate.nasa.gov/evidence/

Even without the data damage done by Professors Mann and Jones the data was seriously flawed. Most weather monitoring stations are located near population centers. Many are at airports. When initially located, weather stations were usually placed in open fields. Later some of these fields became black asphalt paved parking lots or buildings with glass siding were built next door. In one worst case scenario the station ended up in front of the exhaust of an air conditioning condenser unit. Fortunately we now have temperature data from mid atmosphere. In the short time this data has been available there has been no statistically measurable change in

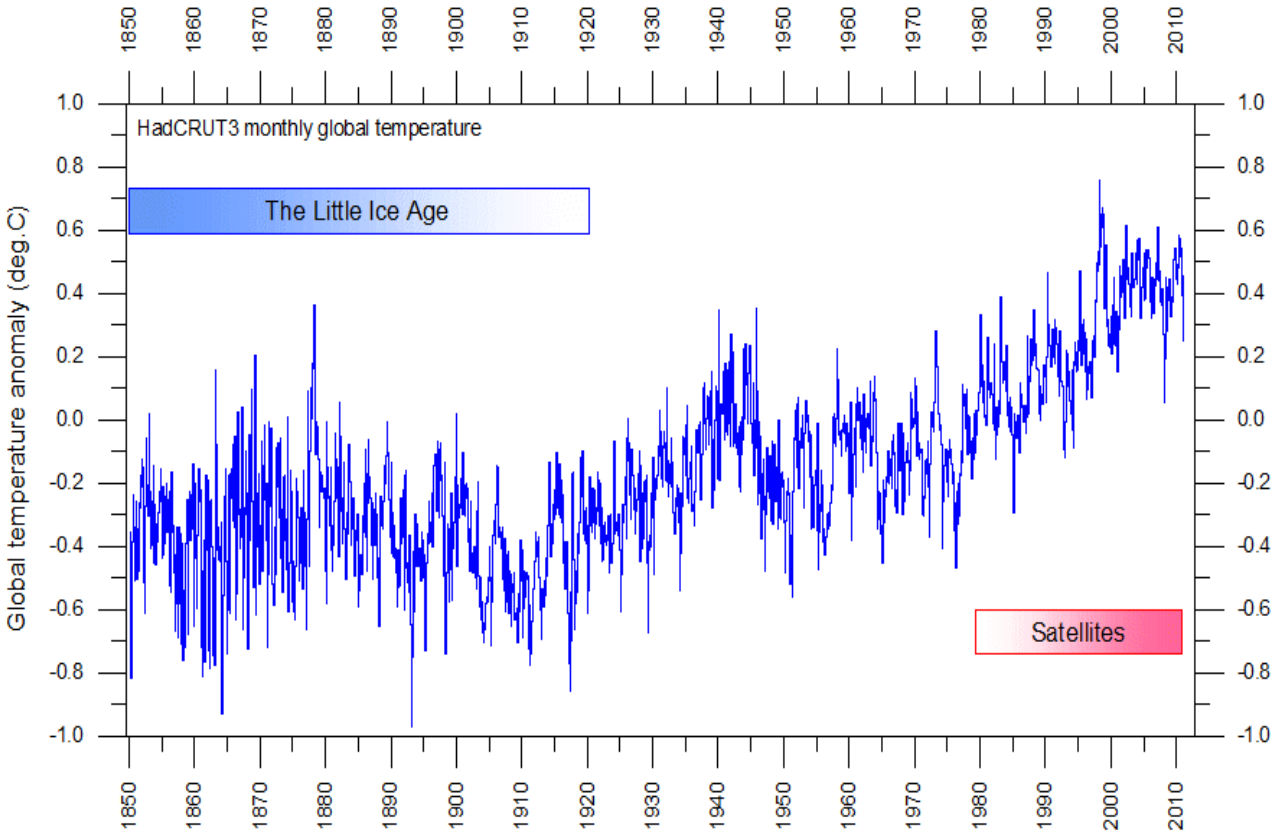
the temperature of the earth. The short time that we have had really good data is too short to make any conclusions about the direction of the climate. The mid atmosphere data is below:



