AGENDA MATERIAL
DATE 5/6/25 ITEM NO. PA 30

Aliza Barraza

From: SW_Sunshine [redacted]
Sent: Monday, May 5, 2025 5:44 PM
To: Jan Lesher; District1; District2; District3; District5; District4; COB_mail
Subject: 5/6/2025 Re Climate (Ice Cores)

Please add this article into official records.

Regarding your claim that ice sheets are melting.

Ice cores and climate change - British Antarctic Survey

https://www.bas.ac.uk/data/our-data/publication/ice-cores-and-climate-change/

Introduction

Ice cores are cylinders of ice drilled out of an ice sheet or glacier. Most ice core records come from Antarctica and Greenland, and the longest ice cores extend to 3km in depth. The oldest continuous ice core records to date extend 123,000 years in Greenland and 800,000 years in Antarctica. Ice cores contain information about past temperature, and about many other aspects of the environment. Crucially, the ice encloses small bubbles of air that contain a sample of the atmosphere – from these it is possible to measure directly the past concentration of atmospheric gases, including the major greenhouse gases: carbon dioxide, methane and nitrous oxide.

Greenhouse gases and the recent past

Direct and continuous measurements of carbon dioxide (CO_2) in the atmosphere extend back only to the 1950s. Ice core measurements allow us to extend this way back into the past. In Antarctic cores with a very high snowfall rate, it has been possible to measure concentrations in air from as recently as the 1980s that is already enclosed in bubbles within the ice. Comparison with measurements made directly from the atmospheric at research stations in

Antarctica show that the ice core acts as a faithful recorder of atmospheric concentrations (see Fig. 1), although we do have to be cautious, as small artefacts can arise at sites with high concentrations of other impurities.

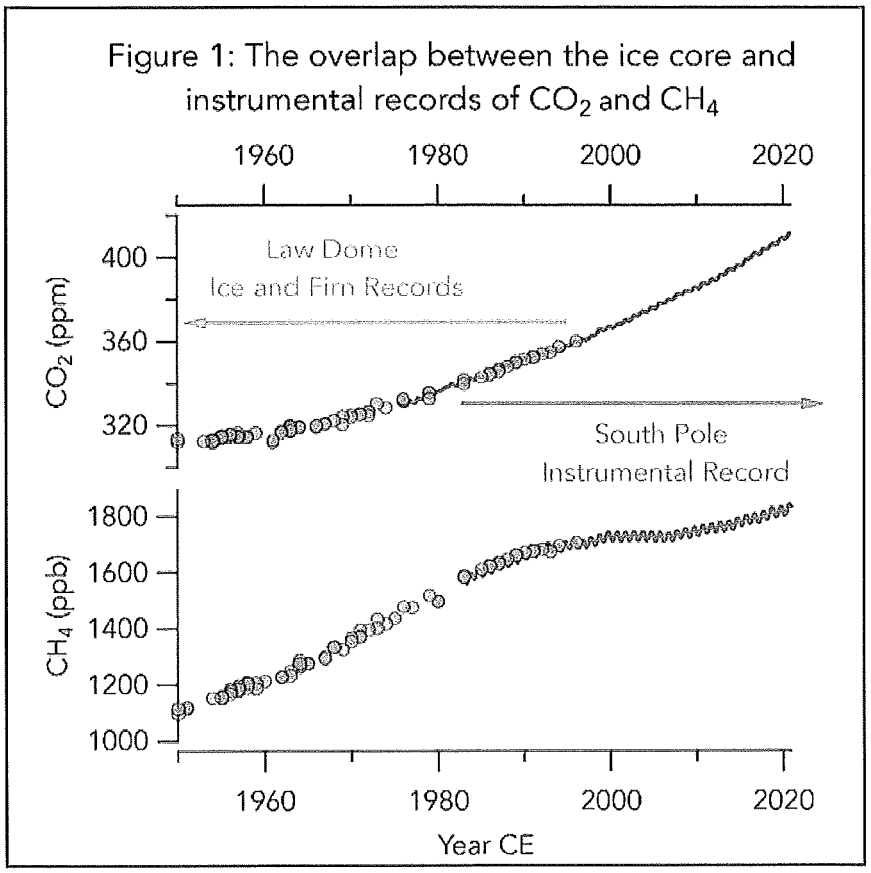


Figure 1: The overlap between the ice core and instrumental records of CO_2 and CH_4

