



Global Warming and Global Change: Facts and Myths

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Abstract

The phenomenon of global warming taking place today is widely believed to be a consequence of increased anthropogenic CO₂ rising in the atmosphere. In reality, the greenhouse gas effect is more complex and has many uncertainties that still don't allow us to create a verisimilar scenario of future changes. Glacier melting is a fact, but commonly presented assessments of current melting intensity is obviously over-estimated due to the use of selective data. In addition, current glacier dynamics are still poorly understood. In the deserts of Central Asia, the climate has become less arid and the largest rivers demonstrate their discharge stability, lakes and seas haven't shown a progressive decrease in their levels. Any changes in interactions between the atmosphere, oceans and areas of glaciations depend mostly on astronomic factors, and mankind, clearly, hasn't yet created enough power to break these global cyclical and natural processes.

Keywords

Greenhouse gas effect, Global warming, Global change, Glaciations

Introduction

It had been thought that since the Little Ice Age (25,000 years ago), many glaciated areas on Earth have demonstrated a decline, especially noticeable since the late 19th century as each of the past three decades has been successively warmer at the Earth's surface than all previous decades, leading to the first decade of the 21st century being the warmest [1]. The temperatures globally have increased by 0.85°C (0.65 to 1.06°C) over the period 1880-2012 [1,2]. The thesis that the main cause of this warming was due to an increase in the concentration of mostly anthropogenic CO₂ (contributing 80% of the greenhouse gas effect) in the atmosphere became the axiom for many reporters [1,3-5]. The argument is that people fire so much oil, coal and gas for their economic development that atmospheric concentrations of anthropogenic CO₂ have increased by an additional 25 billion tons per year, reaching 370 parts per million [5]. Since people do not want to decrease industrial development - and instead continue to intensify it, the future will lead to even higher CO₂ concentrations [5,6]. Temperatures are projected to rise globally resulting in more melting of glaciers, with up to a quarter of the global mass of mountain glaciers disappearing by 2050 and up to a half possibly lost by 2100 [7]. The ocean level has risen by 0.19 m during the period 1901-2010, with an increasing mean rate to 3.2 mm yr⁻¹ between 1993-2010 compared to mean rate 1.7 mm yr⁻¹ between 1901-2010 [1]. So, ocean levels will continue to rise by up to 50 cm, because melting mountain glaciers provide the major water contribution to ocean levels [7,8].

This model of global warming is supported by many scientists, national and international organizations, media and the public from

all over the World. In this report, we'll try to consider the phenomena of the greenhouse gas effect, glacier melting and current trends and model scenarios of climate change, citing alternative explanations for these processes. And we'll take the region of Central Asia as the main focus for our consideration.

Results and Discussion

Greenhouse gas effect

Some atmospheric gases (mostly CO₂), together with water vapor, have a highly reflective quality and function much like a blanket: when the Earth's surface reflects sunlight away from the ground surface, these gases prevent the light and heat from escaping Earth's atmosphere and instead return them back to Earth. This effect is constantly occurring and is called the greenhouse gas effect. It increases with rising CO₂ concentrations in the atmosphere. When CO₂ concentrations are low, the temperatures are low too, and when CO₂ concentrations are high, temperatures are higher [4]. This is an excellent and clear model, but the real processes are more complex and divergent. Rising amounts of CO₂ and other greenhouse gases, especially sulfur-based aerosols, also lead to a decrease in atmospheric transparency which results in less sunlight penetrating through the atmosphere and ultimately less light and heat reaching the ground's surface. This effect has been witnessed after powerful volcanic eruptions have abruptly propelled sulfur aerosols and volcanic ash high into the atmosphere, considerably limiting atmospheric transparency; rather than observing warming, a distinctive cooling of the climate occurred, though for a relatively short period of time. Furthermore, burning of

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hydrocarbons (oil, coal, gas) not only produces CO₂, but also the same amounts of water (C₆H₁₂O₆ + O₂ → 6CO₂ + 6H₂O). In other words, by burning hydrocarbons we generally increase the amount of water in atmospheric circulation. Indeed, the last IPCC reports published [1] have demonstrated clearly the consequences of this process and have indicated an increase in tropospheric air humidity since the 1970s. The rising air moisture increases the greenhouse effect on one hand and forms more clouds on the other that cause a cooling effect: clouds reflect great amounts of sunlight, protecting the Earth surface from heating. So, the fluctuating effects of greenhouse gases are so complex and uncertain that it is very difficult to predict into the future if the Earth will even experience a warming or cooling atmosphere with further rising CO₂ levels [9].

