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An Overview of Scientific Debate of Global Warming and Climate Change

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Abstract

Climate change is not the new phenomenon. The palaeo-climatic studies reveal that during the Pleistocene and Holocene periods several warm and cold periods occurred, resulted change of sea level and change in climatic processes like rise and fall of global average temperature and rainfall. The last medieval warm period was observed from 950 to 1350 AD, followed by the little Ice Age from 1400 to 1900 AD. Occurrence of these climatic changes and their impacts are considered due to natural processes that are geological and astronomical. In 1970s environmentalists and some climate scientists pointed that earth's average temperature is rising linked with the anthropogenic causes of global warming and emission of carbon dioxide through fossil fuels. In late 1980s the problem was discussed in politics and media. To examine and monitor the global rise of temperature and its impacts due to the emission of carbon dioxide an organization of Intergovernmental Panel on Climate Change (IPCC) was created in 1988 by United Nations Environment Program (UNEP). The IPCC released several reports based upon anthropogenic causes of climate change and their impacts. According to IPCC, 2007 report on climate change during the last 100 years the earth's average temperature has increased up to 0.6 degree Celsius and if emission of greenhouse gases particularly carbon dioxide continues to rise, global temperature will rise up to 5.8 degrees Celsius by the end of 2100 AD. Similarly as a result of this threat of global warming, glaciers will disappear even from Antarctica and Arctic sea will open for navigation throughout the year. Many islands and coastal cities will submerge as a result of sea level rise.

In 2004 Canadian Broadcasting T.V presented a documentary with the name "The doomsday called off" in which leading climate scientists, astrophysicist and geophysicist presented evidences that science of global warming presented by IPCC scientists is incomplete and incorrect based upon computer models and stimulations which are deliberately exaggerated. Many climate scientists have shown disassociation with the IPCC views and speculations on the basis of its doubtful, manipulated and exaggerated figures of global warming and some consider it a climate scam. Since then debate between UN pro man-made global warming scientists and anti-man-made global warming climate scientists continue.

Keywords: Climate Change; Global Warming; Greenhouse Gases; Intergovernmental Panel on Climate Change (IPCC)

Introduction

The phenomenon of global warming and climate change came into discussion in the early 1980s when climate scientists argued that warming of atmosphere is because of earth's outgoing long wave radiation, absorbed by the atmospheric greenhouse gases. The level of coverage that the Western mass media gave to global warming was low prior to 1988. But interest increased significantly after the 1988 drought in USA when NASA's chief climate scientist James E. Hansen attributed the anomaly of hot weather to global warming [1]. Similarly, coverage of climate change in the British press began at the end of 1988 which instigated then British Prime Minister Margret Thatcher to promote nuclear energy and to dismantle coal industry due to threat of global warming [2].

Due to growing popularity of the issue of global warming and climate change in global media, politics and environment scientists the Intergovernmental Panel on Climate Change (IPCC) was created in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) to assess the scientific, technical, and socio-economic information relevant for the understanding of the risk of human-induced climate change". Since the creation of the IPCC in 1988, it published several reports on global warming and climate change. These reports claimed that most of the warming observed during last 50 years is linked with human activity, increased natural greenhouse effect process due to man-made emission of greenhouse gases particularly carbon dioxide and methane due to burning of fossil fuels causing global warming. The IPCC scientists claimed in 2007 report that earth's temperature has increased up to 0.6 degree Celsius since the late 19th century and if emission of greenhouse gases continues than global temperature will increase by 1.4 to 5.8 degree Celsius between 1990 to 2100 (IPCC,2007) [3]. As a result of this global warming glaciers will almost disappear and sea level will rise up to 50 meters from the present sea level submerging low land coastal areas and islands and millions of people will be homeless. Similarly this magnitude of warming will

create serious threat for agriculture, flora, fauna and human life. As a result of this extremely disastrous picture presented by United Nations sponsored IPCC scientists' pressure on the governments of countries was growing through media and NGOs that finally an agreement among countries on the reduction of greenhouse gases particularly carbon dioxide was signed in the UN summits on climate change in 1992 in Brazil and in 1997 in Japan. Since then UN summits were held to monitor the progress and the last summit was held in 2016 in China [4].