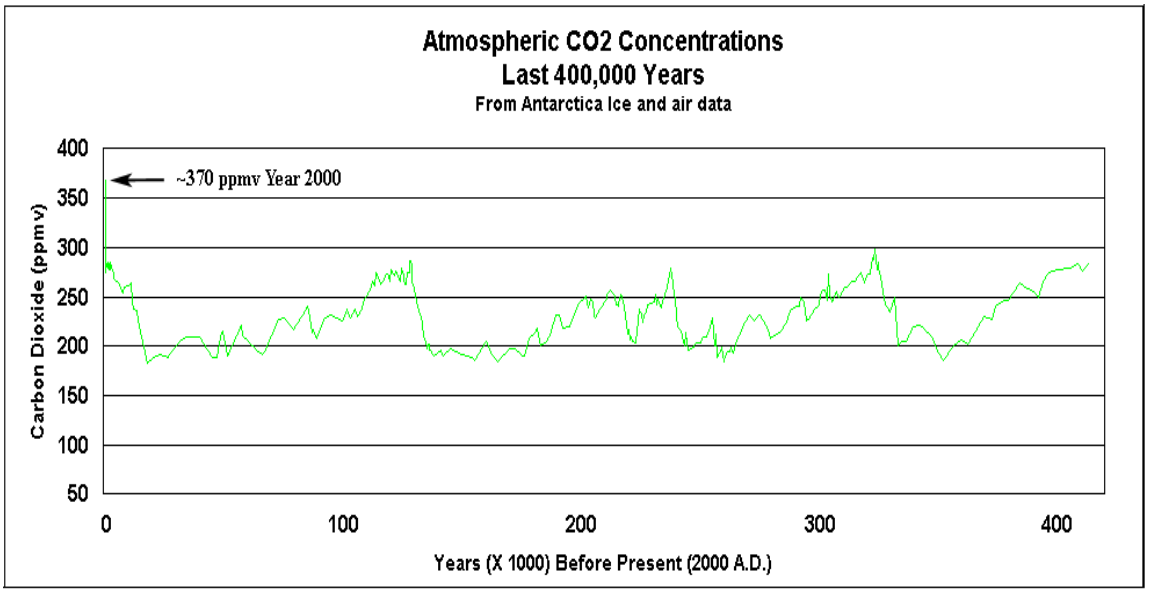
UAH – University of Alabama Huntsville

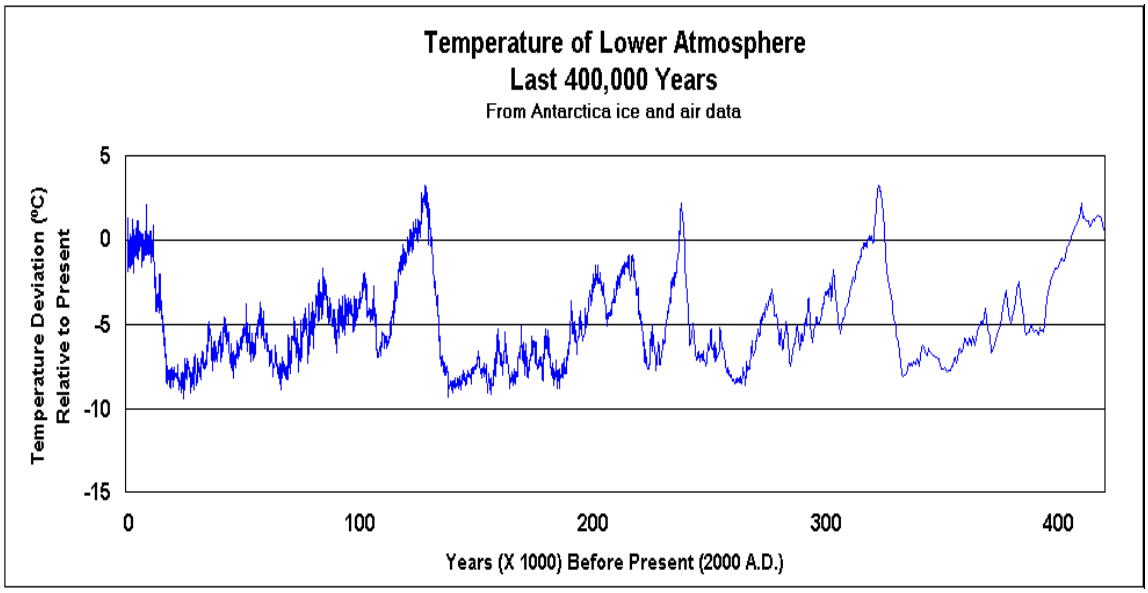
RSS – Remote Sensing Systems Santa Rosa

Below are surface measurements This data while suspect due to many factors does not show any change since 1998. This is despite of significant increases in Carbon Dioxide. This lack of correlation is the truth that professors Mann and Jones wanted to hide.

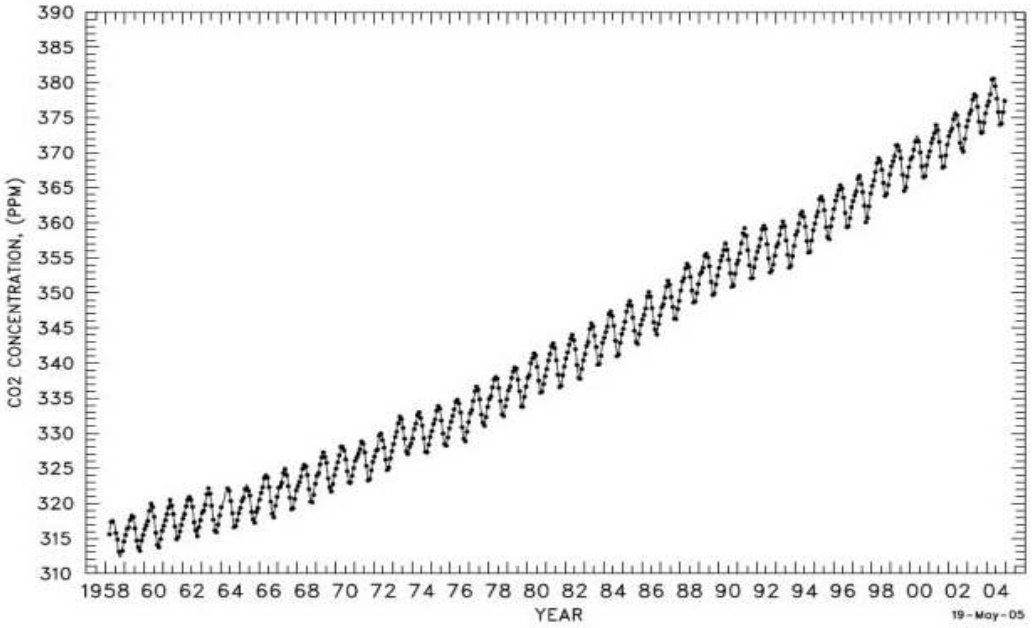


Global monthly average surface air temperature since 1979 according to Hadley CRUT, a cooperative effort between the Hadley Centre for Climate Prediction and Research *and the* University of East Anglia*'s* Climatic Research Unit *(*CRU*), UK. The blue line represents the monthly values. An introduction to the dataset has been published by* Brohan et al. (2005)*. Base period: 1961-1990. Last month shown: December 2010. Last diagram update: 3 January 2011.*