In addition, by burning hydrocarbons we broke the existence balance between the processes of photosynthesis and the decomposition of the biomass. According to the Le Chatelier's Principle, our interference would lead to the strengthening of reverse reactions or to the intensification of the photosynthesis processes (6CO₂ + 6H₂O → C₆H₁₂O₆ + O₂). And in reality, it has been found that increasing CO₂ concentrations in the air are accompanied by intensification of its absorption by plants and oceans: greater amounts of CO₂ are absorbed by the oceans and only a third stays in the atmosphere. In arid regions, several modeling studies [10] demonstrated that an increase in CO₂ concentration led to significant increases in vegetation productivity, and in turn to changes in runoff, the precipitation regime, and air circulation [11]. Recent reports with a high confidence level have shown an increase in tropospheric air humidity since the 1970s, an increase in the level of precipitation in the Northern Hemisphere, especially after 1951, and more intensive air circulation [1]. In other words, vegetation has a distinct role in the exchange of energy, moisture, and carbon between the soil and atmosphere. The arid environments of the Central Asian deserts currently store between 7.0 and 9.0 Gt of organic carbon in the top 50 cm of soils. This is 3 or 4 times lower than during the Holocene Climatic Optimum, when there was a warmer global climate and richer vegetation. That means that an increase in CO₂ concentrations trigger more intensive CO₂ absorption and involvement in the photosynthesis processes, resulting in the inhibition of this gas accumulating in the atmosphere. These processes are still poorly understood and are difficult to predict, and so far, current climate models don't take these processes into consideration at all [11,12]. Nevertheless, the tendency to drought or dryness is currently absent in Asia and likely globally since of the 20th century [1].

During the Holocene Epoch, the climate has changed at least four times during the last 420 thousand years, when periods of glaciations with concentrations of atmospheric CO₂ at 180-120 parts per million, alternated with relatively warm, dry periods with concentrations of CO₂ at 280-320 parts per million [9]. The last time the Polar Regions were significantly warmer than the present time was about 125,000 years ago, when the average polar temperatures were 3-5°C higher [8]. Obviously, the influences of mankind are not related to these events. The periodic oscillations in the Earth's orbit and axial tilt relative to the sun [13], produced climate changes through the late Pleistocene and resulted in multiple shifts from hyper-arid deserts to sub-humid shrub lands [12,14].

During the Last Glacial Maximum (about 21,000 BP), the severe arid period, when annual rainfall was lower (by 100-150 mm) in northern and central Kazakhstan [15] than now, was followed by an increase in humidity at the beginning of the Holocene. In that period, the dry steppes were replaced by mesophytic forest-steppe vegetation with a maximum increase of arborescent species [12]. Furthermore, both a Big and Small Holocene Climatic Optimum were found globally from 8 to 4000 BP and 1.0-0.8 thousand years ago; the Big Optimum was warmer by 1.2°C compared to now and precipitation increased in many desert regions of the World [14,16]. Such climatic conditions favored the development of sub-humid steppes on what

is currently the desert of the Usturt Plateau [12]. During the Small Holocene Optimum, Normans penetrated into Greenland due to the low ice coverage of the Northern Atlantic, and in middle England, grapes were a common agricultural plant. By comparison, during the small glaciations period of 1645-1715, England experienced exceptionally bad harvests, terrible starvation and extreme social conflicts. This phenomenon was connected to the weakening of the sun's radiation by 0.2% and even 1% for the ultraviolet spectrum [9].

As everyone knows, the sun actively impacts Earth's climate. Apart from 11 and 22 year-cycles, there is also a 200 year-cycle that triggered the cold periods in England during the 13th, 15th, 17th and 19th centuries. A.V. Shnitnikov also found an 1850-year cycle, during which short, cool, wet periods alternated with long, warm, dry periods. This cycle is connected with disturbances in the hydrosphere and lithosphere created by the summation of flow-creating forces from the moon and sun when they become aligned - in a straight line - with the Earth. The last time this phenomenon occurred was during the early 15th century, and before that in the 4th century BC. One of the consequences of this alignment was the reinforcement of the vertical water exchange and a great lifting of the cold waters at depth to the ocean surface, which strengthened atmospheric circulation and moistened continents, advanced glaciers and increased the ice cover of seas, resulting in some cooling of the climate. Warming returned to the Earth with the weakening of these flow forces as well as the processes connected to them [9]. Indeed, the global ocean temperature rose over the period 1961 to 2003, while since 2003, it has been cooling [17].