Antarctic ice cores show us that the concentration of CO_2 was stable over the last millennium until the early 19th century. It then started to rise, and its concentration is now nearly 50% higher than it was before the industrial revolution (Fig. 2). Other measurements that can fingerprint the source of this CO_2 (e.g. isotopic data) confirm that the increase must be due to emissions from fossil fuel usage and human-induced changes vegetation and soils. Measurements from older ice cores (discussed below) confirm that both the magnitude and rate of the recent increase are almost certainly unprecedented over the last 800,000 years (Fig. 2). The fastest natural increase measured in older ice cores is around 15ppm (parts per million) over about 200 years. For comparison, atmospheric CO_2 is now rising 15ppm every 6 years. Methane (CH_4), another important greenhouse gas, also shows an unprecedented increase in concentration over the last two centuries. Its concentration is now much more than double its pre-industrial level. This is mainly due to emissions from agricultural sources

and fossil fuel production, that comes on top of natural emissions from wetlands and other sources.

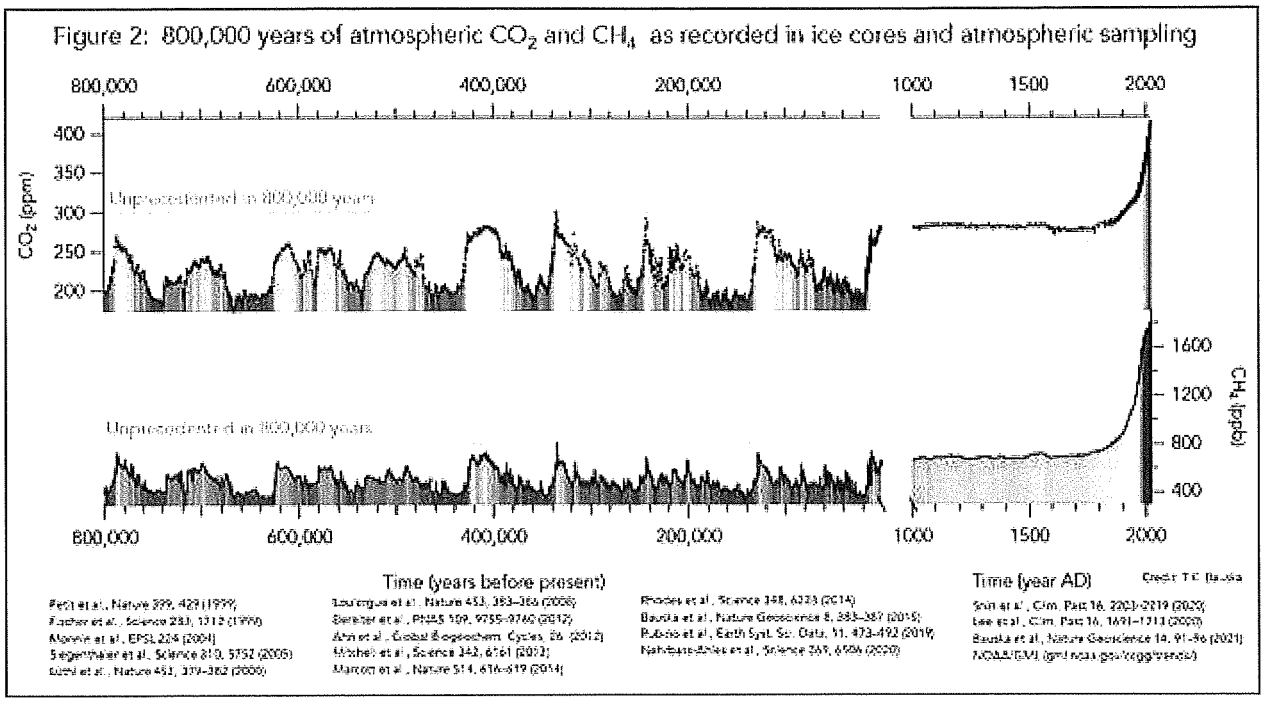
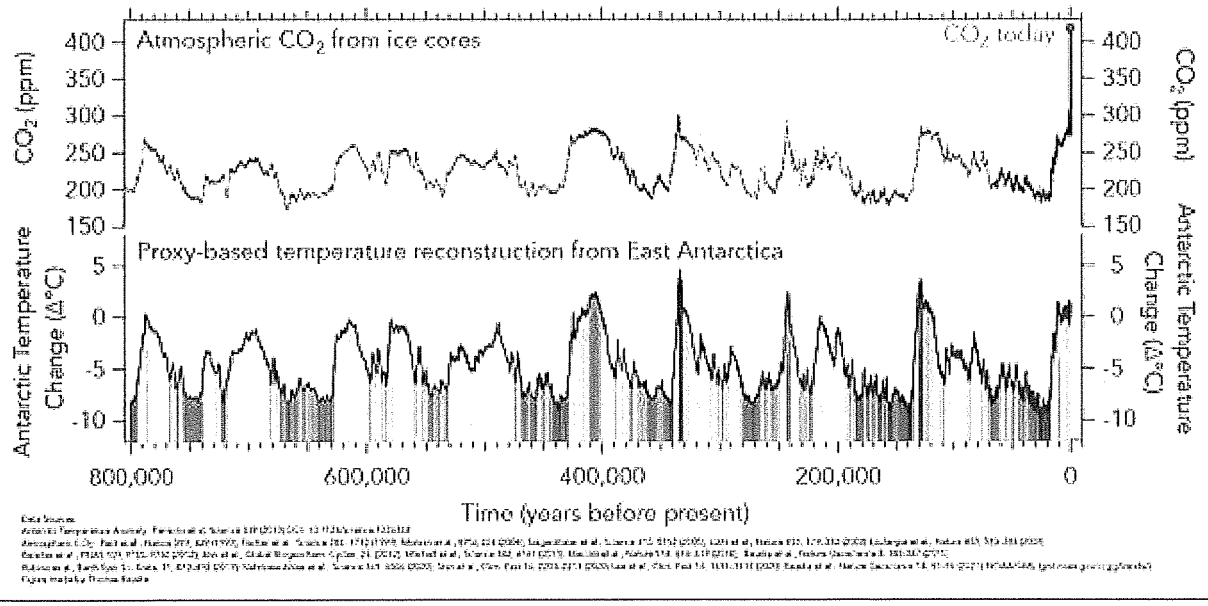


