Letter to Dr Singer from students in Denmark asking important questions:

We are starting a project next week and the topic is "change". We have chosen the subtopic "global warming"

Do you have the time to answer a few questions in writing?

1. What is behind global warming?

2. What can we do to prevent global warming?

3. If we don't do anything about it, how does it affect us and our descendants?

4. What will happen in the future, and what are the alternatives for us, if the Earth becomes unlivable?

5. How can we save Earth if it isn't too late?

RESPONSE

Dear Students:

Dr. Singer was not available to answer your questions. I have worked with him for the past seven years, and he approved this response to you.

You ask some very good questions, which require answers with some detail. Science advances by asking good questions, providing answers that may or may not be correct (guesses), then testing the guesses against all hard evidence, that may or may not support it. If the strongest evidence does not support the guess (the hypothesis), then the guess must be discarded or changed.

The climate has been warming and cooling for hundreds of millions of years. For over two million years, the globe has usually been cold, with long ice ages interrupted by short warm periods of 10 to 15 thousand years. We live in one such warm period of about 10,000 years. The longer periods of cooling (and shorter periods of warming) have been explained as resulting from a changing of the orbit and tilt of the globe in relation to the sun, known as the Milankovitch cycles.

Within the generally-warm past 10,000 years, there has been shorter periods of modest warming and cooling. During a warming period, agriculture began and with it, civilization. The most recent cooling period is known as the Little Ice Age. It occurred between about 1300 to 1850 and was very hard for those living in Northern Europe and China, where we have written records. In Europe, many died from starvation and associated diseases because crops did not ripen. The Nordic settlements in Greenland were wiped out. Great storms occurred in the North Sea, killing thousands of people living in the low countries. It is thought this cooling period was caused by a weaker intensity of the sun, which resulted in increasing cloudiness and corresponding cooling.

Understanding what is behind the current warming of the last century or so, requires a complete understanding of what created periods of warming and cooling over the past 10,000 years, which we do not have. The earth’s climate is extremely complex. It can be described as the result of two fluids in motion interacting with the land. The fluids move in response to the heat generated daily by the sun.

One of the fluids is the ocean, which transports heat on the surface from the tropics to the poles, where it escapes into the atmosphere and to space. A famous surface ocean flow is the Gulf Stream, which keeps Northern Europe much warmer than the corresponding latitudes of Canada. The other fluid is the atmosphere, which transports heat from the surface to the upper troposphere by convection, from which heat can escape to space by radiation. We simply do not understand the movements of fluids sufficiently well to explain exactly how these systems work.

Adding to the complexity is the rotation of the earth, which changes the intensity of solar energy hitting any specific location on the globe. That varies both daily and seasonally, which adds to the ever-changing motions of the atmosphere and the oceans. It may take hundreds of years before these complex motions are fully understood.

In answer to your question: What is behind global warming? We simply do not know in detail, but can guess, then look at the evidence.

Over 100 years ago, scientists wondered why the surface of the earth does not cool as rapidly at night, as many thought it should. An explanation, since then well tested, is that some gases in the atmosphere delay the transport of heat from the surface to space, keeping the earth warmer at night. These gases are called greenhouse gases, the most important of which is water vapor. Deserts, with low atmospheric water vapor, cool more rapidly at night than humid areas at comparable latitude.

A lesser greenhouse gas is carbon dioxide which humans emit by burning fossil fuels. But research by different laboratories have shown that adding carbon dioxide to today’s atmosphere will cause only a small warming, nothing to fear.

Prior to the time when satellite measurements began (1979), the surface thermometers that indicated warming were largely on land, mostly located in the US, Western Europe, and other Westernized areas. The coverage was not global. Surface temperatures may indicate what is occurring in the atmosphere, but are influenced by many other human activities such as building cities, land clearing, and farming. For over 38 years, we have had the benefit of accurate temperature measurements from satellites that cover nearly all the earth, including oceans.

Meanwhile, computer models, known as General Circulation Models, have been used with relatively little success. Built into them is the assumption that the slight warming caused by CO2 will be amplified into a much greater warming due to water vapor. The principles of the scientific method demand that real data from observations be used, and for a computer model to be valid, it must reproduce the observed data. Any warming caused by increased greenhouse gases will be stronger in the atmosphere than on the surface.

Satellite measurements of temperature trends in the atmosphere have been studied intensely, including even tiny corrections for drifting orbits. Furthermore, the temperature trends are double-checked by using four different sets of atmospheric temperature measurements, taken with different instruments, carried by weather balloons; and all closely agree. Now stretching over 38 years, these show a modest warming trend.

From this evidence, we can conclude that: unless compelling evidence indicates otherwise, the warming influence of greenhouse gases, especially carbon dioxide, has been greatly overestimated; efforts to reduce greenhouse gases will not prevent global warming; carbon dioxide-caused warming will be modest; and the Earth will not become unlivable from carbon dioxide warming. Life began on this planet when the atmosphere was far richer in carbon dioxide, and far poorer in oxygen, than it is today.

Starting in 1972, Landsat satellites have been taking images of the earth. They show that the earth is greening with increasing carbon dioxide, becoming richer for life. Thousands of experiments show food crops grow better in atmospheres richer in carbon dioxide than the atmosphere today. Indoor plant nurseries routinely increase the carbon dioxide concentration of their air to three to four times that of today’s atmosphere.

Through the wonder of photosynthesis, using energy from the sun, green plants convert carbon dioxide and water into oxygen and carbohydrates (food). All plants and complex animals depend on this food. We should praise carbon dioxide, not fear it.

To directly answer your questions:

1. What is behind global warming? We don’t know exactly, but based on evidence, greenhouse gases are not the main cause.
2. What can we do to prevent global warming? Nothing. The main cause is natural variation, which we cannot prevent.
3. If we don't do anything about it, how does it affect us and our descendants? You and your descendants will live in a world richer in carbon dioxide, which is a benefit to plants, the environment, and humanity.
4. What will happen in the future, and what are the alternatives for us, if the Earth becomes unlivable? Life began on earth with the atmosphere many times richer in carbon dioxide than today. The earth will not become unlivable from carbon dioxide-caused warming.
5. How can we save Earth if it isn't too late? The earth does not need saving, but it needs good stewards. You can help by not polluting with trash, not wasting energy, and living healthy lives.

Best wishes,

Kenneth Haapala, President

Science and Environmental Policy Project

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