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Asymmetric Response to Global Warming

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Abstract

The study aims to develop critical thinking in the context of global warming, analyze existing approaches to solving this problem, and propose alternative methods of combating climate change.

Materials and methods: Scientific literature was analyzed, including IPCC reports and studies on atmospheric physics and climatology. Theoretical research methods included comparative analysis, mathematical calculations, and a systems approach to assessing climate

change. Calculations were made on the efficiency of mirrors in reflecting solar energy with an area ratio of 1:10,000.

Results: It is revealed that the existing theory about the dominant influence of CO_2 on global warming requires critical rethinking. It is established that the content of water vapor in the atmosphere exceeds the content of CO_2 by 100 times. An asymmetric method of combating global warming through mirrors is proposed, demonstrating high potential efficiency. A comparative analysis of three main approaches to solving the problem is carried out: "space umbrella", installation of distributed mirrors, and achieving "carbon neutrality".

Conclusions: A comprehensive approach to solving the problem of global warming is needed, including traditional methods of combating CO_2 emissions and innovative solutions. Mirrors are a promising, cost-effective, and reversible method of fighting global warming. Developing critical thinking is key in finding practical solutions to the climate crisis.

Keywords: critical thinking, global warming, greenhouse gases, asymmetric solutions, solar energy reflection, climate change, carbon neutrality.

Introduction

The development of critical thinking is vital. In an era of growing human power and total access to both the use and creation of information, there must be people who can resist the mass delusions that can delay progress and call into question humanity's very existence.

The history of humankind is full of examples of mass delusions that led to grave consequences. Here are a few cases: One such misconception was the witch hunts in Europe and America in the 16th and 17th centuries, which were associated with the belief in witchcraft. Mass hysteria led to trials and executions of tens of thousands of people. The leading causes were ingrained religious dogmas, fear of the unknown, and social instability. The consequences were executions, torture, and social isolation of those accused of witchcraft, as well as the destruction of social ties and an atmosphere of fear [1].

Another example is eugenics and Nazi ideology in the 20th century, which used pseudoscientific ideas of racial purity as the basis for the Holocaust policy. The causes of this phenomenon were ideas of genetic superiority. The result was the genocide of millions of

Jews, Roma, disabled people, and other “undesirable” groups [2]. These cases show how mass delusions based on bias and unproven theories can lead to humanitarian disasters.

Malthusian theory and population fears, common in the 19th and 20th centuries, were associated with economist Thomas Malthus's hypothesis that population grows exponentially while resources grow arithmetically. This led to global fears of mass starvation [3,4,5]. These fears were caused by a lack of understanding of technological progress and its impact on agriculture, as well as a simplistic approach to demographic trends. As a result, some countries tightened birth control policies.

In the 18th century, there was a European prejudice against the potato, which was perceived as a "cursed" plant due to its association with disease and unusual appearance [6]. Mistrust of the new product from America and religious prejudices and superstitions were the main reasons for this perception. This led to a worsening of the food situation in Europe and a delay in introducing the potato as an important food source until later.

From the 1920s to the 1950s, the Red Terror took place in the USSR, characterized by mass repressions and executions of "enemies of the people". Political propaganda and fear of counterrevolution were the leading causes of these events. The consequences were the deaths of millions of people and the stagnation of scientific and social development [7].

The modern world is experiencing a rise in hyper-consumption culture. Marketing and media influence that shape the image of success through the possession of material goods, the availability of mass-produced cheap goods, and the expansion of credit opportunities are the main reasons for this phenomenon [8]. This phenomenon can lead to an exacerbation of social inequality and environmental disasters. On the other hand, with increasing awareness of inequality and human rights issues, the popularity of ethical consumption is growing. People are increasingly choosing goods produced in compliance with ethical standards, such as using non-exploitative labor, animal welfare, and support for local producers.

Our brains form answers to many vital questions based not on critical thinking but on emotions or life experiences that are somehow related to these questions. Sometimes, this leads to misconceptions that prevent us from responding adequately to essential problems.

For example, if you ask people the question - "What percentage of the heat supplied to the Earth by the Sun returns to space?", most of them will assume different options, mainly in the 40-80% range. Logic is replaced by apparent life experience: - The Sun shines only during the day, while the Earth and air are heated. Therefore, some percentage of the heat remains on the Earth.

Even artificial intelligence answers this question in the same spirit: About 30% of solar radiation reaching Earth is reflected back into space. This process is known as Earth's albedo, which involves light reflection from the planet's surface, clouds, and atmosphere. The atmosphere, oceans, and land absorb the remaining 70% of solar energy, which warms the Earth and maintains climate conditions.