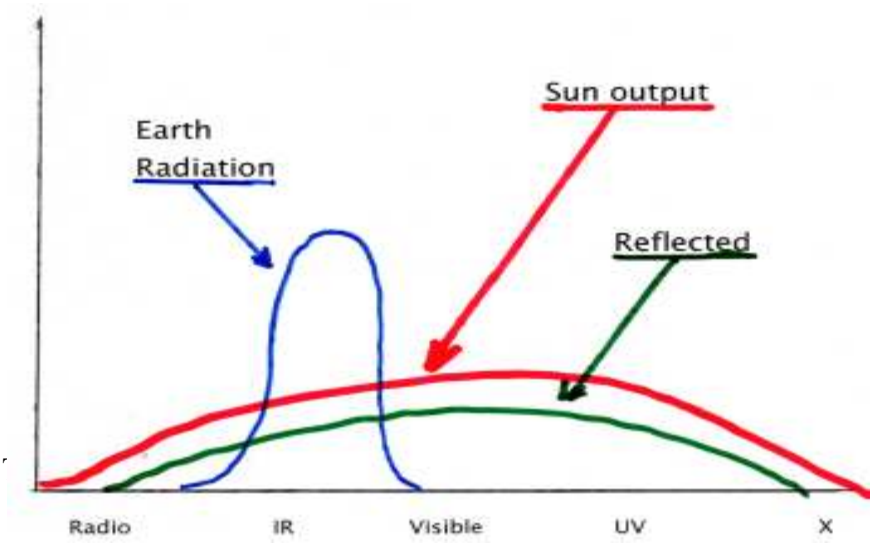


The above charts are similar to the first chart only measured a different way. The story is the same.



Th f Mauna Lo of Carbon Di by satellite we see that at least for the last 20 years there is no correlation. This does not mean that there is not an effect it just means that the Carbon Dioxide green house effect is not the major driver.

It all starts with the sun. The chart below shows the heat input to the earth from the sun and the heat loss from the earth in a simple graph. This graph is not to scale. It is to show the overall effect.

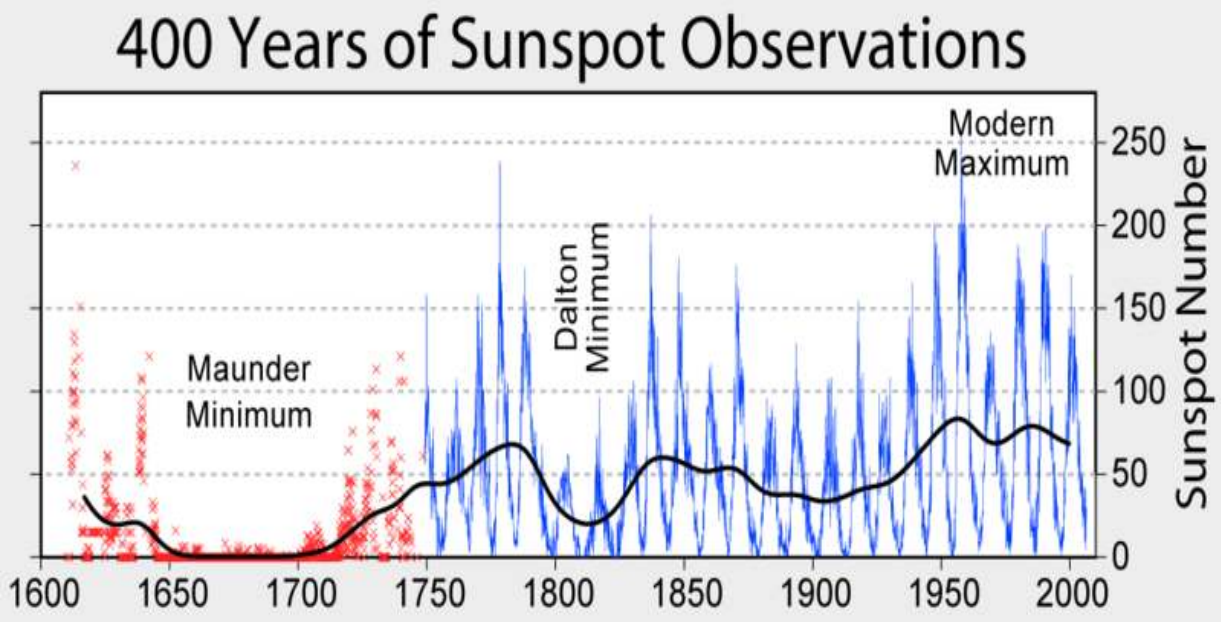


Earth

A little less than 1/3 of the energy of the sun is reflected and a little more than 2/3 is re-radiated as Infra Red out into space. Outer space is 457 degrees below zero F. This is only about 2.7 degrees above absolute zero. This is very cold. On a clear night it is easily to feel the cold of outer space. Simply expose bare skin to outer space. Without the sun we would quickly head for –457 degrees F. There are many factors affecting how much energy we get, how much is reflected and how much is re radiated.
These are the relevant factors:

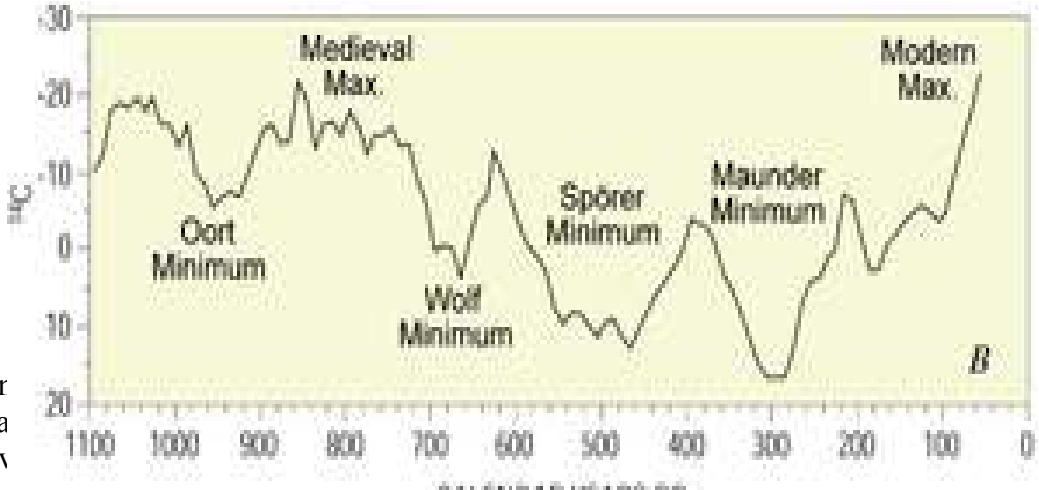
Output of the sun
Particles in the air
Gasses in the air
The orbit tilt
The orbit eccentricity
Relation of the tilt to apogee vs perigee
The building of cities and paving
Our location in the plane of the galaxy

