

Chapter

Global Warming and Climate Change (GWCC) Realities

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Abstract

The study attempted to investigate the urgency of the global warming and climate change by analyzing the available data from the secondary sources. The document analysis technique was used to examine the available literature. When it comes to the urgency of global warming and climate change, the study showed that there are two schools of thought. One is in support of the motion, claiming that global warming is a real phenomenon triggered by anthropogenic behavior, while the other is opposed to the motion, claiming that global warming and climate change are complicated phenomena, and that forecasting future climates is difficult due to the various players involved, about which climate specialists know little or nothing. Based on document analysis, study infers that there is certain uncertainty about the future of the climate, because climate always changes, and it cannot be certainly affirmed that the climate change is man-made (anthropogenic activities) or is due to natural occurrence. However, it is evident that the global surface temperature, borehole temperature, sea surface temperature, and the sea level is increasing over the years. The study suggests that for the humanity to be certain about their future, treating the global warming and climate change as an act of urgency and working towards prevention and mitigation by limiting the production of greenhouse gases and mindfully consuming the natural resources would be the plausible solution for the larger problem of Global Warming and Climate change.

Keywords: Global warming, Climate change, Global surface temperature, Borehole temperature, Sea surface temperature, Sea level

1. Introduction

Global warming is a disastrous phenomenon compounded by the human activities often drilled by the greed and corporate paradigm of thinking. Its totaling effect in the long run might threaten the survival of mankind and any other species for that matter. Many nations recognize it as serious immediate threat and they forms the associations and organizations to combat against it. However, there are few cynical nations, owing to several reason, economic reason being dominant. But, with passage of time, it has become so apparent that even a rational high school student can comprehend the status and need of action, it is very evident to a layman, that the temperature of the earth, be it in any season is gradually increasing and the people working in the field are awe struck by the crops ability to grow in new higher unnatural altitudes. The lexicon “global warming” might be new to them but they have already felt its consequences.

Climate is very essential concept, owing to dependence of existence of life on it. Living beings survive on food, food is produced by plants and growth of plants depends on climate. So, erratic change in the climate will put billions of lives at stake. Therefore, it is of paramount importance that we discuss, monitor and make sure that the climate for different regions remains at its natural range. Many literatures suggest that global warming caused by the global warming gases emitted enormously by the manufacturing factories and automobiles industries are the cause of erratic climate [1–6]. Global warming if unchecked will influence the climate of world to the point that earth tipping point is reached, where the surviving earth cannot further sustain any lives in it, changing the course of history preceded by mass extinction of species in the world. Owing to the likelihood of paying a bigger price latter due the simple negligence in time, it is duties of all the global citizens to be mindful about it and do come together to find the effective solutions to mitigate the problem that is ever going to be bigger as it gets delayed. It would be grave mistake to decide not to heed on this global immediate call, for it has the ability to either make or break our collective future.

There is two school of thoughts with regard to urgency of the matter, where one school of thought believes that understanding the climate change is complex and it is extremely difficult to predict the future of climate in this complex universe, and are skeptical about the anthropogenic global warming, suggesting that the information that is known about weather and its causes is not enough to predict the future climate and the climate model are far from precision [7]. However, another school of thought, expresses its concern and urgency to save the earth form untimely destruction, advocating the need to limit the production of the global warming gases that enhance the chances and intensity of occurrence of the erratic weather [7, 8]. In this modern era, people spent more time looking into screen than looking into sky for weather. As a responsible global citizen, it is our moral obligation to explore the underlying truth and make informed decisions locally. Thus, this study explored the available literature on the global warming and climate change in terms of its urgency.

2. Literature review

Global warming is the term that was introduced or used for the first time by climatologist Wallace Broecker in his article “*Climate Change: Are we on the Brink of pronounced Global warming?*” Global warming is observable increase in the global temperature of earth (both land and water) and climate change is the effect brought about by the process of warming globally or in general, overall long-term change in our climate, including sea level rising, extreme weather, and ocean acidification. However, the term global warming and climate change are used interchangeably but there is difference in it, global warming is more sensitive and more diverging which results in less advocacy by some subpopulations [9]. Further, Krauss [3] clearly puts it in the context when he quotes Lorenz, “Climate is what you expect; weather is what you get.” (p.158). Krauss [3] argues that just because there is an anomalous cold day in Washington, DC does not mean that global warming is not happening. Likewise, just because there is an ultra-hot week in Washington, DC also does not validate global warming.

The solar radiation from the sun is balanced by the thermal radiations reflecting from the earth; this interaction balance and determines the surface temperature of the earth. The incoming solar radiation from the sun is independent but the outgoing thermal radiations depends on the earth’s surface temperature and the presence of greenhouse gases, which absorbs some of the thermal radiations. Greenhouse

gasses (GHG), such as carbon dioxide, methane, nitrous oxides, water vapor, ozone and chlorofluorocarbon (CFC) are responsible for trapping of heat. For instance, water vapor (40%) is responsible for absorbing majority of thermal radiation from earth, followed by carbon dioxide (30%), methane (20%) and other gases (5%) [7]. So, it indicates that outgoing thermal radiation is mostly absorbed by water vapor and carbon dioxide. Likewise, the change in composition of water vapor due to human activities are negligible, so it implies that the greenhouse gases produced by human activities are likely responsible for the most of the trapping of heat [10, 11].