The debate whether the problem of present century global warming and climate change is natural as happened in the past geological epochs and most recent in the medieval warm and cool periods or as a result of man-made activities became popular in United States and Canada when Canadian Broadcasting T.V presented a documentary with the name "The doomsday called off" in which leading climate scientists, astrophysicist and geophysicist presented evidences that science of global warming presented by IPCC scientists is incomplete based upon computer models and stimulations which are deliberately exaggerated. Since then debate between UN pro man-made global warming scientists and anti-man-made global warming climate scientists continue.

Materials and Methods

The present study is based upon the evaluation of ideas and observations presented by some leading astrophysicists, climate scientists, geophysicists, glaciologists and environmentalists in the field of global warming and climate change. The study provides an analytical view about the human induced climate change hypothesis, advocated by IPCC scientists who believe that human induced carbon dioxide emission is responsible of global warming and climate change. Another group of scientists who provide evidences that climate change is taking place but it is a natural phenomenon as happened in the pre-industrial age and not with alarming rate. In this paper secondary sources of data and results were used to examine the factual position of global warming and climate change in retrospect.

Results and Discussion

The problem of human induced global warming and climate change has become very much politicized in media and climate summits of the United Nations. Therefore it is quite difficult to make understandable another look of its scientific and academic status. In this paper an attempt has been made to examine the complexity of the problem in the light of available facts related to atmosphere and climate system.

Energy Sources for the Heating of the Atmosphere

The ultimate source of energy for the heating of earth's surface and atmosphere is the Sun. Out of the total solar radiation that reaches the top of atmosphere, about 49 percent reaches on the earth's surface called insolation. 31 percent is reflected back to space while 20 percent is absorbed by atmosphere. This shows atmosphere absorbs only 20 percent of solar radiation directly while earth's surface is the major source of energy for the heating of atmosphere. Earth's surface after being heated by the insolation, emits radiation in wavelengths ranging from 4 to 70 micrometer called long wave terrestrial radiation. Thus earth's atmosphere is heated by long wave earth's radiation instead of direct solar radiation [5].

Natural Greenhouse Effect

There are some atmospheric gases, called greenhouse gases, which absorb earth's long wave radiation; thereby they contribute to the heating of the atmosphere. Major atmospheric greenhouse gases are water vapour, carbon dioxide, ozone and methane. The heat trapping mechanism of the greenhouse gases is known as the natural greenhouse effect. As a result of the greenhouse effect earth's average surface temperature is 15° Celsius. In the absence of greenhouse effect, earth's global temperature would be -18° Celsius. It may be noted that that the greenhouse effect is a natural process [5,6].

Water Vapour is the Single Largest Atmospheric Gas Rather than Carbon Dioxide

It is quite interesting that pro human induced global warming scientists exaggerate the contribution of carbon dioxide as a major greenhouse gas in absorbing long wave earth's radiation which is not true. The fact is water vapour is the single largest atmospheric greenhouse gas (2 percent by volume), Carbon dioxide is second major absorber (0.0385% by volume). Out of the total atmospheric carbon dioxide only 3 percent come from fossil fuel burning while 97 percent comes through natural processes. Water vapour absorbs in a much wider band of long wave radiation (4-8 micrometer and 12-70 micrometer bands), Carbon dioxide absorbs in narrow bands (13-16 micrometer) and ozone absorbs in a much smaller narrow band 9-10 micrometer). Thus water vapour absorbs in a much wider wave length band, it has the single largest greenhouse effect among all the greenhouse gases (calculated by Prof. S.F Singer (Atmospheric Physicist, University of Virgina) [2].

Increase in Atmospheric Carbon Dioxide Concentration

It is estimated that atmospheric concentration of carbon dioxide was 285-290 ppm before the industrial revolution (18th and 19th century. Measurements of carbon dioxide taken at the Mauna Loa Observatory in Hawai show that atmospheric carbon dioxide has increased from 310 ppm in 1957 to 385 ppm in 2009, IPCC reports claim that if the rising trend continues, atmospheric carbon dioxide may reach 450 ppm by the year 2050. Present atmospheric concentration of 385 ppm is simply 0.0385 percent of the

atmosphere by volume and projected value of 450 ppm by 2050 is nothing 0.045 percent of the atmosphere by volume, which still are very small fraction of the atmosphere [2].