We will discuss them one at a time the chart below shows the sun spot activity since it has been measured. This chart reads from Left to Right.



ess. It has been found that sunspot activity is closely correlated with sun output. During the Maunder minimum grape vines that were growing in England froze and died, the Vikings had to abandoned Greenland and there was famine over much of the world. The Maunder minimum is sometimes called the little ice age. We now have quite a number of ways to accurately measure sun output and global temperature. Unfortunately the more recent accurate ones can't measure the past. Since our accurate measurements only show the very recent past it distorts our perspective. The Black Plague of the mid 1300s reduced the population in Europe. The population had grown back only to be hit by the little ice age. The planet has warmed back to

approximately the period before the Maunder minimum this period is called the medieval maximum. Measurements made before sunspot counting can be made with tree ring analysis of the Carbon 14 to 12 ratio. The results are below:



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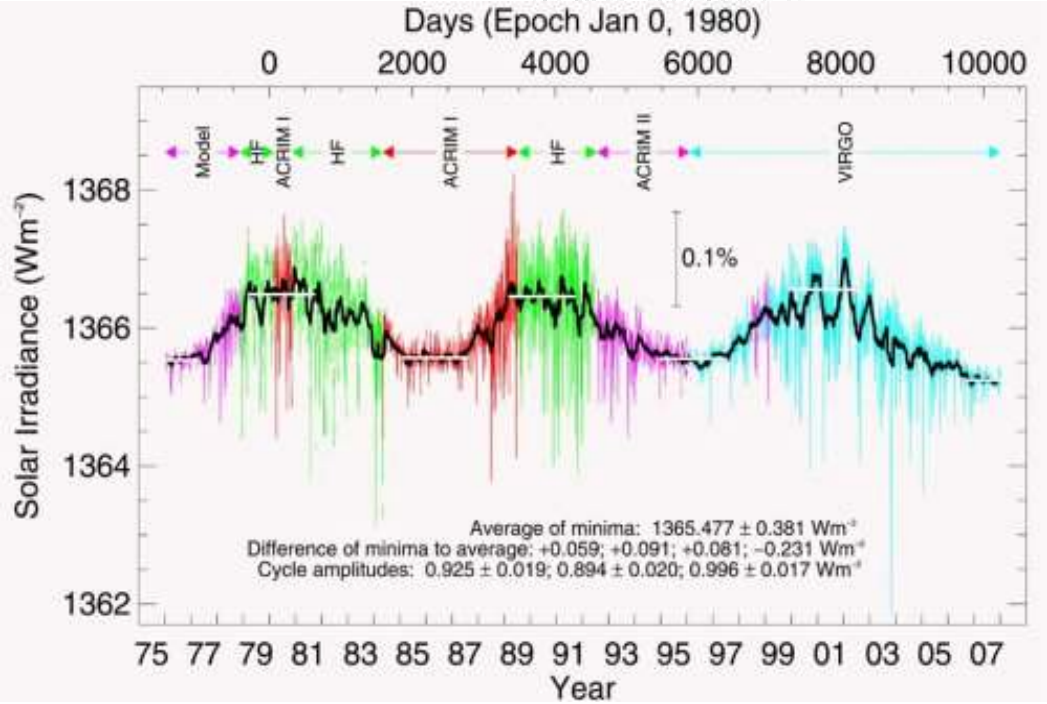