However, some authors [12] argues that the heat trapping by the CO₂ is not significant and rather it is likely that sun radiations are responsible for the global temperature rise. Again, the debate on whether the sun radiations or GHG is responsible for the global temperature continues, recently, Herring [13] refuted the claim that likeliness of sun radiation as the cause of global warming might not be true. He argues that, it is possible that sun can warm the earth provided that the pattern of the solar intensity increases over the years. Likewise, the sunspot data do indicate that there was a small increase in the amount of sunlight from late 1800s to the mid-1900s which experts estimates that it could have contributed at the most up to 0.1°C of the 1.0°C (1.8°F) of warming observed since the pre-industrial era. However, there has been no significant net change in the sun's energy output from the late 1970s to the present (see **Figure 1**), which is when the most rapid global warming was observed. Further, scientists rule out the significant role of sun in global warming due to the fact that if the sun energy output had intensified then it is logical to expect all the layers of earth's atmosphere to be warmed, which is not the case that is been observed. Rather, satellite and weather balloons observation showed that more warming in the lower atmosphere (troposphere) and cooling in the upper atmosphere (stratosphere) [13]. This pattern of differential warming is what is been expected due to result of increasing GHG trapping heat.

The main source of global warming gases is the burning of the fossil fuels and it is observed that a nation with the abundance of the availability of the fossils fuels tends to depend more on fossil fuels than the nations with low abundance of fossils resources [5]. Global energy consumption with regard to fossil fuels are staggeringly high, and its prediction for the coming years are also projected very high, as reflected in the world energy outlook report of 2012 and 2013. Thereby the production of greenhouse gases will be soared and ultimately it might bring about the increase in the global temperature of the earth. Likewise, the rising population's

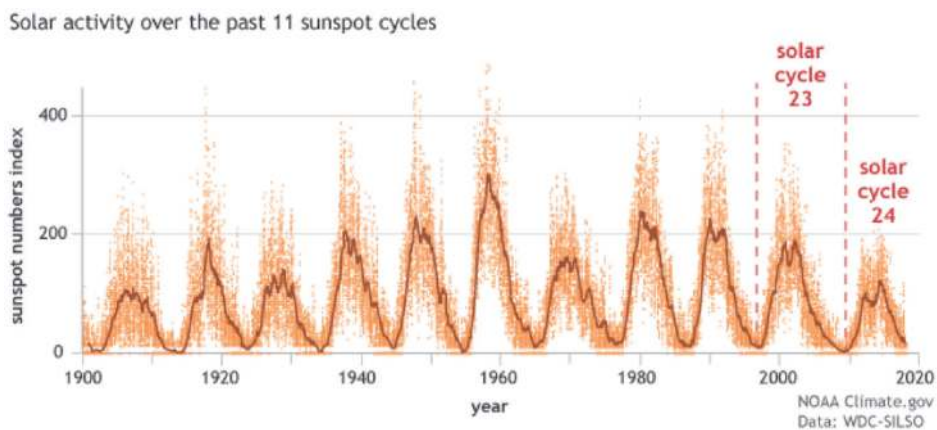


Figure 1. The peaks and valleys in solar geomagnetic activity since 1900, based on the number of sunspots observed on the face of the sun each day (orange dots). Graph by NOAA Climate.gov, based on data from the WDC-SILSO, Royal Observatory of Belgium (source: Herring [13]).

demand for fuel, as well as the need for economic growth and a higher standard of living, are both factors to consider. Lack of political will and institutional failure in to make and enforce effective environmental policies, as well as a lack of related knowledge and Rampant disinformation, have all hampered action against global warming and reduction of the global warming gases [7]. Furthermore, the global temperature rises correlates with the rising pattern in the consumption of the fossil fuel, indicating the likeliness of the GHG warming the earth [3].

With the increase in the concentration of the greenhouse gases it will act like a thick blanket in the atmosphere where it will absorb the solar radiation. The carbon molecules and the oxygen molecule in the carbon dioxide undergoes vibration like stretching, bending, and this action absorbs the solar radiations [1, 2]. Thereby hindering the reflection of solar radiation by the earth making the earth surface temperature warmer.

Many studies affirms that the GWCC is a worrying thing. For example, a study done by Suonan et al. [14] suggests that due to global warming there will be more than worse phenological alteration in some places like in Tibetan Plateau, more than what is predicated or known. This idea makes us think of worst situation if the temperature of the earth keeps warming up. Moreover, the global sea level has risen by about 8 inches since 1880, and it's projected to rise another 1 to 4 feet by 2100 (as a result of melting of ice), thus the danger of storm surges and high tides would increase the flooding in many regions [8].

Shrinking of glaciers, early breaking up of ice on rivers and lakes, shifting of plant and animal and premature flowering are some of the observable effects global climate change had on environment. Moreover, effects that scientists had predicted in the past are now occurring: loss of sea ice, accelerated sea level rise, more intense heat waves. Scientists have high confidence that global temperatures will continue to rise for decades to come, largely due to greenhouse gases produced by human activities. The Intergovernmental Panel on Climate Change (IPCC) which includes more than 1,300 scientists from the United States and other countries, forecasts a temperature rise of 2.5 to 10 degrees Fahrenheit over the next century [15]. Moreover, the IPCC predicts that increases in global mean temperature of less than 1.8 to 5.4 degrees Fahrenheit (1 to 3 degrees Celsius) above sea levels will produce beneficial impacts in some regions and harmful ones in others. Net annual costs will increase over time as global temperatures increases [8].

