International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2020, 10(1), 403-418.

Greenhouse Gases: A Review of Losses and Benefits

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Received: 16 July 2019 **Accepted:** 03 Novmber 2019 **DOI:** https://doi.org/10.32479/ijeep.8416

ABSTRACT

This study provides a review of benefit and losses of greenhouse gases (GHGs). For the last decades, the average global temperature is rising on the surface as well as on the oceans. There are a number of factors behind this rise, but the main cause of this rise is anthropogenic increase in GHGs. The anthropogenic factors comprise of burning of fossil fuel, coal mining, industrialization etc. During the last century, the CO_2 concentration increased by 391 PPM, CH_4 and N_2O have reached at warming levels. The rise in overall temperature is changing the living pattern of humans and it also damages the economy as well as ecosystem for other living species. The rising GHGs concentration may also have some positive effects on the economy, but it has heavy costs as well. GHGs are responsible for the change in climate which include a rise in sea level, ice melting from ice sheets and ocean acidification and climate change is responsible for the other damages like low fresh water resources, damage to the coastal system, damage to human health and raise the issue of food security.

Keywords: Greenhouse Gases, Health, Food, Natural Resources
JEL Classifications: P28, P36, L66

1. INTRODUCTION

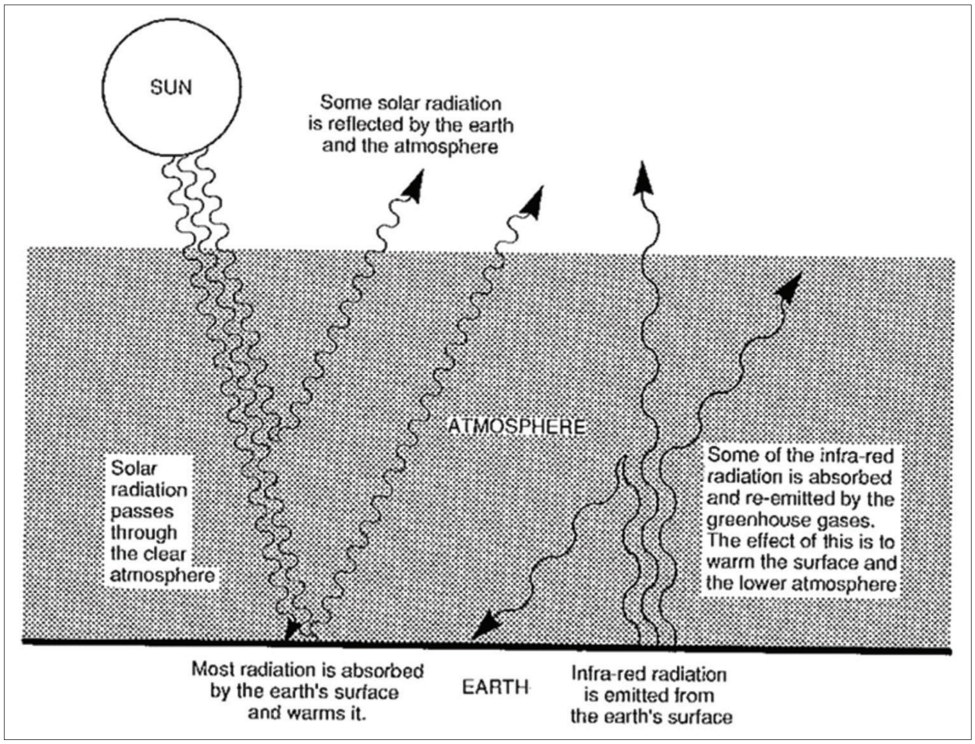
The greenhouse gases (GHGs) are the important part of our ecosystem. Without the existence of GHGs our earth temperature would not be sustained. Instead of the importance of GHGs, the recent rise of GHGs is causing many damages to the human and other living beings. GHGs include CO_2, CH_4, N_2O and CFC. Among them, the main contributor of global warming is CO_2 (Derwent, 1990), which is a long living gas in the atmosphere, before 200 years back it has reasonable level in the air. But due to industrialization, its amount reached to dangerous levels. Due to the high level of GHGs the average earth temperature is rising (Lashof, 1989; Kelly and Wigley, 1990). The hot and summer days are increasing throughout the earth and cool days and nights are diminishing. This hot summer adds to sea levels to more rise. In the snowy areas, the snow sheet is melting, which decreasing the reflectivity of the earth and increasing its energy absorption capacity. This increasing level of GHGs has very negative effects on human and animal's health as well. The fresh water resources are also continuously decreasing and making the climate warmer. Although, there are many empirical studies which highlights the dangerous impacts of GHG's but GHGs have some advantages and benefits for the society. The CO_2 is essential for the plants to grow, so increasing its concentration will give benefits to the plants also in some areas where precipitation increasing will have positive effects on the crops as well. But most of the scientific bodies are still agreeing that GHGs cost lot in terms of dry land loss and food security. Anthropogenic has become the main source of GHG's concentration. The human activities which use the burning of fossil fuel, the raise the concentration level of CO_2 in the atmosphere. Many empirical studies established direct relationship between economic growth and GHGs concentration, with rising population, day by day it is becoming difficult to forgo economic growth for the environment. The industrial countries like the USA and China are causing more damage to the environment as compared to the low-income countries. If the same trend of CO_2 will continue till the end of the 21st century, there would be the high social cost of carbon human will face. The GHGs and its damage follow the pattern where GHGs, increases the temperature of the earth, which cause several damages to the planet. Scientific bodies are searching new technologies to mitigate the damages of GHGs.

1.1. GHGs

Our atmosphere is composed of several gases with different atmospheric concentration including Oxygen (21%), Nitrogen (78%), Water Vapor (0-4%), Argon (1%), Carbon Dioxide (0.04%), and others are Nitrous Oxide (trace), Methane (trace), Halo-carbon (trace) and Ozone (trace). These gases play a major role to make our earth's climate, sustainable for living beings. We inhale Oxygen when we breath. The trace gases have to maintain the temperature of our earth through a process called "greenhouse effect." These trace gases are very low in quantity, but has very high impact on overall temperature. If these gases would not present in the atmosphere our atmosphere would be 30°C cooler than the present temperature. There are three major components which define the greenhouse effects;

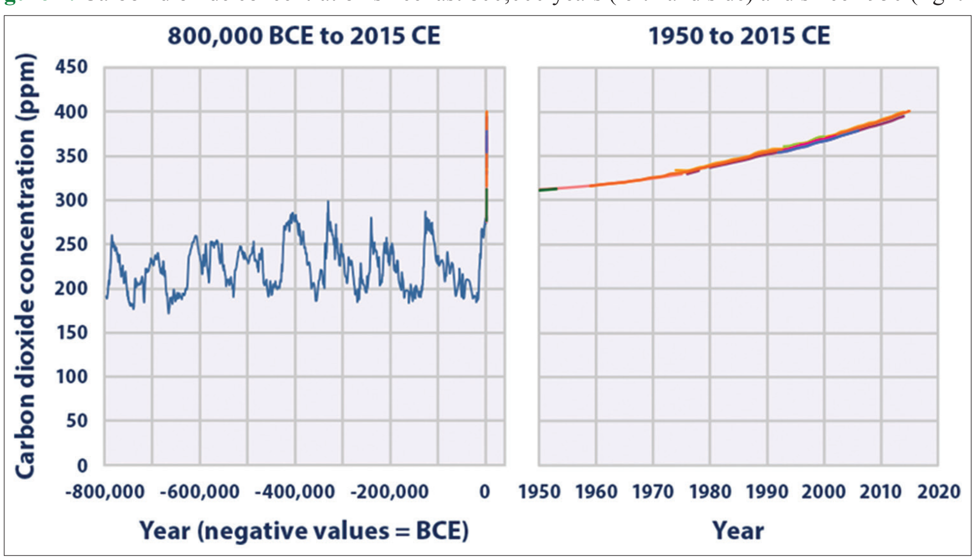
a. The heat absorbing capacity of that gas
b. The atmospheric concentration of that gas
c. The lifetime of that gas.

Figure 1: Illustration of green house effect



Source: IPCC/FAR/WG1/SPM/Page # 8

Figure 2: Carbon dioxide concentration since last 800,000 years (left hand side) and since 1950 (right hand side)



Source: Environmental protection agency

According to the Ma et al. (2013), the heat absorbing capacity of CH_4 is 25 times greater than the CO_2 and N_2O has 296 times >CO_2. CO_2 alone live more than 100 years in the atmosphere.