Earth's Temperature Variations During last 1000 years

Earth's temperature was never constant, Instead, its past temperatures varied in cyclical patterns. Earth's temperatures for the past 1000 years were constructed on the basis of historical records, measured temperature data and several proxy data (ice core data, tree ring analysis, pollen analysis). Earth's temperature pattern in the past 1000 years shows two relatively long cycles

a. The Medieval warm period from 950 AD to 1350 AD followed by
b. The cool period called little ice age from 1400 to 1900 AD.

According to Dr. Steffensen of Neil Bohr Institute of Geophysist, university of Copenhagen who conducted 3km deep ice core study at Greenland concluded that the Little Ice Age marked the lowest temperature in the last 8000 years of earth's history while the Medieval Warm period was about 1.5 degree Celsius warmer than the present day. It is clear that increased in temperature was natural without burning of fossil fuels like coal. Like in the past the natural process of global warming is still valid in the present period [2,7].

Scientific Facts Contradicting IPCC's Claims of Global Warming and Climate Change

There is a large group of scientists who strongly oppose IPCC's claims of global warming caused by human activity (due to burning of fossil fuels) on many grounds. Some of the contradictions and neglecting factors are discussed below.

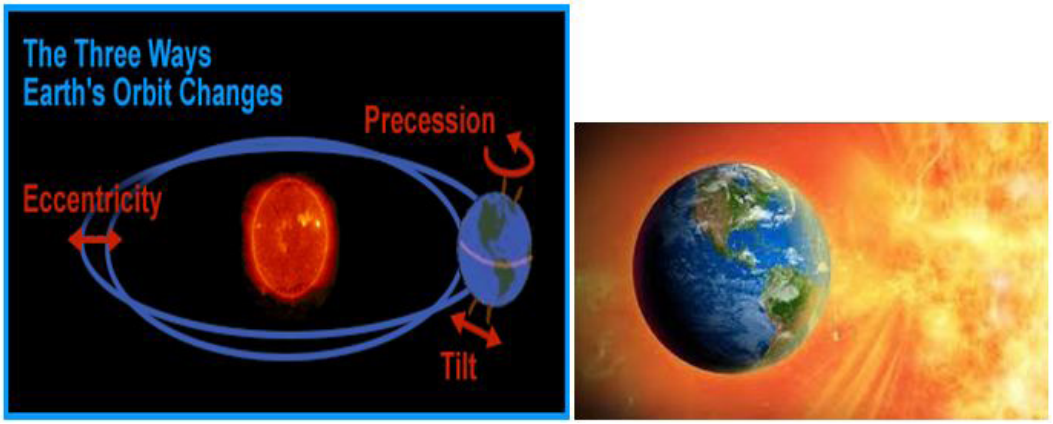
a. Complexity of the Earth's Climate System

Earth's climate system consists of several interactive components of lithosphere (rocks), hydrosphere (water), cryosphere (sphere of ice), biosphere (living organism) and atmosphere (sphere of air). There are several subsystems of these spheres which interact and develop a complex system of climate system of the earth. Therefore any forecast of climate system based upon selected parameters of stimulated computer model as used by IPCC for future projection and estimation is not real and correct picture of global warming and climate change. According to Dr Sallie, Harvard Centre for Astrophysics did not agree that unusual rise of temperature in 20th century is because of man-made climate change. Dr. David Legates, Centre of climate Research criticized the IPCC computer stimulation model for climate change because computer models work like garbage in and garbage out far from the real world. Dr. Freeman Dyson (Emeritus Physics Professor) Prineton University is of the opinion that we can learn a lot from computer models, but we cannot learn what will happen 10 years from now. Dr. Neil Frank(former Director of the US National Hurricane Centre, Miami pointed out that weather forecasting done by numerical models cannot make accurate forecasts for 5 to 10- day weather, Then how do we believe in 50-100 year temperature forecasts, based upon climate models [8,9].

