

Climate Questions

I had a career in computer software and therefore know that computer models have to be proven. They should never be used to prove anything. They can only be used to give a best guess prediction that reflects the beliefs of those who designed the model. This made me doubt carbon dioxide was causing global warming, because the only proof given was from computer models. This is not scientific proof. I have a bachelor's degree in physics that did not specialize in any particular field of physics. Instead it gave me a broad knowledge of physics, which includes thermodynamics. With this little bit of knowledge I did research to answer the questions I had about climate change. I had 13 questions which I researched. The results of my research did not solve the question as to what to expect for climate change, but it did give me a better understanding of the causes of climate change. I would like to share the results of my research with you and the readers of your website.

I hope this will give a better understanding (on an undergraduate level) of the causes of climate change and stimulate others to research the subject.

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1. Burning fossil fuels creates carbon dioxide. Where did the carbon in fossil fuels come from ?

All the carbon in fossil fuels came from the atmosphere via photosynthesis. Photosynthesis took carbon dioxide from the atmosphere, energy from sunlight, and water to make biomass. Overtime the biomass was converted into fossil fuels. Burning fossil fuels recycles carbon back into the atmosphere from where it came.

2. What are the primary Greenhouse Gases

Water vapor and carbon dioxide are the main greenhouse gases. Water vapor varies from 0 to 4 percent of the atmosphere. Water vapor is about 1 percent of the atmosphere. Carbon dioxide is about .04 percent of the atmosphere. Water vapor makes up 95 percent of the greenhouse gases. The warmest temperatures on earth are recorded in the driest deserts where 95 percent of the greenhouse gases are absent. Why does this happen?

Temperatures rise rapidly where there is an absence of water vapor because a lot of heat energy (latent heat) is required to change ice into water and to change water into water vapor.

Water vapor allows clouds to form, increasing the earth's albedo (the percentage of radiation reflected into space). Warming is hindered until the water droplets in the clouds are changed into water vapor. After the clouds are changed into water vapor temperatures begin to rise more rapidly.

Temperature is a poor indicator of how much heat energy is in the atmosphere. Humidity and heat capacity must be considered. The latent heat required to change water droplets into water vapor is still in the atmosphere, but this latent heat did not change the temperature.

3. What causes an ICE AGE?

There are many possible causes of ice ages, but the lack of carbon dioxide is not one of them. Even those who believe carbon dioxide can cause great warming don't believe the lack of carbon dioxide causes great cooling.

Just as you don't need a degree in astrophysics to know the sun will rise tomorrow, you don't need advanced degrees in climatology to know there will be another ice age. The simple proof is "They have always occurred and they will continue to occur". Carbon dioxide has no influence in the matter.

Those who want to know more about the most likely cause of ice ages should read about Milankovitch cycles.

4. What about Ice Ages

Over the last half million years the earth has repeatedly experienced a 100,000 years of ice age followed by 12,000 years of interglacial warming. We are presently about 12,000 years into the latest interglacial warming. Should we worry about the earth returning to its normal state of an ice age?

Yes, it is inevitable that another ice age will occur. Then the earth will only be able to support a population billions less than now. If man could find a way to control the climate and prevent another ice age, it would be the greatest discovery ever.

5. Is there a greenhouse effect and if so how does it work?

Yes there is a greenhouse effect and it can be seen in how a greenhouse works. A greenhouse consists of a barrier/filter that encloses a volume of air. The barrier/filter lets radiation (sunlight) pass through while filtering some narrow bands of infrared radiation. The barrier/filter is usually made of clear glass or plastic. The radiation that passes through the barrier/filter (B/F) warms the air inside the enclosure. The barrier function of the B/F prevents the heat within the enclosure from escaping (via convection) and warming the air above and around the enclosure. This in effect takes the heat energy that would warm a large volume of air (miles in height) and concentrates it to only warm the small volume of air within the enclosure. This is analogous to a magnifying glass that takes light from a large area and concentrates it on a small area. In both cases the smaller

volume or smaller area gets quite warm.

Objects inside the greenhouse enclosure, including the floor are warmed by the sunlight. The objects and floor warm the air inside the enclosure and emit infrared radiation. A narrow band of this radiation is not allowed to pass through the B/F. This aids the warming, but this warming is minor relative to the warming due to concentrating the warming to a small volume.

Attempts have been made to show that carbon dioxide in the atmosphere causes a greenhouse effect. To illustrate this they show carbon dioxide as a B/F in the atmosphere and enclosing the atmosphere between the B/F and earth. The illustration shows light passing through the carbon dioxide B/F and then through the atmosphere to reach earth. This illustration is very misleading. Carbon dioxide does not form a barrier that encloses the atmosphere. Carbon dioxide is part of the atmosphere. There is no concentrating of heat energy received from the sun into a small volume of the atmosphere.

