

EFFECT OF GLOBAL WARMING ON THE ICE CAP MELTING OF POLES

EL-MELIGI A.A.

AMA International University Bahrain, Natural Sciences and Math Dept., Kingdom of Bahrain

ABSTRACT

This study investigates the effect of global warming on the ice caps melting of poles. Data about ice caps melting was collected from the professional organizations and research institutions, National Snow and Ice Data Center (NSIDC), and Japan Aerospace Exploration Agency (JAXA). The data shows an increasing in the melting of the ice caps in different areas of the world. The ice glaciers of Arctic decrease by about 10 % in the past 30 years. The ice loss in Antarctica and Greenland together contributes approximately 12 % of the rise in sea levels. The thickness of the ice caps will be decreased. The potential energy of the ice cover will be converted into kinetic energy. The coastal and islands areas of the world are vulnerable to the climate change and will be affected by the ice caps melting. The sea levels could rise about 50 cm by 2100. This level seems that it is not a significant increase but this rise would cause many effects. It could fast the erosion and would increase the evacuation of the coastal areas in the world. Reducing the green house gases is a crucial need to control global warming. Based on the JAXA data, the sea ice extent in 2013 is higher than the extents of 2012, 2007, and 2011. It means that there is an improvement in the world climate by decreasing the green house gases.

Keywords: Ice Caps Melting, Earth Poles, Green house Gases, Islands

1. Introduction

We need to save the environment and to decrease environmental pollution. The environmental pollution impacts on the humans, animals, plants, oceans, seas, rivers, ice caps of south and north poles. The pollution increases due to increasing industrial activities. These activities increase the emission of pollutant gases or greenhouse gases, carbon dioxide, chloroflorocarbon (CFC), and other gases (Jerry, 2007). These gases increase the earth temperature. Nowadays, there is an international awareness towards this problem (Rodríguez-Camino, 2010). The United Nation (UN) has an annual summit to chase industrial countries to decrease the greenhouse gases emission. On the other hand, cars emissions, chemicals fumes, and smoke from factories are considered air pollution. The ice cap of polar is defined as a region planet, which is covered in ice. The formation of ice cap is due to two factors: high elevations of the ice cap and sun radiation are rare. South Pole forms the main ice cap on the earth, with about 90 % of the ice in the world. The ice covers Antarctica has average of 2.133 kilometers thick. Environmental pollution, mainly greenhouse gases, increases the earth temperature. The increase of temperature will affect the polar ice cap melting, especially South Pole, which form 90% of the ice in the world. The ice caps melting have melted faster in last twenty years than in the last thousands of years. As confirmed by scientists, the ice caps melting accelerate the rate of rising sea levels. Times international newspaper reported that "the ice caps are melting so fast that the world's oceans are rising more than twice as fast as they were in the 1970s (TIN, 2013)." As noticed by scientists, the sea ice skin of the Arctic Ocean shrinks. The satellites show this behavior and present important matters within the images, especially, some physical properties of the ice, such as the way of entrance of the marine water into the ice skin (Witze and Alexandra, 2010). The physical properties of the sea ice have not fully investigated. Therefore, scientists are working to study more about the physical properties of the ice cap. They would like to know more about the fate of the polar ice cap. The research of international research institutes presents that thermal water expansion has an effect on ice cap melting (Cazenave, 2010). Cazenave stated that by 2100, the Thames River in London could rise by 8 to 35 inches. The data collected by a researcher

