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CLIMATE CHANGE AND ITS IMPACT ON COASTAL WETLANDS OF SRI LANKA

Abstract:

Due to the formation and expansion of continents and oceans of the earth, the island of Sri Lanka has assumed its present position between 5° 52´N-9° 55´N and 79° 30´E-81° 55´E, facing global events of climate change. With these evolutions, fauna (including humankind) and flora of Sri Lanka, perchance gone to extinct or living. From Holocene, particularly since Nioglacial time, an increase of population, development of agricultural practices;social, cultural and economic development have taken place. Different social groups from Mid-Holocene to-date have faced floods and famines due to climate and sea level changes. Sea level changes, which followed the climate change submerged the coastal lowlands creating physical, social and economic problems to the inhabitants, who are living along the coastal zones. In Sri Lanka, the worst case scenario of maximum level of sea rise of about 59 cm or more by100 years predicted in 2007 by the Intergovernmental Panel on Climate Change (IPCC).In the Sri Lankan context, coastal watersheds include salt and brackish-water marshes, mangrove swamps, inter-tidal mud flats etc. All these are formed around the river estuaries, lagoon mouths and their peripheries, and are subjected to tidal levels. And help to flood protection and production, prevent erosion control, existing wildlife food & habitat, for commercial fisheries, water quality, and for recreation. Submergence of coastal wetlands due to sea level rise, aggravates the physical, social and economic problems, and the environmental systems go on wrong side of the tracks.

Key Words: ***Global warming, Climate change, Coastal wetlands, Sea level rise.***

Introduction

Human activities have led to large increases in heat- trapping gases over the past century on the Earth. As a result, the global average temperature and sea level have increased, causing damage to the worldwide coastal wetlands, and changing the precipitation patterns. The global warming of the past 60 years is due primarily to human-induced increases in heat-trapping Green House Gases (GHG). Human intercession has also been identified as a main reason for many other aspects of the climate system, including changes in ocean heat content, precipitation, atmospheric moisture, and Arctic sea ice. Global temperatures are projected to continue to rise over this century; globalwise and country-wise. Hence, this paper examines the climate change in Sri Lanka and its impact on coastal wetlands glancing the palaeo climate change.

The last glacial period occurred from the end of theEemian interglacialuntil the end of theYounger Dryas, encompassing the period c. 115,000 – c. 11,700 years ago. This most recent glacial period is part of a larger pattern of glacial andinterglacialperiods known as theQuaternary glaciationextending fromc. 2,58 millionyears ago to present, and the events inbetween two it is possible to correlate with Sri Lankan events (Katupotha1994).The definition of theQuaternaryas beginning 2.58 million years ago is based on the formation of the Arctic ice cap. TheAntarctic ice sheetbegan to form earlier, at about 34 Ma, in the mid-Cenozoic(Eocene–Oligocene extinction event), and also evidences recorded in the deep oceanic sediments of Mannar Basin, Sri Lanka (Ratnayake et al., 2014).

Due to the formation and expansion of continents and oceans of the Earth, Sri Lanka is assuming the present position between 5º 52´N-9º 55´N and 79º 30´E-81º 55´E. Accordingly, during the Lower Pleistocene period (c. 2.588 - 1.806) Erratic pebbles and boulders, stream fed deposits and other terrestrial deposits flowed from the Central Highland to coastal zone to the Second Planated surface (Katupotha 2013). Based on stranding evidence of sea level fluctuations, sand dunes, gravel deposits, formation of Red Beds, laterite, nodular ironstone can be correlated with their formation in the Lower Pleistone period (Cooray 1984, Katupotha 1988a, 1995, Ratnayake and Sampei, 2015a). By Middle Pleistocene (c.0.781 Ma ago), flourishing and then extinction of many large mammals (Pleistocene mega-fauna) in the Middle Pleistocene period. Katupotha (2016) and Arawinda and Katupotha et al (2017) reveal that the Quaternary period shows the extinctions of numerous predominantly larger, especially mammalian mega fauna species (e.g. Panthera leo, Panthera tigris,Panthera pardus, Boselaphus tragocamelus, Antilope cervicapra, Bosgaurus,Hexaprotodon sinhaleyus, Rhinoceros sinhaleyus, Rhinoceros kagavena, Elephas maximus sinhaleyus).Many of them lived during the transition from the Pleistocene to the Holocene epoch. The debate on the demise of the mammalian megafauna is often characterized by two highly polarized points of view: climate-induced extinction; and human-induced extinction. Evolution of anatomically modern humanswas appearingat this time.