6. Does increasing the amount of carbon dioxide in the atmosphere increase global warming?

Yes and no. Carbon dioxide absorbs radiation from the sun that is in a narrow bandwidth and thus warms the atmosphere. Once there is enough carbon dioxide in the atmosphere to absorb all the radiation in this narrow bandwidth, increasing carbon dioxide levels has little affect.

Although there is very little carbon dioxide in the atmosphere, about .04 percent, there is more than enough to absorb all the radiation in the narrow bandwidth that carbon dioxide absorbs. Thanks to Avogadro we know that every cubic inch of air we breath contains 4.4×10^{20} molecules. You can visualize a cubic inch of air containing 7.6×10^6 layers of molecules, each layer containing 5.78×10^{13} molecules. Since carbon dioxide is .04 percent of the atmosphere, .04 percent of the layers in the cubic inch can be considered to be carbon dioxide. That means there are 3000 layers of carbon dioxide molecules in every cubic inch of air. This means for every cubic inch of air a ray of sunlight passes through, it passes through 3000 layers of carbon dioxide molecules. There is more than enough carbon dioxide in the air to absorb all the radiation in the narrow bandwidth that carbon dioxide absorbs.

7. Does increasing the concentration of carbon dioxide in the atmosphere have a warming or cooling affect?

Attempts to correlate rises in temperature to rises in carbon dioxide levels have failed. There is no evidence that increases in carbon dioxide levels have a warming effect.

On the other hand, the universally accept theory of photosynthesis does show increasing

the levels of carbon dioxide has a cooling affect. Photosynthesis takes water, carbon dioxide and energy from sunlight to create biomass. If plants have ample water and other nutrients, then the greater concentration of carbon dioxide in the air the faster photosynthesis takes place. This means more of the sun's radiant energy is converted into chemical energy in biomass and less is available to warm the atmosphere. Increasing carbon dioxide levels has a cooling effect.

8. Why do ice cores show that hundreds of years after the earth's climate has warmed the amount of carbon dioxide in the atmosphere increases?

This most likely is because carbon dioxide is readily dissolved in water. This is seen in carbonated soft drinks, beer, and champagne. As the temperature of water rises carbon dioxide becomes less soluble in the water. The oceans contain a lot of dissolved carbon dioxide. As ocean temperatures rise less carbon dioxide can be dissolved. The oceans then release the carbon dioxide into the atmosphere. Since the oceans have a greater heat capacity than the atmosphere, they take much longer to warm than the atmosphere. This causes a lag of hundreds of years between the rise in atmospheric temperature and the release of carbon dioxide from the oceans.

Another reason for the rise in carbon dioxide after atmospheric temperatures have risen, is that during ice ages a lot of vegetation is killed and left frozen under glaciers. When the glaciers recede this vegetation decomposes and returns carbon dioxide back into the atmosphere. It takes a long time for the glaciers to recede after the atmosphere has already warmed.

If carbon dioxide was the cause of global warming it would have increased before atmospheric temperatures rose.

9. Was global warming global?

No. During the last period of global warming, which ended in 1998, the northern hemisphere warmed more than the southern hemisphere. Carbon dioxide stays in the atmosphere a long time. This allows it to diffuse evenly around the globe. If global warming had been caused by carbon dioxide it would have occurred equally in the northern and southern hemispheres. This did not happen.

The reason the northern hemisphere became warmer than the southern hemisphere was most likely due to something that does not stay in the atmosphere a long time and therefore only affects the area where it originated (northern hemisphere). Two probable causes are apparent. The first is the heat energy released from burning fossil fuels and atomic power generation. The second is particulate pollution. Both of these originate mainly in the northern hemisphere.

The amount of energy released by burning fossil fuels and atomic power generation is

small relative to the energy the earth receives from the sun. But this energy is significant when you consider that the energy we receive from the sun is in the form of radiation, most of which passes through the atmosphere without warming it. It is the temperature of the atmosphere that is measured to determine global warming.

The fossil fuels we burn heat the air in our homes, heat the radiators of our internal combustion engines, etc, all of which directly heat the atmosphere. The air temperature in our cities, where most of this energy is released is degrees warmer than their surroundings. About 1.5 quadrillion British Thermal Units of heat energy are released each day due to the burning of fossil fuels and atomic power generation. This is enough energy to raise the temperature of the atmosphere over the northern hemisphere .8 degrees Fahrenheit.

Note: this amount of temperature rise would only occur if the heat energy was added instantaneously instead of over 24 hours. The slow release of this heat energy still results in a significant temperature rise.

Particulate pollution absorbs almost all the radiation it receives, unlike like greenhouse gases which only absorb radiation in tiny bandwidths. There is no limit to the amount of radiation particulate pollution can absorb. If the particulate pollution is dense enough it can turn day into night. The warmest temperatures recorded in the United States were recorded in the Dust Bowl years (1930s).