1.2. Logic Behind Green House Effect

Figure 1 explains the greenhouse gasses reaction, the Sun is the main source of energy in our solar system. It is impossible to live without the Sun. Energy from the Sun is due to the fusion process in which two atoms of hydrogen combine together and make a single atom of helium. In all this process, some of the hydrogen mass converted into energy. The Sun radiate energy in many ways (e.g., light, heat, ultraviolet) and in the form of short waves (which contain huge amounts of energy). This energy reaches to the surface of the earth but before that our atmosphere which consist of gases stops 2/3 of the radiation from reaching to the earth. The remaining 1/3 reaches of the earth and some of its portion absorbed by the earth in the form of invisible radiation, after that our earth radiates this energy back towards space. All this process is called radiative forcing. The GHGs stop the earth's reflected energy going back to space and send back to earth. This whole process is called the greenhouse effect. The Oxygen and Nitrogen do not have any greenhouse effect. The most important GHGs is CO_2, which is only 0.04 of the atmosphere; it is clear that if the GHGs concentration will increase in the atmosphere they will stop more and more energy from going back to space and make earth warmer and warmer.

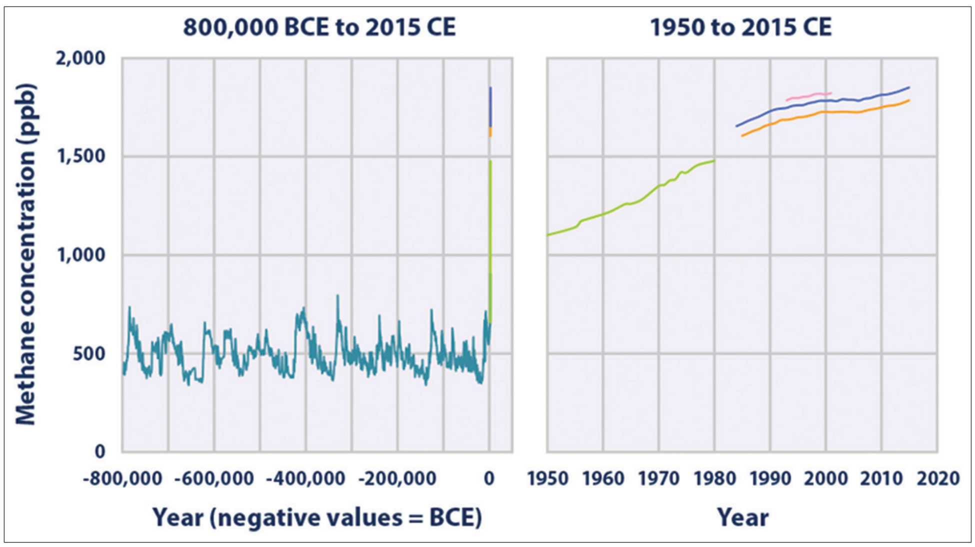
1.3. Concentration and Sources of GHGs

Many trace gases like CO_2, N_2O lives naturally in the atmosphere, but during recent days, it has been observed that concentrations of these gases is increasing in the atmosphere. The main cause of this concentration, is due to increase in anthropogenic, human activities like burning of fossil fuel etc.

1.3.1. Carbon dioxide

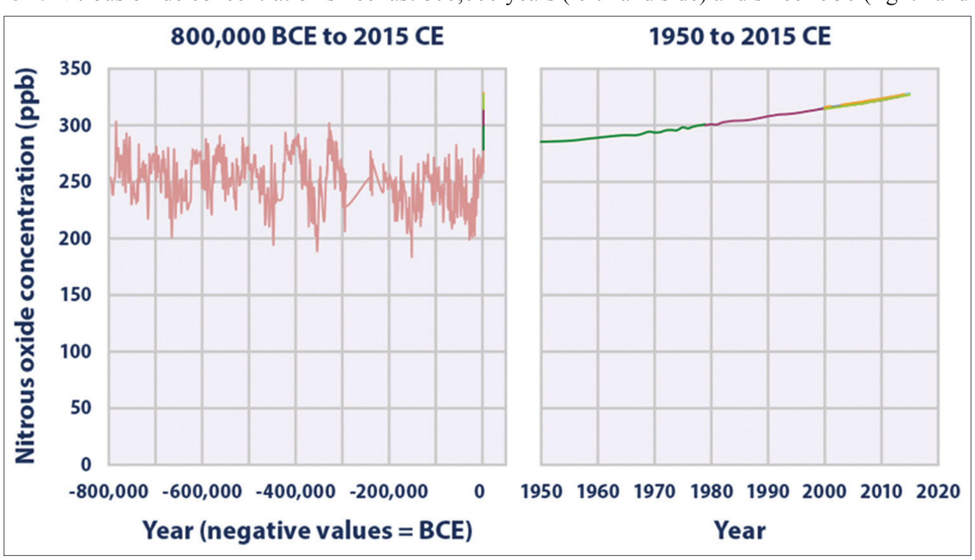
Figure 2 explains the historical overview of carbon dioxide concentration in the world. It is a long-lived gas, the pre-industrial

Figure 3: Methane concentration since last 800,000 years (left hand side) and since 1950 (right hand side)



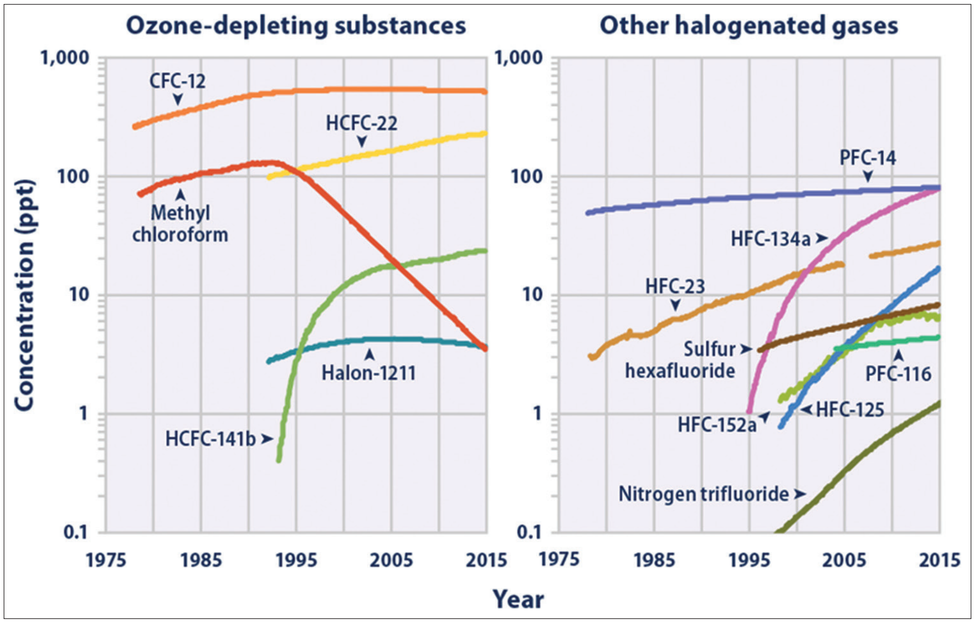
Source: Environmental protection agency

Figure 4: Nitrous oxide concentration since last 800,000 years (left hand side) and since 1950 (right hand side)



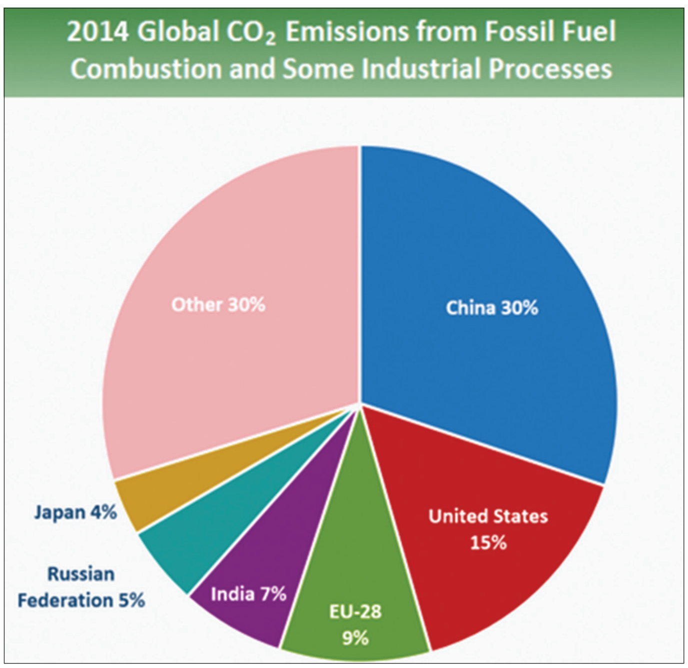
Source: Environmental protection agency

Figure 5: Halo carbon concentration since 1975



Source: Environmental protection agency

Figure 6: Global countries releasing CO_2 in the atmosphere



Source: Environmental protection agency

concentration of CO_2 was 280 PPM (Neftel et al., 1985a), but today its concentration increased by 400 PPM. There are two major sources of this increase (I) burning of fossil fuel and (II) deforestation. This increase is enough to participate in greenhouse effect (Hansen et al., 1984; Broccoli and Manabe, 1987).