b. Recent Global Warming and Climate Change is because of Natural Factors

It is quite interesting that the mandate of IPCC scientists to published reports on climate change based upon man-made factors particularly burning of fossil fuels. Therefore IPCC reports did not consider natural factors of climate change. Evidences on the basis of ice cores, tree rings and historical data confirm the medieval warm period and cold period which were caused by natural processes like

1. Change in Earth-Sun orbit shape and angle of earth's axis
2. Variations in solar radiation and activities, such as solar flares or sunspots, if large enough, could have an impact on the global temperature (Figure 1)



Source: Chrichfield, 2010 [5]
Figure 1: Solar flares

For example, in the seventeenth century, a fainter sun was believed to have contributed to a climatic period known as the "Little Ice Age", where the average global temperature was about 1 degree Celsius cooler than it is today. Dr. Willie Soon (Harvard Centre of Astrophysics, USA) concluded that earth's temperature anomaly from 1875 to 2000 is much better explained from solar irradiance than to carbon dioxide anomly. 3A more widely accepted volcanic ash theory suggests that from time to time volcanic ash has increased both the albedo of the atmosphere, reducing insolation at the earth's surface. Ash layers in Antarctic ice show a period of intense volcanic activity from about 30,000 to 17000 years ago, during which temperatures decreased by about 3 degree Celsius. In the modern era the eruption of Mount Tambora on the Indonesian Island of Sumbawa in 1815 ejected an estimated 150 cubic kilometer ash into atmosphere. The following year was known as 'the year without a summer" in the United States and Europe but a direct cause and effect relation is hypothetical [5]. The factor of massive volcanic eruption affect on temperature which dropped temperature up to 1 degree Celsius was also noticed in 1980s due to massive discharge of ash from Mt. Pinatubo. 4. Deep ocean conveyor belt circulation theory also suggests the eruptions of hot molten volcanic materials on the ocean floor and oceanic ridges which affect the movement of horizontal and vertical circulation of water and rise of global surface temperature [10].

c. Water Vapour is the Overwhelming Primary Greenhouse Gas

Water vapour because of wider wave length and largest share by volume is the largest greenhouse effect among all the greenhouse gases. Water vapour contributes 95 percent to the greenhouse effect, all other greenhouse gases put together contribute only 5 percent to the greenhouse effect and man-made portion of carbon dioxide contributes only 0.117 percent to the greenhouse effect. IPCC did not consider water vapour as a greenhouse [11].

d. Effect of Urbanization and Urban Heat Island

Urban areas are much warmer than the surrounding open/rural areas because of the building materials, high density of buildings, high rise buildings, large number of vehicles and heat emissions. Since the 1970s, urban areas have grown rapidly in number and size all over the world. Very importantly, almost all the weather stations are located in cities. So rapid growth in urbanization has created a bias toward warmer temperature. This factor was also not considered by the IPCC. Prof. John Christi, an astrophysics of the university of Albama studied ground recorded temperature and found temperature is rising while the weather satellite temperature data and air balloon recorded temperature show little change in temperature. He also studied urban heat island phenomenon in the city of Albama and pointed out that down town temperature is 5 to 6 degree higher than suburban open areas. Therefore people feel false impression of climate change. It is true that climate of cities are warmer but this is because of building structure, high rises etc [12].

e. Global Distribution of Climatic Stations and Data Bias

There were about 100 weather stations in the world in 1875, all of which were located in Europe and North America. This number has increased to about 1700 in 1975, and since then the number of stations has increased dramatically, thanks to the efforts of the World Meteorological Organization. At present there are about 10,000 weather stations around the World. This shows that most of the stations did not exist prior to mid -1970s. Most of them are located on the continents of northern hemisphere, in the mid-latitudes in urban areas and most of them do not have historical records because they did not exist prior to mid-1970s. So our climate data set is biased towards landmass.

The quality of global temperature was also questioned by many climate scientists. The most important is Dr. John Christy (Professor of Astrophysics) university of Alabama and author of several IPCC reports. His article was published in 2010 in UK's Sunday time. According to him recorded temperatures at these stations have been influenced and compromised by such factors as land use changes, urbanization, industrialization and in many cases physical movement of station location from one site to other site. All these factors led to the bias toward warmer temperatures [7,13].

