GLOBAL
CLIMATE CHANGE

It's real.

People who deny that "anthropogenic global climate change" exists are simply wrong. Humans *have caused*, *are causing*, and *will continue to cause* global climate change.

Climate reflects long-term weather patterns and averages. As Mark Twain once said, "Climate is what you expect. Weather is what you get."

Weather results from the interplay between five general types of influence: insolation (the sun), the lithosphere (the physical Earth), the hydrosphere (the water on the Earth), the atmosphere, and the biosphere (all life on the Earth). Weather, over the long range, determines climate. We have changed all these inputs to a great degree.

So, if you hear someone say, "Global climate change is not caused by humans," then it's like they're saying "Well, I changed the flour to corn meal, the chocolate chips to peanuts, and the butter to Crisco, but they're still going to come out Tollhouse cookies."

INPUTS TO
WEATHER AND CLIMATE

- ✓ **Humans have drastically changed the hydrosphere from what it was. We have dumped incredible amounts of pollution into the oceans, one result of which are huge floating islands of plastics in mid-ocean. We have changed the chemical balance of the oceans, gradually, and even its temperature, at least in selected regions. We have altered many, many miles of shoreline, and have dredged and filled – and that's just talking about the oceans. We've altered fresh water resources even more.**
- ✓ **Humans have greatly changed the atmosphere. Remember the ozone crisis which we actually succeeded in averting because we responded to it? That's an atmospheric phenomenon. Smog is an atmospheric phenomenon also caused by humans. Dust storms (many immense), airborne radiation, injection of water vapor, emissions of huge amounts of carbon dioxide, release of many other chemicals: these are all human caused. Plus, storms are becoming more violent. The atmosphere is not what it used to be.**
- ✓ **Life on Earth – the biosphere? We have not only driven many species to extinction and to near-extinction, we have also hugely changed the balance of life by building artificial environments and by deliberately breeding and so increasing the numbers of certain animals that we prefer, as well as causing immense increases in pest species, like rats and cockroaches. We've deforested vast tracts of the Earth and are still doing so at a rapid rate, and even areas not substantially deforested are now much changed in other ways. Much sunlight that was once absorbed by trees to make sugars is now absorbed as heat. Oh, yes, we've changed the biosphere beyond belief.**
- ✓ **The lithosphere has radically changed at the surface of the Earth. We've paved over large areas, dried out areas, wetted areas, and made many other changes to the Earth's surface. One big result of this is that we've reduced the albedo – that's the reflectivity of the Earth. Much sunlight that was once reflected by snowfields and ice is now absorbed as heat.**
- ✓ **And how have we changed the sun? We haven't, but by changing the atmosphere, we've actually reduced the amount of sunlight reaching the surface of the Earth. However, we haven't reduced it enough to stop warming, just enough to slow it down a little – and much of that light is still heating the upper atmosphere, and getting redistributed by high-altitude air currents.**

GLOBAL DIMMING

Global dimming is the effect of reducing the sunlight that reaches the Earth's surface. Over the past fifty years, global dimming has reduced the sunlight reaching us by around 10%. That's a big difference.

What causes this global dimming? It's caused by an increase in water vapor, particulate pollution, and other clouding gases in the atmosphere. These block sunlight. However, this actually increases the warming of the upper atmosphere itself more, as these elements of the atmosphere absorb the light.

But what's more is this: Global dimming only slows global warming slightly, if at all. It may be a factor in why the poles are heating faster than elsewhere, as the upper atmosphere may be distributing that blocked light as heat to upper latitudes.

GLOBAL CLIMATE CHANGE VS. GLOBAL WARMING

Global warming is real, but is only one major component of climate change. Not all areas are getting or are going to get warmer. Some areas will get cooler, with changes in ocean currents an important part of this happening.

Another terrible part of global climate change is global climate destabilization. This means more and worse storms of many kinds, including hurricanes.

CARBON DIOXIDE AND WARMING

Carbon dioxide is known as a "greenhouse gas." While present in the atmosphere only in very small quantities, it is essential for plant growth. A thousand years ago, it was at about a quarter of one percent of the atmosphere. Now, it's more than a third of one percent. That may not seem like much, but it's actually a huge increase. Carbon dioxide is very effective at trapping the sun's heat in the atmosphere.

Most animals release carbon dioxide when they breathe out, including humans. All internal combustion engines (cars, trucks, etc.), most heating systems, and most factories put vast quantities of carbon dioxide into the atmosphere, and the rate of release is increasing. More and more and more. And more and more and more heat is trapped in the atmosphere.

There are many other greenhouse gases, too, and many of them are far more powerful than carbon dioxide. These include water vapor and methane.

TEMPERATURES

Why aren't air temperatures increasing faster than they area? It's because the heat is mostly quickly absorbed by the oceans. The oceans are warming much faster than land or air, and are absorbing large amounts of carbon dioxide. This is both causing sea levels to measurably rise, and also is resulting in the ocean becoming more acidic. This is already killing vast quantities of oceanic life.

