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A Reevaluation on Collide of CO_2 Emission on Climate Change

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ABSTRACT

The goal of this paper is to investigated the main cause of global warming is the emission of CO_2, methane, ozone, water vapor etc. which is release from the burning of fossil fuels, deforestation and agriculture activities owing to the extensive use of artificial fertilizers. We understood that warming trend is expected to continue increasing at dramatic rates. Earth's atmosphere is dividing into five main layers. CO_2 is the second most abundant greenhouse gas after H_2O vapor.

Keyword: Exosphere, Thermosphere, Mesosphere , Stratosphere and Troposphere

INTRODUCTION

Climate change in the statistical distribution of weather patterns over periods ranging from decades to millions of years, it may be a change in average weather conditions or the distribution of events around that average. Climate change may be limited to a specific region or may occur across the whole Earth. Scientist believe Earth is currently facing a period of rapid warming brought on by rising levels of heat trapping gases known as greenhouse gases in atmosphere. Natural events and human activities are to believe to be contributing to an increase in average global temperatures (Hafbauer, 1991). This is caused primarily by increases in "greenhouse" gases such as Carbon dioxide (CO_2) . A warming planet thus leads to a change in climate which can affect weather in various ways, as will be discussed further below. Greenhouse gases retain the radiant energy provided to Earth by Sun in process known as the greenhouse effect. Greenhouse gases occur naturally and without them the planet would be too cold to sustain life as we know it. Since the beginning of the industrial Revolution in the mid-1700s, however human activities have added more and more of these of gases into the atmosphere. For example levels of carbon dioxide, a powerful greenhouse gas, have risen by 35% since 1750, largely from the burning of fossil fuels such as coal, oil and natural gas. With more greenhouse gases in the mix, the atmosphere acts like a thickening blanket and traps more heat (John, 1872).

MATERIALS AND METHODS

Air, pressure and density decrease in the atmosphere as height increases. However, temperature has a more complicated profile with altitude. The pattern of this profile is constant and recognizable through means such as balloon soundings; temperature provides a useful metric to distinguish between atmospheric layers. In this way, Earth's atmosphere can be divided into five main layers. From highest to lowest, these layers are:

Exosphere

The outermost layer of Earth's atmosphere extends from the exo-base upward. It is mainly composed of hydrogen and helium. The particles are so far apart that they can travel hundreds of kilometers without colliding with one another. Since the particles rarely collide, the atmosphere no longer behaves like a fluid. Theses free moving particles follow ballistic trajectories and may migrate into and out of the magnetosphere or the solar wind.

Thermosphere

Temperature increases with height in the thermosphere from the mesopause up to the thermopause and then is constant with height. Unlike in the stratosphere where the inversion is caused by absorption of radiation by ozone, in the thermosphere the inversion is a result of the extremely low density of molecules. The temperature of this layer can rise to $1500°\text{C}$ $(2700°\text{F})$ though the gas molecules are so far apart that temperature in the usual sense is not well defined. The air is so rarefied that an individual molecule travels an average of 1 kilometer between collisions with other molecules. The international space station orbits in this layer between 320 and 380 km (200 and 240 mi). The reason of the relative in frequency of molecular collisions, air above the mesopause is poorly mixed compared to air below. While the composition from the troposphere to the mesosphere is fairly constant above a certain point, air is poorly mixed and becomes compositionally stratified. The point dividing these two regions is known as the turbo pause . The region below is the hemisphere and the region above is the heterosphere. The top of the thermosphere is the bottom of the exosphere called the exobase. Its height varies with solar activity and ranges from about 350-800 km (220-500 mi; 1100000-2600000 ft).

Mesosphere

The mesosphere extends from the stratopause to 80-85 km (50-53 mi; 260000-280000 ft). it is the layer where most meteors burn up upon entering the atmosphere. Temperature decreases with height in the mesosphere. The mesopause, the temperature minimum that marks the top of the mesosphere, is the coldest place on Earth and has an average temperature around $-85°\text{C}$ $(-120\,°\text{F}; 190K)$. At the mesopause, temperatures may drop to $-100°\text{C}$ $(-150\,°\text{F}; 170K)$. Due to the cold temperature of the mesosphere, water vapor is frozen, forming ice clouds. A type of lightning referred to as either sprites or ELVES, form many miles above thunderclouds in the troposphere.

