Glacier Melting, Disaster and Awareness Programme

Bharat Raj Singh[*1] and Amar Bahadur Singh[2]

ABSTRACT

Large ice formations, like glaciers and the polar ice caps, naturally melt back a bit each summer. But, in the winter, snows, made primarily from evaporated seawater, are generally sufficient to balance out the melting. Recently, though, persistently higher temperatures caused by global warming have led to greater-than-average summer melting as well as diminished snowfall due to later winters and earlier springs. This imbalance results in a significant net gain in runoff versus evaporation for the ocean, causing sea levels to rise. Satellite measurements tell us that over the past century, the Global Mean Sea Level (GMSL) has risen by 4 to 8 inches (10 to 20 centimeters). However, the annual rate of rise over the past 20 years has been 0.13 inches (3.2 millimeters) a year, roughly twice the average speed of the preceding 80 years.

As with glaciers and the ice caps, increased heat is causing the massive ice sheets, that cover Greenland and Antarctica to melt at an accelerated pace. Scientists also believe ice-melt water from above and seawater from below is seeping beneath Greenland's and West Antarctica's ice sheets, effectively lubricating ice streams and causing them to move more quickly into the sea. Moreover, higher sea temperatures are causing the massive ice shelves that extend out from Antarctica to melt from below, weaken, and break off. When sea levels rise rapidly, as they have been doing, even a small increase can have devastating effect on coastal habitats. As seawater reaches farther inland, it can cause destructive erosion, flooding of wetlands, contamination of aquifers and agricultural soils, and lost habitat for fish, birds, and plants. When large storms hit land, higher sea levels mean bigger, more powerful storm surges that can strip away everything in their path.

In addition, hundreds of millions of people live in areas that will become increasingly vulnerable to flooding. Higher sea levels would force them to abandon their homes and relocate. Low-lying islands could be submerged completely. Thus, it needs launching of serious awareness programme through print media, electronic media to curb the glacier melting by reducing heavy consumption of hydrocarbon and focus on zero pollution researches to develop energy production alternatives.

Keywords : *Ocean stories, ocean life, protecting the ocean, underwater exploration.*

1.* Director-IET, School of Management Sciences, Lucknow, (U.P.), India. e-mail : brsinghlko@yahoo.com

2. Professor, Journalism & Mass Communication, Nehru Gram Bharti University, Allahabad, (U.P.), India.

1. INTRODUCTION

Everywhere on Earth, ice is changing. The famed snows of Kilimanjaro have melted more than 80 percent since 1912. Glaciers in the Garhwal Himalayas in India are retreating so fast that researchers believe that most central and eastern Himalayan glaciers could virtually disappear by the year 2035. Arctic sea ice has thinned significantly over the past half century, and its extent has declined by about 10 percent in the past 30 years. NASA's repeated laser altimeter readings show the edges of Greenland's ice sheet shrinking. Spring freshwater ice breakup in the Northern Hemisphere now occurs nine days earlier than it did 150 years ago, and autumn freeze-up ten days later. Thawing permafrost has caused the ground to subside more than 15 feet (4.6 meters) in parts of Alaska. 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 [**1-7].**

When temperatures rise and ice melts, 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 a 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).

Scientists point out that sea level has risen and fallen substantially over Earth's 4.6-billion-year's history. But, the recent rate of global sea level rise has departed from the average rate of the past two to three thousand years and is rising more rapidly—about one-tenth of an inch a year. A continuation or acceleration of that trend has the potential to cause striking changes in the world's coastlines.

Rising sea level, sinking land, eroding coasts, and temperamental storms are a fact of life for Curole. Even relatively small storm surges in the past two decades have overwhelmed the system of dikes, levees, and pump stations that was upgraded in the 1990s to forestall the Gulf of Mexico's relentless creep.

The current trend is consequential not only in coastal Louisiana but around the world. Never before have had so many humans lived so close to the coasts: More than a hundred million people worldwide live within three feet (a meter) of mean sea level. Vulnerable to sea-level rise, Tuvalu, a small country in the South Pacific, has already begun formulating evacuation plans. Megacities such as Shanghai, Bangkok, Jakarta, Tokyo, and New York, where human population has concentrated near coastal plains or river deltas, are at risk. The projected economic and humanitarian impacts on low-lying, densely populated, and desperately poor countries like Bangladesh are potentially catastrophic. The scenarios are disturbing;

even in wealthy countries like the Netherlands, with nearly half its landmass already at or below sea level.

Rising sea level produces a cascade of effects. Bruce Douglas, a coastal researcher at Florida International University, calculates that every inch (2.5 centimeters) of sea-level rise could result in eight feet (2.4 meters) of horizontal retreat of sandy beach shorelines due to erosion. Furthermore, when salt water intrudes into freshwater aquifers, it threatens sources of drinking water and makes raising crops problematic. In the Nile Delta, where many of Egypt's crops are cultivated, widespread erosion and saltwater intrusion would be disastrous since the country contains little other arable land **[8-10]**.