Figure 2: 800,000 years of atmospheric CO_2 and CH_4 as recorded in ice cores and atmospheric sampling

Natural climate change: glacial-interglacial cycles

By measuring the ratios of different water isotopes in polar ice cores, we can determine how temperature in Antarctica and Greenland has changed in the past. The oldest continuous ice core we have was drilled by the European Project for Ice Coring in Antarctica (EPICA) from Dome C on the Antarctic plateau (Fig. 3). It extends back 800,000 years and shows a succession of long, cold 'glacial' periods, interspersed roughly every 100,000 years by warm 'interglacial' periods (of which the last 11,000 years is the most recent). This succession of events is well-known from other records, and the coldest periods in Antarctica are the times when we had ice ages. Ice sheets extended over North America as far south as places like Chicago and New York, and over Britain to south of The Wash.

Figure 3: The oldest ice core records for atmospheric CO_2 and temperature change in Antarctica



The role of greenhouse gases in glacial-interglacial cycles

From the air in our oldest Antarctic ice core, we can see that CO_2 changed in a remarkably similar way to Antarctic climate, with low concentrations during cold times, and high concentrations during warm periods (see Fig. 3). This is entirely consistent with the idea that temperature and CO_2 are intimately linked, and each acts to amplify changes in the other (what we call a positive feedback). It is believed that the warmings out of glacial periods are paced by changes in Earth's orbit around the Sun, but these small changes in climate are amplified, mainly by the resulting increase in CO_2, and by the retreat of sea ice and ice sheets (which leads to less sunlight being reflected away).

We can see how remarkably closely Antarctic temperature and CO_2 tracked each other, but what about global temperature? Here we can examine the last time the earth emerged from an ice age. Scientists have compiled other geologic records of temperature from around the world to calculate he average global temperature. On this global-scale, CO_2 starts increasing before temperature (see Fig. 4.) (Shakun/Osman), thus temperatures are said to "lag" behind CO_2. This demonstrates that CO_2 was not only a feedback on natural climate change but in fact major forcing that drove the earth out the last ice age.

In our modern era, of course, it is human emissions of CO_2 that are expected to kick-start the sequence of events. We see no examples in the ice core record of a major increase in CO_2 that was not accompanied by an increase in temperature. Methane concentration also tracks the

glacial-interglacial changes, probably because there were less wetlands in the colder, drier glacial periods.