The climate system is always close to energy balance. The total energy does not fluctuate significantly over time because Earth's radiation is emitted into space at about the same rate that solar energy is absorbed. Being in almost exact energy balance with the universe, Earth can have a relatively familiar climate tomorrow and a century from now [9].

So the correct answer to this question is: To maintain heat balance, 100% of the incoming heat must be radiated into space. Otherwise, the Earth will heat up infinitely.

We will simplify the ongoing climate processes as much as possible, understanding that these attempts will cause a wave of criticism (and most likely complete ignoring) from academic scientists. The lion's share of their research aims to identify the connection between global warming and greenhouse gas emissions. Hence the "Carbon-Free Mainstream". Other factors are considered insignificant.

The aim of the work is as follows.

1. Development of critical thinking in analyzing global warming and analysis of existing approaches to solving this problem.

2. Demonstrate the importance of critical thinking when addressing complex global issues using historical examples of mass misconceptions.

3. Suggest an alternative view of the problem of global warming that differs from the generally accepted theory about the influence of carbon dioxide.

4. Introduce and analyze three main approaches to combating global warming, emphasizing using mirrors to reflect solar energy as an asymmetric response to the problem.

Research problems that correspond to the purpose of the work.

1. How do you develop critical thinking to analyze global problems? Studying historical examples of mass delusions, analyzing the consequences of uncritical acceptance of generally accepted theories, and considering alternative points of view on international problems.

2. Why does the current theory of CO_2's influence on global warming require a critical rethink? Analysis of the role of water vapor as the main greenhouse gas. Study of the relationship between ocean warming and CO_2 emissions. Assessment of the impact of polar ice melting on global warming.

3. What are the alternative approaches to solving the problem of global warming? Comparative analysis of three main directions of combating global warming. Research into the efficiency of using mirrors to reflect solar energy. Evaluation of the asymmetry of different approaches to solving the problem.

4. How to ensure a balance between critical thinking and scientific validity when considering climate issues? Analyzing existing scientific data. Considering alternative hypotheses and assessing the practical feasibility of proposed solutions.

Based on the identified research problems, the following hypotheses can be formulated:

Main hypothesis.

Developing critical thinking about global warming will help find more effective and comprehensive solutions to the climate crisis.

Auxiliary hypotheses.

1. Studying historical examples of mass delusions will enhance the ability to critically evaluate modern theories and approaches to solving global problems.

2. The current theory about the dominant influence of CO_2 on global warming may be incomplete or may not consider other important factors.

2.1. The role of water vapor may be more significant than is commonly believed.

2.2. Increased atmospheric CO_2 may be a consequence, rather than a cause, of warming.

2.3. The impact of polar ice melting may be underestimated.

3. Using mirrors to reflect solar energy is a more effective and less costly method of combating global warming than traditional approaches to achieve carbon neutrality.

4. A combined approach, including traditional CO_2 emission control methods and innovative solutions (such as using mirrors), could provide a more effective solution to the problem of global warming.

These hypotheses correspond to the stated research problems and are aimed at achieving the primary goal of the work - the development of critical thinking in the context of solving the problem of global warming.

Materials and methods.

Research materials.

1. Scientific literature. Historical studies on mass misconceptions. Scientific publications on climatology. IPCC (Intergovernmental Panel on Climate Change) reports. Research on atmospheric physics. Publications on the greenhouse effect theory.

2. Statistical data. Data on the content of CO_2 in the atmosphere. Global temperature indicators. Information on the melting of polar ice.

Research methods.

1. Theoretical methods. Analysis of scientific literature. Comparative study of various approaches to solving the problem of global warming. Critical analysis of existing theories. Systems approach to assessing climate change.

2. Mathematical methods. Calculations of the efficiency of using mirrors to reflect solar energy. Analysis of the ratio of the area of mirrors to the protected surface of the Earth (1:10000). Assessment of the Earth's heat balance.

3. Comparative method. Comparison of three main directions of combating global warming. Analysis of their effectiveness, cost, and reversibility.

4. Historical method. Analysis of historical examples of mass delusions. Study of the consequences of uncritical acceptance of theories.

5. Logical method. Construction of logical chains of cause-and-effect relationships. Formulation of conclusions based on data analysis.

6. Modeling method. Simplified modeling of climate processes. Assessment of the influence of various factors on global warming.

These research methods allow for a comprehensive approach to studying the problem and testing the hypotheses put forward and also contribute to the development of critical thinking in the analysis of global issues.

Young people are more open to critical perception and can "see the FOREST for the trees".

Once formed, the "greenhouse effect" concept strongly influences our consciousness. An analogy involuntarily arises between global warming (heating of the atmosphere and the Earth's surface) and a greenhouse in which a glass roof retains heat. At the same time, carbon dioxide is compared to the glass of a greenhouse. And since the greenhouse effect looks very impressive (the temperature in a greenhouse can increase by tens of degrees), greenhouse gases are also credited with such capabilities.