In some places, marvels of human engineering worsen effects from rising seas in a warming world. The system of channels and levees along the Mississippi effectively stopped the millennia-old natural process of rebuilding the river delta with rich sediment deposits. In the 1930s oil and gas companies began to dredge shipping and exploratory canals, tearing up the marshland buffers that helped dissipate tidal surges. Energy drilling removed vast quantities of subsurface liquid, which studies suggest increased the rate at which the land is sinking. Now Louisiana is losing approximately 25 square miles (65 square kilometers) of wetlands every year, and the state is lobbying for federal money to help replace the upstream sediments that are the delta's lifeblood.

Local projects like that might not do much good in the very long run, though, depending on the course of change elsewhere on the planet. Part of Antarctica's Larsen Ice Shelf broke apart in early 2002. Although floating ice does not change sea level when it melts (any more than a glass of water will overflow when the ice cubes in it melt), scientists became concerned that the collapse could foreshadow the breakup of other ice shelves in Antarctica and allow increased glacial discharge into the sea from ice sheets on the continent. If the West Antarctic ice sheet were to break up, which scientists consider very unlikely this century, it alone contains enough ice to raise sea level by nearly 20 feet (6 meters) **[11]**.

Even without such a major event, the IPCC projected in its 2001 report that sea level will rise anywhere between 4 and 35 inches (10 and 89 centimeters) by the end of the century. The high end of that projection—nearly three feet (a meter)—would be "an unmitigated disaster," according to Douglas **[12]**.

Down on the bayou, all of those predictions make Windell Curole shudder. "We're the guinea pigs," he says, surveying his aqueous world from the relatively lofty vantage point of a 12-foot-high (3.7-meter) earthen berm. "I don't

think anybody down here looks at the sea-level-rise problem and puts their heads in the sand." That's because soon there may not be much sand left **[13-15]**.

From the above projection, it is not only disastrous to the population living around coastal area, it will further create intense storms, heavy rainfall, and snowfall etc and living creature might get badly affected.

2. RISING SEA LEVEL AND ITS ADVERSITY

It is not the only change Earth's oceans are undergoing. The ten-year-long World Ocean Circulation Experiment, launched in 1990, has helped researchers to better understand what is now called the Ocean Conveyor Belt. Oceans, in effect, mimic some functions of the human circulatory system. Just as arteries carry oxygenated blood from the heart to the extremities, and veins return blood to be replenished with oxygen, oceans provide life-sustaining circulation to the planet. Propelled mainly by prevailing winds and differences in water density, which changes with the temperature and salinity of the seawater, ocean currents are critical in cooling, warming, and watering the planet's terrestrial surfaces—and in transferring heat from the Equator to the Poles.

Robert Gagosian, president and director of the Woods Hole Oceanographic Institution, believes that oceans hold the key to potential dramatic shifts in the Earth's climate. He warns that too much change in ocean temperature and salinity could disrupt the North Atlantic thermohaline circulation enough to slow down—causing drastic climate changes in time spans as short as a decade.

Oceans are also important sinks, or absorption centers, for carbon dioxide, and take up about a third of human-generated CO_2. Data from the Bermuda monitoring programs show that CO_2 levels at the ocean surface are rising at about the same rate as atmospheric CO_2. But, it is in the deeper levels where Bates has observed even greater change. In the waters between 820 and 1,476 feet (250 and 450 meters) deep, CO_2 levels are rising at nearly twice the rate as in the surface waters.

Something else about the way the Earth was breathing as CO_2 level not only fluctuated seasonally, but also rose year after year. Carbon dioxide level has climbed from about 315 parts per million (ppm) from Keeling's first readings in 1958 to more than 375 ppm today. A primary source for this rise is indisputable: humans' prodigious burning of carbon-laden fossil fuels for their factories, homes, and cars **[17].**

Tans show a graph depicting levels of three key greenhouse gases—CO_2 , methane, and nitrous oxide—from the year 1000 to the present. The three gases together help keep Earth, which would otherwise be an inhospitably cold orbiting rock, temperate by orchestrating an intricate

dance between the radiation of heat from Earth back to space (cooling the planet) and the absorption of radiation in the atmosphere (trapping it near the surface and thus warming the planet).

Most of the scientists believe that Greenhouse Gases are at the root of our changing climate. "These gases are a climate-change driver," Exactly how large that effect might be on the planet's health and respiratory system will continue to be a subject of great scientific and political debate.

There are no words, though, to describe how much, and how fast, the ice is changing. Researchers long ago predicted that the most visible impacts from a globally warmer world would occur first at high latitudes: rising air and sea temperatures, earlier snowmelt, later ice freeze-up, reductions in sea ice, thawing permafrost, more erosion, and increases in storm intensity. Now all those impacts have been documented and help them incorporate scientific data into management decisions for the city's threatened infrastructure.