However, not everyone believes that the earth's surface temperature is rising, and even if global warming is true, not everyone accepts that human activities are the primary cause. Also, not everyone agrees that climate change is a problem. As a result, critics and deniers of global warming and climate change do not see the need to take steps to delay or reverse these trends [5, 7]. USA disengaging from Kyoto protocol and Paris agreement on climate showed the polarity of attitude of nations and people towards the GWCC issue. Moreover, at number of climate summit, member countries failed to agree to number of "Environmental targets" in recent years (Kyoto, Copenhagen, so on) [5].

Extend to which the idea of global warming and climate change have reached to the mankind largely depends on their exposure to the main stream medias and social media. It is found out that the social media network does plays vital role in spreading the knowledge and awareness of the GWCC and it is also indicated that they understand the concept better when they are expose to those terms in positive or negative light [16]. However, as watchdog it is responsibility of media and social media to uncover the truth, but some studies suggest that newspapers aren't doing much to convince the health impact of GWCC to the public [17]. Moreover, in the study done by Shapiro and Park [18], they found out that people responses to the GWCC in social media particularly their reactions to YouTube video of GWCC are

general and shows little or no concern about GWCC, which indicates many people aren't so convince about the reality of GWCC.

On the contrary, the very existence of 175 plus active organization on climate change [19], and 100 plus top websites on climate change [20], indicates the concern and the urgency expressed by the people around the world. Study done by Liu et al. [21] also affirms that many congressmen do believe GWCC as real thing. Further, IPCC asserts that scientific evidence for warming of the climate system is unequivocal, global temperature rise, warming of oceans, shrinking of ice sheets, rising of sea level, acidification of ocean, and declining of Arctic sea ice are some of the events that conveys the story of the happening event so called Global warming and climate change [8]. In addition, study done by Allen and McAleer [22] suggests that the of negative emotions or indifference to global warming might be due to lack of clear logical framework and confusion of short-term variations in localized weather with the long-term global average climate change.

The happenings of global warming can be traced through using the technique of observation and examining the rise in the land surface temperature, borehole temperature profile, sea surface temperature, and sea level [7, 8, 23]. If there are increase in all those four independent parameters, it is the indication that the global warming is occurring [7]. This increase is attributed to the increase in the global warming gases, CO₂ concentrations in the atmosphere have risen from 0.028 percent in pre-industrial 1750 to 0.043 percent today. Until recently, it was thought that stabilizing CO₂ levels in the atmosphere at about 0.055 percent by 2035 will be enough to keep global warming below 2°C. However, 3°C is becoming more possible, which will induce wreaking havoc on human colonies, coral reefs, rain forests, and polar ice caps. To keep temperature rises below 2°C, urgent international action is required, which means keeping CO₂ levels below 0.045 percent. Only if governments can negotiate on cooperative national and international action can this become a possibility [23].

Despite the two school of thought on the urgency and status of GWCC, the evidences from the surface temperature, sea level rise, sea surface temperature, and borehole temperature profile indicate that the global warming is happening and it is going to be a major threat in the future, which will be discussed in the result and discussion section in detail.

3. Methodology

The study utilized the qualitative design and uses document analysis approach of the data collected from the existing documented secondary sources. Resources were collected via use of Research for Life search engine, mostly peer-review journals and accredited resources were used in finding the useable data. Data were collected from more than fifteen different sources. Primarily the main sources of the collected data included Journal article titled "Global warming and climate change: Realities, Uncertainties and Measures" by A. P. Alzebeokhai, published in 2009, data from the NASA-Global climate change, data from NOAA (National centers for environmental information: National oceanic and atmospheric administration), and Intergovernmental Panel on Climate Change (IPCC) (latest and updated information as of 2019).

The data collection and analysis are done in line with the research question on "Is Global warming and climate change (GWCC) really occurring, and how urgent it is?" Data from several climate expert organizations such as NASA-Global climate change, IPCC, NOAA and other accredited scientific journals are used for the same.

The data from those separate sources were compared and analyzed. Owing to the lack of primary data, no statistical software was employed for the analysis.

4. Result and discussion

The result from the analysis of four separate sets of observations, including surface temperature measurements, sea surface temperature, sea level changes, and temperature profiles in boreholes, all indicate that the earth's surface temperature is increasing, suggesting that it is warming. Each of these separate sets of observations yields findings that overlap and complement each other, suggesting that the GWCC is a real phenomenon.

4.1 Surface temperature

The surface of the earth has warmed by an average of 1.0°C (1.8°F) in the last 100 years, according to regular measurements of the earth's surface temperature recorded daily from thousands of weather stations around the world, both ashore and stumped. Mean weekly, monthly, and annual temperatures are calculated using daily temperature measurements. As a result, the average annual temperature change can be easily monitored from year to year. The global mean temperature has risen by 0.1°C per decade over the last two decades, with 2005 being the warmest year on record [7]. The effects of large population centers on global mean temperature, referred to as the "urban heat island effect," are calculated and corrected for; however, this accounts for less than 15% of observed global warming. Global warming is not constant across the globe, both in terms of time and space; high latitude regions warm more than low latitude regions [7]. Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. Global temperature rise is likely to reach 1.5°C between 2030 and 2052, if it continues to increase at the current rate [15]. Moreover, according to the Global climate change report 2018 [23], compiled by NOAA, shows that the surface temperature is increasing, the data compared the temperature recorded from 1880 till 2018 which showed that, 2016 is the warmest recorded temperature with 0.95 temperature anomaly degree Celsius, followed by 2015 with 0.91 anomaly degree Celsius, and 2017 with 0.85 anomaly degree Celsius [23].