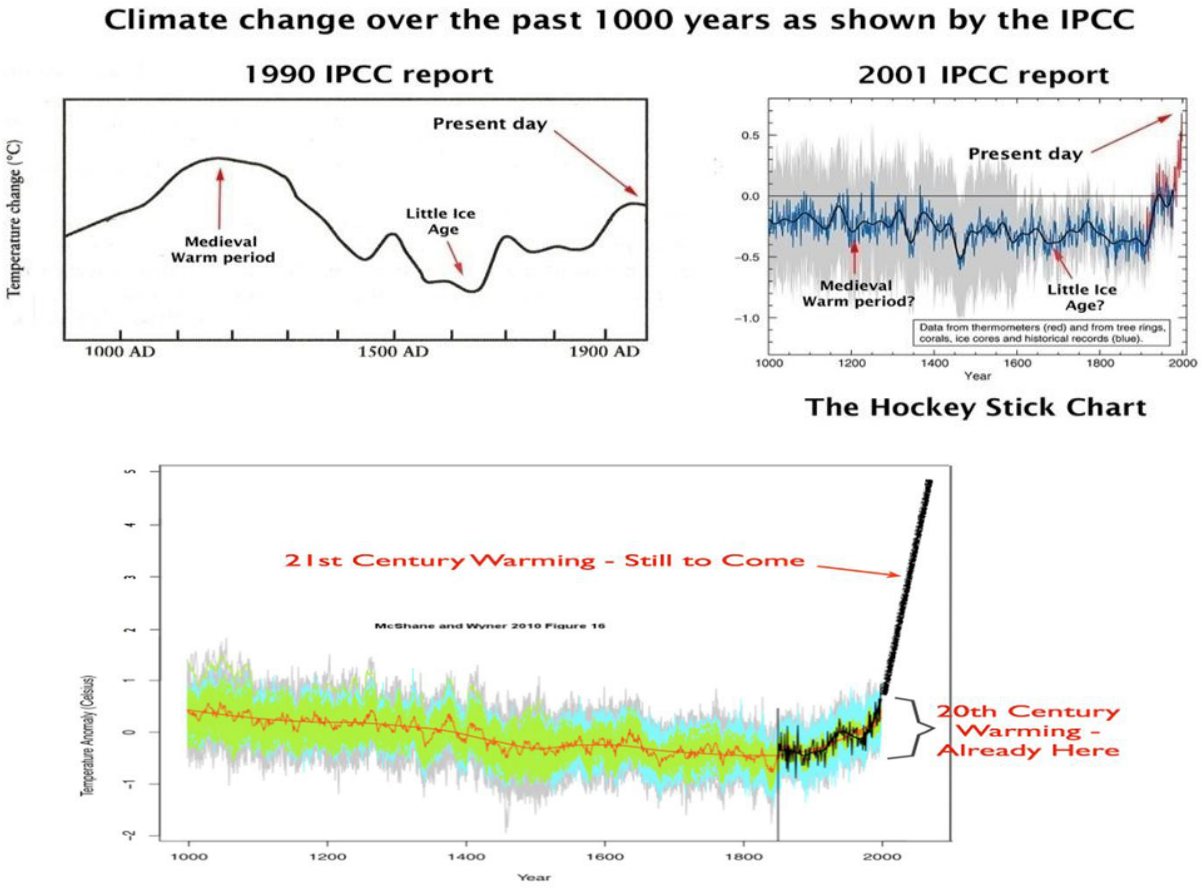
f. Credibility of IPCC is Questioned

A major blow to IPCC credibility came on October 19, 2009 when thousands of documents and emails were leaked out by some computer hackers from the Climate Research Unit (CRU) of UK's East Anglia University. CRU is one of the IPCC's centre for research on global warming and climate change. Some of these documents were published in newspapers and discussed in talk shows labeled as the Climate Gate. These leaked documents reveal misconduct of the top IPCC climate scientist in the UK and USA in creating manufactured data about release of carbon dioxide through burning of fossil fuels and industries causing global warming. Some of the US governmental agencies like US National Climate Data Centre and NASA's Goddard Institute for Space Studies were also involved in data manipulation [2].