So, climatic changes are the result of a complex overlay of alternating cycles of warmth and cold of various amplitudes and durations depending on many natural causes, but mostly from astronomic factors resulting from the interaction between the Earth, Moon and Sun. As to supporters of exclusively anthropogenic causes for the Earth's current climatic changes, they don't have enough solid arguments for their point of view. First, during the Big Holocene Optimum (8-5 thousand years ago), when climatic processes were exclusively natural, the temperature of the atmosphere was even warmer than it is today. Second, if the current climatic changes are the consequence of human-induced processes over the last 100 years, why have considerable fluctuations and a warming climate been noted several times during the last 10 thousand years, when such human impacts were negligible? Third, if anthropogenic factors triggered the current rising temperatures, why are alternating periods of warm and cold weather still detected? And fourth, the energy of the Earth's climate system is 5000 times more powerful than the total energy mankind can produce [9].

It is clear from this short review on the greenhouse gas effect that these processes are multifaceted and conflicting, and predictions of future scenarios that come close to real climatic changes is still problematic because of so many uncertainties. Therefore, even the authors in IPCC reports write cautiously about climate trends and avoid precise predictions of future processes [1]. And the existing, well-known models predicting Earth's overheating are more speculation by the authors than any real scenario of future transformations.

Glacier dynamics

The cryosphere, which includes snow, river and lake ice, sea ice, glaciers and frozen ground, plays a unique role in the Earth's systems of climate, water cycles, surface gas exchanges and sea level, and therefore has fundamental control on the physical, biological and social environment over a large part of the World's surface [1]. We are living in an inter-glaciation period, where shrinking glaciers are being found all over the Earth. This phenomenon is believed by many as a result of current global increases in temperatures [7]. Glaciologists have made numerous investigations all over the World, and they believe that many glaciers have demonstrated processes that

have resulted in very conspicuous declines [1]. For example, in the mountains of Tien Shan and Dzhungarian Alatau, glacier shrinkage up to 38-40% was found to have occurred over the last 40-45 years [18]. And many believe that glaciers will continue to shrink in the future even without further temperature increases [1]. However, a more detailed consideration of this trend along with other reports reveals a more complex situation.

First, the most dramatic glacier shrinkage is seen in the lower-elevation and peripheral mountain ranges, especially near densely populated lowlands [19], while glaciers of inner, high-elevation ranges show considerably slower decreases (3-5%); the melting intensity varies widely depending on debris coverage, glacier size, their aspect, slope inclination and landscape ruggedness along with many other environmental factors [20]. However, for public reporting on the issue, the most striking observations were cited without any qualifying details. Second, to find more general trends, researchers consider the longest periods of time as possible by comparing glacier sizes measured during the 1950s to current sizes, with the resulting differences represented as glacier melt during that period [21]. However, for acquiring data in the 1950s, glaciers were measured by using only aerial pictures, since that was what was available at that time. Unfortunately, aerial photographs alone make it impossible to distinguish snow cover from ice. These data, though, were then compared with data from the 2000s that used modern satellite imagery, where researchers can quite accurately measure the size of a glacier, excluding its snow cover [22]. So, initial glacier sizes were over-estimated in the past, which has resulted in more striking differences to the present. These differences, then, are now being interpreted as melting intensity. And at this point in time, no one can credibly estimate what part of these data were mistakes in methodology and which represent real glacier ice melt [20].

Third, not all glaciers are declining even with the current climate conditions. From the 1950s to the 1980s, 73% of glaciers were retreating, 15% were advancing and 12% were stable [7]. In Asia, stable and advancing glaciers are observed everywhere in the mountain ranges of Karakorum, Pamir, and Tien Shan [23-26]. For example, in Karakorum, the North Gasherbrum Glacier showed especially fast expansion by advancing 400 m per year (2007). These kinds of glaciers are experiencing what is called a surging or pulsation phenomenon, when they advance, stabilize and retreat, following a cycle that repeats over many years [27]. From here, it is possible to suggest that glaciers won't disappear completely, but rather will change their size and location according to fluctuating environmental conditions. They find a new stability until the next changes of the Earth's position, and consequently changes in atmospheric circulation [13].