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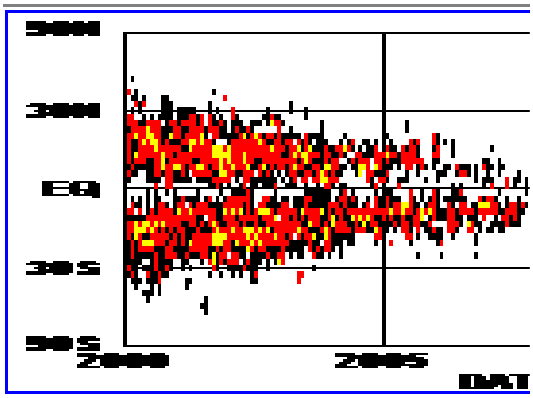
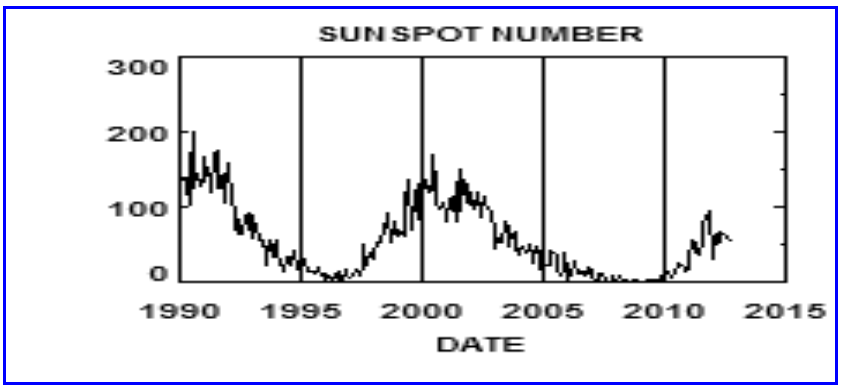
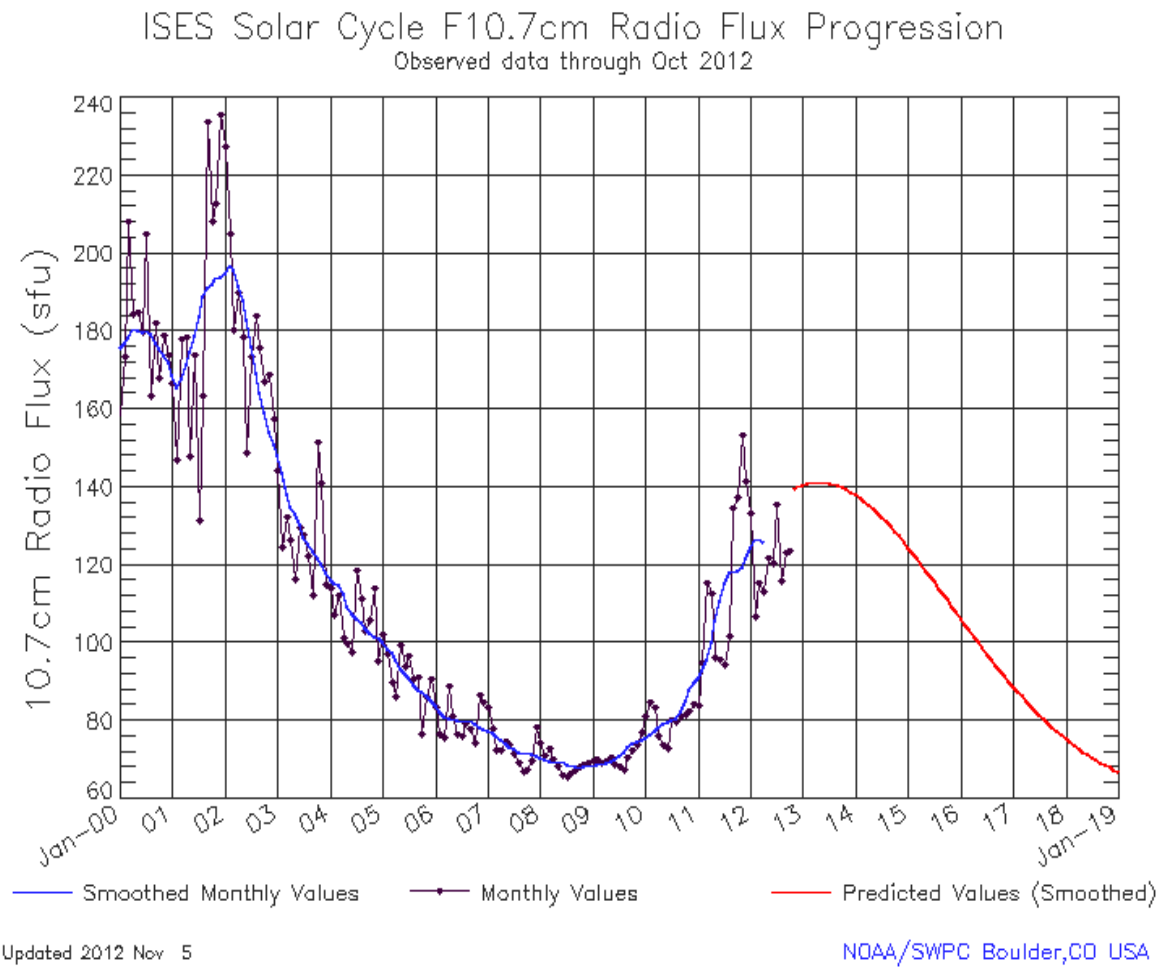




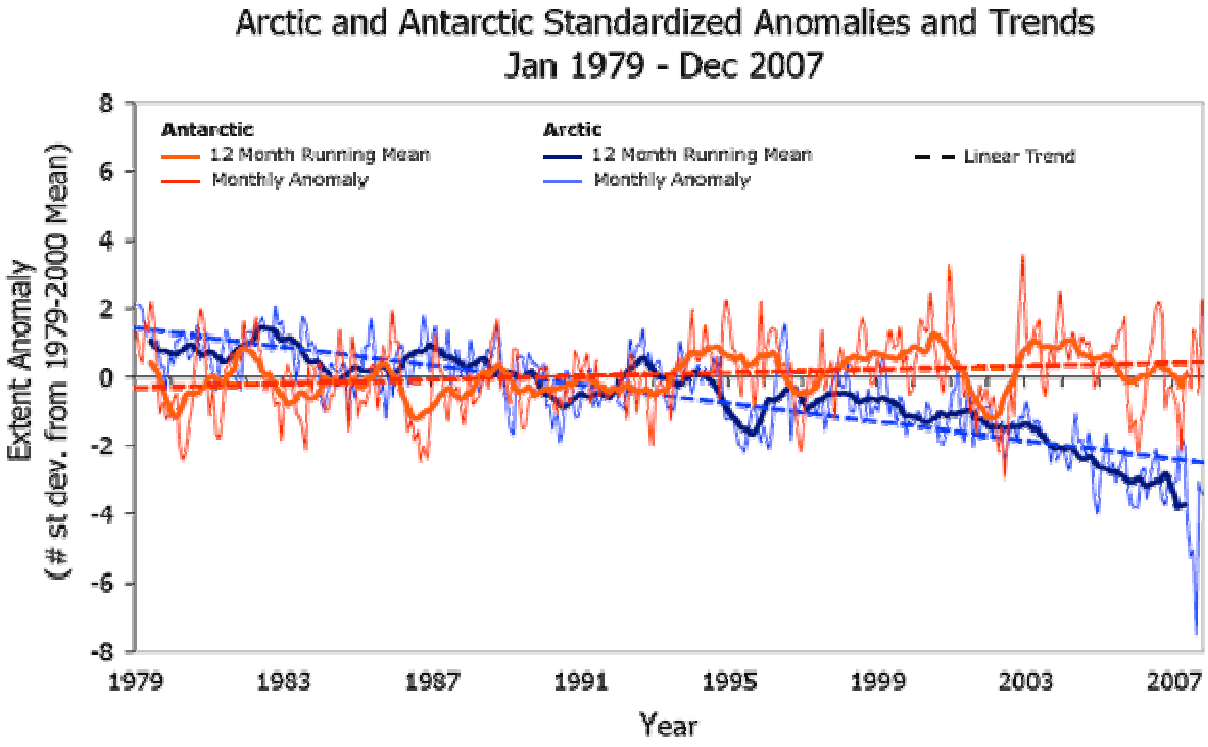
Based on the movement of the sunspots toward the equator of the sun, NOAA has projected the sun activity through 2019. This projected sun out-put decrease is significant. If this is accurate we will have significant global cooling. The chart below shows the current sun activity and the projection. Note the projected level compared with the recent sun activity.