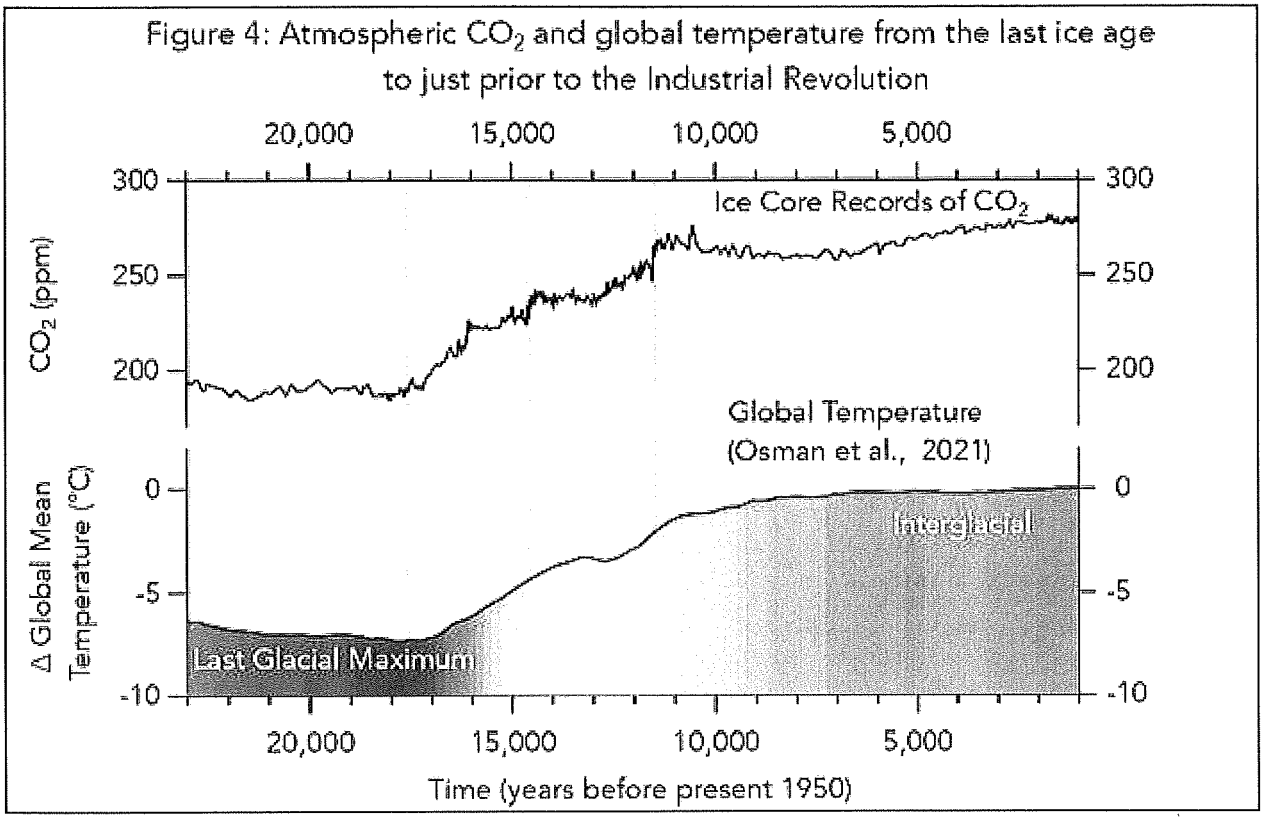
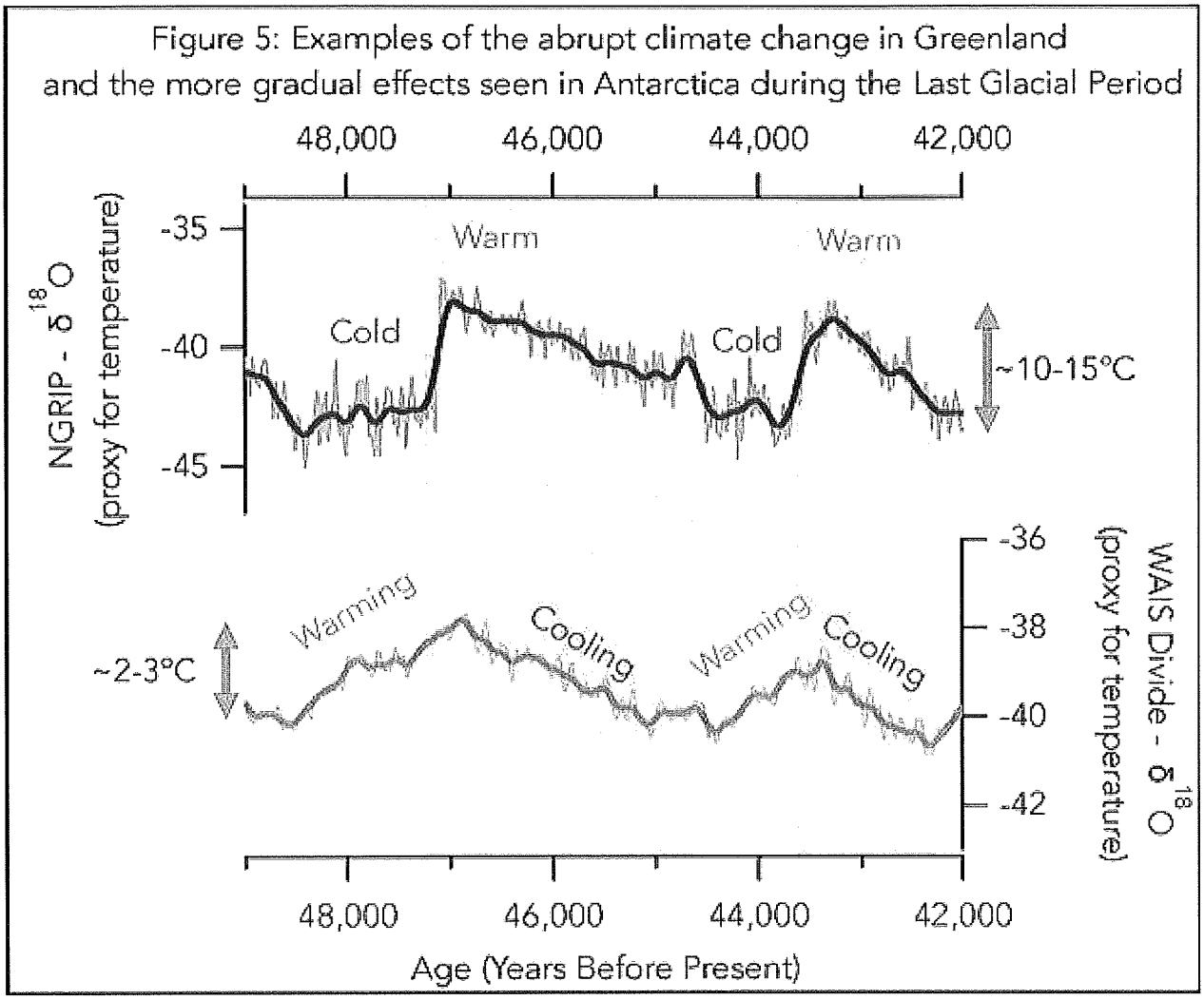