Fourth, glaciers grow not because of dropping temperatures, but because of increasing precipitation. So, the current melting of glaciers is not a result of global temperature rises, but rather a shift in the distribution of precipitation. What's more, throughout the mountains of Central Asia, the air temperatures during the melting season (July-August) have increased only slightly over the past decades, while the mean annual precipitation rate has decreased significantly at high altitudes in the inner mountain ranges [20]. Quite obviously, this is the main reason for the retreat of these glaciers.

Fifth, most of the recent investigations of glacier dynamics have used satellite images to estimate melting intensity [1]. This is an incredible monitoring method that allows easy detection of changes in any glacier in the World. However, no one really tries to understand the processes being observed. Generally authors bring two standard explanations: global warming, if a glacier is retreating, and glacier pulsation, if it is advancing. But to understand the real nature of trends, it is necessary to invest many years in field work for the laborious task of collecting numerous data over time: measuring glacier coverage and thickness, snow cover and precipitation regime, and many other field observations. It is vital that meteorological data

be collected for accumulation and melting zones of glaciers to be able to predict a glacier's dynamics, otherwise our predictions will be speculative at best, rather than a valid, fact-based result. However, there are very few meteorological stations in glacier zones, and in Central Asia, many stations have stopped functioning since the collapse of the USSR: the number of snow-gauging stations in the river basins of Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan, for example, has decreased from 257 in 1985 to 30 in 1995 [12].

It is clear from this short review of glacier dynamics that current glacier processes are not greatly understood, and some currently well-known explanations for glacier changes are not connected to reality at all. To reveal real trends, apart from estimations from satellite images, it is necessary to invest in many years of on-the-ground field work. If we don't do this, then we can't create real scenarios for future processes. However, since this is a very expensive way to gather data and it takes a long time, it seems it is easier to use already prepared, widely-known explanations and present those to the public as truthful. This is exactly what is happening in today's reality.

Climate change in the central asia deserts

The IPCC (2000) [28] has predicted that climate warming will continue to increase by 1-2°C per century for Central Asia, and a series of meteorological data show a steady increase in annual and winter temperatures in Central Asia. However, there are inconsistencies in this data. Only a few meteorological stations have collected data for longer than a century, while most data covers just half that time; and at least within Central Asia, many data-gathering stations have stopped functioning with the end of the Soviet era in the early 1990s. Furthermore, most stations are located in oases, where climatic trends often depend on irrigation intensity and other artificial factors, while only discrete meteorological stations collect data from internal regions of deserts. These local and limited data, then, are used to typify all Central Asian deserts and to give conclusions for the entire, vast arid zone, though many deserts often have diverse features. Therefore, some models project greater aridity in the future and some lower due to the uncertainty and lack of consistent data in climate modeling data [12].

According to analogues with former scenarios (Holocene Optimum), the Central Asian deserts will become moister as a result of global warming, because they are located north of 30° latitude and are expected to benefit from the southward shift and probable intensification of the westerly cyclones, which will be similar to climate conditions during the early Holocene. Data have been collected in several parts of Central Asia that seem to indicate that precipitation actually has increased at the end of the 20th century [12]. Compared to aridity levels noted from 1982-1990, a decrease in aridity was detected in Kazakhstan from 1991-2000 and a southward shift was found in the northern boundary of the desert zone in Central Asia [29]. In addition, an increase in precipitation was seen in Uzbekistan and Turkmenistan [30]. Explanations of precipitation changes in the Central Asian deserts consist of shifting westerly cyclonic circulation, depending on the position of the Siberian high anticyclone area [12].