POLAR WARMING

What's clear about climate change, shown by many scientific models, is that the polar regions are getting a disproportionate amount of the warming. Most of the heat, in other words, is going to the Arctic and Antarctic areas. This results in less ice forming, and ice melting faster in the summer.

This polar warming affects the weather all over the rest of the world. As these weather patterns change, the climate destabilizes and more and more extreme events occur: worse hurricanes, worse tornadoes, worse droughts, and worse floods.

But the ice, in and of itself, is a problem in global climate change. There are two kinds of ice melt in the polar regions. Much of the ice is sea ice. When sea ice melts, the level of the ocean's surface stays the same, since the ice was floating, so was in isostatic balance. Not only that, but the sea ice is salt-water ice, so the ocean's salinity stays about the same. But the water has a lower albedo than the ice, so the ocean absorbs more heat once the ice is melted.

Ironically, sea ice has increased around Antarctica. This is for a related reason: as melting of the land ice on Antarctica accelerates, more fresh water flows into the oceans. Much of it floats on top of the salt water and freezes more quickly than the salt water, because fresh water freezes at a higher temperature than salt water. So, in this case, more ice is also because of global warming.

LAND ICE

The other kind of ice is land ice. This is fresh-water ice, and most of it is on the island of Greenland and on the continent of Antarctica. This ice melts at a higher temperature than the sea ice. Sea ice melts around zero degrees Fahrenheit (did you wonder why they chose that point for zero?), while land ice melts at 32 degrees Fahrenheit. So the sea ice melts first, and it has been melting fast. For the past three years, AND FOR THE FIRST TIME IN HISTORY, people have been able to sail around the north coast of North America during the summer – the fabled but never-found Northwest Passage.

But the land ice is melting too, at a more and more rapid pace. When this ice melts, the fresh water runs into the ocean and begins diluting the polar areas of the oceans, reducing the salinity. This in turn can possibly change the thermocline of the ocean, or the relative levels of water of different temperatures.

The problem with changing the thermocline is that it threatens to dampen or even shut down what's commonly known as the Atlantic Conveyor. This is a very important set of currents that carry warm water from the tropics to northern areas, and causes many other climate effects. This is why the northern European coast is relatively warm. Without this current, the British Isles could become a frozen wasteland. Even worse, it could start a new ice age – yes, ironically, global warming can start a new ice age.

But, wait, there's more. Melting of the Greenland and Antarctic ice will raise sea levels, and already are doing so very slowly. Melting of a massive amount of ice could raise sea levels twenty feet or more. This would mean the loss of much of the most important land on Earth.

METHANE CLATHRATES

There's a third kind of ice – the tundra. The tundra is already melting rapidly. This is the frozen land of the Arctic. As it melts, it becomes swampy. The ecology changes terribly, with many plants and animals dying off, and life becoming harder for humans who live there.

But wait, there's a FOURTH kind of "ice." These are known as methane clathrates. There is a huge amount of methane, also known as natural gas, stored in semi-solid deposits under the Arctic ocean floor. Warming of the polar oceans means that this methane starts being released. METHANE IS A GREENHOUSE GAS MANY, MANY TIMES MORE POTENT IN GLOBAL WARMING THAN CARBON DIOXIDE. Russian scientists have already reported finding large methane plumes in the Arctic Ocean.

Release of large amounts of methane gas from the Arctic could mean that global climate change starts accelerating, and *fast*. We really do not know how much the change may be speeded up.

CLIMATE CHANGE DENIAL

There are people who say that global climate change is a myth, and the result of a conspiracy. That's a ridiculous statement. A conspiracy? Between MOST of the world's scientists? And to what end? To make the world a better place for our children?

Here's the truth: GLOBAL CLIMATE CHANGE DENIAL IS THE RESULT OF A CONSPIRACY, and a very corrupt one, at that. Most high-profile people making this claim are being paid big money to make that claim, and have little or no scientific credibility.

The deniers claim that they have a petition signed by 100,000 scientists saying that there is no anthropogenic climate change. This petition has been investigated, and it turns out that almost none of the signers have any valid scientific background in climate science. In fact, it turns out that most of the people aren't even really scientists who signed it. The petition is a fraud.

The denial movement was given huge momentum when Phillip Morris, a tobacco company, decided that they needed a "straw man" in terms of discredited science to protect themselves. In other words, they had been claiming (falsely, of course, and they knew it) that the research showing that smoking was damaging to health was bad science. They felt that they had to find another scientific trend to discredit to show that scientists were often wrong. They chose climate change science, then in its relative infancy.

Does this sound bizarre and unreal? Yes, it's too bizarre to be fiction. Exxon-Mobil soon joined Phillip-Morris, and they started funding people like Stephen Milloy, a crackpot corporate flack (a fan of expanded use of DDT and asbestos), who established the website www.junkscience.com. It's obvious why Exxon-Mobil became involved, to try to keep people as dependent as possible on fossil fuels. Other companies soon became involved.

So the next time you hear about some denial of global climate change, you will understand that it's either someone who has mistakenly believed the liars, or else it's one of the liars themselves talking.