1.3.2. Methane

Figure 3 explains the historical overview of methane concentration in the world. The second greenhouse gas is Methane CH_4, the pre-industrial concentration of CH_4 was 0.8 PPM (Craig and Chou, 1982; Khalil and Rasmussen, 1984). In year 1978, the concentration was approx 1.51 PPM (Blake and Rowland, 1988) and in the year 1990, the concentration was 1.71 PPM (Zander et al., 1990). The recent concentration is 1890 PPB. The major source of CH_4 is Natural Wetlands (Svensson and Rosswall, 1984), Rice Paddie (Aselmann and Crutzen, 1989), Biomass burning (Crutzen et al., 1985), Coal Mine Ventilation (Oremland 1988), Leak from pipelines and discharge from oil and gas wells (Cicerone and Oremland, 1988).

Table 1: Top 10 warmest years since 1880

Rank 1=Warmest Period of Record: 1880-2016	Year	Anomaly °C	Anomaly °F
1	2016	0.94	1.69
2	2015	0.90	1.62
3	2014	0.74	1.33
4	2010	0.70	1.26
5	2013	0.67	1.21
6	2005	0.66	1.19
7	2009	0.64	1.15
8	1998	0.63	1.13
9	2012	0.62	1.12
10 (tie)	2003	0.61	1.10
10 (tie)	2006	0.61	1.10
10 (tie)	2007	0.61	1.10

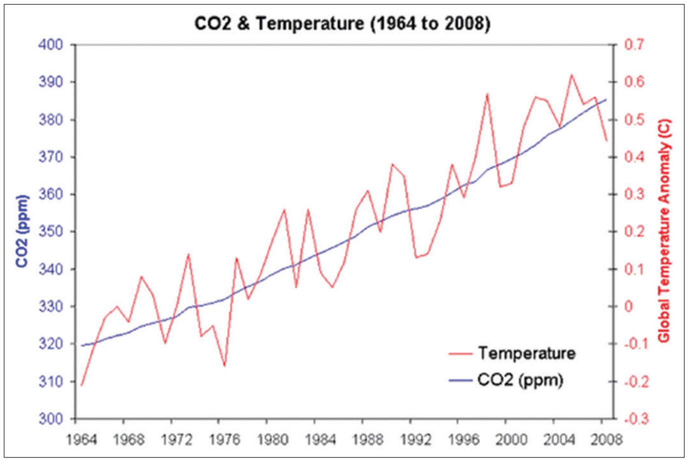
Source: NOAA

Table 2: Level of ice sheet on earth

Period	Ice sheet loss (mm year–1 SLE)	
Greenland		
2005-2010 (6-year)	0.63	±0.17
1993–2010 (18-year)	0.33	±0.08
Antarctica		
2005–2010 (6-year)	0.41	±0.20
1993–2010 (18-year)	0.27	±0.11
Combined		
2005–2010 (6-year)	1.04	±0.37
1993–2010 (18-year)	0.60	±0.18

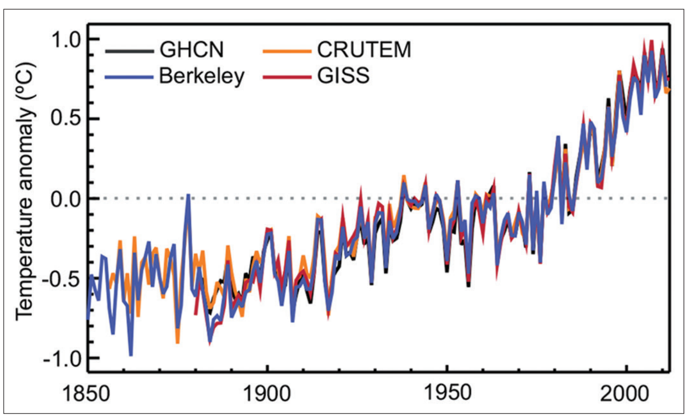
Source: IPCC AR5

Figure 7: Statistical method of finding the relationship between greenhouse gases and Temperature shows that there is no correlation between these two variables. The CO_2 continues to rise, but there is a variation in the temperature



Source: The data from NOAA. Relationship between CO_2 and temperature

Figure 8: Global annual land surface air temperature anomalies. From 1961 to 1990 taken as an average



Source: Berkeley, CRUTEM, GHCN and GISS

1.3.3. Nitrous oxide

The Nitrous oxide is also one of the major components of the greenhouse effect. The pre-industrial concentration of N_2O was 285 PPB (Zardini et al., 1989) but in the year 1990, its concentration was 310 PPB (Elkins and Rossen, 1989) and in recent times, the concentration is increased by 328 PPB. The major source of N_2O are Oceans (McElroy and Wofsy, 1986), Aerobic Soil (Matson and Vitousek, 1987), and Fertilizers (Bremner et al., 1981). Figure 4 explains the historical overview of nitrous oxide concentration throughout world.

1.3.4. Halo-carbon

The other dominant source of the greenhouse effect is Halo-carbon, it includes CFC and HFC. Figure 5 explains the halo carbon concentration since 1975. It is mainly a product of industry and before industrialization, its concentration was almost zero and after industrialization different type of halo-carbons have different concentration. The halo-carbon are the most common cause of Ozone depletion (UNEP, 1987).

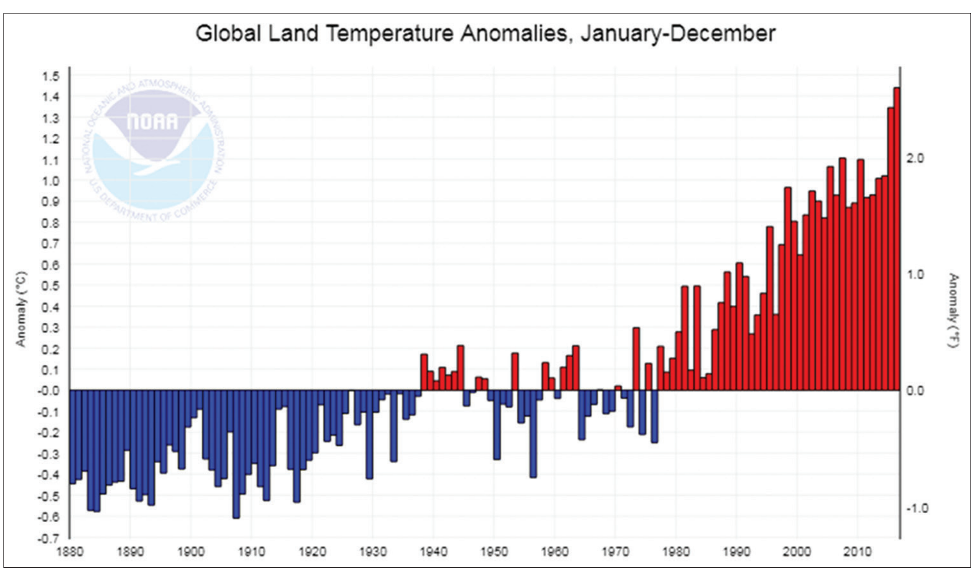
1.3.5. Water vapor

Another major player in the global warming scenario is water vapor. Increased water vapor in the atmosphere causes second atmospheric layer to cool and first layer of warmth. (Manabe and Strickler, 1964; Solomon et al., 2010) but the concentration of water vapor is not affected by human activities. Since the pre-industrial time, many developed countries are sending CO_2 emission in the air. The most concentration is sent from China after than USA. For more details view Figure 6.