Shiklomanov [31] showed that an increase in mean annual temperature by 1-2°C and a 10% decrease in precipitation could reduce annual river runoff by up to 40-70% for river basins in areas with a water deficit. Dramatic scenarios have already been created of water stress due to changes in river discharge all over the World [32]. The shoaling of rivers in Eurasia is an old topic, beginning in the 19th century. And Berg [33] showed that only fluctuations of river runoff existed during historic times and these changes depended on temporal climatic deviation, while the progressive drying of rivers was not observed. At the present time, the biggest Central Asian Rivers, the Amu-Darya and Sir-Darya, which depend ultimately on the rhythm of the glaciations in the Pamir and Tien Shan mountains, demonstrate their runoff stability with only small fluctuations during

the last decades [34]. The Aral Sea repeated major recessions and advances during the past 10,000 years, and fluctuations in its surface level were at least 20 m and possibly even more than 40 m; the Aral's present fate is a consequence of local human over-use of the waters of the Amu-Darya and Sir-Darya rivers. The level of the Caspian Sea depends entirely on runoff from the Volga and Ural River basins and the climate of European Russia [12]. During the Holocene, the Caspian Sea had striking changes in its level from -9 m asl up to -34 m asl, while current fluctuations are only between -25 m asl and -29 m asl [35].

In general, the amount of water on our planet doesn't change; we just observe shifts in its distribution. At any given time, it is possible that the amounts of precipitation fall less on land and more in the oceans, or precipitation is observed more in one hemisphere and less in another, but the same total amount of moisture will be available on Earth. The fluctuations of precipitation around the World are the result of the changing distribution of cyclones and anticyclones above land and oceans occurring over different years. If we assume that cyclones are concentrated in oceans and anticyclones above land, then oceans would have cloudy weather with little evaporation and the land would have clear weather without rain, and as a result less precipitation would fall to the Earth. On the other hand, if anticyclones were prevalent in the oceans and cyclones on land, a great amount of evaporation would come from both and as a result there would be an over-abundance of precipitation on the Earth. Thus atmospheric circulation shifts the distribution of cyclones and anticyclones over the Earth from one year to the next, provoking changes in precipitation [33]. Recent data does not refute this idea yet, and currently, nobody can say it is wrong. At present, it is thought that precipitation levels have increased in the Northern Hemisphere, though there is a low confidence for data up to 1951 and, correspondingly, for consistency of this trend for longer than 60-70 years; while for Southern Hemisphere, the data are contradictory and uncertain at best [1].

Interactions between the oceans and atmosphere create varying circulation patterns that distribute warmth and precipitation on the Earth, which leads to the cyclic advancing and retreating of glaciers that have been observed from the early Holocene up to the present. During this period, the amounts of CO₂ in the atmosphere and the levels of precipitation have changed considerably around the world. This is a natural cyclical process and human activity has contributed just a little warmer and wetter climate than there would have been if it were purely natural. A new period of glaciations will come when the "pendulum" of natural processes reaches its maximal deflection and starts its backward motion. This cycle can only be transformed with changes to the orientation and orbit of the Earth, which has happened every 40,700 years (ecliptic plane) and 92,000 years (eccentricity of Earth's orbit) [36]. People do not have the capability to change this planetary cycle - only to add a few small disturbances to its effects.

Conclusions

As stated previously, climate change is caused through a very complex process of interactive factors, many of which are yet to be fully studied or understood. To follow current arguments that say human beings are a major contributor to climate change and, thus global warming, is impulsive at best and, within the scheme of climate change processes, lacks definitive data to support this position. It is known, however, that:

1. People supply additional amounts of CO₂ into the atmosphere, but these amounts are still relatively small compared to what is produced through natural processes.
2. Increased CO₂ in the atmosphere has both warming and cooling effects across the world, thus making future climate changes still difficult to predict with any accuracy.

3. It is true that many glaciers are currently in decline, but there are also other glaciers that are either stable or even growing under the same atmospheric conditions, and nobody can explain why these glaciers aren't also melting.

4. The current climate warming that is being observed around the world is a part of a natural cycle that is the result of the interactions between the Earth, Moon and Sun and mankind still hasn't developed enough power for impacting this cycle.

Even though it has been proven that human beings have made contributed to concentrations of CO₂ in the atmosphere, this can only be considered as one factor in the very complex climate processes observed around the world. Compared to the overwhelming power of natural phenomena, many of which are still little understood, anthropogenic CO₂ increases are not by themselves dominant enough to cause global warming. More research needs to be applied over a long period of time in many different disciplines in order to better understand how all the components affecting climate change interact. One point that has been clearly demonstrated, however, at least in the more developed countries, is that members of the human species do have enough power to exterminate themselves through mindlessly polluting their own habitat.

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