The Hockey Stick Graph

Dr. Michaewl Mann (of the Pennsylvania State University and a leading IPCC scientist reconstructed earth's temperature anomaly fir the period 1000 to 2000 AD. His study was based on tree ring data analysis. The shape of his plotted graph is similar to that of an ice hockey stick; this graph is known as The Hockey Stick Graph. In the third and fourth (2007) IPCC reports this graph was adopted replaced by the original graph, used in first and second reports. This was criticized by many climate scientists. Although the hockey stick graph was quite attractive in appearance. It has two major flaws. First it shows that earth's temperatures were below

normal for a long period -1000AD to 1970s (for about 970 years) then temperature increased dramatically since 1980s. Secondly it also shows the long accepted Medieval Warm period (950 AD to 1350AD) as colder than normal. It was found out that the hockey stick graph was drawn on the basis of a very small ring samples (10 out of 85 samples) and by data manipulation and statistical exaggeration [3,14,15].



Source: IPCC, 2007 [3]

Figure 2: Climate Change over the past 1000 years as shown by the IPCC

Assessments of IPCC about Global Warming Impacts on Sea Level Rise and Glacier Melting are Incorrect and Overstated

According to IPCC reports issued 2007 global mean surface air temperature has increased by 0.3 to 0.6 degree Celsius since the late 19th century. As a result of melting of glaciers and polar ice sheets global sea level has risen by 15 to 20 cm over the past 100 years. If this trend continues sea level will rise up to 50 to 80 meter by the end of 2100AD. Low land areas and islands like Maldives will submerge into sea water [3,16] (Figure 2).

Professor Nelis Axil of Stockholm University and president of International Organization of Sea level change and coastal evolution conducted several studies on the beaches of Maldives and concluded that during last 50 years no permanent rise of sea level. He observed that due to high evaporation local sea level is falling and Maldives have no threat of disappearance [17].

IPCC claimed that Antarctica will lose 40 percent of its ice as early 2050, however a recent study done by the Atmospheric Science Department, University of llinois shows that the ice cap in Antarcticahas been fluctuating about its mean value since 1978 and has been increasing since 2003. IPCC also claimed that Himalayan glaciers will disappear by 2035(IPCC, 2007) but recent conducted by glaciologist Dr. John Shroeder of the University of Nebraska(2009), based on satellite analysis since 1960 shows that Himalyan glaciers have been growing since 1980 [18-22].

What will be the Future of Energy Requirement of the World If UN Policy of Climate Change and Reduction of Carbon Dioxide is implemented by Government

In each earth' summit of UN it is stressed to the heads of countries that the level of carbon dioxide must be reduced and fossil fuels (coal, oil and gas)energy generating sources must be replaced by renewable energy sources like solar and wind. It is a desire but not reality. For economic development low price, affordable and sufficient sources of energy is essentially required. Because of this fact fossil fuels have dominated over other sources of energy.

The shares of global energy consumption by sources in 2015 were: Oil (41%), coal (10%), gas 15%, electricity 18%, Bio-fuels and waste 12 %, Solar and wind (3.5%). Similarly shares of global Electricity consumptions by sources in 2015 were: coal (42%) , gas 22% , Hydro 16.3% , Nuclear 11% , oil 4.5%, (solar, wind etc. 5.7%).

Conclusion

The issue of global warming and climate change has been popular since 1980s in media and politics when environmentalists claimed that earth is in danger due rising of temperature which is because of human activities particularly emission of carbon dioxide through burning of fossil fuels. This argument was taken up by UN Environmental program formed IPCC. IPCC published several reports of global warming and climate change and forecasted very alarming picture of climate change. Since 1990 there are two groups of scientists one supports IPCC assessments and human induced causes of global warming while other group disagrees with IPCC estimated and projected figures of global warming and consider them overstated ,fabricated and manipulated based upon computer models. They consider warming is due to natural processes as happened in the past.

The debate of global warming between pro and anti IPCC scientists continue.

- It is almost a consensus that global warming is taking place.
- The differences are:
- 1. Whether it is natural or man-made.
- 2. Whether the rate is alarming or slow.
- 3. Whether the policy of UN Climate Summit to replace fossil fuels energy resources with solar and wind is pragmatic particularly for poor countries.

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