indicate that sea level rose at 0.34 cm within 15 years. In fact, the rising of water is faster than the average 0.17 cm recorded over the past 50 years. Cazenave said: "this rate, observed since the early 1990s, could reflect acceleration linked to global warming." In 2006, a famous reporters in a document found that both poles of earth are melting, which could harm coastal towns (Blakemore, 2006). Also, nobody can deny the fact of ice cap melting, said by the international research institute. As confirmed, temperatures increased 1F through twentieth century. Climatologists stated that the ice cap crowning Kilimanjaro's peak shrank in the nearly hundred years between 1912 and 2007. It was stated that 26% of the reduction happened within 8 years (2000 to 2007). It was believed that the acceleration of ice cap melting is due to global warming. It was the first time that the scientists calculated the ice volume lost from mountain's ice fields (Thompson, 2008). Ice caps melting of poles increase over the past 20 years and reach more than 4 trillion tones of ice. This huge amount moved into the oceans, rising up sea levels. According to melting polar ice, sea level has raised to 1.1 cm (Carrington, 2012). The polar ice sheets are melting fast as shown by different measures. Satellites pictures by NASA and ESA show that the most comprehensive melting of ice sheet appears in Antarctica and Greenland to date (Shepherd, 2012). As shown by a published research paper, melting Antarctic and Greenland ice sheets have added 1.1cm to world sea levels since 1992 (Cornish, 2012). There is a change in mass of ice caps of Greenland and east Antarctica and Antarctic Peninsula between 1992 and 2011. The change in mass is huge and estimated by gigatonnes per year, respectively. Since 1992, there is an increase in the average contribution of polar ice on the rate of world sea level rise (GRACE, 2013, NAS, 2013). In fact, global warming has great effect on the ice cap melting (Kerr, 2012). Greenland's ice cap is the largest in the northern hemisphere and the second largest in the world, after the Antarctic ice cap. As reported by NASA, the velocity of ice sheet increases in summer. This behavior aligns with the ice sheet surface melting intensity and timing. Based on GPS measurements, they found that the melt water accumulating in these lakes drains through the 1.2-kilometre-thick ice sheet to the bedrock, lubricating the ice sheet and making it slide faster (NS, 2008). The current rates of melting surpass the previous rates for Present melt rates exceed the past rates for thousands of centuries (Fishera, *et al.*, 2012). Surface of the earth will be affected by the melting of ice cap. The ice cap thawing reduces the pressure on the rock below the ice cap sheet. This process will lower the melting point of magma. As stated, from 1880 to 1990 the magma increases by 10 % more than the average of magma per century during the previous nine hundred year (GRL, 2008). There are a number of studies have been processed to understand the relation between global warming and ice caps melting (Robin, 2006). As revealed from these studies, long term study needs to be done to understand such relation. Also, they need to monitor the future change, which will occur in the sea levels. As mentioned, the fast increase in the sea levels is due to melting of the ice caps. The melting will input huge amounts of fresh water into the sea. This process follows the temperature of the earth (Antonio, 2011). As studied, the polar bears could be influenced by the global warming (Jerry, 2007). The polar animals' habitat, especially, polar bears, is essentially ice caps of the sea. The polar bears have been classified by the Department of the Interior in the US as a "threatened" species which is one step below an "endangered" species (Jerry, 2007). Also, islands will be affected by the increasing of the levels. As stated the ice caps melting and the rises of the ocean's level may lead disappearance of the islands in Tuvalu. There nine islands of Tuvalu locate in the Pacific Ocean (Whitty, 2003). Nowadays, millions of people live on many islands of the worlds and these islands are vulnerable to the rising waves. Accordingly, people and their cultures will be at risk, and they will lose their nations (ADB, 2012). The climate change affects the large ice sheet on earth, for example Antarctic and Greenland ice sheets. The global warming leads to climate change, which increases the melting of the ice sheets. The ice sheets will move and this will lead to disturbance of the habitat of the aquatic organisms and islands in the oceans. Researchers try to model the variations in the ice sheet to understand the future effect of the climate change on the melting process (Pattyn, 2006). Therefore, this study aims at monitoring ice caps melting of poles and the effect on sea and ocean water levels. Also, how can we control the global warming to control ice caps melting?

2. Research Methodology

The research methodology of this research will depend on collecting information and data about the polar ice cap melting from the professional organization and institution, such as National Geographic, NASA, National Snow and Ice Data Center (NSIDC), Japan Aerospace Exploration Agency (JAXA), etc. Reports will be collected about the polar ice cap melting and views about the problem. Analysis and interpretation of the data will be done using scientific logic procedures and descriptive analysis will be done. The satellites pictures can be used to give an idea about the situation of the ice cap melting of the poles. In fact, scientists can use these pictures to predict future changes of the ice caps melting.

3. Results and Discussion

3.1. Danger of Ice Cap Melting

The question has been delivered by the scientists; is there a danger of the ice caps melting? In fact, there is no clear answer about this question, but there evidences have been noticed by the scientists that the ice caps of poles are in danger and they will melt. They don't know when it will happen. The increase of earth's temperature will accelerate ice caps melting. As stated, The Greenland has a reasonable amount of ice; if it melted it would add about seven meters to the oceans. Scientists from the Universities of London and Edinburgh say that ice loss in Antarctica and Greenland together contributes approximately 12 percent of the rise in sea levels (SD, 2012). It is revealed by the National Snow and Ice Data Center (NSIDC) that North Pole ice is continuing to melt at a danger rate. The Arctic Summer ice may disappear over the next few years, much earlier than scientists had previously predicted (NSIDC, 2012). The data about the extent of Arctic ice caps indicates that there is a decline to the lowest rate in September 2012. The lowest extent drops to 1.32×10^6 miles² (NSIDC, 2012). The Arctic ice caps declined at the rate of 13% each decade since 1979. It was observed that the lowest ice extent had been seen for the 33 years from summer of 2012 year. The mean reason for the notable change is the global warming due to climate change. Continues emission of green house gases increases the earth temperature. The united nation has a call for the industrial counties to, at least, decrease the emission. If the declining rate of September Arctic sea ice continues at the current rate this may lead a great danger for the ice cap melting. Accordingly, the sea level will increase and will cover certain coast cities, villages and islands all over the world. It was revealed that the Arctic sea ice was decreased. It was three million miles² in 2007 and decreased by about 47 % in August 2012 to be 1.58 million miles square. This record was the lowest since NASA starts to record in 1979 (NASA, 2013). The scientists state that the ice cap of Arctic reaches its minimum in summer. This behavior occurs before building the ice cover during winter. This change in the ice cap behavior in recent years indicates that there is a fundamental change in Arctic ice cover. In 2007, the summer weather was very favorable to the melting ice, in 2012; it is the delicacy of the ice cover that has contributed to the record retreat of Arctic sea ice (SD, 2012).