Additionally, the data from three major compilations based on measured surface temperatures: from GISS (Goddard institute for space studies), HadCRU (global temperature dataset) and NCDC (national oceanic and atmospheric administration) showed upward trend (see **Figure 2**). They have expressed the trend as the temperature difference ("anomaly") with respect to the 1901–2000 average as the baseline [24].

The comparison of the three different dataset form three climate recoding source showed that the temperatures juggle up and down, but the overall trend is upward meaning the globe is warming.

Upon analysing trend through the average of the three datasets over the period 1975–2009 (during which greenhouse gas forcing was the dominant driver of climate change), the following are (see **Figure 3**).

For all three-temperature series, the trend from 1975 to 2009 is about the same (0.17 +/- 0.03 degrees per decade). The error reflects the trend's 95 percent confidence interval, i.e., if the trend analysis were repeated a hundred times on the actual underlying results, the trend will be within the range of 0.14 to 0.20 degrees per decade 95 times out of 100 (see **Figure 3**) [24].

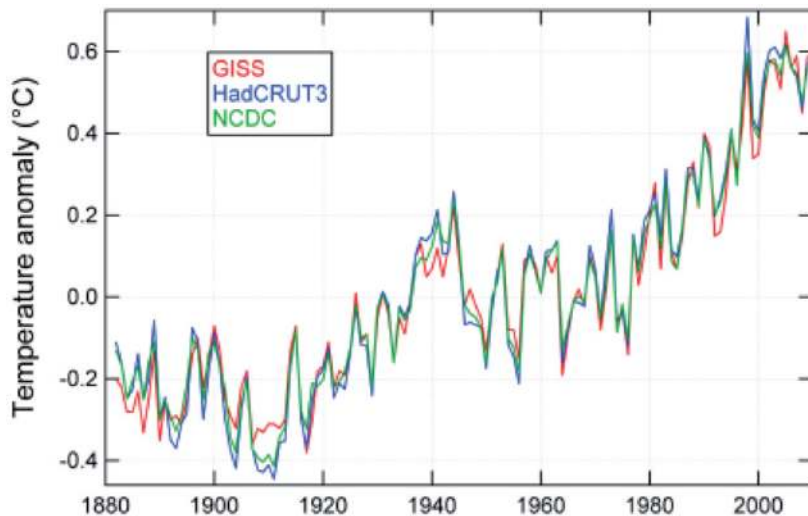


Figure 2.
Comparison of three data set on surface temperature (source: Verheggen [24]).

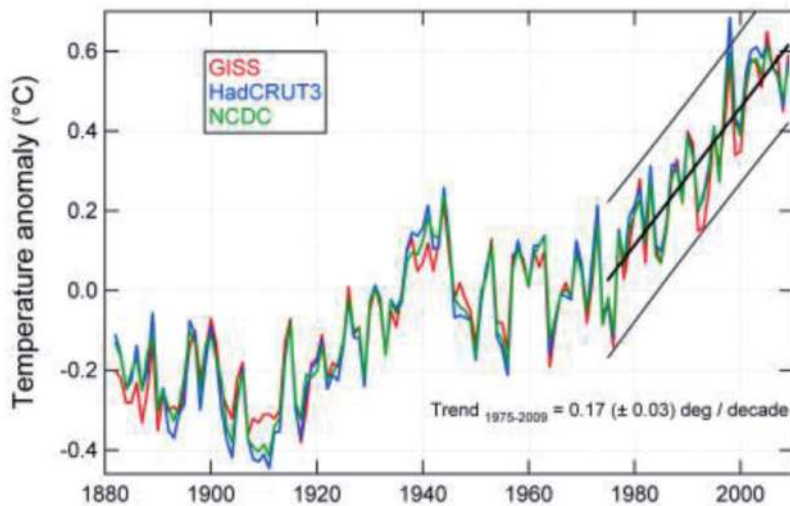


Figure 3.
Showing average temperature from three dataset (source: Verheggen [24]).

The thin black lines (see **Figure 3**) represent the 95% confidence “predictions bands” for the data. Based on the observed variability, 95% of the data are expected to fall within these lines. The observed yearly variability in global temperatures (occasionally exceeding 0.2 degrees) is such that 10 years is too short to discern the underlying long-term trend (0.17 degrees per decade) [24]. Thus, data from all different sources shows and depicts that the surface temperature of the earth has increased over the decade, with different data source agreeing to the value range of 0.1°C increase per decade [24]. This indicates the occurrence of global warming.

4.2 Sea level rise

Another predictor of global warming and climate change comes from a completely different series of findings (the measurements of water level changes). The amount of water in the oceans is rising as a result of thermal expansion of water within the oceans and, as well as due to, melting of glaciers and polar ice as the earth warms.