1.4. How Do We Know?

Almost all the scientific communities are agreed on the greenhouse effect, but there are uncertainties in the rate of change in radiative forcing due to changes in concentration. Statistical methods do not show any correlation between concentration and radiative forcing. To understand, the relationship between concentration and radiative forcing, we use radiative transfer models because our

Figure 9: Global annual land surface air temperature anomalies from 1880 to 2016



Source: NOAA

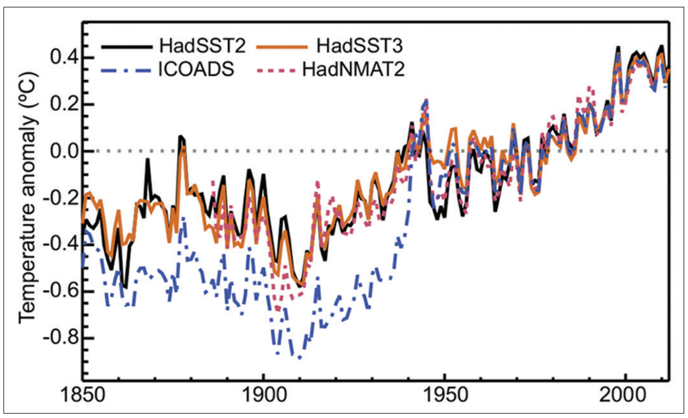
atmosphere is a very complex system. It is not only present value which affects the atmosphere, but also the past and future and the presence of cloudiness, water vapor also affects the atmosphere. The following equation is used to estimate the radiative forcing on the basis of change in concentration.

$$AF = f\,(C0, C) \quad (1)$$

Where AF is the change in radiative forcing and C is the change in concatenation. By using the model, we can estimate the coefficient. For CO_2 the coefficient is (AF = 6.3), In (C/C0) where C is CO_2 in PPM), coefficient taken from Hansen et al. (1988), functional form from is used by (Wigley and Raper, 1987).

Figure 7 presents the overview of carbon dioxide and temperature, in the presence of new technologies, now we also have ice core evidence in which the scientists examine the air trapped in the ice sheets and suggest that the pre industrial concentration of GHGs was far lower than the present. In the past, Svante Arrhenius was the first man who answered the question, are GHGs cause to increase in temperature? According to his point of view, if there is an increase in carbonic acid, which is the combination of CO_2 and H_2O the global earth temperature will rise (Arrhenius, 1896). Followed by his work most of the studies has been conducted to find the relationship between GHGs and Global warming. Recently, we have evidence which suggest that the GHGs concentration is increasing since industrialization began which is causing global warming (Duan and Wu 2006; Hurtt et al., IPCC AR5; Oreskes, 2004; Keeling et al., 1989a). Global Warming is due to the increasing concentration of GHGs in the atmosphere (Lashof, 1989; Kelly and Wigley, 1990; Alley et al., 2007). The most known contributors of radiative forcing are CO_2 (61%), CH_4 (17%), N_2O (4%) and CFCs (12%) (Derwent, 1990). CO_2 is one of the major gas, which is causing a rise in the earth temperature (Hansen et al., 1981; Hansen et al., 2010). Greenhouse gas concentration is causing Global warming, which is not only affecting land, but also the oceans at the same time (Willis et al., 2010). IPCC in its AR4 concludes that in the troposphere, the concentration of GHGs is increasing and earth temperature is also increasing which is a clear sign that the global warming is related to the increased concentration of GHGs. Lacis et al. (2010) at NASA's Goddard Institute for Space Studies (GISS) studied that Carbon Dioxide act like a thermostat and control the earth temperature. There is not only the observed concentration of GHGs, but also the observed changes in the climate, like rise in sea level, ice sheets melting and change in precipitation which suggest that the earth is warming.

Figure 10: Global annual sea surface temperature anomalies from 1859 to 2005

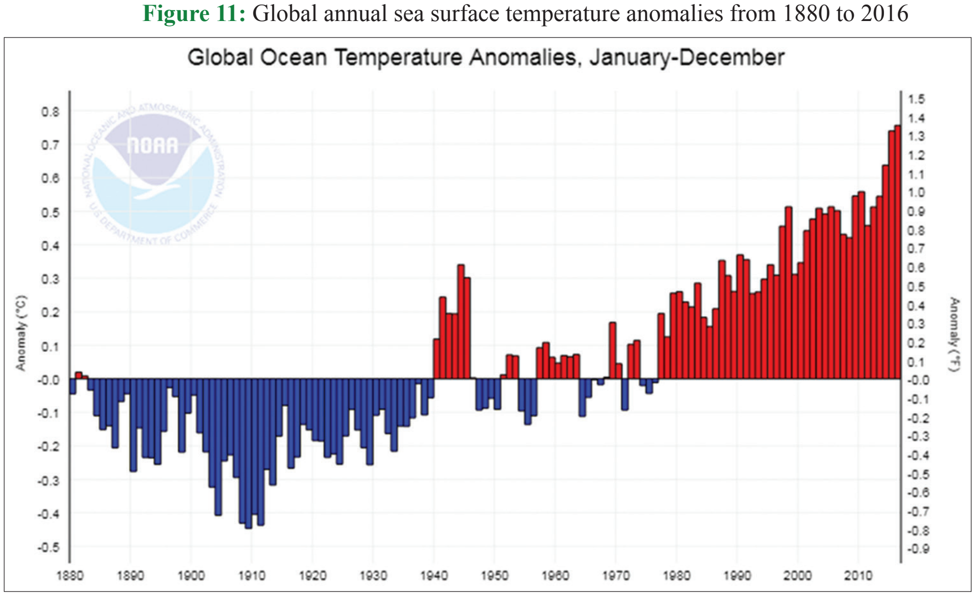


Source: HadSST2, HadSST3, ICOADS, HadNMAT2

2. OBSERVED CHANGES IN CLIMATE DUE TO GHGS

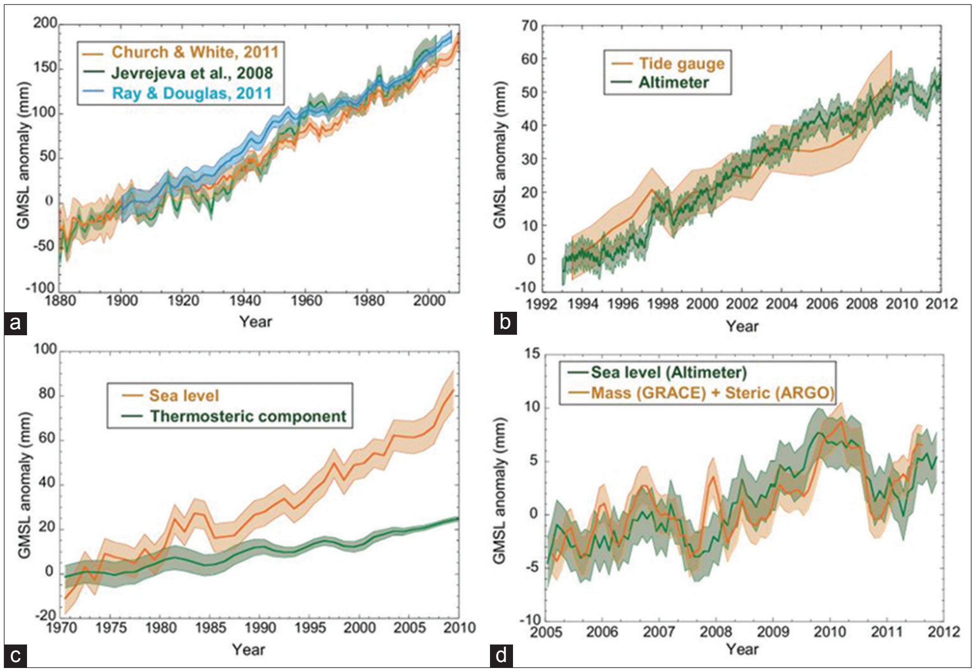
Plenty of changes have been observed in the climate due to increase in GHGs. The main change is in temperature as it is observed that the average temperature is rising all over the world. There is also change in Ice sheets and rising sea level.

