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GLOBAL CLIMATE CHANGE AND ITS CONSEQUENCES

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Abstract
The article examines the pressing issues of global climate change, one of the most critical challenges facing the global community today. It substantiates that climate change is not only a representation of large-scale natural hazards but also a catalyst for various transformations in national economic sectors. The study analyzes the process, forecast, and consequences of climate change, highlighting the risks of disasters in both technological and social spheres as a result of global warming.

Keywords: Global challenges, climate, weather, climatic factors, climate periodicity, astronomical factor, genetic climate classification, long-wave infrared radiation, "greenhouse effect," "emission trading" (carbon quota trading).

Introduction

The issue of climate change has been recognized by the United Nations (UN) as one of the most pressing global challenges. The global nature of this problem lies in the fact that the consequences of climate change are being felt across all countries and regions of the world. At the same time, every individual, to some extent, is responsible for the changes occurring on our planet. In a broader sense, global challenges arise due to disruptions in the relationship between nature and humans (society), making them inherently both natural and anthropogenic in origin.

Among the various factors essential for the sustainable development of society and a decent quality of life for humanity, climatic conditions hold particular significance. Even minor deviations from climatic norms can lead to serious challenges.

This issue is so vast in scale that its consequences are equally global, potentially hindering the sustainable development processes of nations. Therefore, the problem of climate change has been included in the **17 Sustainable Development Goals (SDGs)** adopted by the international community. Among these, **Goal 13** is specifically dedicated to **"Taking urgent action to combat climate change and its impacts."**

The term *climate* originates from the Greek verb **"κλίνω"**, deriving from **"κλίμα"**, which means **"slope"**—referring to the angle of inclination of the celestial sphere observed in a specific region, particularly the tilt of sunlight reaching the Earth's surface

at noon. This term was introduced into science by Greek astronomers and founders of mathematical geography, **Hipparchus and Hypsicles** (circa 160–125 BCE) [1].

Nowadays, due to drastic changes in climatic conditions, **desertification and soil salinization** are accelerating worldwide, leading to the **degradation of thousands of hectares of land** and worsening ecological conditions. A report by the **United Nations** highlights that **"land degradation reduces soil fertility, threatens food security, and exposes millions of people to poverty and hunger."**

This situation underscores the urgent need to enhance **digital systems for biodiversity monitoring** and develop **advanced environmental monitoring techniques**, requiring the expansion of research focused on these challenges.

Research Object and Methods

Climate refers to the long-term weather patterns characteristic of a specific location, which depend on the Earth's tilt relative to solar radiation. It is formed under the influence of **seasonal and geographical variations in weather conditions**, solar radiation, the properties of the Earth's surface, and the associated atmospheric circulation.

A clear understanding of the climate of a particular place can only be obtained through **long-term meteorological observations**, which help determine its unique climatic features in comparison to other regions. Climate is a result of **continuous natural processes** occurring in both the atmosphere and the active layer of the Earth's surface. The **differences in climate across various parts of the Earth** are due to variations in **climate-forming factors**, which are influenced by the **geographical conditions** of the region. The main geographical factors affecting climate include:

- **Latitude and altitude**
- **Proximity or distance from the sea**
- **Topography (orographic features)**
- **Vegetation cover characteristics**
- **Presence or absence of snow and ice**
- **Levels of atmospheric pollution**

These factors contribute to the formation of **different climatic conditions across latitudes**, shaping the unique climate patterns observed in various regions.

Research Results and Discussion

It is important to note that the relationship between the Sun and the Earth, as well as the factors influencing Earth's climate, have undergone changes throughout the history of the planet's development. Evidence supporting this includes the coal deposits found in Antarctica and the Svalbard Islands, as well as the recurring glaciation periods of the Quaternary period. Scientists also acknowledge the existence of cyclical changes in climatic processes.

