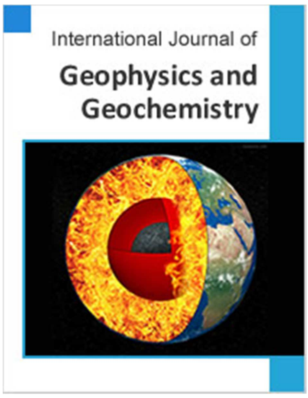
International Journal of Geophysics and Geochemistry
2016; 3(1): 1-5
Published online March 2, 2016 (http://www.aascit.org/journal/ijgg)
ISSN: 2381-1099 (Print); ISSN: 2381-1102 (Online)

American Association for Science and Technology



Keywords
Atomsphere,
Global Climat Change,
Earth Mass,
The Law of Gravity,
Greenhouse Gases

Received: February 16, 2016
Revised: February 25, 2016
Accepted: February 27, 2016

Revealing the Cause of Global Climate Change from the Formation and Evolution of Atomsphere

Cui-Xiang Zhong

Department of Science and Technology, Jiangxi Normal University, Nanchang, China

Email address
cuixiang_zhong@sohu.com

Citation
Cui-Xiang Zhong. Revealing the Cause of Global Climate Change from the Formation and Evolution of Atomsphere. *International Journal of Geophysics and Geochemistry.* Vol. 3, No. 1, 2016, pp. 1-5.

Abstract
Global climate change is a serious environmental problem facing the world today. Although many people have accepted with half-believing and half-doubting the view that human's emission of greenhouse gases is the primary factor in global climate change, many scientists including NIPCC are skeptical about this view, they have refuted this view with plenty of evidence, and they believe natural driving is the main factor for global climate change, but they haven't found such a convincing natual driving force yet. So the author has researched deeply into various natural forces that could affect climate change, and has found a compromise result, that is, with the growth of Earth's mass, Earth can absorb more and more greenhouse gases from the cosmic space and human production, including water vapor, carbon dioxide and dust particules, making atomsphere thicker and thus the greenhouse gases captured by the atomsphere difficult to escape, finally inhencing greenhouse effect, causing global warming.

1. Introduction

Meteorological observation shows that Earth's mean surface temperature has increased by about 0.8°C (1.4°F) over the last 100 years, with about two-thirds of the increase occurring since 1980. Global warming and its serious effects have aroused world-wide attention, and the issue of global warming is now extensively debated around the world [1-3].

In order to effectively deal with global climate change, we should first find out the real cause for it, and then decide the corresponding effective strategy. Warming of the climate system is unequivocal, and many people believe that it is primarily caused by increasing concentrations of greenhouse gases produced by human activities such as the burning of fossil fuels and deforestation. But this conclusion has caused a lot of controversy in scientific circles. Many experts represented by NIPCC have refuted this view with plenty of evidence, and they believe natural driving is the main factor for global climate change, but they haven't found such a convincing natural driving force yet [4]. So the author has researched deeply into various factors that could affect climate change, and has found a compromise result, that is, with the growth of Earth's mass, Earth can absorb more and more greenhouse gases from both the cosmic space and human production, including water vapor, carbon dioxide and dust particules, making atomsphere thicker and thus the greenhouse gases captured by the atomsphere difficult to escape, finally inhencing greenhouse effect, causing global warming.

2. The Formation and Evolution of Earth's Atomsphere as Well as the Thermal Structure of Earth's Atomsphere

Global climate change is usually closely related to the formation and evolution of the earth's atomsphere, so the study of global climate change should start with the formation and evolution of the atmosphere.

2.1. The Formation and Evolution of Earth's Atomsphere

The evolution of Earth's atmosphere is believed to have undergone three distinct stages [5-6]:

(1) Earth's primordial atmosphere

When the early earth formed and cooled, its earliest atmosphere probably consisted of primarily CO_2, H_2, He and compounds of such elements as bromine, chlorine, fluorine, and sulfur. But early Earth's gravity is not strong enough to hold lighter gases such as H_2 and He, so these lighter gases are relatively rare on Earth compared to other bigger planets in the universe and were easily lost to space early in Earth's history.

(2) Earth's second atmosphere

With the growth of Earth's mass, Earth can absorb more and more water vapor from the cosmic space. The accumulation of water vapor in the atomsphere makes large bodies of water or iceform on the surface of the Earth. Under the constant erosion of water, some parts of the Earth's lithosphere became more and more thin, and moreover some places of these parts were even worn out by water, making water enter the mantle. When the magma contacted water permeating through outside crack, the water gasified immediately. If the crack was large enough, a volcanic eruption might occur. Gases produced by volcanoes entered the atomsphere to form the secondary atmosphere (Atmosphere II), so the secondary atmosphere contained H_2O, CO_2, SO_2, CO, S_2, Cl_2, N_2, H_2, NH_3, and CH_4. But no much free O_2 in Atmosphere II, because there was still a lot of metal in the surface of Earth at that time, most metals reacting easily with O_2 to form metal oxides.