Figure 11: Global annual sea surface temperature anomalies from 1880 to 2016



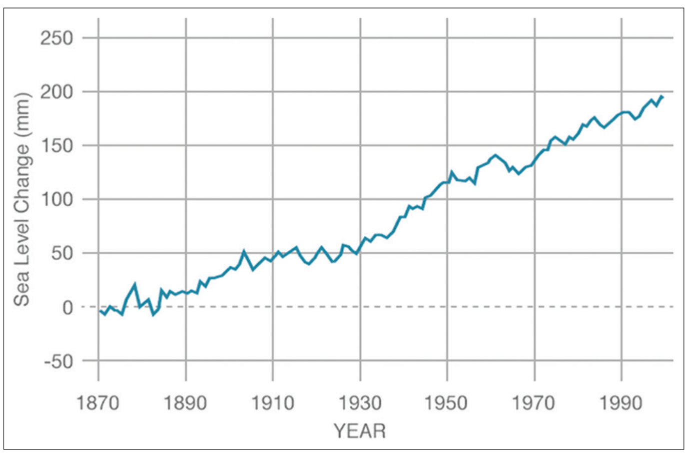
Source: NOAA

Figure 12: (a-d) Global mean sea level rise anomalies



Source: IPCC AR5

Figure 13: Global mean sea level rise anomalies



Source: NASA

2.1. Change in Temperature

2.1.1. Land surface air temperature

IPCC AR4 mentioned that the Land Surface Air temperature is continuing to increase. GISS (Hasen et al., 2010), GHCN (Lawrimore et al., 2011), CRUTEM4 (Jones et al., 2012) and Berkeley (Rohde, 2013a) estimation of temperature concludes that since the year 1900 the earth temperature has risen. There are plenty of regional analysis has been conducted, including Europe (Winkler, 2009; Bohm et al., 2010; Tietavainen et al., 2010; van der Schrier et al., 2011), China (Li et al., 2009; Zhen and Zhong-Wei, 2009; Li et al., 2010a; Tang et al., 2010), India (Jain and Kumar, 2012), Australia (Trewin, 2012), Canada (Vincent et al., 2012), South America, (Falvey and Garreaud, 2009) and East Africa (Christy et al., 2009). They all agree with the fact that the Earth Temperature is continuing to rise. As Antarctic is the coolest place in the world, but according to recent researches and data analysis by (O'Donnell et al., 2011; Chapman and Walsh, 2007; Steig et al., 2009; Monaghan et al., 2008), they all are agreed that the Antarctic has been getting warmer since year 1950. The earth temperature has risen since 20th century had started and the warming is accelerating since year 1970. The NOAA data suggest that the year 2016 has been the warmest since 1880 and the decade 2000 was also the warmest decade in the recorded history. There is a huge evidence that since about the year 1950, the global land areas faced warming in both max and min temperature extreme (Donat et al., 2013c). Figure 8 shows that global annual land surface air temperature anomalies from 1961 to 1990.

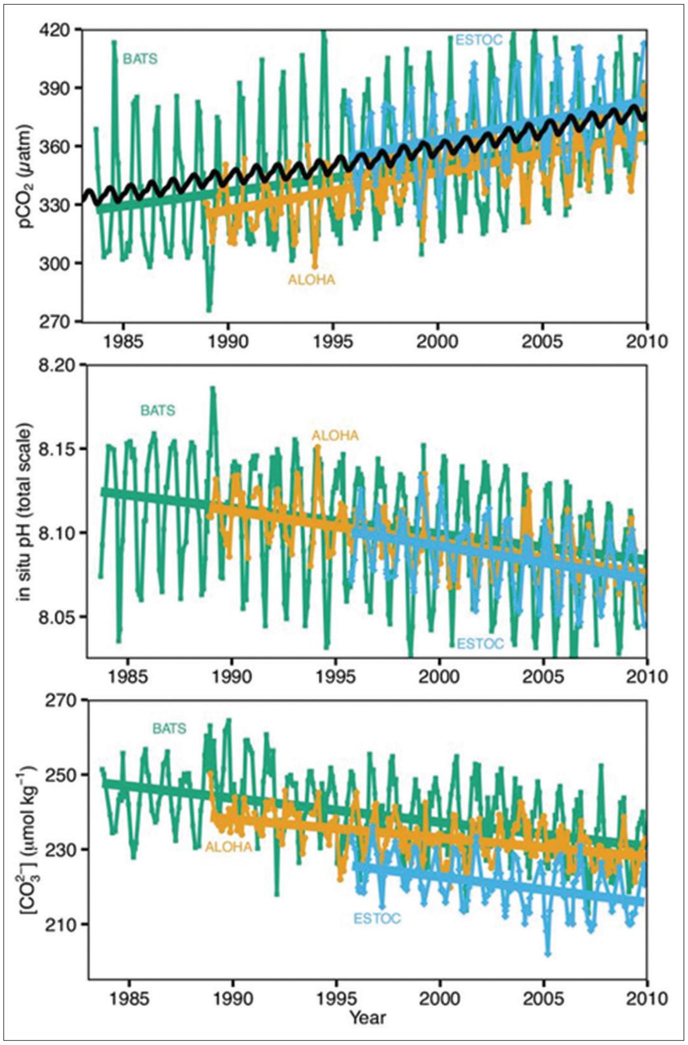
2.1.2. Sea surface temperature

Figure 9 shows that global annual land surface air temperature anomalies from 1880 to 2016. The Sea surface temperature is also continuously rising as overall GHGs concentration is rising. The results of four series such as ERSST (Smith et al., 2005; 2008), HadSST2 (Rayner et al., 2006), HadNMAT2 (Kent et al., 2013) and (ICOADS, v2.5) suggest that the sea surface temperature is rising. The Satellite SST data records also suggest that there is a rapid increase in the sea surface temperature. Figure 10 shows the global annual sea surface temperature anomalies from 1859 to 2005. Since the year 1880, there is almost 1.5°C increase in the sea temperature and from year 1980, the increase is almost 1°C. As time passes, the increase in the sea surface temperature is accelerating. The NOAA data suggest that since 2000 the SST has been increasing more sharply and the year 2016 was the warmest year in the recorded history. Table 1 presents the top 10 warmest years since 1880.

2.2. Precipitation

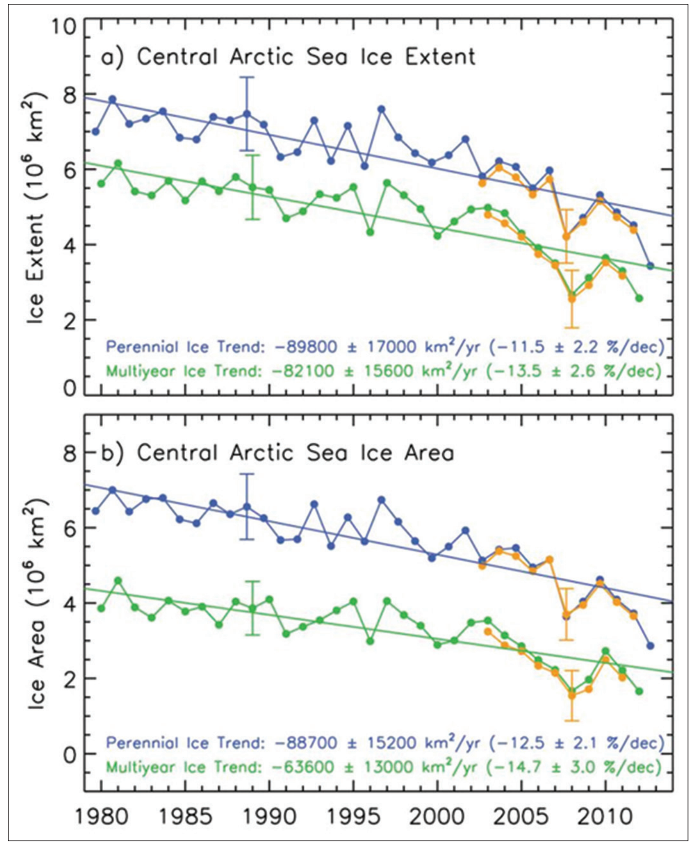
It has been observed that the global trends in precipitation from 1901 to 2005 are statistically not good (WGI AR5 Chapter 2; Bates et al., 2008). Since the year 1950, the extreme events like rainfall and droughts are worst (Arndt et al., 2010). These changes

Figure 14: The time series data of Atlantic and North Pacific oceans, which show pCO_2 (top), pH (center) and carbonate ion (bottom)