These are the orbital effects:

Axis Tilt:

The tilt of the axis has a period of 41 thousand years. Less tilt makes the poles colder and tends to make more temperature difference between the poles and equator. Less tilt means cooler poles. Cooler poles grow ice and cause cooling. Weather would be more active because of the Pole/Equator temperature difference. When the tilt is more extreme, as it is now, the climate should be warmer. At the same time the tip is becoming more or less extreme the tip with respect to the apogee (Times when the earth is further away from the sun) and perigee (Times when the earth is nearer to the sun) is changing. This phenomenon is called precession and has a period of 23 and 19 thousand years. This has two consequences: Because there is more land North of the equator than South when the axis tilt brings the Northern hemisphere closer in the winter, as it does now, the climate is milder and the overall effect is to have a warmer climate in general. The other effect is the relative summer heating compared to winter cooling. With the axis bringing the South Pole closer in the summer and further away in the winter the South Pole climate is more severe. This situation will reverse in about 10,000 years. At the same time we are having sea ice melting in the North the South it is experiencing significant sea ice expansion as shown below:



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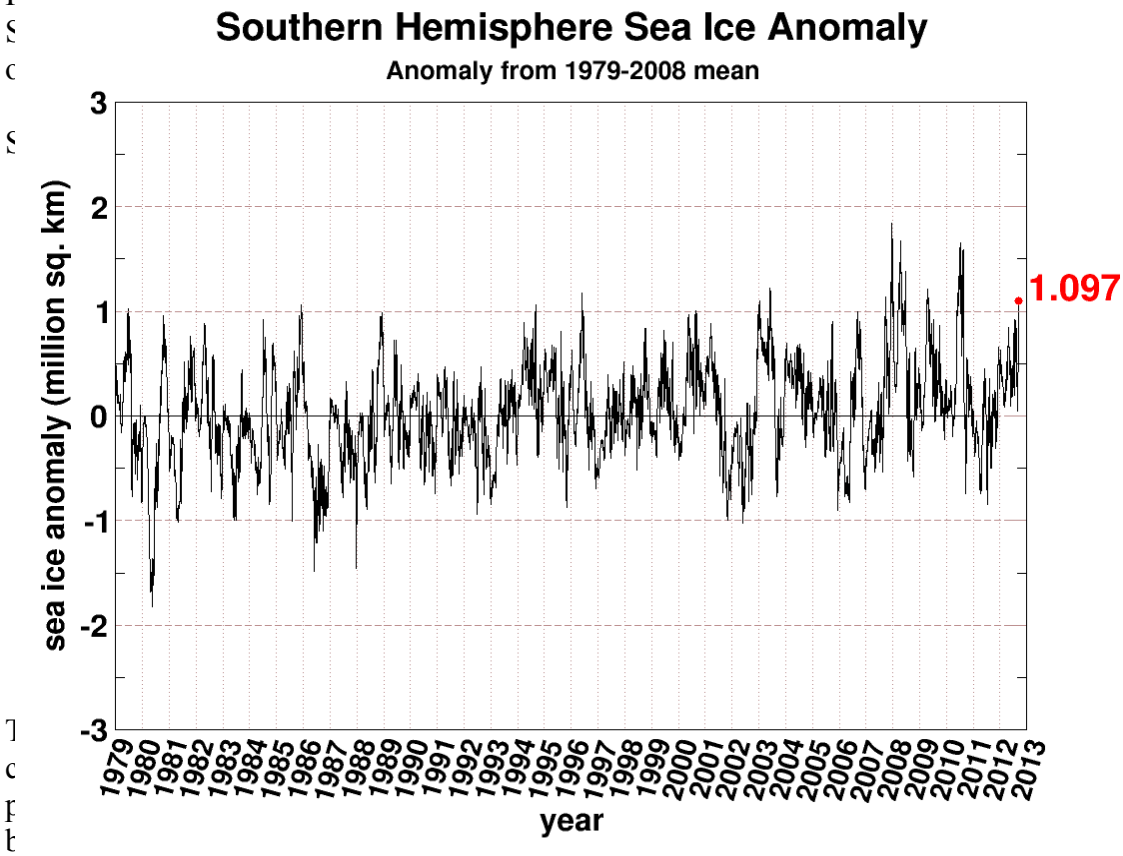

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Eccentricity:

The orbit becomes more or less elliptical in periods of 400, 123 and 95 thousand years. An elliptical orbit makes the earth away more than near. Annual cooling when away will be more than heating when near. The orbital energy per mass ratio of comets can be the same as the earth and they will be dirty snowballs. An elliptical orbit converts potential energy to kinetic energy and back again. When the earth is further from the sun the potential energy is greater and the kinetic energy is less. Lower kinetic energy means that the earth moves slower so it spends more time away.