Stratosphere

The stratosphere extends from the tropopause to about 51 km (32 mi; 1700000 ft). Temperature increases with height due to increased absorption of ultraviolet radiation by the ozone layer, which restrict turbulence and mixing. While the temperature may be $-60°C\ (-76\ °F; 210K)$ at the tropopause, the top of the stratosphere is much warmer and may be near freezing. The stratosphere, which is the boundary between the stratosphere and mesosphere, typically is at 50 to 55 km (31 to 34 mi; 1600000 to 1800000 ft). The pressure here is $\frac{1}{1000}$ sea level.

Troposphere

The troposphere begins at the surface and extends to between 9 km (30000 ft) at the poles and 17 km (56000 ft) at the equator with some variation due to weather. The troposphere is mostly heated by transfer of energy from the surface so on average the lowest part of the troposphere is warmest and temperature decreases with altitude. This promotes vertical mixing (hence the origin of its name in the Greek word "$\tau\rho o\pi\eta$", trope meaning turn or overturn. The troposphere contains roughly 80% of the mass of the atmosphere. The tropopause is the boundary between the troposphere and stratosphere (Sawyer 1972).

Other layer

Within the five layers determined by temperature are several layers determined by other properties such layers are; ozone, ionosphere, planetary boundary layer, hemisphere and heterosphere.

Ozone layer

The ozone layer is contained within the stratosphere, in this layer ozone concentrations are about 2 to 8 parts per million which is much higher than in the lower atmosphere but still very small compared to the main components of the atmosphere. It is mainly located in the lower portion of the stratosphere from about 15 – 35 km (9.3 – 22 mi; 49000-110000 ft) though the thickness varies seasonally and geographically. About 90% of the ozone in our atmosphere is contained in the stratosphere.

Isolation and production

Carbon dioxide is mainly produced as an unrecovered side product of four the technology: combustion of fossil fuel, production of hydrogen by steam reforming, ammonia synthesis and fermentation (Lamb, 1997). It can be obtained by or from air distillation; however, this method is inefficient. The combustion of all carbon containing fuels such as methane (natural gas), petroleum distillates (gasoline, diesel, kerosene, propane) but also of coal and wood will yield carbon dioxide and in most cases water. As an example the chemical reaction between methane and oxygen is given below

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O \qquad 1$$

The production of quicklime (CaO), a compound that enjoys widespread use, involves the heating (calcining)of limestone at about 850°C

$CaCO_3 + \rightarrow CaO + CO_2$ 2

Iron is reduced from its oxides with coke in a blast furnace, producing pig iron and carbon dioxide:

$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ 3

Yeast metabolizes sugar to produce carbon dioxide and ethanol, also known as alcohol, in the production of wines, beers and other spirits, but also in the production of bioethanol:

$C_6H_{12}O_6 \rightarrow 2CO_2 + 2C_2H_5OH$ 4

All aerobic organism produce CO_2 when they oxidize carbohydrates, fatty acids and proteins in the mitochondria cells. The large numbers of reactions involved are exceedingly complex and not described easily. Refer to (cellular respiration anaerobic respiration and photosynthesis). The equation for the respiration of glucose and other monosaccharide is

$C_6H_{12}O_6 \rightarrow 6\ O_2 + 6\ H_2O$ 5

Photo autotrophy (i.e plants, cyanobacteria) use another modus operandi: plants absorb CO_2 from the air and together with water react it to form carbohydrates:

$nCO_2 + nH_2O \rightarrow (CH_2O)_n + nO_2$ 6

Laboratory methods

A variety of chemical routes to carbon dioxide are known such as the reaction between most acids and most metals carbonates. For example the reaction between hydrochloric acid and calcium carbonate (limestone or chalk) is depicted below

$$2HaCl + CaCO_3 \rightarrow CaCl_2 + H_2CO_3 \qquad 7$$

The carbonic acid (H_2CO_3) then decomposes to water and CO_2. Such reactions are accompanied by foaming or bubbling or both. In industry such reactions are widespread because they can be used to neutralize waste acid streams (Spencer, 2003).

Industrial production

Industrial carbon dioxide can be produced by several methods, many of which are practiced at various scales. In its dominant route, carbon dioxide is produced as a side product of the industrial production of ammonia and hydrogen. These processes begin with the reaction of water and natural gas (mainly methane). Although carbon dioxide is not often recovered, carbon dioxide results from combustion of fossil fuels and wood as well fermentation of sugar in the brewing of beer, whisky and other alcoholic beverages. It also result from thermal decomposition of limestone$CaCO_3$, in the manufacture of lime (Calcium oxide CaO), directly from natural carbon dioxide springs, where it is produced by the action of acidified water on limestone or dolomite.