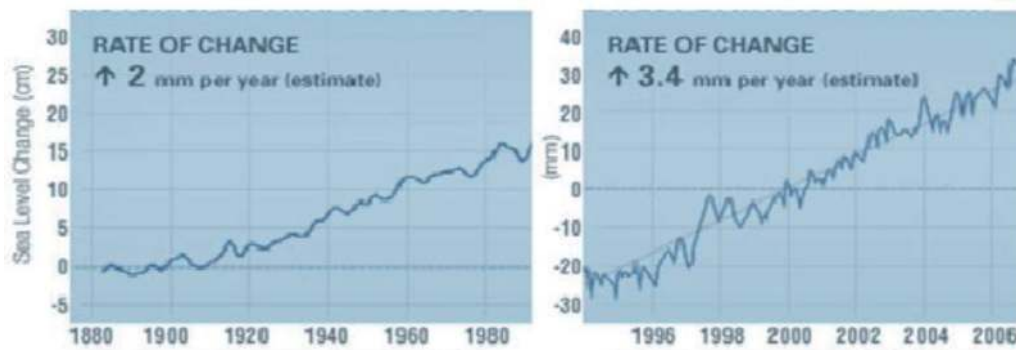


Figure 4. Mean annual sea level rise associated with the thermal expansion of sea water due to warming and widespread melting of ice sheets (source: Aizebeokhai [7]).

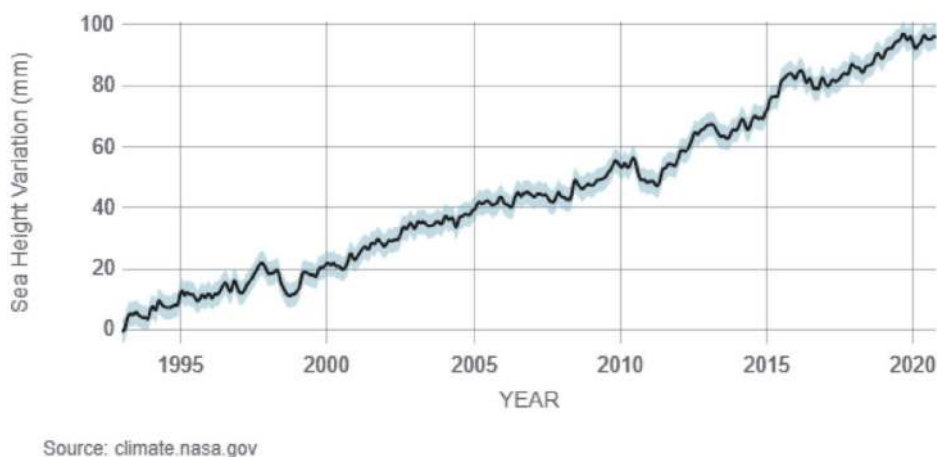


Figure 5. Trend of increase in sea level (satellite data) (source: NASA-global climate change [25]).

Regular water level observations are taken at various sites, equivalent to temperature measurements; daily water level variations, mostly due to tides and storms, are averaged to obtain mean sea level for a given period of time. **Figure 4** depicts the average annual change in sea level between 1880 and 2008. Over the last century, the average water level has risen by around 18 cm [7]. Between 1880 and 1990, it increased by an estimated 2 mm per year on average (left chart in **Figure 4**) and is now growing at a rate of about 3.4 mm per year (right chart in **Figure 4**). Similar to global temperature changes, sea level changes, aren't constant, so the detailed changes aren't always in line with surface temperature measurements. The thermal expansion of the water column occurs later than the associated change in surface temperature, with ocean currents influencing the timing. Global temperature changes, as well as changes in sea level, are not constant, and the details of these changes are not always in line with surface temperature measurements. The water column's thermal expansion occurs later than the related change in surface temperature; the differences are affected by ocean currents (**Figure 5**) [7].

Furthermore, the latest data from the NASA-Global Climate Change, shows that the trend of sea level is upward and increasing. The increase rate of 3.3 mm per year is recorded [25]. Thus, the data from the existing sources both from past and the recent, indicates the rise in the sea level, agreeing to rise value range of 2 to 3.4 mm per year. Which hints to the occurrence of the global warming and retreat of the ice sheets and glaciers.

4.3 Borehole temperature profile

The thermal history of the earth's subsurface offers a third evidence of global warming and global climate change. The subsurface stores temperature records over time that are related to the prevailing environment at the time. Responsive thermometers are used to calculate temperature profiles with depth in boreholes, caves, and deep mines. Temperature anomalies due to geological features, upward flow of warmth from the earth's interior, heat produced by crustal rocks, and variations in groundwater movement are generally adjusted for. Surface temperature oscillations propagate downward with depth, with shorter duration fluctuations attenuating more than longer period fluctuations. As a result, only long-term fluctuations in temperature penetrate great depths, with seasonal changes penetrating around 15 m until the signals fade. Century-long variations, in contrast to seasonal variations, can be observed to depths of about 150 m, and millennial cycles can be observed to depths of 500 m or more. These depths are easily attained by low-cost drilling. The subsurface serves as a selective filter, eliminating short-term temperature fluctuations and maintaining excellent records of global warming and, as a result, climate change (**Figure 6**) [7, 26].