Movement in and out of the plane of the galaxy:

Stars including our sun do not go around the galaxy in nice neat circular orbits. The sun seems to be moving in and out of the plane of the galaxy with a period of 63 million years. Because stars interact with each other as they pass each other this can become much shorter or much longer. Recent work at the Cern laboratory in Switzerland has shown that cosmic rays have a significant effect on cloud formation in the upper atmosphere. The effect of being out of the plane of the galaxy will be heaver bombardment of cosmic rays that will increase upper level clouds which in turn will cause global cooling. There have been periods in the past where the earth was believed to be much colder. These periods have been called snowball earth. This in and out of the plane of the galaxy motion is one suspect in explaining his phenomenon.

Particulate effect:

Fine particles in the atmosphere reflect the energy from the sun. At the same time they act to reflect Infrared rays that send energy back out into space at night. The net effect is cooling. We have in recent history experienced two episodes that have demonstrated this effect. Krakatau in 1883 and the Tambora in 1815 were volcanoes in Indonesia that erupted sending fine particles and Sulfur Dioxide into the upper atmosphere. Both created what was then called the year without summer. Fine particles and Sulfur Dioxide are anti-greenhouse. They reflect the energy from the sun. The smog in cities, the haze in East Asia and the smoke from fires all contribute to

global cooling. It does mater where the fine particles are. Fine particles near the ground are less effective at cooling than those up high. Sulfur Dioxide forms fine droplets that act like particles. We will have global heating if we eliminate air pollution.

Soot is another story. Large soot particles fall on surfaces and are efficient energy absorbers. Soot should cause global warming. I have not found any studies that have been done to quantify this effect.

Gasses in the atmosphere:

Some gasses have more climate effect than others. Both concentration and infrared absorption play a part. More atoms per molecule cause a greater effect and the heaver the atoms the greater the effect.

Monatomic gasses Helium, Neon, Krypton and Argon are essentially transparent to infrared. And do not contribute to the green house effect.

Diatomic gasses like Oxygen, Nitrogen and Hydrogen have greater effect.

Triatomic gasses like water vapor and Carbon Dioxide have even more effect.

Pentaomic gasses like Methane have even more effect.

Composition of dry atmosphere, by volume[3]

ppmv: parts per million *by volume (note:* volume fraction *is equal to* mole fraction *for ideal gas only, see* volume (thermodynamics)*)*

Gas	**Volume**
Nitrogen (N_2)	780,840 ppmv (78.084%)
Oxygen (O_2)	209,460 ppmv (20.946%)
Argon (Ar)	9,340 ppmv (0.9340%)
Carbon dioxide (CO_2)	394.45 ppmv (0.039445%)
Neon (Ne)	18.18 ppmv (0.001818%)
Helium (He)	5.24 ppmv (0.000524%)
Methane (CH_4)	1.79 ppmv (0.000179%)
Krypton (Kr)	1.14 ppmv (0.000114%)
Hydrogen (H_2)	0.55 ppmv (0.000055%)
Nitrous oxide (N_2O)	0.325 ppmv (0.0000325%)
Carbon monoxide (CO)	0.1 ppmv (0.00001%)
Xenon (Xe)	0.09 ppmv (9×10^{-6}%) (0.000009%)
Ozone (O_3)	0.0 to 0.07 ppmv (0 to 7×10^{-6}%)
Nitrogen dioxide (NO_2)	0.02 ppmv (2×10^{-6}%) (0.000002%)
Iodine (I_2)	0.01 ppmv (1×10^{-6}%) (0.000001%)
Ammonia (NH_3)	trace
Not included in above dry atmosphere:	
Water vapor (H_2O)	~0.40% over full atmosphere, typically 1%-4% at surface

Oxygen and Nitrogen are the principle components of the atmosphere. Both are greenhouse gasses. Without our atmosphere the earth would be hot during the day and drop to extremely cold temperatures at night. Our moon has the same sunshine as earth and is cooler on average.

Moon Equator temperature: Maximum 242 degrees F
Minimum –279 degrees F Mean –63 degrees F

This effect is not trivial. The earth magnetic field reverses often. The reversal is not predictable, however the magnetic pole has been moving away from the geographic pole as long as we have been measuring the magnetic pole location and it has been decreasing for as long as we have been able to measure the strength. During the period of reversal when the field is near zero some of our atmosphere will be lost due to the solar wind. This will cause cooling. This has happened often and life on earth has survived.

The most important green house gas is water vapor. It is ten times as abundant as all of the other green house gasses combined. Water vapor absorbs infrared radiation and re radiates it. This is the typical mechanism of green house gasses. Increased levels of water vapor create a green house effect but also produce clouds. The clouds in the day reflect the energy from the sun and

result in global cooling. Clouds in the night reflect infrared back resulting in global heating. When the US had the 9/11 attacks on the World Trade Centers and the Pentagon all of the airlines stopped flying. The lack of high clouds in the day caused global heating and the lack of high clouds in the night caused global cooling. Below is the official National Oceanographic and Atmospheric Administration (NOAA) position on water vapor:

"Water Vapor is the most abundant greenhouse gas in the atmosphere, which is why it is addressed here first. However, changes in its concentration is also considered to be a result of climate feedbacks related to the warming of the atmosphere rather than a direct result of industrialization. The feedback loop in which water is involved is critically important to projecting future climate change, but as yet is still fairly poorly measured and understood.