RESULT AND DISCUSSION

The rate at which energy is received from the sun and the rate at which it is lost to space determine the equilibrium temperature and climate of earth. This energy is distributed around the globe by winds, ocean, currents and other mechanisms to affect the climates of different regions. Factors that can shape climate are called climate forewings or forewing mechanisms. These include processes such as variations in solar radiation, deviations in the earth's orbit, mountain building and continental drift and changes in greenhouse gas concentrations. There are varieties of climate change feedbacks that can either amplify or diminish the initial forewing. Some parts of the climate system such as the oceans and ice caps respond slowly in reaction to climate forewing while other responds more quickly. Forewing mechanisms can be either or internal or external. Internal forewing mechanisms are natural processes within the climate system itself, external forewing mechanisms can be either natural or anthropogenic.

Whether the initial forewing mechanism is internal or external the response of the climate system might be fast, slow or combination. Therefore the climate system can respond abruptly but the full response to forewing mechanisms might not be fully developed for centuries or even longer. Ozone in the earth's stratosphere is created by ultraviolet light striking oxygen molecules containing two oxygen atoms (O_2) splitting them into individual oxygen atoms (atomic oxygen); the atomic oxygen then combines with unbroken O_2 to create ozone O_3. The ozone molecule is also unstable and when ultraviolet light hits ozone it splits into a molecule of O_2 and an atom of atomic oxygen, a containing process called the ozone oxygen cycle, thus creating an ozone layer in the stratosphere, the region from about 10 to 50 kilometers above earth's surface. About 90% of the ozone in our atmosphere is contained in the stratosphere. Ozone concentrations are greatest about 20 and 40 kilometers where they range from about 2 to 8 parts per million. If all of the ozone were compressed to the pressure of the air at sea level, it would be only 3 millimeters thick.

The ozone layer of the atmosphere protects life on earth by absorbing harmful ultraviolet radiation from the sun. If all the ultraviolet radiation given off by sun were allowed to reach the surface of earth most of the life on earth's surface would probably be destroyed. Ozone can be destroyed by a number of free radical catalyst the most important of which are the hydroxyl radical (OH) the nitric oxide radical (NO), the atomic chlorine iron (Cl) and the atomic bromine ion (Br). All of these have both natural and a manmade source, at the present time, most of the OH and NO in the stratosphere is of natural origin but human activity has dramatically increased the level of chlorine and bromine. These elements are found in certain stable organic compounds especially chlorofluorocarbon $(CFCs)$ which may find their way to the stratosphere without being destroyed in the troposphere due to their low reactivity. Once in the stratosphere, the (Cl) and (Br) atoms are liberated from the planet compounds by the action of ultraviolet light

$$CFCl_3 + \ electromagnetic\ radiation \rightarrow CFCl_2 + \ Cl \qquad 8$$

The (Cl) and (Br) atoms can then be destroy ozone molecules through a variety of catalytic cycles. A chlorine atom reacts with an ozone molecule, taking an oxygen atom with it and leaving a normal oxygen molecule. The chlorine monoxide can react with a second molecule of ozone to yield chlorine and two molecules of oxygen. The chemical shorthand for these gas phase reactions is

$$Cl + O_3 \rightarrow ClO + O_2 \qquad 9$$

The chlorine atom changes an ozone molecule to ordinary oxygen

$$ClO + O_3 \rightarrow Cl + 2O_2 \qquad 10$$

The ClO from the previous reaction destroys a second ozone molecule and recreate the original chlorine atom which can repeat the first reaction and continue to destroy ozone. The overall effect is a decrease in the amount of ozone, more complicated mechanisms have been discovered that lead to ozone destruction in the lower stratosphere as well.

SUMMARY

Climate change may have a specific region or may occur across the whole earth, scientist believe earth is currently facing a period of rapid warming brought on by rising level of heat trapping gases known as greenhouse in the atmosphere. The atmosphere of the earth is a layer of gases surrounding the planet earth that is retained by earth gravity. The atmosphere protects life on earth by absorbing ultraviolet solar radiation, warming the surface through heat retention and reducing temperature extremes between day and night.

CONCLUSION

Climate change and global warming it is wise to be energy efficient because by saving energy we are saving ourselves. To reduce the over dependence on energy is normal obligation that the people of the world face today. It must be remembered that energy is not unlimited and so it is sensible to turn the wind and solar energy which are ecologically viable.

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