The temperature profiles suggest substantial warming in the last century from 0.6°C in southeast Utah to more than 2.0°C in Alaska. Curves are arbitrarily offset for display purpose (see **Figure 6**). The temperature profiles of boreholes spread across a length of about 500 km of northern Alaska shows anomalous warming of 2 to 5°C in the upper 100 to 150 m of the permafrost and rocks [7]. Similarly, borehole temperature profiles in eastern Canada shows a less rapid warming of about 1.0°C. A warming of about 0.5 and 1.0°C were observed in Nebraska sites and Utah sites, respectively (see **Figure 6**). These results indicate that geothermal data mimicked the geographic variations of warming observed in weather station data. Baseline temperatures from previous centuries are often inferred from geothermal evidence, enabling researchers to date the start of the industrial revolution to this century and thus determine the effect of industrialization on global warming and climate change [7]. As a result of the data from the borehole temperature profile from various places, the temperature rises in the range of 0.5 to 5°C at 100 to 150 m. This hints to the likelihood of global warming.

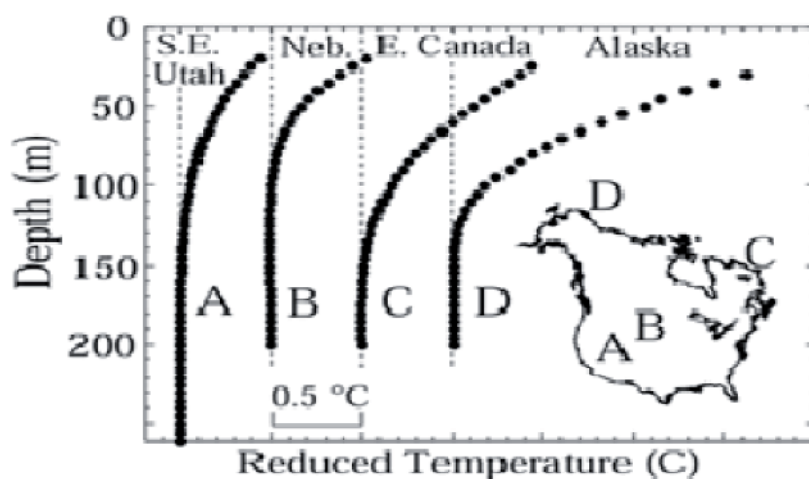


Figure 6. Borehole temperature profile from sites in North America showing warmer temperatures within near-surface depths of 100–150 meters (source: Aizebeokhai [7]).

4.4 Sea surface temperature

The thermometer measurements made on water samples taken by merchant and navy ships as they sailed the world's oceans date back to about 1850, and constitute the instrumental record of natural processes within the oceans. The data is best for parts of the oceans along major trading routes, and it's understandable that they are scarcer further back in time. These readings, like those from land-based meteorological observation posts, must be gridded to provide a global average sea surface temperature. Since the oceans cover about 75% of the earth's surface, the sea surface temperature record is close to global temperature records, as one would expect (Figure 7).

The two records are identical, but the SST (sea surface temperature) varies across a narrower spectrum than the land surface temperature, and the land temperature are subjected to dramatic swings. This disparity is primarily due to the oceans' higher heat potential than the air (it takes a long time to heat and cool the oceans).

The measurement and data collected from hundreds of buoys stationed across the ocean at the depth range of about 2000 m collected over the years as early as 1955, showed that not just the surface of the oceans but the whole upper half of the ocean is gradually warming. Over the past 50 years average of 0.1 to 0.2°C was recorded. So, while the whole ocean has absorbed a huge amount of heat, its overall temperature has changed little. Nevertheless, the very surface of the ocean has warmed almost as much as the rest of earth's surface [26]. Thus, from the past data and the present data it shows that the oceans are warming up slowly which almost resonates with the increase in land surface temperature, indicating the occurrence of global warming.

Analysis of four dimension (indicators) indicates the happening of global warming. The connection between the global warming and climate change is well documented. For instance, according to IPCC [27] "Changes in many extreme weather