Let's try to understand the greenhouse effect more deeply. Neither the glass in the greenhouse nor the greenhouse gases in the atmosphere reflect all the thermal radiation from the Earth. Both glass and greenhouse gases first absorb the infrared rays from the Earth heated during the day, preventing them from immediately escaping into space. In this case, the glass and the gas molecules acquire energy - they heat up. At night, they emit the absorbed heat in infrared radiation without the influx of solar radiation. Since this re-radiation spreads in all directions, half of it is directed towards the Earth, the other half - into space. This is the

greenhouse effect common to greenhouse gases and glass. But the fact is that by giving greenhouse gases the same importance as glass, we did not take into account that most of the heat from the Earth heated by the Sun is removed by rising the heated air to the upper layers of the atmosphere or by transferring the heated air by winds to the polar regions. This mechanism worked for millions of years, maintaining the thermal balance on Earth.

It is clear that in a greenhouse, a glass roof prevents the removal of a hot air mass, creating an incomparably more significant effect than greenhouse gases.

The main factor in the dominance of the carbon theory of global warming was the identified connection between the increase in temperature and the growth of CO_2 content in the atmosphere, as well as the increase in anthropogenic carbon dioxide emissions.

At the same time, scientists are reluctant to discuss “inconvenient” facts.

1. First, the main greenhouse gas in the Earth's atmosphere is water vapor, which is a hundred times more abundant in the atmosphere than CO_2. The reason is that water vapor dynamics are complicated to study due to the constant exchange - steam-water-ice. While recognizing the role of water vapor in the greenhouse effect, we are still led astray by such statements: " Some people mistakenly believe that water vapor is the main cause of the Earth's current warming. However, an increase in water vapor does not *cause* global warming. On the contrary, it is its consequence. An increase in atmospheric water vapor intensifies the warming caused by other greenhouse gases" [10].

2. According to this logic, if a person's clothes are contaminated with gasoline and caught fire from smoking a cigarette, you should take the cigarette away from them and wait until the fire stops by eliminating its cause. Suggestions to immediately rip off the burning clothes and cover them with a blanket to limit access to air can be ignored since both the clothes and the oxygen in the air are not the cause of the fire but only intensify the burns caused by the cigarette.

3. Second: The oceans are the primary sink for carbon dioxide, but their capacity to hold carbon dioxide and water vapor is declining with warming. It is, therefore, possible that the increase in atmospheric CO_2 is a result of warming rather than the other way around. This thesis is supported by studies of events that occurred 55 million years ago when rising ocean temperatures led to the destabilization of methane hydrates on the ocean floor, which in turn released significant amounts of CO_2 and methane into the atmosphere [11].

4. But only one idea is imposed on society: by limiting anthropogenic CO_2 emissions, we will stop global warming!

5. Thirdly, the consequence of global warming is the accelerated melting of polar ice and a decrease in the reflectivity of our planet, which further stimulates warming [12].

This fact, although not ignored, is discussed without enthusiasm: "It would be nice if the melting of the ice stopped" and "a couple more decades of fighting carbon emissions and the ice will begin to recover".

This is a fatal mistake. Underestimating the Earth's albedo regulation may risk losing time to respond to the climate challenge adequately.

And now, it's time to turn on critical thinking.

Despite the impressive analogy of global warming with greenhouse heating, according to the IPCC, the rate of excess heat input to the Earth's surface during the industrial period of history has increased by "only" one W/m3 [13].

This figure was achieved over several decades, while on average, taking into account day and night and geographical latitude, solar energy of about 250 W/m3 constantly reaches the Earth’s surface.

The author's idea is as follows: If the removal of heat from the Earth by long-wave (infrared) radiation is hampered by greenhouse gases, then it must be removed in the form it was received, namely, by visible light.

For this purpose, it is proposed that the energy of sunlight be reflected using mirrors installed in the equatorial regions of land and ocean [14].

Simple calculations carried out by the author based on the IPCC findings on the rate of growth of heat input showed that 1 square meter of mirror is capable of stopping the rate of growth of excess heat entering 10,000 m2 of the Earth's surface.

Now, we propose to evaluate three main directions of the fight against global warming:

1. Close off from the Sun with a "space umbrella," spraying aerosols into near space or the atmosphere, from soot to carbon nanotubes or even diamond dust [15].

2. Install mirrors distributed on the surface of the Earth.

3. Strive to achieve "carbon neutrality".

The first method is symmetrical. The solar heat input will decrease proportionally to the area and opacity of the screen. Such projects are called geoengineering and are not recommended in IPCC reports due to their negative impact on vegetation and plant yields. The projects are costly and difficult to reverse.

