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Global Warming – Truth and Myths

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Abstract

Climate change is inevitable. Contributing to this change are (1) natural effects, which include the Earth in an interglacial period and (2) various other effects such as anthropogenic effects, which include the release of non-indigenous gases into the atmospheres. However, the exact contribution of each effect to global climate change is not known with any degree of certainty and the blame can only be partially laid on the existence of the interglacial period and somewhat less on other effects.

It is not the purpose of this paper to debunk the idea of climate change but to recognize other factors that can play a role in the changing climate.

Keywords: Climate change, interglacial period, anthropogenic activity, other effects

Introduction

By definition, the physical climate system involves the atmosphere, land surfaces, and oceans of the Earth, along with the snow and ice that is so prominent in many northern climes. These components interact with one another and with aspects of the earth's biosphere to determine not only the day-to-day weather, but also the long-term averages that are referred to as climate.

The most general definition of climate change is a change in the statistical properties of the climate system when considered over long periods of time, regardless of cause. Accordingly, fluctuations over periods shorter than a few decades, such as El Niño, do not represent climate change. The term sometimes is used to refer to climate change caused by human activity, as opposed to changes in climate that may have resulted as part of Earth's natural processes. In this sense, especially in the context of environmental policy, the term climate change has unfortunately and incorrectly been associated with anthropogenic (human activities) global warming as the causative factor. With in scientific journals, global warming refers to an increase in the surface temperature of the earth while climate change is amore all-inclusive term that includes global.

The issue of global climate change is often associated with the use of fossil fuels as sources of energy. Of most concern is the increase in emissions of carbon dioxide (CO2) due to emissions from fossil fuel combustion:

$$C_{\text{fossil fuel}} + O_2 \rightarrow CO_2$$

Other factors, including land use, ozone depletion, animal agriculture, and deforestation, are also of concern in the roles they play – both separately and collectively – in affecting climate, microclimate, and various climate variables.

Interglacial Periods

An interglacial period (alternatively an inter-glacial period) is a geological interval of higher global temperature lasting thousands of years that separates consecutive glacial periods (Figure 1). Each peak and valley that separate glacial periods is also subject to fluctuations in temperature that can cause variations in the behavior of the climate of the Earth within the upslope (global warming) or the down slope (global cooling) (Figure 1). In fact, it is important to realize that in any climate change scenario that there will be unpredictable variations for the so-called global mean temperature and only best estimates can be made.

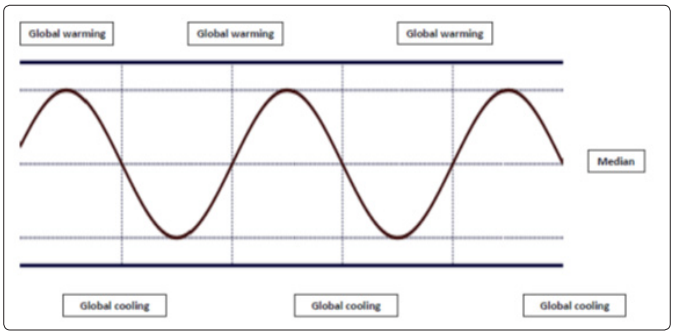

Figure 1: Representation of Global Warming (Sub-tropical and Tropical Peaks) and Global Cooling (Ice Age Valleys) Cycles

However, the beginning and termination of the glacial periods can cause major disruptions in the climate. In particular, the termination of glaciations is also responsible for the release of carbon dioxide into the atmosphere [1]. This should lead to questions about the validity of using the concentration of carbon dioxide (from fossil fuel combustion) in ice cores as the main cause of global warming [2-6].

In addition, snow and ice are viscoelastic materials which mean that snow and ice can move and deform over time and are, therefore, unstable as storage media [7-11]. This must throw doubt on the validity of the measurements of carbon dioxide in ice cores as an accurate method for determining the cause of global warming and the claims made in any treatise on global warming relating to settling the blame of fossil fuel combustion [12, 13].

The most significant climate processes since the middle to late Pliocene (approximately 3 million years ago) are the glacial and interglacial cycles. In addition, the possibility that the Earth suffered episodes of global glaciations as recently as the Neoproterozoic period, between about 900 and 543 million years ago, has been discussed in terms of the variation of carbon dioxide in the atmosphere [3, 5, 6 and 14].