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For instance, A.V. Shnitnikov identified periodic changes in natural humidity across the continents of the Northern Hemisphere over a span of 1,800 years. Each cycle consists of two phases:

1. A cool, humid, and mild climate phase lasting 300–500 years
2. A hot and dry climate phase lasting over 1,000 years

Between these two major climate phases, transitional periods of 100–300 years are observed (Jakulin, 1989). The study of past climatic changes falls under the field of paleoclimatology, with additional contributions from disciplines such as paleogeomorphology, paleobotany, and paleozoology. Within this context, geology plays a crucial role.

The current climate conditions dominating Earth's surface emerged primarily after the glaciation periods of the early, middle, and late Quaternary period. While the Sun remains the primary energy source for life on Earth, the atmosphere plays a significant role in climate formation. The composition and transformation of the atmosphere are closely linked to the evolution of organic life. As academician I.V. Vernadsky noted, the development of the organic world has directly influenced atmospheric composition.

The atmosphere acts as a protective "blanket" surrounding the Earth, preventing extreme heating and cooling. Without the atmosphere, life on Earth would not exist. Climatologists estimate that in the absence of carbon dioxide, the global temperature would decrease by 6°C, and without water vapor, the surface temperature would drop by 25°C (Ososkova et al., 2005, p. 5).

Scientists categorize the natural factors influencing climate formation into three groups:

1. Astronomical factors
2. Geographical factors
3. Circulatory factors

Regardless of classification, certain elements play a fundamental role in shaping Earth's climate. Among these, the primary factor is the amount of solar radiation and light energy reaching the Earth's surface. Other significant contributors include:

- The distribution of oceans and landmasses
- Geographical location and topography
- Reflection of solar radiation from the Earth's surface
- Atmospheric composition and circulation
- Ocean currents

Various approaches and classifications exist for grouping Earth's climates, reflecting the complexity and diversity of climatic conditions worldwide.

These include B.P.The genetic classification developed by Alisov in the 1930s is favored by many. In this classification, types of air masses that humkronize throughout the year or during hot and cold periods are taken as a basis. It classifies into 4 primary and 3 transitional climate mitacas. The main climatic regions are: equatorial, tropical, temperate and polar (in the Northern Hemisphere - Arctic, in the Southern Hemisphere – Antarctic). They are the main ones, because in these climatic regions the same air masses are dominated throughout the year, which are typical only for these places.

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Among the main regions are the transition regions: subequatorial, subtropical and subquatorial (in the Northern Hemisphere - subarctic, in the Southern Hemisphere – subantarctic). All transitional climate regions have a "sub" front suffix in their name (in Latin it has the meaning "under"). In transitional climatic regions, air masses change in accordance with the seasons. They enter here from neighboring regions, respectively. For example, in a subtropical climate, summer is just as hot as in the tropics, and winter is cold because cold air masses enter from temperate latitudes instead of a tropical airflow. Within climatic regions, isolated climatic oblasts such as continental, Marine, monsoon-climate or west coastal climate oblasts are found [1]. In the formation of the above-mentioned air masses, the balance of radiation on the surface of the Earth, the change in air temperature and humidity from the poles to the equator, is taken as a basis (geographer. slovar, 1988, p.137). These climatic conditions, which decided on the surface of the Earth, by the middle of the 20th century were faced with a strong anthropogenic force of influence. That is, an increase in the number of inhabitants, an increase in the demand for Natural Resources - an increase in insecurity, and finally an increase in the force of human influence on nature, armed with science and technology, will lead to a change in the climate of the globe. This process has the following negative consequences for Uzbekistan:

- the increase in the coefficient of evaporation of water as a result of an increase in temperature affects the decrease in water resources, shortages in the regions;
- as a result of the environmental strain, the number of days during the year when there is no precipitation at all increases;
- due to the decrease in soil moisture, the risk of repeated droughts is increasing, and productivity indicators are falling;
- The decrease in the volume of water flowing into the sea of the island accelerates the transformation of the river delta into a desert and the emergence of new desert areas at the bottom of the dry sea;
- Dusting in large areas in atmospheric air is increasing;
- changes in anomalous phenomena such as warming and cooling lead to the destruction of agricultural products and fruits.