Fig.1: Worldwide Sea Level Rise

Scientific research indicates sea levels worldwide have been rising at a rate of 0.14 inches (3.5 millimeters) per year since the early 1990s. The trend, linked to global warming, puts thousands of coastal cities, like Venice, Italy, (seen here during a historic flood in 2008), and even whole islands at risk of being claimed by the ocean.

Over the past century, the burning of fossil fuels and other human and natural activities have released enormous amounts of heat-trapping gases into the atmosphere. These emissions have caused the Earth's surface temperature to rise, and the oceans absorb about 80 percent of this additional heat.

The rise in sea levels is linked to three primary factors, all induced by this ongoing global climate change:

2.1 Thermal Expansion

When water heats up, it expands. About half of the past century's rise in sea level is attributable to warmer oceans simply occupying more space.

2.2 Melting of Glaciers and Polar-Ice Caps

Large ice formations, like glaciers and the polar-ice caps, naturally melts back a bit each summer. But in the winter, snows, made primarily from evaporated sea-water, are generally sufficient to balance out the melting. Recently, though, persistently higher temperatures caused by global warming have led to greater-

than-average summer melting as well as diminished snowfall due to later winters and earlier springs. This imbalance results in a significant net gain in runoff versus evaporation for the ocean, causing sea levels to rise.

Fig.2: Glacier Melting of Greenland's North-west Coast

2.3 Ice loss from Greenland and West Antarctica

As with glaciers and the ice caps, increased heat is causing the massive ice sheets that cover Greenland and Antarctica to melt at an accelerated pace, scientists also believe melt-water from above and sea-water from below is seeping beneath Greenland's and West Antarctica's ice sheets, effectively lubricating ice streams and causing them to move more quickly into the sea. Moreover, higher sea temperatures are causing the massive ice shelves that extend out from Antarctica to melt from below, weaken, and break off.

2.4 North Greenland Glaciers

The North Greenland Glaciers are changing rapidly, lead by author Jeremie Mouginot, an assistant researcher in the Department of Earth System Science at the University of California, Irvine, said in a release. The shape and dynamics of Zachariae Isstrøm has changed dramatically over the last few years. The glacier is now breaking up and calving high volumes of icebergs into the ocean.

Similarly, the glacier's equally massive neighbor, Nioghalvfjerdsfjorden, is also melting, but is even retreating at a slower rate. Together, these melting giants could increase the global sea levels by more than 39 inches.

Fig.3: Melting of Polar Ice

2.5 Consequences

When sea levels rise rapidly, as they have been doing, even a small increase can have devastating effects on coastal habitats. As sea-water reaches farther inland, it can cause destructive erosion, flooding of wetlands, contamination of aquifers and agricultural soils, and lost habitat for fish, birds, and plants. When large storms hit land, higher sea levels mean bigger, more powerful storm surges that can strip away everything in their path.

In addition, hundreds of millions of people live in those areas that will become increasingly vulnerable to under flood. Higher sea levels would force them to abandon their homes and relocate. Low-lying islands could be submerged completely.

2.5 How high will it go?

Most predictions say the warming of the planet will continue and likely accelerate. Oceans will continue to rise as well, but predicting the amount is an inexact science. A recent study says that we can expect the oceans to rise between 2.5 and 6.5 feet (0.8 and 2 meters) by 2100, the year enough to swamp many of the cities along the U.S. East Coast. More dire estimates, including a complete meltdown of the Greenland ice sheet, push sea level rise to 23 feet (7 meters), enough to submerge London.

3. CONCLUSION

From the above study, it is learnt that the entire globe is facing following specific issues:

- The IPCC projected in the year 2001 that, sea level will rise anywhere between 4 and 35 inches (10 and 89 centimeters) by the end of the century. The high end of that projection—nearly three feet (a meter)—would be "an unmitigated disaster.
- Oceans are important sinks, or absorption centers, for carbon dioxide, and take up about a third of human-generated CO_2. In the waters between 820 and 1,476 feet (250 and 450 meters) deep, CO_2 levels are rising at nearly twice the rate as in the surface waters.
- Once impenetrable permafrost that kept the foundation solid has bucked and heaved so much that walking through it almost be like walking down the halls of an amusement park fun house.
- More than a hundred million people worldwide live within three feet (a meter) of mean sea level. Vulnerable to sea-level rise, Tuvalu, a small country in the South Pacific, has already begun formulating evacuation plans. Megacities where human populations have concentrated near coastal plains or river deltas—Shanghai, Bangkok, Jakarta, Tokyo, and New York—are at risk.
- The Intergovernmental Panel on Climate Change reports that intense rain events have increased in frequency during the last 50 years and human-induced global warming most likely contributed to the trend.
- Recently in the years 2014 and 2015, all over the world, situation became bad to worst in respect of floods, draughts, storms, heavy rain fall and snow fall. This will continue in coming years, till situation of Global Warming is not curbed. An awareness

about Climate Change is to be focused and all countries on the globe have to address the sea level rise problems as a top priority.

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