The current Holocene interglacial period has persisted since the end of the Pleistocene, approximately 11,400 years ago. Furthermore, during the 2.5 million year span of the Pleistocene, numerous glaciations events, or significant advances of continental ice sheets in North America and Europe have occurred at intervals of approximately 40,000 to 100,000 years. These long glacial periods were separated by more temperate and shorter interglacial periods.

During interglacial periods, such as the present one, the climate warms and the tundra recedes towards the pole following the ice sheets. Forests return to areas that once supported only tundra-type vegetation. Briefly, the tundra is a type of ecosystem where the tree growth is hindered by low temperatures and short growing seasons. There are three types of tundra: (i) arctic tundra, (2) alpine tundra, (3) Antarctic tundra. In the tundra ecosystem, the vegetation is typically composed of plants such as dwarf shrubs, grasses, mosses, and lichens. Scattered trees grow in some tundra regions.

Interglacial periods and glacial periods coincide with cyclic changes in the orbit of the Earth, such as: (1) a change in the orbit of the Earth around the sun, or eccentricity of the orbit, (2) a shift in the tilt of the axis of the Earth, the obliquity of the orbit, and (3) precession, or a wobbling motion of axis of the Earth. Warm summers in the northern hemisphere occur when that hemisphere is tilted toward the sun and the Earth is nearest the sun in its elliptical orbit. Cool summers occur when the Earth is farthest from the sun during that season. These effects are more pronounced when the eccentricity of the orbit is large. However, when the obliquity is large, seasonal changes are more extreme.

Moreover, the cyclical nature of the energy output from the Sun is not yet fully understood but, with that in mind or in reality being ignored by the climate change doomsday aficionados, there are natural fluctuations in the cycle of warming and cooling that have little to do with anthropogenic sources [15, 16]. In fact, solar variability has had effects including in the period from 1645 to 1715 AD, part of the Little Ice Age from 1550 to 1850 AD that was marked by relative cooling and greater glacier extent than the centuries before and afterward [17,18].

The name "Little Ice Age" is not characterized by similar amounts of polar ice so far south but rather by a period of several hundred years in which the winters were particularly severe in the Northern Hemisphere. In addition, other climatic features such as cooler summer temperatures, changes in the amount of rainfall and major shifts in wind patterns were observed. The period just before the Little Ice Age — 1100-1300 — also presents a weather anomaly. It was characteristically different from the present day in that average temperatures were higher. Thus a more marked shift to a colder time is more visible in the historical record [18].

An interglacial optimum, or climatic optimum of an interglacial, is the period within an interglacial that experienced the most favorable climate that occurred during that interglacial, often during the middle part of the period. The climatic optimum of an interglacial follows, and is followed by, phases that are within the same interglacial and that experienced a less favorable climate (but nevertheless a better climate than during the preceding/succeeding glacial periods). During an interglacial optimum, sea levels rise to their highest values, but not necessarily exactly at the same time as the climatic optimum.

In the present interglacial period (the Holocene), the climatic optimum occurred during the Sub-boreal (approximately 3000 BC to 500 BC) and Atlanticum (approximately 7000 BC to 3000 BC). The current climatic phase following this climatic optimum is still within the same interglacial (the Holocene). This warm period was followed by a gradual decline until about 2,000 years ago, withanother warm perioduntil theLittle Ice Age (1250 to 1850 AD).

The preceding interglacial optimum occurred during the Late PleistoceneEemian Stage (130,000 to 115,000 years ago) during which time the sea level was approximately 25 to 30 feet higher than current levels and the water temperature of the North Sea was approximately 2°C (3.6°F) higher than at present. Global sea level change for much of the last century has generally been estimated using tide gauge measurements collated over long periods of time to give a long-term average. More recently, altimeter measurements – in combination with accurately determined satellite orbits – have provided an improved measurement of global sea level change. In the early Pliocene, global temperatures have been estimated to be 1 to 2°C (1.8 to 3.6°F) warmer than the present temperature, yet sea level was approximately 150 to 240 feet higher current levels. It would seem that temperature is not a major determinant of the sea level and several variable factors are involved, of which carbon dioxide concentration in the atmosphere is not the major culprit and which are not always considered by global climate change proponents [19-22].