Figure 4: Atmospheric CO_2 and global temperature from the last ice age to just prior to the Industrial Revolution

Abrupt climate change

The climate changes described above were huge, but relatively gradual. However, ice cores have provided us with evidence that abrupt changes are also possible. During the last glacial period, Greenland experienced a sequence of very fast warmings (see Fig. 5).

The temperature increased by more than 10°C within a few decades. Other records show us that major changes in atmospheric circulation and climate were experienced all around the northern hemisphere. Antarctica and the Southern Ocean experienced a different pattern, consistent with the idea that these rapid jumps were caused by sudden changes in the transport of heat in the ocean. At this time, there was a huge ice sheet (the Laurentide) over northern North America. Most likely, freshwater delivered from the ice sheet to the North Atlantic periodically disrupted the overturning of the ocean, causing the transport of tropical heat to the north to reduce and then suddenly increase again. While this mechanism is unlikely to occur today's world, it does show us that, at least regionally, the climate is capable of extraordinary changes within a human lifetime – rapid switches we certainly want to avoid experiencing.



Summary

Ice cores provide direct information about how greenhouse gas concentrations have changed in the past, and they also provide direct evidence that the climate can change abruptly under some circumstances. However, they provide no direct analogue for the future because the ice core era contains no periods with concentrations of CO_2 comparable to those of the next century.