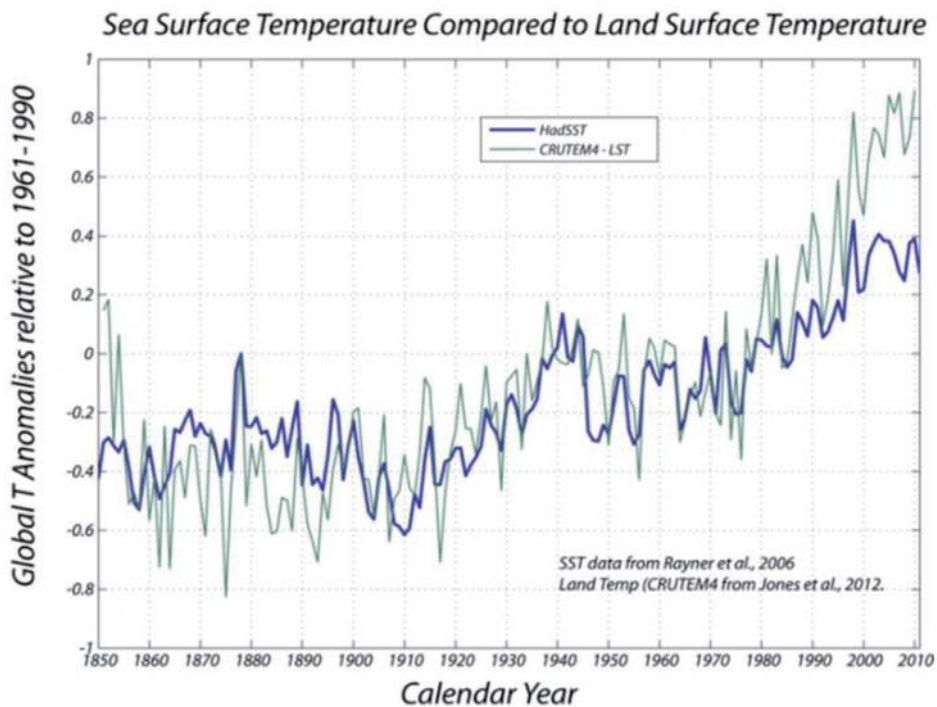


Figure 7. Comparison of Sea surface temperature and land surface temperature (source: Brawlower and Bice [26]).

and climate events have been observed since about 1950. Some of these changes have been linked to human influences, including a decrease in cold temperature extremes, an increase in warm temperature extremes, an increase in extreme high sea levels and an increase in the number of heavy precipitation events in a number of regions” (p.7). Moreover, IPCC [15] predicts differences in mean temperature in most land and ocean regions, hot extremes in most inhabited regions, heavy precipitation in several regions, and the probability of drought and precipitation deficits in some regions, caused by the phenomenon of global warming.

5. Conclusion

Earth is facing the global warming. Scientifically, there is no longer any doubt that the surface temperature of land, sea surface temperature, and sea levels are increasing. The logical reason of this increasing trend is far beyond the occurrence of natural cause. Despite the different propaganda between the global warming and climate change denier and the advocates, it is of paramount importance to heed for the interest of the humanity and survival of humankind. There is still considerable confusion regarding the exact timing and scale of global warming, as well as the impacts that would result from it, although this is also due as much to human responses to the issue as it is to scientific uncertainties. Growing temperatures, changes in rainfall levels and seasonality; increased frequency of severe weather events such as droughts, floods, and hurricanes; sea level rise; melting of polar ice and glaciers are only a few of the consequences that can be expected. Desertification, loss of tropical forests and coral reefs, decreases in agricultural production, extinction of species, water scarcity, increasing natural disaster losses, and the spread of tropical diseases are likely to be among the ecological and human effects of these changes. Whether the severity of these impacts results in only a slight deterioration in environmental quality and social well-being, or a truly catastrophic collapse that leads to famine, mass displacement, and resource wars, will be determined by how we behave in the coming decades, as well as the probability of an unanticipated response within the climate system to rising temperatures and greenhouse gas emissions.

The polarity of the views with regard to the urgency is demystified by a study in China [28]. The authors reported that on the global scale the average public concern about the GWCC among Chinese citizens are relatively low, further analysis revealed that youth and women with greater post-materialist values had more concern about GWCC than that of their counterparts. Likewise, citizens from provinces with higher economic dependency on carbon-intensive industries were found to have less concern about GWCC than people from provinces with lower carbon dependency. Their study revealed the underlining motive of the GWCC deniers and skeptics. Perhaps, the polarity in views between two school of thought has much to do with national or regional benefit than the actual truth.

Skeptics of global warming are not very convinced of the fact that the change in the climate and the extreme climate, periodically experienced, are the result of the effect of global warming, enraged by the production of greenhouse gases like carbon dioxide. However, they are also equally not able to disregard the voluminous literature which suggests that the climate change is primarily linked with the global warming. Understanding the climate change in totality is sophisticated, owing to the number of players involved in it, which aren't yet fully understood by the experts themselves.

However, the existing literature suggests based on the evidences of increase in the *surface temperature, sea surface temperature, borehole temperature, and sea level,*


that it would be wise on the part of humanity to act to minimize the global warming – to which burning of fossil fuels is main culprit. Cause of global warming is well documented and known by majority of the people, what is apparently failing, is in the action to minimize the production of global warming gases and excessive natural resources consumption. Humans are most intelligent species, yet most skeptical and cynical creature who ever walked the earth, choice are-to scum to habit of cynicism, or accept the fact for real and act to maintain the balance in nature for the sake of humanity.