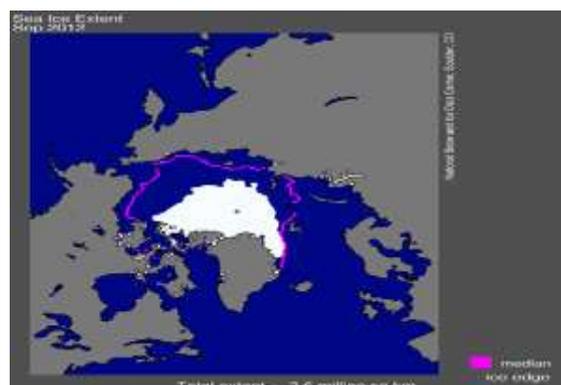


Figure 1: the extent of the Arctic sea ice for September 2012 (NSIDC, 2012).

As said by Mark Serreze, NSDIC director, summer of 2007 was a perfect weather to melt ice caps. This is because the ice was too thin and weak (SD, 2012). The reason for this behavior is that the layers of ice is becoming more of a seasonal ice cover and large areas are now ready to melting out in summer. Also, it can be said that the multilayers of ice formed within many years will be easily loosed and melted. The first law of thermodynamic stated that energy neither be created or destroyed, but converted from one form to another (Adkins, 1983). Accordingly, the potential energy of the ice cover will be converted into kinetic energy. As stated, the ice cap in Peru will completely melt in 2100 if it continues melting by the current high rate. This will affect thousands people who rely on its water for drinking and electricity high, dry, and in the dark.

3.2. Glacier National Park and Glaciers Melting

The Sperry Glacier in Glacier National Park (GNP), Montana, USA, has been investigated by the scientists from the U.S. Geological Survey Global Change Research Program. The results show that the glaciers of the GNP have decreased. The GNP was created in 1910. There were an estimated 150 glaciers in the 1910. Since then the number has declined to less than 30, and most of those remaining have shrunk in area by two-thirds. The scientists expect that most of the park glaciers will disappear within thirty years. They were very pessimistic by expecting that the glaciers may disappear all (Glinek, 2012). The scientists believe that increasing of the greenhouse gases in the atmosphere due to combustion of nonrenewable energy sources, oil, natural gas and coal, leads to increase the earth temperature. The scientists record the increase in the average annual surface temperature, which has been considered as signs for some changes in the planet: the ice level, salinity level and oceans temperatures (Glinek, 2012). There is a significant increase in the glaciers loss. This behavior is due to rise of temperatures rise and high rate of ice melting. Accordingly, more water flows to the seas from glaciers and ice caps, and ocean water warms and expands in volume. This combination of effects has played the major role in raising average global sea level between four and eight inches (10 and 20 centimeters) in the past hundred years, according to the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2013). It was discovered that the levels of the sea risen and fallen substantially over earth 4.6 billion years ago. Recently, the sea levels change by high rate, which will lead to remarkable changes in the world's coastlines. As shown in Figure 3, the latest value is 8,967,120 km² (JAXA, 2013). There is a gradual change in the area of the Arctic over the months of the year. The maximum loss of the area occurs during August, September and October. The area starts to increase again in November and December. The highest loss of the ice area was in 2012. This means that the earth temperature was increased in 2012. As shown in the Figure 3, the sea ice extent in 2013 is higher than the extents of 2012, 2007, and 2011. This behavior means that there is an improvement in the world climate by decreasing the green house gases. Also, it means that the world increases using of the renewable energy sources.

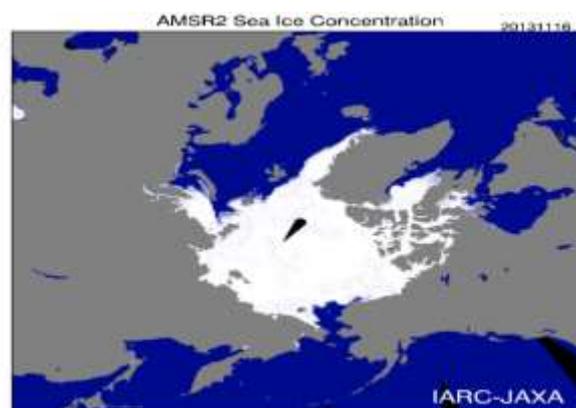


Figure 2: Arctic Sea Ice Monitor-JAXA (JAXA, 2013).