Furthermore, the common assumption in interpreting ice-core carbon dioxide records is that diffusion in the ice does not affect the concentration profile. However, this assumption has been tested and the solubility of carbon dioxide in the ice melt water leads to errors in the estimation of the carbon dioxide concentration in the ice core there by throwing considerable doubt not only on the origin of carbon dioxide in ice core sample but also (and especially) on the amount of carbon dioxide in various ice core samples [23]. Also, this raises doubt about the subsequent interpretation of the analytical data relating the relative concentration of carbon dioxide in ice cores as the major culprit behind global climate change.

Human Activity

The atmosphere (excluding moisture) consists of nitrogen (78%) and oxygen (21%) as well other gases, including greenhouse gases such as carbon dioxide, are collectively classified as trace gases due to their low concentrations. There is the belief that human activity is altering the composition of the atmosphere by increasing the concentration of greenhouse gases. Greenhouse gases occur naturally in the atmosphere and their presence results in what atmospheric scientists call the greenhouse effect. It is important to remember that the greenhouse effect is what keeps the earth warm enough to be habitable. The current concern is directed at an enhanced greenhouse effect, one that would put more heat-absorbing gases into the atmosphere, thereby increasing global temperatures.

The recent attention given to the greenhouse effect and global warming is based on the recorded increases in concentrations of some of the greenhouse gases due to human activity. Of particular interest are water vapor, carbon dioxide (CO_2), methane (CH_4), nitrogen oxides (such as nitrous oxide, N_2O, nitric oxide, NO, and nitrogen dioxide, NO_2), chlorofluorocarbons (informally represented here as CHaClbFc, where a, b, and c are whole numbers), and ozone (O_3). With the exception of chlorofluorocarbons, all of these gases occur naturally and/or are also produced by anthropogenic activity.

Water vapor is the most important greenhouse gas – unlike most of the other atmospheric gases, water vapor is considered to be a variable gas insofar as the percentage of water vapor in the atmosphere can vary greatly depending on the location and source of the air. For example, over the tropical oceans, water vapor may account for 4% v/v of the total volume of gases, while over deserts or at high altitudes, it may be nearly absent. Although other greenhouse gases are individually less important than water vapor, increasing the concentrations of these gases may affect global climate in significant and measurable ways.

Carbon dioxide (CO_2) is considered the most important human-influenced greenhouse gas. Scientific measurements reveal an unmistakable global increase in the amount of carbon dioxide, which arises primarily from the burning of fossil fuels (motorized vehicles, electric power plants, and homes heated with gas or oil) and the burning and clearing of forested land for agricultural purposes. But is carbon dioxide the real culprit for global climate change?

Methane (CH_4) is largely a product of natural biologic processes, but its output can also arise from anthropogenic activity. This gas is emitted from the decay of organic matter in waterlogged soils (for example, wetlands and rice paddies) and from the digestive tracts of grazing animals (for example, ruminants). The additions from human activities include (1) emissions from livestock, (2) emissions from landfills, and (3) leakage from natural gas during production and transportation.

Chlorofluorocarbons (CFCs) have no natural source; they are produced entirely by human activity – they have historically been used widely as refrigerants in air conditioners, refrigerators, freezers, and heat pumps. Chlorofluorocarbons are found in some foam plastics and used in some electronics manufacturing. Even though the production of chlorofluorocarbons has been vastly reduced, these compounds remain in the atmosphere for many years.

Nitrous oxide (N_2O) is a naturally occurring greenhouse gas, which has increased significantly in recent years due to human activity. Nitrous oxide is emitted from coal-burning power plants and can be released from the breakdown of chemical fertilizers in the soil.