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References

- [1] Agarwal SK. Global warming and climate change. New Delhi: APH Publishing Corporation; 2011. Available from: <http://www.indiaenvironmentportal.org.in/files/GlobalWarming%20Book.pdf>
- [2] Shrivastava A. Global Warming. New Delhi: APH Publishing Corporation; 2009.
- [3] Krauss LM. The physics of climate change. London: Head of Zeus Ltd; 2021.
- [4] Budzianowski W. Time delay of global warming. *International Journal of Global Warming*. 2011;3(3):289.
- [5] Johnsson F, Kjärstad J, Rootzén J. The threat to climate change mitigation posed by the abundance of fossil fuels. *Climate Policy*. 2018;19(2):258-274.
- [6] Henderson RM, Reinert SA, Dekhtyar P, Migdal A. Climate Change In 2017: Implications for Business [Internet]. Hbs.edu. 2017 [cited 20 March 2019]. Available from: https://www.hbs.edu/environment/Documents/Climate_Change_2017.pdf
- [7] Aizebeokhai AP. Global Warming and Climate Change: Realities, Uncertainties and Measures. *International Journal of Physical Science*. 2009;4(13):868-879.
- [8] Jackson R. The Effects of Climate Change [Internet]. *Climate Change: Vital Signs of the Planet*. 2019 [cited 10 March 2020]. Available from: <https://climate.nasa.gov/effects/>
- [9] Benjamin D, Por H, Budescu D. Climate Change Versus Global Warming: Who Is Susceptible to the Framing of Climate Change? *Environment and Behaviour*. 2016;49(7):745-770.
- [10] Agarwal A, Narain S. Global Warming: in an Unequal World [Internet]. *Indiaenvironmentportal.org.in*. 2003 [cited 17 February 2020].
- [11] Climate change: Evidence, Impacts, and Choices. [Internet]. *Ipclimatechange.trg-learning.com*. 2013 [cited 4 March 2020]. Available from: <http://ipclimatechange.trg-learning.com/wp-content/uploads/2013/11/NAS-Climate-Change-Evidence-Impacts-and-Choices.pdf>
- [12] Florides L. A., Christodoulides, P. and Messaritis, V., 2010. Global warming and CO2 Vs Sun. In: Harris, S. A. (Ed.). *Global Warming*, Chapter 3: 23-62. Croatia, IntechOpen. 249p. Doi: 10.5772/10283.
- [13] Herring D. Couldn't the Sun be the cause of global warming? | NOAA Climate.gov [Internet]. *Climate.gov*. 2020 [cited 12 March 2021]. Available from: <https://www.climate.gov/news-features/climate-qa/couldnt-sun-be-cause-global-warming>
- [14] Suonan J, Classen AT, Sanders NJ, He J. Plant phenological sensitivity to climate change on the Tibetan Plateau and relative to other areas of the world. *Ecosphere*. 2019;10(1).
- [15] IPCC Special report "Global Warming of 1.5 degree Celsius-summary for teachers. [Internet]. *ipcc.ch*. 2018 [cited 13 March 2020]. Available from: https://www.ipcc.ch/site/assets/uploads/sites/2/2018/12/ST1.5_OCE_LR.pdf
- [16] Lineman M, Do Y, Kim JY, Joo GJ. Talking about Climate Change and Global Warming [Internet]. 2015 [cited 16 March 2020]. Available from: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0138996>
- [17] Weathers MR. Newspaper Coverage of Global Warming and Climate Change

(GWCC) as a Public Health Issue. Applied Environmental Education & Communication. 2013;12(1):19-28.

[18] Shapiro MA, Park HW. More than entertainment: YouTube and public responses to the science of global warming and climate change - Matthew A. Shapiro, Han Woo Park, 2015 [Internet]. SAGE Journals. 2014 [cited 11 March 2020]. Available from: <https://journals.sagepub.com/doi/abs/10.1177/0539018414554730?journalCode=ssic>

[19] Member Organizations [Internet]. US Climate Action Network. 2019 [cited 12 March 2020]. Available from: <https://www.usclimatenetwork.org/member-organizations>

[20] 100 Top Climate Change Sites [Internet]. World.org. 2013 [cited 23 March 2020]. Available from: <http://www.world.org/weo/climate>

[21] Liu X, Vedlitz A, Stoutenborough J, Robinson S. Scientists' views and positions on global warming and climate change: A content analysis of congressional testimonies [Internet]. 2015 [cited 17 March 2020]. Available from: <https://link.springer.com/article/10.1007%2Fs10584-015-1390-6>

[22] Allen DE, McAleer M. Fake news and indifference to scientific fact: President Trump's confused tweets on global warming, climate change and weather [Internet]. Eprints.ucm.es. 2018 [cited 12 January 2020]. Available from: <http://eprints.ucm.es/47902/1/1817.pdf>

[23] Global Climate Report - Annual 2018 | State of the Climate | National Centers for Environmental Information (NCEI) [Internet]. Ncdc.noaa.gov. 2018 [cited 17 March 2020]. Available from: <https://www.ncdc.noaa.gov/sotc/global/201813>

[24] Verheggen B. Global Average temperature increases. GISS, HadCRU

and NCDC compared. [Internet]. My view on climate change. 2010 [cited 19 March 2020]. Available from: <https://ourchangingclimate.wordpress.com/tag/ncdc/>

[25] Sea Level | NASA Global Climate Change [Internet]. Climate Change: Vital Signs of the Planet. 2020 [cited 17 February 2020]. Available from: <https://climate.nasa.gov/vital-signs/sea-level/>

[26] Brawlower T, Bice D. Temperature: Ocean Warming | EARTH 103: Earth in the Future [Internet]. E-education.psu.edu. 2019 [cited 10 February 2020]. Available from: <https://www.e-education.psu.edu/earth103/node/753>

[27] Climate Change 2014 Synthesis Report Summary for Policymaker [Internet]. Ipcc.ch. 2014 [cited 1 March 2020]. Available from: https://www.ipcc.ch/site/assets/uploads/2018/02/AR5_SYR_FINAL_SPM.pdf

[28] Liu X, Hao F, Portney K, Liu Y. Examining Public Concern about Global Warming and Climate Change in China. The China Quarterly. 2019; 242:460-486.