There is an experiment of NASA about the ice sheet of Greenland and other areas of the world. The results present a shrinking in the ice sheet of the Greenland. The shrinking of the ice sheet indicates the crucial effect of the climate change on the ice caps melting. In Northern Hemisphere (NH), spring ice caps breakup 9 days earlier than it happened one hundred fifty year ago. The NH autumn ice caps freeze up 10 days later. In parts of Alaska, the land descends more than 460 centimeters due to thawing permafrost. From the Arctic to Peru, from Switzerland to the equatorial glaciers of Man Jaya in Indonesia, massive ice fields, monstrous glaciers, and sea ice are disappearing, fast. Global warming will increase the earth temperature. This will melt the ice caps, which will increase the water level in the sea and ocean.

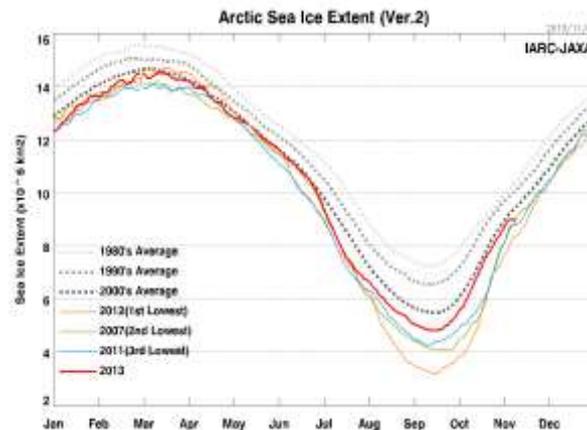


Figure 3: Arctic sea ice extent-Japan Aerospace Exploration Agency (JAXA, 2013).

The volume of the sea and ocean will expand. These groups of effects will play the major role in increasing the average sea level between 0.1 and 0.2 meters within the past 100 years. This estimation was done by Panel on Climate Change (IPCC). As stated, the scientists discovered that the level of the sea rises and falls ultimately over 4.6 billion year of the earth's history. In fact, the sea level in the recent years is rising rapidly about one tenth inch per year. Therefore, the world islands and coast areas will change due to rapid increasing of the sea level.

3.3. Greenhouse Gases and Ice Caps Melting

The greenhouse gases are responsible for the global warming. They form a shield around the earth and prevent the excessive sun rays to be escaped from the earth surface. The sun rays increase the temperature of the earth and the phenomena called Greenhouse. There are a number of the greenhouse gases. The great effect arises from carbon dioxide (CO₂). The main sources of the CO₂ production are cars and industry. The UN has forced the industrial nations to control the emission of the greenhouse gases. In fact, the economic consequences may affect controlling of the greenhouse gases emission. The economists expect a conflict between global warming and growth of the economy (EPA, 2013). As stated, it is one theory that rising temperatures cause more ice to break off from these glaciers and fall into the ocean displacing water, which could cause sea levels to rise (EPA, 2013). The Environmental Protection Agency (EPA) states that the global warming increases the ice caps melting. Researchers confirm that Pacific Island states will be greatly affected due to global warming (Tisdell, 2008). As reported, stabilization of greenhouse gas levels is important and it needs continues monitoring to follow any change in the climate (Rodríguez-Camino, 2010).

3.4. Ice Melting and Sea levels

There is a great impact of the ice cap melting on the sea levels. The scientists expect that the sea levels will increase within the next decades. As estimated, the sea levels could rise as much as half meter (50cm) by 2100. This level of the 50 cm seems that it is not a significant increase but this rise would cause many effects. It could fast the erosion and would increase the evacuation of

the coastal areas in the world (Rodríguez-Camino, 2010). It can be discussed that ice cap melting has a great effect on the world coastal areas. One of the most important effects is the erosion. The process of coastal erosion is a natural process along the world's coastlines that occurs through the actions of currents and waves and results in the loss of sediment in some places and accretion in others. The erosion will decrease the habitat for many organisms. Aquatic ecosystem will be affected. Some island will be covered by water.

4. Conclusions

Green house gases increase the temperature of the earth, which enhance global warming. The global warming has a great effect on the climate change all over the world. The global warming leads to ice caps melting of the poles. As noticed from the study, there is a significant increase in the melting of the ice cap areas in the world. The melting will lead to increase the ocean and sea water levels. There are many coastal areas and islands in the world, which will be submerged by the water.

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