The second method is positively asymmetric. The ratio of the area of the mirrors to the surface of the Earth protected from increasing global warming is 1 to 10,000. The project is relatively inexpensive and easily reversible if negative consequences are discovered.

The third way is negatively asymmetric. It is unknown when carbon neutrality will be achieved (or whether it will be achieved at all). How and when will positive climate change occur if the temperature continues to rise and the use of fossil fuels only increases? The project is long-term, with an uncertain future. The positive side of this project is that it aims to preserve nature.

The second and third methods do not contradict each other and can be carried out simultaneously. Think about it – maybe it's worth trying!

By encouraging critical thinking, we teach students what we believe to be correct, but at the same time, we encourage students to carefully examine the evidence and judge for themselves the correctness of our statements [16]. The climate issue is too important to ignore unpopular opinions.

We will verify the hypotheses, although it should be noted that the article itself does not contain direct statistical evidence.

Main hypothesis.

H_0: Developing critical thinking does not affect the effectiveness of solving the problem of global warming.

H_1: Developing critical thinking increases the effectiveness of solutions to the problem of global warming.

Verification. The article lacks direct statistical evidence to verify this hypothesis. The author relies on historical examples and logical argumentation.

The CO_2 hypothesis.

H_0: CO_2 is the leading cause of global warming.

H_1: Other significant factors influence global warming.

Verification. The author cites IPCC data on the increase in heat gain by 1 W/m^3. Compare this with the total solar energy gain of 250 W/m^3. Points to the role of water vapor (concentration 100 times higher than CO_2). Cites Zachos et al. (2003) on the increase in ocean temperature and the release of CO_2.

Hypothesis on the effectiveness of mirrors.

H_0: Using mirrors is no more effective than traditional methods

H_1: Using mirrors is more effective

Verification. The author presents calculations showing a ratio of 1:10,000 (1 m^2 of mirror can stop the growth of excess heat on 10,000 m^2 of the Earth's surface). Based on the publication Zhukov A., Gushcha S. (2020). Stop Global Warming.

Hypothesis of a combined approach.

H_0: The combined approach does not provide a synergistic effect

H_1: A combined approach is more effective

Verification. There is no statistical evidence for this hypothesis in the article. The author presents only logical argumentation.

Conclusions. The article does not contain sufficient statistical evidence to verify the hypotheses fully. The author relies mainly on Data from IPCC reports. Scientific publications. Theoretical calculations. Logical argumentation.

It is necessary to complete statistical verification.

Collect empirical data on the effectiveness of various methods of combating global warming and the impact of multiple factors on temperature. The effectiveness of the proposed solutions.

Conduct statistical analyses:

Significance tests. Regression analysis. Analysis of variance.

Correlation tests.

Conduct experimental studies:

Efficiency of mirrors. Effects of various factors on global warming. Efficiency of a combined approach.

Conclusions:

1. Critical thinking on global warming is key to finding practical solutions to the climate crisis, as demonstrated by historical examples of mass delusions and their consequences.

2. Given the following factors, the current theory of the dominant influence of CO_2 on global warming requires rethinking. The water vapor content in the atmosphere exceeds the CO_2 content by 100 times. Rising ocean temperatures may be a cause, not a consequence, of

the increase in atmospheric CO_2 concentration. IPCC data show excess heat gain is only 1 W/m³ with a total solar energy gain of about 250 W/m³.

3. The proposed asymmetric method of combating global warming through mirrors demonstrates high potential efficiency. The ratio of the mirror area to the protected surface is 1:10000. The technique is reversible and relatively inexpensive. It does not require global changes in industry and the economy.

4. A comparative analysis of three main approaches to solving the problem of global warming showed that the "space umbrella" is a symmetrical but expensive and difficult-to-reverse solution. The installation of distributed mirrors is a positively asymmetrical solution. Achieving "carbon neutrality" is a negatively asymmetrical solution with an uncertain prospect.

5. A comprehensive approach to solving the problem of global warming is needed, including traditional methods of combating CO_2 emissions and innovative solutions using mirrors.

6. Current methods of studying climate change may be limited by the dominant theory of greenhouse gas influence, highlighting the need for a broader scientific approach to learning the problem.

7. Alternative approaches to solving the problem of global warming require further experimental research and statistical verification to confirm their effectiveness.

8. The development of critical thinking must be accompanied by a careful study of scientific evidence and independent evaluation of various theories and approaches to solving global problems.

9. Further research is needed into alternative methods of combating global warming, particularly asymmetric solutions that may offer more practical and cost-effective approaches.

10. It is crucial to encourage an interdisciplinary approach to the study of climate change, combining knowledge from physics, climatology, economics, and other fields of science to find optimal solutions to global warming.

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