Ozone (O_3) is also a greenhouse gas – it is important not to confuse the presence of the ozone in the stratosphere The ozone layer (sometime referred to as the ozone shield) is a region of the atmosphere that absorbs most of the ultraviolet radiation from the Sun. It contains high concentrations of ozone in relation to other parts of the atmosphere, although still small in relation to other gases in the stratosphere. The ozone layer is mainly found in the lower portion of the stratosphere, from approximately 12 to 19miles above Earth, although its thickness varies seasonally and geographically. In the troposphere, ozone can be a major component of urban smog – leading to damaging crops and aggravating respiratory problems as well as enhancing the greenhouse effect. The concentrations of these greenhouse gases are increasing (although chlorofluorocarbons are being largely eliminated and their concentrations have begun to decrease in the lower atmosphere). However, greenhouse gas emissions are not uniformly distributed globally – the majority of the emissions come from the more developed countries, where power generation, power consumption, and living standards are highest.

Conclusions

Climate change is inevitable. It is already happening as a result of the current interglacial period. Contributing to this change are (1) natural effects, which include the Earth in an interglacial period and (2) anthropogenic effects, which include the release of non-indigenous gases into the atmospheres. However, the exact contribution of ach to global climate change is unknown and the blame can only be partially laid on the shoulders of interglacial period and somewhat less on anthropogenic effects.

Although evidence for a significant fundamental climatic change is substantial, but – and perhaps more interestingly – the specific reasons for this change are not fully understood [18]. Although reasonably complete global records of surface temperature are available beginning from the mid-late 19th century – the time period after the Little Ice Age when warming was occurring. In the late decades of the 20th Century, the term global warming was in vogue and substantial government funding was available for research in this area. Within the recent decades, the cause of global cooling has been diminished and the term global warming took over. But this term did not fit the prevalent weather patterns and it is now the cause of global climate change – a more convenient umbrella-like catch-all for any changes (warming or cooling) that are the result of cyclic weather patterns.

In reality, the climate of the Earth can be affected by natural factors that are external to the climate system, such as changes in volcanic activity, solar output, and the variance of the orbit of the Earth around the Sun. Of these, the two factors relevant on timescales of contemporary climate change are changes in volcanic activity and changes in solar radiation. In terms of the energy balance of the Earth, these factors primarily influence the amount of incoming energy. Volcanic eruptions are episodic and have relatively short-term effects on climate.

A crucial feature of the climate system is that the energy of the Sun is not distributed uniformly, but rather is most intense at the equator and weakest at the poles. This non-uniform energy distribution leads

to temperature differences, which the atmosphere and ocean act to reduce by transporting heat from the warm tropics to the cold Polar Regions. This non-uniform heating and the resulting heat transport give rise to ocean currents, atmospheric circulation, evaporation, and precipitation that we ultimately experience as weather.

Since there is little or nothing that can be done about climate change because of the current interglacial period when warming will occur and because there is currently no major alternative to fossil fuels, politicians and other leaders, who clearly know better, feel compelled to deny it. For exactly the same reasons politicians' do not acknowledge the needs for preparing for peak energy – perhaps it is too far into the future that peak energy will occur and for many politicians look to the future means looking to the next election.

Currently, in the context of climate change, there needs to be a lesser reliance on emotion and more reliance on hard accurate and reliably unbiased science [24-29]. On the other hand, publicly singling out specific researchers on any side of the discussion based on perspectives that they have expressed sends a very dangerous message to all researchers [30,31].

Climate change is more a natural hazard and arises as part of the evolution of the Earth and the idea that there can be a one-size-fits-all global solution to address future climate change fails to deal with the real and major issue of climate and climate-related issues. There should be planning (rather than responding to the panic-laden issue related to carbon dioxide) as to the means by which future generations will deal with the effects of an interglacial period on the Earth. There is a need to uphold the principles of fair-minded examination of the evidence and allow open debate [32].

In fact, the current information for global climate change points to global warming/climate change being influenced by the sum of all effects with no one effect (such the anthropogenic effect) being the major contributor from a multi-component group of effects.

To combat the emotion of the moment and future emotions, it is necessary to gather opinions from independent, nongovernment organizations and scientists who are free of financial and political conflicts of interest – too often ideological or economic agendas limit the options [27,33]. Climate change, whether anthropogenic in its origin or, is a global phenomenon but it must be recognized that anthropogenic causes of climate change are only one small part of a much wider climate hazard – the dangerous natural weather and climatic events that Mother Nature periodically invokes will always be present [15,16,34-42].

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