(3) Earth's third atmosphere

Due to the following two processes:

- Photochemical dissociation — breakup of water molecules by ultraviolet
- Photosynthesis — CO_2 + H_2O + sunlight = organic compounds + O_2

Much O_2 has been added to atmosphere. Once rocks at the surface were sufficiently oxidized, more oxygen could remain free in the atmosphere. So today, the atmosphere is about 21% free oxygen.

2.2. The Thermal Structure of Atomsphere

With the increase of Earth's mass, the atomsphere become thicker and thicker. Now the Earth is enveloped by an atmosphere composed of five layers, namely troposphere, stratosphere, mesosphere, thermosphere (including ionosphere) and exosphere, as is shown in Fig. 1.

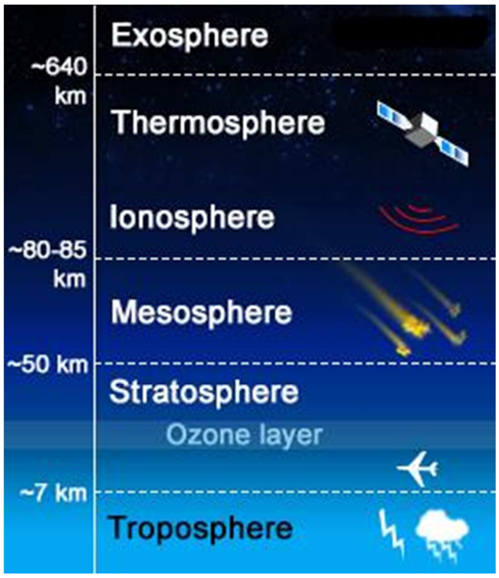


Fig. 1. *The thermal structure of atomsphere.*

Troposphere

It begins from the Earth's surface and extends to between 7 km at the poles and 17 km at the equator. The heating caused by solar energy reduces the density of air, causing it to rise. In the process of opposing the surrounding air, the air in this layer expends energy, resulting in a decrease in its temperature. The decreasing temperature causes the vapor content of the air to condense and then go down. The troposphere contains about 80% of the total mass of the atmosphere.

Apart from water vapor, nitrogen (78%), oxygen (21%) and traces of argon and hydrogen ozone are present in this layer. Lately, the percentage of carbon dioxide present in this layer has started rising, increasing the threat of global warming and greenhouse effect on Earth.

The temperature of the troposphere drops with increase in altitude. The boundary between the troposphere and the stratosphere is known as the tropopause, which is the point where air temperature stops decreasing with altitude.

Stratosphere

Above the tropopause is the stratosphere. This layer extends from an average altitude of 11 to 50 kilometers above the Earth's surface. This stratosphere contains about 19.9% of the total mass found in the atmosphere. Very little weather occurs in the stratosphere. Occasionally, the top portions of thunderstorms breach this layer. In the first 9 kilometers of the stratosphere, temperature remains constant with height. From an altitude of 20 to 50 kilometers, temperature increases with an increase in altitude. The higher temperatures found in this region of the stratosphere occurs because of a localized concentration of *ozone* gas molecules. These molecules absorb ultraviolet sunlight creating heat energy that warms the stratosphere. Ozone is primarily found in the atmosphere at varying concentrations between the altitudes of 10 to 50 kilometers. This layer of ozone is also called the *ozone layer*. The ozone layer is important to organisms at the Earth's surface as it protects them from the harmful effects of the Sun's ultraviolet radiation. Without the ozone layer life could not exist on the Earth's surface.

Mesosphere

It stretches from 50 km to around 80 to 85 km. The temperature of air in this layer decreases with increase in the height. In the mesosphere, the atmosphere reaches its coldest temperatures (about -90° Celsius) at a height of approximately 80 kilometers. At the top of the mesosphere is another transition zone known as the mesopause.Most of the meteors and rock fragments burn up in this layer before they can enter the Earth's stratosphere.

Thermosphere

It extends from about 85 km to more than 640 km. The temperature of air in this layer increases with height in the lower regions after which it remains steady. A small change in energy can cause a large change in the air temperature of this layer. The temperature in this layer can rise up to 1,500 degrees Celsius or higher. It is the hottest layer in the atmosphere. Oxygen present in this layer absorbs solar radiation, increasing the temperatures in this layer. The thermosphere is hotter during the day than at night. It absorbs most of Sun's heat. Sometimes the air expands, leading to an increase in height of the top of the thermosphere.