Atmospheric CO2 levels have started to increase from 100 parts per millionvolume (ppmv) at the end of the last glaciation to the current level of385 ppmv, causing some sources of global warming and climatechange, possibly from anthropogenic sources around 0.126-0117 Ma years ago in the Upper Pleistocene period.During this last glacial period there were alternating episodes of glacier advance and retreat due to the existed climatic changes. Within the last glacial period the Last Glacial Maximum was approximately 22,000-19,000 years ago. During this period, dry climatic conditions and strong winds prevailed throughout the country and the sea level was 120-140m below the present level. The First Planated Surface submerged by sea water, and now exists submerged. (This surface is designated as Submerged Plateau by Sommerville (1907) and submerged Peneplain by Deraniyagala (1958). As well, streams fed deposits, erratic pebbles and boulders and other fluvial deposits flowed from the Central Highland to coastal zone (to Second Planated Surface, Katupotha 2013).

While the general pattern of global cooling and glacier advance was similar, local differences in the development of glacier advance and retreat make it difficult to compare the details from continent to continent and country to country. Approximately 13,000 years ago, the Late Glacial Maximum began. The end of the Younger Dryas about 11,700 years ago marked the beginning of the Holocene geological epoch, which includes the Holocene glacial retreat. Those events have occurred clearly surrounding Sri Lanka, and associated islands as well as in the Indian Ocean region.With the last glacial period ends, the salient feature was rise of human civilization. The Sahara forms from savannah, and agriculture begins, allowing humans to develop the different civilization, though the earth and build human settlement (Ratnayake, 2016b).

What is Climate Change?

The global climate is the connected systems of sun, Earth and oceans. Again, all these systems are related to the wind, rain and snow, forests, deserts and savannas, in addition everything people do (Figure 1). The climate of a place can be described as its rainfall, changing temperatures and wind systems during the year and so on. A description of the global climate includes how, the rising temperature of the Pacific feeds typhoons which blow harder, drop more rain and cause more damage, but also shifts in global ocean currents that melt Antarctica ice which slowly makes sea level rise until low elevation islands and Ocean's edges are submerged.

The "Global Climate Change" is not a new concept, and its history goes back to the origin of the Earth. The formation of the Earth occurred 4,570 to 4,567.17 million years ago. Since then, in the Earth's history, there were five major glaciations, namely, Huronian (2,300 Ma), Cryogenianor Sturtian-Varangian (850-635 Ma), Andean-Saharan (460-430 Ma, Karoo (360-260 Ma) and the Quaternary (2.58 Ma to Present). Accordingly, the word "Glaciation" means the formation, movement and recession of glaciers. Glaciation was much more extensive in the past, when much of the world was covered in large, continental ice sheets. Currently, glaciers cover about 10 per cent of the world's land area (14.9 million km^2).

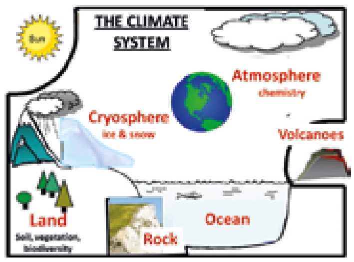

Figure 1. Climate change and its connected systems of sun, earth and oceans (Source: US Environmental Protection Agency)

During the Quaternary Glaciation, ice sheets expanded, notably from Antarctica and Greenland, and fluctuating ice sheets occurred elsewhere (for example, the Laurentide ice sheet). The major effects of the ice age were the erosionof land and the deposition of material, over large parts of the continents; the modification of river systems; the creation of millions of lakes, including the development of pluvial lakes far from the ice margins; changes in sea level; the isostatic adjustment of the Earth's crust; flooding; and abnormal winds. The ice sheets themselves, by raising the albedo(the extent to which the radiant energy of the Sun is reflected from the Earth) created a significant contribution to further cool the climate. These effects reshaped entire environments on land and in the oceans, and their associated biological communities.

Past Sea level change in Sri Lanka

By the end of the Permian Period (260 Ma) Karoo Glaciation had ended and the present Mannar Basin developed within a deep canyon (about 4-7 km deep) on the Precambrian basement. Accordingly the Mannar Basin gradually filled through the marine sediments by drastic events since the Jurassic Period to Holocene (Ratnayake et al., 2014, 2018a; Ratnayake and Sampei, 2015b, 2018). Between this time span, Sri Lanka reached to its present position between 5º52'N - 9º55'N and 79º30'E - 81º55'E (Katupotha 2013). Further, during this time span, global climate and sea level changes occurred several times and reached to present configuration of the Indian Ocean, islands, continents and continental margins. Such clime and sea level changers were causing the filing of Mannar Basin and Palk Strait. By the Last Glacial Optimum, the sea level was 140 – 120m below the present level and Sri Lankan and Indian landmasses were appeared well connected. About 13,000–10,000 years ago, the Late Glacial Maximum prevailed and the Last glacial period was ended. By this time Pleistocene glaciers receded and climate was warm (Figure 2 and 3).At that time, Tamraparni River and other rivers that originated in Tamilnadu used to flow from Tirunelveli district to Mannar Basin, northwestern Sri Lanka. Similarly, northwestern rivers of Sri Lanka also flowed to the Mannar Basin. The Holocene sea level rise was a significant jump in sea level by about 60m during the early Holocene, between about 12,000 and 7,000 years ago, spanning the Asian Mesolithic. Further, these events clearly emphasized that 7,000 years ago, ancient Sri Lanka was not an island, but it was well-connected through land route to the Indian peninsula (Ratnayake 2016a, 2016b). Post-glacial sea level rise, drowning of the continental shelf of Sri Lanka and sea level was at least 1.5-4.0m above from present levels (Figures 3 and 4).