Source: BATS, ALOHA, ESTOC

Figure 15: Ice area and ice extent of Central Arctic from 1979 to 2012



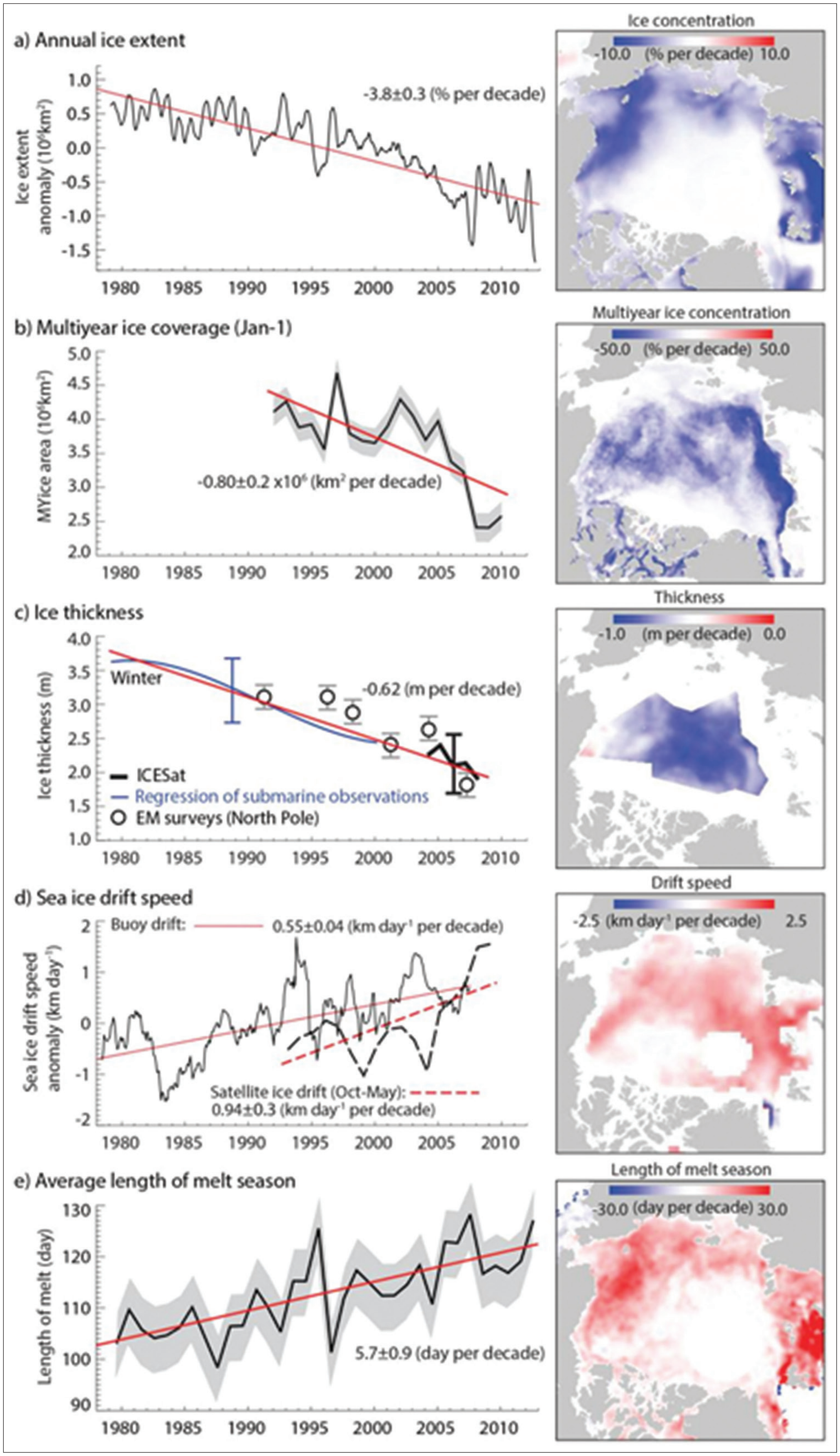
Source: Comiso (2012)

are attributed to global warming (Stott et al., 2010 and Lambert et al., 2012). The change in global and regional precipitation is due to the anthropogenic forcing (Zhang, 2007a). It has also been observed that there are shorter snowfall seasons and snow melting seasons start before the historical time (Takala et al., 2011). In China, around 37% of the land facing drought with low soil moisture (Wang et al., 2011). Over the past century the global precipitation is decreasing CRU (Mitchell and Jones, 2005) and GHCN (Vose et al., 1992), the gauge-based precipitation data sets reveal that there has been a decrease in the precipitation globally from 1900 to 2005. Figure 11 shows the global annual sea surface temperature anomalies from 1880 to 2016. In the USA, there is a change in the snowfall and in the western USA, the snowfall is converting into rain (Feng and Hu, 2007; Kunkel et al., 2009). In the South Western part of Canada, the snowfall is decreasing (Mekis and Vincent, 2011). In the heavy snow fall area of Japan, the snowfall is decreasing (Shekar et al., 2010). The snowfall and rainfall days in Switzerland also changed (Serquet et al., 2011). Monaghan and Bromwich (2008) found a decline in the snowfall of the Antarctic in the year 2004. The decrease in the stream flow has been reported in mid and low latitude river basin like Yellow River since 1960 (Piao et al., 2010) where precipitation has been decreased. In some areas such as Part of USA the stream flow has been increased (Groisman et al., 2004). Analysis explain that there is a decrease in the cloud cover in may region of the world, including Poland (Wibig, 2008), China and Tibetan Plateau (Endo and Yasunari, 2006; Xia, 2010b), particular the clouds at the upper level (Warren et al., 2007) and also over Africa, South America and Eurasia and in particular (Warren et al., 2007). Although the satellite measurement shows that the heavy rainfall during the warmest years (Allan and Soden, 2008).

2.3. Sea Level Rise

Figure 12 shows the global mean sea level rise anomalies. During the 18th century, the European ports installed the tide gauges to measure the sea level. Since then it›s necessary for human beings to take a record on sea levels because the data explained that the sea level is rising, which is not a good sign for the people living on the coastal areas. After the discovery of the phenomena of global warming the missing links on the reason of rising sea level come under the consideration. IPCC in its first assessment report found that the rise in the sea level is due to the rising concentration of GHGs. Church et al. (2011a) conclude that the primary contributors to sea level rise are the ice from the land. Due to the GHGs concentration, the earth is going warmer and glaciers and sea ice is melting rapidly that's the reason to increase the sea level. Warrick and Oerlemans (1990) found the same types of results. They further said that if we are able to stop the GHGs concentration the sea level will still rise. The rise in sea level is due to the thermal expansion and ocean heat content. As

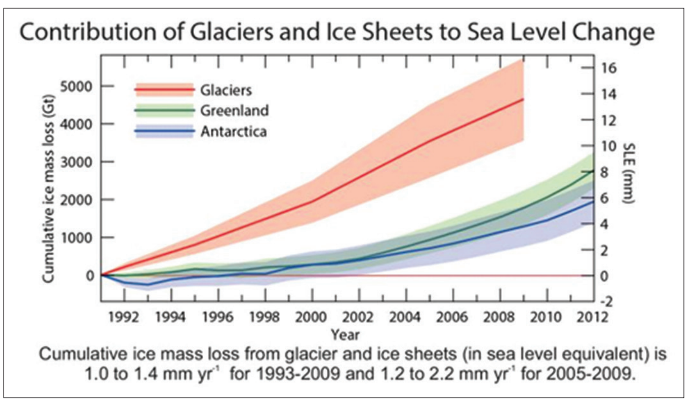
Figure 16: Different Ice measurement of Arctic sea ice including ALMS, SIDS and MYIA



Source: IPCC AR5

GHGs are increasing the atmosphere, the temperature is tending to rise, which is causing the effect of thermal expansion in the sea and increasing ocean heat content. In the recent times, the tide gauges record is available to check the sea level. The record suggests that sea level is rising over the 20th century (Mitchum et al., 2010; Woodworth et al., 2009). The rate of change in the sea level from 1901 to 2010 was 1.7 mm/year. During the year 2017, the measurements show that the average sea level increase is 84.8 mm since 1993 and from the year 1870 the total change is almost 190 mm. The sea level is continually increasing at a rate of 1/8 of an inch per year. The data suggest that there is an upward trend in the sea level change. Although, it is difficult to find the exact value of sea level change due to global warming because there are other factors like vertical land changes also affect the sea level but using satellite and updated tide gauge technology a comprehensive record on sea level rise with the correction of vertical land changes. Figure 13 shows the global mean sea level rise anomalies.