The air in this layer is very thin due to which gas particles hardly encounter each other. The high-energy UV and X-ray photons break down gas molecules. Thus, air in the upper thermosphere contains atomic oxygen, atomic nitrogen and helium. They even break apart electrons from gas particles, producing highly charged ions. These electrically charged ions and their collisions with electrically neutral gases give rise to electrical currents in some parts of the thermosphere.

The outer boundary of the thermosphere is known as the *thermopause*. It is at a height of 500 to 1000 kms or higher.

Ionosphere

That part of the atmosphere, which is ionized by solar radiation, is known as the ionosphere. As some scientists call ionosphere an extension of the thermosphere, ionosphere may not be regarded as a separate atmospheric layer. The temperature increases with increase in height. The ionosphere constitutes about 0.1% of the atmospheric mass. It forms the inner layer of the magnetosphere, or simply, the sphere of influence of Earth's magnetic/gravitational force. Even the ionosphere experiences auroras.

Exosphere

It is where the Earth's atmosphere meets the outer space. It houses free-moving particles that may migrate from the magnetosphere. Itranges from about 500-1000 km up to 10,000 km. Exosphere is the upper limit of the atmosphere. This layer is where atoms and molecules escape into space. The atmosphere becomes very thin in this layer. This layer contains hydrogen and traces of helium, carbon dioxide and atomic oxygen. The air is so thin that it can be compared with the vacuum in space. Gas particles in the exosphere travel along curved paths. They either come down into the lower atmosphere due to Earth's gravitational pull or escape into outer space.

The lower boundary of the exosphere is known as the exobase or thermopause. It stretches from 500 to 1000 km. The height of the exobase varies with changes in the intensity of solar radiation. Below the thermopause, gas particles have atomic collisions. Above it, they have ballastic collisions.

Each layer of the Earth's atmosphere has a marked significance dictated by the layer's composition. The troposphere is home to all the weather changes while the ozone's protective envelop in the stratosphere helps life thrive on the planet. Owing to the mesospheric airglow, the night-sky is never pitch dark. The changing colors of the sky are a part of the optical phenomena, the atmospheric optics give rise to. Airplanes travel in the stratosphere, space shuttles travel through the thermosphere, while the ionosphere enables radio transmission. Atmosphere is the protective shield that makes the Earth a livable place.

3. Revealing the Reason of Global Climate Change According to the Law of Universal Gravitation and the Change of Atmosphere

As early as seventeenth century, Newton put forward the following idea: diffuse matter scattered in space can be condensed into satellites, planets, and even stars under gravitation. After the efforts of successive generations of astronomers, physicists and other scientists, this idea has been gradually developed into a very mature theory of the formation of the planet. According to this theory, it is generally recognized that nebular material first condense into large and small planetesimals, then these planetesimals condense into satellites or planets. During the growth of a planet, it has unceasingly incorporated the nebula materials near the orbits to become larger and larger, and gradually moved away from its mother star.

As the sun rotates around the center of the Milky way, it constantly captures and burns various kinds of celestial bodies and other cosmic matter to generate a lot of dust and gases, so the earth can constantly absorb cosmic dust, gases, comets, meteorites and so on from the space. Since the earth is rich in water, it's easy to accrete the cosmic matter, making Earth's mass grow constantly. It is estimated that the earth's existing mass is 5.977×10^{24} kg and grows with an annual rate of 40 thousand tons [7, 8]. Some other scholars even starting from the basic principles of the general theory of relativity proved that many celestial bodies grow constantly, the Earh also grows with an annual rate of 1.2×10^{12} tons and expands 4.5mm. As the earth grows into a large planet, the earth is surrounded by an increasingly thick atmosphere [9, 10].

In fact, the formation of the earth's atmosphere is a consequence of the gravitational force between the earth and atmosphere's particles, such as molecules, atoms and dust particles. According to the law of universal gravitation: any two objects in the Universe exert gravitational attraction on each other, with the force directed along the line of centers for the two objects that is proportional to the product of their masses and inversely proportional to the square of the separation between the two objects. Assume the masses of two objects are repectively m_1 and m_2, and the separation between the two objects is r, then the gravitational force between the two objects is as follows:

$$F = G\frac{m_1 \times m_2}{r^2}, G = 6.67\times10^{-11} Nm^2 / kg^2$$

In addition, according to the law of uniform circular motion, When a particle experiences uniform circular motion around the center of the earth, the centripetal force is given by the gravitational attraction between the the Earth and the particle. Assume that the earth's radius is R(=637004m), its mass is M, the height of the particle from the ground is h, its mass is m_1, and its velocity is v, then

$$G\frac{M\times m_1}{(R+h)^2} = \frac{m_1 v^2}{R+h}, \qquad v = \sqrt{\frac{GM}{R+h}}$$

That is any particlewith linear speed v without considering its mass could experience uniform circular motion in a circle of radius $R+h$ around the center of the Earth, as is shown in Fig. 2. This is the principle of the formation of atmosphere.