As the temperature of the atmosphere rises, more water is evaporated from ground storage (rivers, oceans, reservoirs, soil). Because the air is warmer, the absolute humidity can be higher (in essence, the air is able to 'hold' more water when it's warmer), leading to more water *vapor* in the atmosphere. As a greenhouse gas, the higher concentration of water vapor is then able to absorb more thermal IR energy radiated from the Earth, thus further warming the atmosphere. The warmer atmosphere can then hold more water vapor and so on and so on. This is referred to as a 'positive feedback loop'. However, huge scientific uncertainty exists in defining the extent and importance of this feedback loop. As water vapor increases in the atmosphere, more of it will eventually also condense into clouds, which are more able to reflect incoming solar radiation (thus allowing less energy to reach the Earth's surface and heat it up). The future monitoring of atmospheric processes involving water vapor will be critical to fully understand the feedbacks in the climate system leading to global climate change. As yet, though the basics of the hydrological cycle are fairly well understood, we have very little comprehension of the complexity of the feedback loops. Also, while we have good atmospheric measurements of other key greenhouse gases such as carbon dioxide and methane, we have poor measurements of global water vapor, so it is not certain by how much atmospheric concentrations have risen in recent decades or centuries, though satellite measurements, combined with balloon data and some in-situ ground measurements indicate generally positive trends in global water vapor."

As you can see from the above NOAA does not know how the most powerful greenhouse gas affects climate.

Methane is a powerful green house gas. It absorbs a wide range of infrared. Methane is created by life and by releases from deposits. It is destroyed by reactive oxygen species. One of the strong indicators of life is the level of Methane in the atmosphere.

Carbon Dioxide is the green house gas that has been the focus of the climate alarmists. Plants take in Carbon Dioxide and give off Oxygen. Animals and fire take in plant material and oxygen then give off Carbon Dioxide. Higher levels increase plant growth.

Sum of the effects:

- Very recent low sun output is cooling
- Higher Carbon Dioxide warming
- Low levels of Sulfur Dioxide is heating
- Fine particles are cooling
- Large soot particles heating
- Orbit is warming
- Paving and building is warming

Science Conclusion:

All of the factors are having an effect. The natural processes currently overwhelm the net effect of man.

Future Climate Disruption:

Super Volcano eruptions are certain to cause years without summer and the associated famine and civilization break down. If it is Yellowstone the US will be mostly destroyed.

The sun is certain to go through a period like the Maunder Minimum causing famine and civilization break down.

The earth is certain to move out of the plane of the galaxy causing an extended period of extreme cooling.

Lunatics are likely to cause global cooling by using nuclear bombs. If all of the Mid East lunatics throw there bombs we will have a year without summer just like a super volcano.

We are likely to prevent an asteroid from disrupting the climate. But, comets move faster, are less predictable and are less observable until they get too close. Some may hit and disrupt the climate.

Run away green house warming may not be possible but if it is there are ways to stop it.

What can we do to prevent warming?

Most of the factors are beyond our control.

Factor	Degree of control
Sun output	None
Orbit	None
Water vapor	Little
Other greenhouse gasses	Some
Particles	Some
Paving and building	Full

Control Schemes:

We could Flood the Quatrra Depression and Lake Assal This would change the climate in the region and lower sea level. Flooding the Quatrra Depression is a project that has been studied for some time. It would also generate hydroelectric power without using fossil fuel.

The sea could be seeded with Iron. There are various studies that indicate one atom of Iron will remove between 100,000 and 400,000 molecules of Carbon Dioxide. This has been done on a small scale.

From *Geotimes* August 2008:
"In the late 1980s, John Martin, an oceanographer at Moss Landing Marine Laboratories, pieced together the relationship between phytoplankton and iron. He noted several areas in the ocean where phytoplankton seemingly had all the nutrients they needed to thrive, but were not flourishing. He proposed that a lack of iron — which enters the ocean from land by wind-swept dust — was the problem. He also studied paleoclimate records from the past 500,000 years, which show that when the atmosphere is rich in iron-laden dust, carbon dioxide levels decrease. The correlation led Martin to famously joke, "Give me half a tanker of iron, and I'll give you an ice age."
Since then, dozens of scientists have cruised around the world, pouring tons of dissolved iron into the ocean. No ice ages followed. But these experiments validated Martin's hunch that a lack of iron limits phytoplankton populations, and sparked debate on whether artificial iron fertilization could mitigate global warming.
The first validation came a few months after Martin died in 1993. Researchers from Moss Landing Marine Laboratories organized Iron Experiment I. They sailed to a 64-square-kilometer patch of ocean 500 kilometers south of the Galapagos Islands and seeded the sea with iron. During the nine-day experiment, phytoplankton biomass doubled. In the last 15 years, scientists have conducted 11 similar experiments in other iron-limited regions of the equatorial Pacific, northern Pacific and Southern oceans. In these experiments, scientists investigated ocean patches no larger than a couple hundred square kilometers for up to several weeks. In all cases, adding iron to these waters fueled phytoplankton blooms.
These experiments also demonstrated that the oceans draw down carbon dioxide in response to the flourishing blooms. But it is not clear what happens next, Coale says. Most experiments did not observe the most important stage of the phytoplankton bloom: its demise, when phytoplankton die and the carbon sinks toward the ocean's bottom."
Contrary to what many believe upland forests are Carbon Dioxide neutral. The trees take Carbon Dioxide out of the atmosphere when they grow and put it back when they burn or decay. By mulching yard waste we are putting Carbon Dioxide back into the atmosphere. By cutting down trees, making paper and burying the paper in a landfill Carbon Dioxide is removed from the atmosphere. Burying yard waste has the same effect.
There is another way. Over 650,000 tons of jet fuel is used every day. Replacing even 1% with Carbon Disulfide when the aircraft are at high altitude would be the equivalent to a volcano and have a dramatic cooling effect.

It turns out that stopping warming can be done in many ways.

What can be done if we are going into an ice age?

This is a harder problem. If the sun goes into a Maunder Minimum state or worse we could fly high altitude aircraft at night and not in the day. This would do some heating but it like most schemes, would not do much. All of the schemes to stop global cooling to prevent an ice age Like covering the moon with a monatomic layer of aluminum to reflect the sunlight seem too science fiction. Rather than focusing on a problem that can be dealt with we need to study ways to prevent a problem like an ice age where we don't presently have solutions.