Farmers use smudge pots to capture the heat radiated from earth to prevent their orchards from freezing. Smudge pots spew out lots of particulate pollution to do the job. Low level particulate pollution may have helped the northern hemisphere warm more that the southern hemisphere.

10. Is Earth's Rotation a Factor

Normally the earth's rate of rotation is slowing down. Data supplied by the International Earth Rotation and Reference System Service (group that calculates leap seconds) shows that from about 1998 the earth's rate of rotation has increased. Does this have anything to do with climate change?

When a spinning skater extends his arms he rotates slower. When he brings his arms closer to his sides he spins faster. If the earth is now spinning faster, that means its mass is now closer to its axis of rotation. This could be caused by more water being deposited on land near the poles in the form of ice and snow. The earth's rate of rotation has increased since 1998. Satellite data shows the earth's atmosphere has been cooling since 1998. This may be the cause of the earth's rotating faster.

11. Do changes in solar activity change the climate?

Yes. Obviously if the sun gave off a lot more or a lot less radiation it would affect the earth's climate, but over the short period man has measured this radiation there has not been a great deal of change. Solar activity though is more than just changes in the amount of radiation.

Solar activity consists of solar cycles. Each cycle lasts 9 to 14 years. During periods of low solar activity the solar cycles are longer. During each solar cycle the sun's magnetic poles flip (the north magnetic pole becomes a south magnetic pole and vice versa). During periods of low solar activity the sun has a weaker magnetic field and also gives off less radiation. The result of all these factors is the sun warms the earth less during periods of low solar activity.

During periods of low solar activity the earth's climate is affected in four ways.

- a. The earth receives less radiation from the sun. This cools the climate.
- b. The sun's magnetic field is weaker, this allows more galactic cosmic rays to reach earth. These rays cause more clouds to form (the cloud chamber effect). The clouds increase the earth's albedo. More of the sun's radiation is reflected back into space. This cools the climate.
- c. The sun's magnetic poles flip less often. This means there is less electromagnetic heating of the earth's atmosphere.

The sun's magnetic field collapses and regenerates each time the sun's magnetic poles flip. This collapsing and regeneration of the sun's magnetic field causes magnetic lines of force to pass through the earth and its atmosphere. When magnetic lines of force pass through a conductor they create electric currents. These currents warm the conductor just like electricity warms an electric blanket. Less frequent flips mean less magnetic lines of force pass through the earth and its atmosphere. This means less warming of the earth and its atmosphere during periods of low solar activity. This cools the climate.

Those who don't believe the earth's atmosphere is a conductor have never seen lightning.

- d. The sun's magnetic field is weaker. This means there are less magnetic lines of force. When a conductor passes through magnetic lines of force, currents are created in the conductor. These currents warm the conductor. When the earth and its atmosphere pass through the sun's magnetic field during periods of low solar activity there are less currents created. This cools the climate.

Solar activity has only been observed for a few hundred years. During this time there has been very good correlation between solar activity and atmospheric temperature. When there was high solar activity the climate was warmer. When there was low solar activity the climate was cooler. We have just entered a period of low solar activity and the correlation continues.

12. Can the climate change quickly?

Yes, but rapid cooling is more likely to occur than rapid warming. This is due to the fact that the earth's albedo can increase more rapidly than it can decrease. Ice and snow reflect more of the sun's radiation back into space than darker surfaces. Therefore the more the earth's surface is covered by snow or ice the cooler it becomes. The ice and snow on Greenland and the Antarctica are quite thick and will not melt quickly. If the snow and ice on Greenland alone would melt the oceans would rise 23 feet. Since the earth's ocean surface is twice the area as the earth's land surface, this means there is enough ice and snow on Greenland to cover all the earth's land surface to depth of 46 feet. This amount of ice and snow will not melt quickly. Therefore the earth's albedo will not decrease quickly due to warming.

An inch of snow reflects as much of the sun's rays as mile thick ice. A large area of inch deep snow cover can occur quite quickly, increasing the earth's albedo. This cools the earth's atmosphere and slows the melting and sublimation of the existing snow and ice. This cooling facilitates the production of even more snow and ice. This again increases the earth's albedo. This chain reaction can cool the earth's climate quite rapidly.

13. If man could control the earth's climate, would man want a colder or warmer climate?

Obviously if man could control the climate he would prevent another disastrous ice age. The question is would man want a little warmer or a little cooler climate. If the climate was a little warmer there would be longer growing seasons, vast areas of land would no longer be too cold for agriculture, flu seasons would be milder, less dangerous driving conditions in winter, lower heating bills, more wild life would survive the winters, a northwest passage would aid commerce, etc. If the climate was a little cooler the ice fishing season would be longer, etc. It would be a difficult choice.