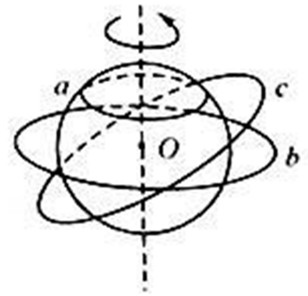


Fig. 2. *Paricles experiencing circular motion around the Earth construct the atomsphere.*

Thus we have the following conclusions:

(1) Any particle with linear speed $\sqrt{\frac{GM}{R+h}}$ could experience uniform circular motion in a circle of radius $R+h$ around the center of the Earth. On the sphere of radius $R+h$ and Earth's center, there are a lot of particles experiencing uniform circular motion with linear speed $\sqrt{\frac{GM}{R+h}}$, forming a thin layer enveloping the Earth.

(2) If the linear speed of a particle on the sphere of radius $R+h$ is less than $\sqrt{\frac{GM}{R+h}}$, then it come down into the lower atmosphere; only if the linear speed of a particle on the sphere of radius $R+h$ is greater than $\sqrt{\frac{GM}{R+h}}$ can the particleescape from the layer and go up to a higher layer.

(3) When the mass of Earth increases, the sphere of radius $R+h$ can capture many particles with higher linear speed. The particles originally moving on the sphere would come down into the lower atmosphere, increasing the density of the lower layers of atomsphere.

(4) The particles rising from troposphere were usually impacted by the high-speed particle flow of the upper layer to come back to the original troposphere, forming convection. When the mass of Earth increases, many particles of the upper layers would come down to the troposphere and couldn't escape from this layer, increasing the density of the troposphere, causing the rising of temperature.

(5) With the growth of Earth's mass, the atomsphere can absorb more and more greenhouse gases from both the cosmic space and human production, increasing the density of the atomsphere, finally inhencing greenhouse effect, causing global warming.

The following table shows various linear-speed-limits of particles that might be cought by the spheres at different heights. On the sphere of radius $R+h$, any particle with linear speed less than $\sqrt{\frac{GM}{R+h}}$ would come down to the lower layers, unable to escape.

Table 1. *Various linear-speed-limits of particles at different heights.*

Distance of the sphere from ground (m)	linear-speed-limitsof particles(m/s)
1	7969
1,000	7968
12,000	7962
50,000	7938
85,000	7917
500,000	7674
3000,000	6571

4. Conclusions

Global climate change is usually closely related to the formation and evolution of the earth's atomsphere, so the study of global climate change should start with the formation and evolution of the atmosphere. According to the law of cosmic galaxies' formation and evolution, the mass of the Earth is increaing, so the atomsphere is also getting thicker and thicker. With the growth of Earth's mass, the atomsphere can absorb more and more greenhouse gases from both the cosmic space and human production, increasing the density of the atomsphere, finally inhencing greenhouse effect, causing global warming.

References

[1] IPCC. Climate Change 2007: Synthesis Report (Summary for Policymakers) [M]. Cambrige University Press, 2007: 2-22.

[2] IPCC. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the International Government Panel on Climate Change [M]. Cambridge, UK and New York: Cambridge University Press, 2007.

[3] Daniele De Wrachien, Mudlagiri B. Goli.Global Warming Effects on Irrigation Development and Crop Production: A World-Wide View [J]. Argriculture science, 2015, 6, 734-747.

[4] Ge Quan-sheng, Wang Shao-wu, Fang Xiu-qi. An uncertainty analysis of understanding on climate change [J]. Geographical Research, 2010, 29(2): 192-203.

[5] J. M. Wallace， P. V. Hobbs. *Atmospheric Science: An Introductory Survey* [M]. Academic Press，New York, 1977.

[6] John E. Frederick. Principles of Atmospheric Science [M]. Jones & Bartlett Pub, 2008. 11.

[7] Silong Tao et al. An Overview of Earth Sciences [M]. Geology press, Beijing, 1999. 2.

[8] David McConnell. The Good Earth: Introduction to Earth Science [M]. McGraw-Hill Education, 2014. 8.

[9] Cui-Xiang Zhong. The Formation and Evolution of the Earth as well as Global Climate Change [J]. International Journal of Geophysics and Geochemistry, 2015, 2(2): 8-17. Published online, April 30 (http://www.aascit.org/journal/ijgg)

[10] Cui-Xiang Zhong. A New Theory of the Origin of the Solar System and the Expansion of the Universe [J]. International Journal of Geophysics and Geochemistry, 2015, 2(2): 18-28. Published online, April 30 (http://www.aascit.org/journal/ijgg)