According to climatologists, global warming is occurring due to the processes described above. The primary cause is the greenhouse gases that absorb long-wave radiation emitted from the Earth's surface, creating a greenhouse effect in the atmosphere.

Mechanism of the Greenhouse Effect

- About 30% of incoming solar radiation is reflected back into space by the atmosphere (mainly by clouds).
- Approximately 15% is absorbed by the atmosphere itself.
- The remaining energy passes through the atmosphere, reaches the Earth's surface, and heats it [5].
- The Earth then re-emits this energy as long-wave infrared radiation into space.

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• However, some of this radiation is trapped by greenhouse gases instead of escaping into space, leading to atmospheric warming and creating a greenhouse layer that affects the Earth's climate.

The increase in greenhouse gases is primarily linked to human activities, such as industrialization, deforestation, and fossil fuel combustion. There are six main greenhouse gases, with carbon dioxide (CO_2) being the most significant. Others include:

1. Methane (CH_4)
2. Nitrous oxide (N_2O)
3. Perfluorocarbons (PFCs)
4. Hydrofluorocarbons (HFCs)
5. Sulfur hexafluoride (SF_6)

Historical Perspective on Human Impact

International Response and Climate Agreements

The severe impacts of global climate change, particularly in coastal regions, became increasingly evident in the 1960s, drawing the attention of climatologists and global policymakers. As a result, the United Nations (UN) took the lead in addressing this crisis.

- In 1972, climate change concerns were officially acknowledged in the Stockholm Declaration on Environmental Protection, adopted by world leaders.
- In 1979, the First World Climate Conference issued a declaration warning about anthropogenic climate change.
- Throughout the 1980s and 1990s, several international climate conferences were held to discuss and address these issues.
- In 1988, the Intergovernmental Panel on Climate Change (IPCC) was established by the UN to assess climate change.
- In 1990, the IPCC released its first comprehensive climate assessment report, predicting that without effective measures, global temperatures could rise by 0.3°C per decade over the next 100 years.

As part of global climate action, in 1992, the UN Framework Convention on Climate Change (UNFCCC) was adopted at the Rio de Janeiro Earth Summit, coming into effect on March 21, 1994. Today, 189 countries are signatories to this convention.

During these international climate conferences, legal and policy frameworks were established to reduce greenhouse gas emissions and mitigate climate change impacts. The implementation of the UNFCCC has been continuously evaluated through various global summits aimed at furthering climate action [2].

Of particular importance in this regard was the Kyoto (Japan) Protocol, signed in 1997 and entered into force on February 16, 2005. At this convention, unlike the previous ones, reduced volumes of greenhouse gas emissions for developed countries were established. Negotiations led to a commitment to reduce greenhouse gases by 8% in EU countries, 7% in the United States and 6% in Japan over the period 2008 – 2012 compared to 1990. The highest “limits” were also set for other developed countries [3].