Figure 17: The ice mass loss equivalent to sea level from the Greenland and Antarctica



Source: IPCC AR5

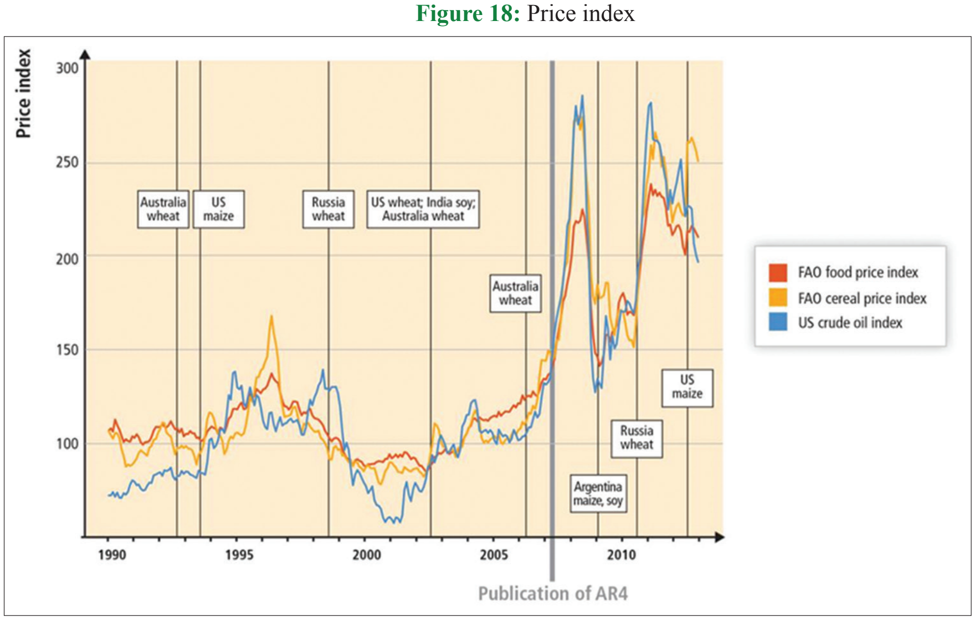
2.4. Ocean Acidification

Oceans are the main reservoir of CO_2. Ocean store 50 times more CO_2 as compared to the atmosphere (Sabine, 2004). So, the oceans are the important sink for CO_2. According to (Le Quéré et al., 2010; Mikaloff and Fletcher, 2006) 30% of total anthropogenic emission is stored by the oceans. The oceans uptake CO_2 and make a weak acid H_2CO_3. The approx oceans PH is almost between 7.8 and 8.4 which is >7, so oceans do not have any acid component in it. The recent trend shows that there is a decrease in the oceans PH which is causing the ocean acidification (Keeling et al., 2004). The global decrease in surface PH of the oceans was 0.08 from 1765 to 1994 (Sabine, 2004). The CO_2 is the dominant cause of the change in oceanic chemistry (Doney et al., 2009). Although Oceans do a lot to uptake the extra CO_2 from the atmosphere, but it is causing rise in the oceans as well. There is plenty of damage for ocean life as well. If anthropogenic CO_2 will increase at this amount by the end of the year 2100, the oceans PH will reduce to 7.4 which is a very dangerous sign for human and sea life at the same time. Figure 14 shows the time series data of Atlantic and North Pacific oceans' level of CO_2.

2.5. Changes in Cryosphere

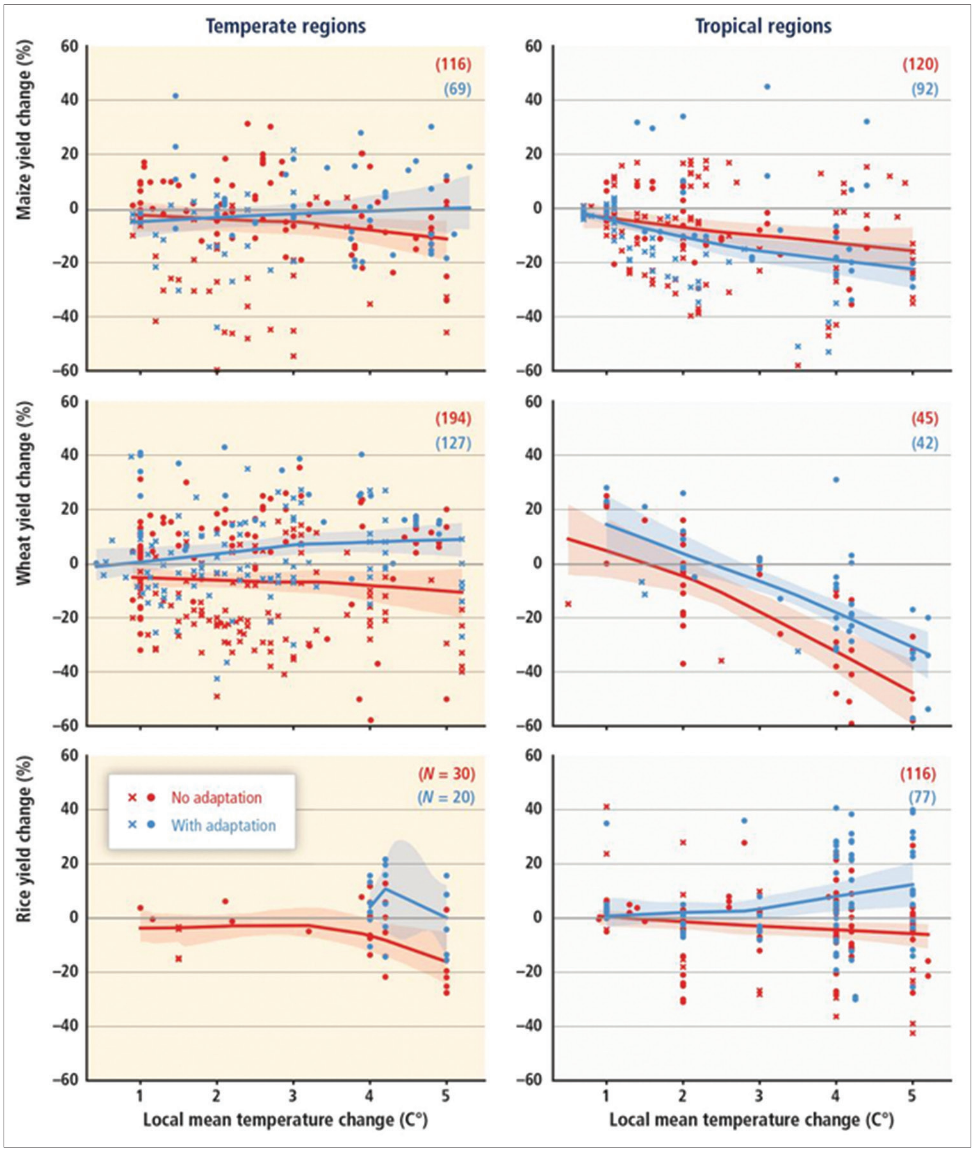
Cryosphere is referred to the water in the frozen state. It has several components, including snow, river ice shelves, and lake ice, ice sheets, sea ice, ice caps and glaciers. Ice on the surface is very necessary for earth albedo because of its 95% reflectivity. Arctic is a sea which is covered with ice almost whole the year. Its ice extent varies seasonally about in the summer 6×106 km^2 and in winter about 15×106 km^2 (Comiso and Nishio, 2008; Cavalieri and Parkinson, 2012; Meier et al., 2012). In recent observation, it is observed that Arctic Ice sheet losing its mass. The mass loss occurs in summer more rapidly as compare to winter (Comiso, 2012, Comiso and Nishio, 2008). In 2012 the ice extent was 3.44×106 km^2 and in 2007 the extent was 4.22×106 km^2 (Comiso and Nishio, 2008, Stroeve et al., 2007). The Arctic is losing its area and also the thickness of the ice sheet (Wadhams, 1990).

Figure 18: Price index



Source: IPCC AR5

Figure 19: Rice yield change, wheat yield change, maize yield change in terms of temperature change



Source: IPCC AR5

Figure 15 shows the ice area and ice extent of Central Arctic from 1979 to 2012.

Figure 16 shows the different ice measurement of Arctic sea ice including ALMS, SIDS and MYIA. The Antarctic sea ice extent also varies seasonally almost 3 × 106 km^2 in February and 8 × 106 km^2 in September (Zwally et al., 2002a; Comiso et al., 2011). Antarctic sea ice is also growing thinner and thinner (Wadhams et al., 1992). According to an estimate, there are total 168,331 number of glaciers with the total area of 726,258 with the total maximum mass of 191,879 in the world (Randolph Glacier Inventory, [RGI]). According to (WGMS, 2008) the length of glaciers is continually decreasing in many regions of the world, including Alaska, Newzeland, Canada and USA and Antarctica. The RGI data reveal that the glaciers are also losings their area. Leclercq et al. (2009) provided a detail analysis of mass loss of the glaciers. In many parts of the planet, the glaciers are losing area and mass. Moura et al. (2013) mention that Andes Tropical has lost mass rapidly since the 1980's (Rabatel et al., 2013; Rabassa and Coronato, 2009) and glaciers of Himalayan also loosing mass (Bolch et al., 2012). The Greenland Ice sheet losing mass and increasing sea level for the year 1990 (Olesen et al., 2012; Shepherd, 2012; Sasgen et al., 2012). Antarctic is also losing ice from its land (Ivins et al., 2011; Thomas et al., 2011a). From the year 1992 to 2011, the amount of ice loss of both sheets were 4260 Gt, which is equal to 11.7 mm of sea level. Table 2 presents the ice sheet of the Earth.