Fact file

- Ice core. Cylinder of ice drilled out of an ice sheet or glacier. Most ice core records come from Antarctica and Greenland.
- Ice cores contain information about past temperature, and about many other aspects of the environment.
- Atmospheric carbon dioxide levels are now 50% higher than before the industrial revolution. This increase is due to fossil fuel usage and changes in land-use.
- The magnitude and rate of the recent increase are almost certainly unprecedented over the last 800,000 years.

- Methane also shows a huge and unprecedented increase in concentration over the last two centuries.

References

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AGENDA MATERIAL
DATE 5/6/25 ITEM NO. RA30

Aliza Barraza

From: SW_Sunshine [redacted]
Sent: Monday, May 5, 2025 5:44 PM
To: Jan Lesher; District1; District2; District3; District4; District5; COB_mail
Subject: 5/6/2025 Re Climate resolution, vote NO!

Some people who received this message don't often get email from [redacted] Learn why this is important

CAUTION: This message and sender come from outside Pima County. If you did not expect this message, proceed with caution. Verify the sender's identity before performing any action, such as clicking on a link or opening an attachment.

Please add Dr. Moore's information into official records.

Thank you.

What They Haven't Told You about Climate Change

The only constant... is change.

That's true about life. And it's true about the climate. The climate has been constantly changing since the earth was formed 4.6 billion years ago.

For example, in just the past 2000 years, we have seen the Roman Warm Period, when it was warmer than today...Then came the cooler Dark Ages... Followed by the Medieval Warm period, when it was at least as warm as today... Then we had the Little Ice Age -- that drove the Vikings out of Greenland. And, most recently, a gradual 300-year warming to the present day. That's a lot of changes. And, of course, not one of them was caused by humans.

During the past 400,000 years there have been four major periods of glaciation -- meaning that vast sheets of ice covered a good part of the globe -- interrupted by brief interglacial periods. We are in one of those periods right now. This is all part of the Pleistocene Ice Age which began in earnest two and a half million years ago. It's still going on, which means that we

are still living in an ice age. That's the reason there's so much ice at the poles.

Thirty million years ago the earth had no ice on it at all.

So, then, what about carbon dioxide, the great villain of the Global Warming alarmists? Where does that fit in to this picture? Not as neatly as you might think.

Temperatures and carbon dioxide levels do not show a strong correlation. In fact, over very long time spans -- periods of hundreds of millions of years -- **they are often completely out of sync with each other.**

Over and over again, within virtually any time frame, we find the climate changing -- for reasons we do not fully understand. But we do know there are many more factors in play than simply the concentration of CO2 in the atmosphere -- factors such as the shape and size of the earth's elliptical orbit around the sun, activity from the sun, and the amount of wobble or tilt in the earth's axis, among many others. Even the relatively short 300-year period from the peak of the Little Ice Age to the present has not been steady. The latest trend has been a warming one, but it began nearly a century before there were significant carbon dioxide emissions from burning fossil fuels. And, **there has been no significant warming trend in the 21st century. Contrary to media headlines,** the trend over the past couple of decades has been essentially flat.

Meanwhile human-caused CO2 emissions are higher than ever. About 25 percent of all the CO2 emissions from human sources have occurred during this period of no net warming.

So, what are we in for next? Will the temperature resume an upward trend? Will it remain flat for a lengthy period? Or, will it begin to drop? **No one knows**. Not even the biggest, fastest computers.

All the information I've presented -- the increases, decreases and plateaus in temperature over the ages and into the last centuries -- is available to anyone

who wants to seek it out. Yet to state these simple facts is to risk being called a "climate change denier." Not only is that absurd, it's mean-spirited.

It's absurd because no one, not even the most fervent skeptic, denies that the climate is changing. And it's mean-spirited because to call someone a climate change denier is to intentionally link them to people who deny the Holocaust.

So, maybe it's time to stop the name-calling.

Predicting the climate, one of the most complex systems on earth with thousands of inputs, many of which we don't understand, isn't an exact science, or anything close to it. Maybe it's just a tad arrogant to suggest that we can predict the weather or the climate or just about anything 60 years from now.

The science is not "settled." The debate is not over.

The climate is always changing. It always has. And it always will.

Dr. Patrick Moore, Co-Founder of Greenpeace.