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While the Republic of Uzbekistan is not among the countries with specific obligations, it is significant that the proposals related to the "share trading" expressed by the United States (waste quota trading) are relevant to it. Under this proposal, developed countries can buy their shares from countries with low emission levels for their emissions into the atmosphere beyond their obligations. It can be done by paying the monetary equivalent or by giving new technologies or by providing funds. In the same period, the parties (countries) have national programs that are concluded in accordance with their socio - economic potential in order to fulfill the obligations of the Kyoto Protocol. The Kyoto Protocol is humanity's first practical step in combating the growth of gas emissions that produce a greenhouse effect. Due to Uzbekistan's attitude to the problem of global climate warming, Uzbekistan has become an equal member of the UN, and it is continuously supporting international cooperation related to the fate and future of mankind and the protection of nature. The UN circular Convention (RKIK Oon) was ratified by the Government of Uzbekistan in June 1993. It was given the status of Universal to study it and find a solution. The Hydrometeorogical service center under the Cabinet of Ministers of the Republic of Uzbekistan was established as the organization responsible for fulfilling the obligations of RKIK Oon in Uzbekistan. In its implementation, a secretariat was established, which coordinates 34 institutions and their work (in 1995, the head of the Department V.Y.Chub appointed). In 1999, the First National information of the Republic of Uzbekistan was presented under the UN Framework Convention on climate change (2008. P. 137). When the average annual changes in air temperature for 1933-2007 were analyzed in Uzbekistan, it became known that it was increasing by 0.2 0C every 10 years. This is 40% more than the average rate of air warming in the northern hemisphere. As a result of warming, the snow and ice fields in the mountains located in the Aral Sea basin have shrunk to more than 1/3. In the region, there is a steady warming direction (trend) of the Inter-year climate. The change in the index of Standardized Precipitation (in percentage calculation compared to 1961-1990, when taken as a base) is also observed with a relative increase in atmospheric precipitation on the basis of warming (see subject of"geographic prediction and practice"). Noteworthy work is being carried out in the Republic to fulfill the obligations of the Kyoto Protocol. A reduction in atmospheric release (during 1990 – 2005) of carbon dioxide (CO2) and nitrogen (Zaki bijitqisi), which are directly calculated greenhouse gases (except methane), was achieved. Warming of the climate leads to a decrease in water resources by 10-15% due to evaporation from the water table, and by 10-20% due to transpiration. The sum of annual temperatures increases by 5-10%, the duration of the cold period decreases by 5-15 days. This leads to changes in agro-climatic conditions in the cultivation of agricultural crops [7]. The decision of the Cabinet of Ministers of the Republic of Uzbekistan "on approval of the regulation on the procedure for the preparation and implementation of investment projects within the framework of the Kyoto Protocol Clean Development Mechanism" on April 10, 2007 determined the tasks for mitigating and adapting to global climate warming. The environmental, socio-economic consequences of climate warming are very complex and

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multifaceted. It is advisable to make it work on the basis of a strategy of continuous change and adaptation to it. Overcoming the problem of climate warming, that is, a global increase in air temperature, is a very complex task. Because even this problem goes back to the relationship of" nature-humanity", that is, the harmonious development of this trinity in balance. To find these ways of balance and maintain it, it is necessary to carry out the following practical measures:

- reduce the use of fossil fuels and switch to renewable energy sources;
- improving energy efficiency and modernizing industries with energy-saving technologies;
- increase greenery in nature, prevent forest fires, increase Groves;
- the transition to environmentally friendly agriculture;
- preservation of organic substances in the soil (since their loss directly affects the greenhouse effect);
- switch to environmentally friendly modes of transport.

On October 6, 2020, by decision of the president of the Republic of Uzbekistan, the "concept of development of the forestry system until 2030" was approved. The resolution established a system of leasing the Forest Foundation's unforested land for up to 49 years, effective January 1, 2020. A number of new forms of support for Forest Fund land users have been introduced in order to improve the efficiency of forest fund Land Use[6]. In particular, in 2020-2022, the procedure for applying the rental fee "zero" to tenants who rent Forest Fund land under the following conditions; for ten years, when the forest fund's land, which is located in desert areas, is not supplied with water and is not covered with forest; for ten years, when the forest fund's land, which is not supplied with water and

It should be noted that in return for the acceleration of reforestation and afforestation activities, by 2030, the forest covered areas will be increased to 6.1 million hectares, and the forest cover level of the Republic will be increased to 15%.

Conclusion

Ensuring strict compliance with biodiversity conservation requirements, combating desertification and drought, and protecting biological resources are crucial measures for mitigating the adverse effects of climate change. Enhancing the effectiveness of efforts against wind and water erosion, as well as strengthening cooperation between government agencies and non-governmental organizations in environmental protection, will yield positive outcomes.

The sustainable management of land and water resources plays a key role in preserving biodiversity, ensuring food security, and adapting to climate challenges.

The worsening climate indicators observed each year can be linked to human exploitation of Earth's natural resources. Many nations now regard climate change as one of the greatest threats to global security. The devastating environmental disasters

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occurring worldwide should serve as a strong impetus for developing additional mechanisms to ensure ecological security at both national and international levels.

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