Figure 17 presents the ice mass loss equivalent to sea level from the Greenland and Antarctica. The Greenland temperature has risen since 1990s (Benson et al., 2013). On the regional level, many studies have been conducted and they conclude that ice in lakes and rivers is continuing to fall (Benson et al., 2013; Wang et al., 2011; Jensen et al., 2007). The permafrost temperature is continuing to rise (Wu and Chen, 2007; Zhang et al., 2007; Smith et al., 2008). The rise in permafrost temperature release CO_2 in the atmosphere which again causing increases in the CO_2 (Vogel et al., 2009; Zimov et al., 2006; Qiao et al., 2014). Since 1980, the temperature has risen by 2C. There is a decreasing trend in the discharge of the top 200 rivers, including the Congo, Yenisei, Mississippi, Parana, Columbia, Ganges, Niger and Uruguay, since 1948-2004 (Dai and Rabinovitch, 2009).

3. IMPACT ON HUMAN LIFE

3.1. Fresh Water Resources

More than 50% of the fresh water come from mountain runoff and snow fall. As it is mentioned in the precipitation that the precipitation is continuing to fall and it is impacting the fresh water resources. The river discharge has fallen since 1950. The soil moisture is also declining. The demand for water due to population growth has increased in many areas of the world (Gerten et al., 2011). The stream flow also falls which is causing to decrease in water supply to dry land. When the climate warms up the water become water vapor. It not only reduces the amount of water on the ground, but also affect the climate as well. Due to the low precipitation the ground water recharge falling in some areas (Aguilera and Murillo, 2009). The glaciers store water in the winter season and discharge in the warm period (Viviroli et al., 2011). Due to the melting glaciers the stored water is continuing to fall. Due to climate change the snow in many areas is converting into rain and those areas which rely on snow in the dry season will not be able to extract the benefit of snow in the form of fresh water and they face severe drought. Glaciers melting can also cause flooding and destroy the crops where there are no proper measures are taken to avoid floods. Water is used to produce energy with low amount of water and lack of stream-flow and river discharge will affect the production of electricity as well, which will in another case shift this production to more coal and oil usage which will again cause global warming. The more CO_2 and energy production with sources other than water will pollute more and more fresh water resources. Due to the heavy rainfall which is observed in some area the soil erosion is another issue.

3.2. Coastal System

There are three major things which are affecting the marine coastal system; Sea Level Rise, Ocean Warming, Ocean Acidification. Due to the ocean acidification the ocean water is turning into the weak acid, which is reducing the calcium in the oceans, it is causing lots of problems for sea animals like coral reef or shell fish. Due to the oceans warming most of the species migrating towards the cold water. The ocean is changing the habitat of the marine species. The sea level rise has plenty of problems for humans. Due to the sea level rise most of the ocean's shoreline are shifting their path which is decreasing the dry land. Erosion is another problem which is due to sea level rise. Rising sea level will drown some plants and animals as well. Warmer temperature causes oral bleaching which weaken some animals and they face high mortality rate. Due to the warmer temperature and the sea level rise there are high chances of floods and storms which will cause damage to the society. Oceans warming will cause species to die as almost 17% of our food come from the sea and almost 3 billion people consume protein from the sea. Almost 90% of the transportation of goods and services are from the oceans due to the climate change, so all these things will be affected by the sea. Almost 40% of our population live in cities where the land meets the sea. Due to the Sea level rise most of our population will expose to the sea. In the year 2010 almost 270 million people are exposed to the sea.

3.3. Human Health

As temperature warm up, the heat related deaths have increased. In the tropical region of the world heat related deaths significantly increase in the past decade. According to the WHO, each year 12.6 million deaths are happening because of the climate. There are three ways by which climate effect the lifestyle; First direct effect, which include extreme weather, heat, drought etc. Second, effects through natural system which include diseases and pollution. Third, effects through human system which include mental stress, under nutrition etc. There is a direct relationship between hot days increase and increase in mortality (Lee et al., 2013). IPCC in its special report SREX concludes that there is a decrease in cold days and increase in the hot days and it is very likely that heat related deaths will also increase (Christidis et al., 2012). In the year 2012, there are almost 15000 deaths happened in France alone due to heat (Fouillet et al., 2008). Human body temperature is almost 38C and if the outside temperature increase by 40.6C, there is a high chance of organ damage and loss of consciousness (Wyndham and Strydom, 1969). Due to the climate change, the floods will happen and in the year 2011, 6 out of 10 biggest disasters were flooding the total number of people died were 3140 (Guha-Sapir et al., 2011). Flooding and windstorms affect human health by drowning, infectious diseases (e.g. vector borne disease, injuries and cholera (Jakubicka et al., 2010; Burroughs et al., 2007). In countries, where warm days are increasing vector borne diseases are also increasing like malaria, dengue fever etc. Most commonly, the climate change is destroying the ozone layer which will cause the sun UV rays to pass through it and it can cause skin cancer and skin burn. The estimate of deaths related to forest fires was 339,000 deaths per year, and from 260,000 to 600,000 deaths are related to air pollution (Reid et al., 2016).

3.4. Food Security

Food is the essential part of human life. Without food we all will die. It is observed that the climate change has a negative impact on Wheat and Maize production (Lobell et al., 2011). Extreme events have also sizable impact on food security (Rivero et al., 2014). As in many areas of the world, the rainfall is decreasing, which is impacting the fresh water resources and decreasing the amount of crop yield. The warming oceans and acidification causing some fishes to die and their production is getting lower. Floods are also causing damage to the corps. In this scenario, the food prices are tending to rise on global level. It is estimated that due to the climate change, there is almost 19% increase in the prices (Lobell et al., 2011). Due to the climate change the soil is losing its moisture, which is causing a negative effect on the food production. Decrease in the food production, causing increases in the food security. The major crops like wheat, rice and maize are fully impacted by the increase in the temperature. It is causing damage to these crops as rice needs a lot of water to grow, but due to temperature rise the water is evaporating quickly, which is causing a decrease in the production also premature growth of crops is also observed. Due to warming the crop insects are increasing and the damage due to these insects is almost 16 to 18% (Oerke, 2006). The other remaining plants are treated by a lot of protests which is decreasing the quality of crops. Figure 18 presents the overview of the food price index.

4. BENEFITS OF GHGS

Figure 19 presents the rice yield change, wheat yield change, maize yield change in terms of temperature change. The requirement of irrigation water would be reduced for paddy rice in the areas where precipitation would be increased (Koo et al., 2013). The growing time will become shorter for crops (Koo et al., 2013). In high latitude areas, global warming has some benefits for the crop production (Jaggard et al., 2007; Gregory and Marshall, 2012; Supit et al., 2010). There would be an increase in CO_2, which will benefit the plants and trees. As Arctic ice is melting, the new oceans paths are open for trade. China is currently using the Arctic ocean path to send goods towards America, which is a cost-effective solution. The technology upgradation is required to mitigate the emission of GHGs, so the economy gets new demands of energy efficient equipment like Hybrid cars and low smoke power plants or catalyst converters.

5. CONCLUSIONS

GHGs are dangerous for the future of the human and other living beings lives on the planet. Although, many measures are taken to mitigate the severeness of GHGs, but yet they are causing harm to human life. Currently, the increasing concentration of GHGs is creating difficulties for human beings to live on the planet. If these GHGs are not controlled properly, it can make our earth warmer enough to end life on the planet. Many disadvantages are still hidden, but scientific body is working to find and predict the changes in the planet's atmosphere due to the GHGs. In some cases, the confidence and evidence are low, but yet the evidence we were enough to predict that our future on this planet is at risk. Mitigating GHGs concentration is not easy and belong to a single country or governments of the countries, but every individual has to play its key role to overcome bad outcomes of economic growth. Although there are many claims which shows the benefits of GHGs, but these benefits are in the short run in the long run the GHGs are damaging the earth.

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