Unconsolidated sandy beaches and dune deposits, beach rock, lagoon and estuarine clays, alluvium, buried and emerged coral reefs were formed (Katupotha 1988a; 1988b; 1988c, 1995). Likewise, a global overview of glacier advances and retreats (grouped by regions and by millennia) for the Holocene is compiled from previous studies. Further, Solomina, et al (2015) represent the he reconstructions of glacier fluctuations are based on (a) mapping and dating moraines defined by 14C, Terrestrial cosmogenic nuclide dating (TCN) and Optically-Stimulated Luminescence OSL, lichenometry and tree rings (discontinuous records/ time series), and (b) sediments from proglacial lakes and speleothems (continuous records/ time series).
Using 189 continuous and discontinuous time series, the long-term trends and centennial fluctuations of glaciers were compared to trends in the recession of Northern and mountain tree lines, and with orbital, solar and volcanic studies examine the likely forcing factors that drove the changes recorded by Solomina et al (2015).

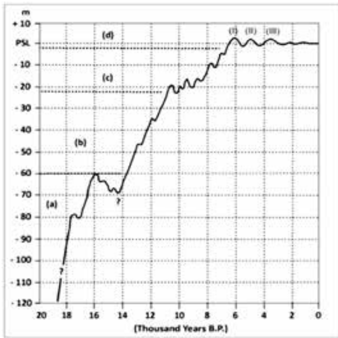

Figure 2.Sea-level oscillations in Sri Lanka sinceLast Glacial Maximum (Katupotha 1995, 2015)

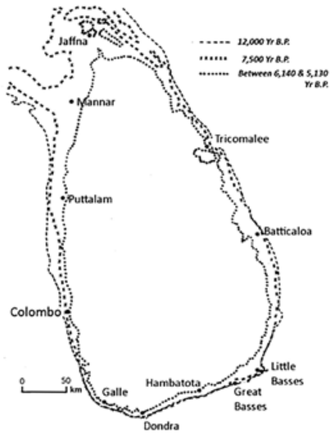

Figure 3. Possible coastlines of Sri Lanka (i) 12,000 yr B.P; (ii) around 7,500 yr B.P. and (iii) between 6,250 and 5,130 yr B.P. By 2,100 the sea level will rise 1.0m 1.2m or more from the present level (Katupotha 1994).

Figure 4. Before 7,500 years ago, the ancient Sri Lanka was not an island but it was well-connected through land route with Indian peninsula. The Tamraparni River that originated in Tamilnadu flowed from Tirunelveli district to Mannar Basin, Sri Lanka.

During the Neoglacial advances clustered at 4.4-4.2 ka, 3.8-3.4 ka, 3.3-2.8 ka, 2.6 ka, 2.3-2.1 ka, 1.5-1.4 ka, 1.2-1.0 ka, 0.7-0.5 ka years corresponding to general cooling periods in the North Atlantic. Some of these episodes coincide with multidecadal periods of low solar activity, but it is unclear what mechanism might link small changes in the irradiance to widespread glacier fluctuations (Solomina et al (2015). Explosive volcanism may have played a role in some periods of glacier advances, such as around 1.7 - 1.6 ka (coinciding with the Taupo volcanic eruption at 232 ± 5 CE) but the record of explosive volcanism is poorly known through the Holocene. These glacial advances clustered data and information possible to compare with Holocene high sea level episodes (Katupotha 1988a, 1988b, 1995 and 2016) and the reigning sovereign's periods of Sri Lanka (Table 1).

Climate change and Sea level rise in Sri Lanka

Human kind is interested in climate change and how a changing climate will affect the ocean and humans. With the majority of people living in coastal states, rising water levels can have potentially large impacts. Scientists have determined that global sea level has been steadily rising since 1900 at a rate of at least 0.1 to 0.25 cm per year.

Recent climate change in Sri Lanka

Sea level can rise by two different mechanisms with respect to climate change. First, as the oceans warm due to an increasing global temperature, seawater expands, taking up more space in the ocean basin and causing a rise in water level. The second mechanism is the melting of ice over land, which then adds more water to the ocean. Trapped within a basin bounded by the continents, the water has nowhere to go but up. In some parts of the world, especially low-lying river deltas, local land, including wetlands are sinking (known as subsidence)-making sea levels much higher. About 40% of the world's population live within 100 kilometers of the ocean,

Table 1. Climate and sea level changes in Sri Lanka since Early Holocene Eposh

Younger-Dryas and Neoglacial advances clustered	Sea level episodes in Sri Lanka	Reigning sovereign's periods	Remarks
14 ka	Holocene warming, Sea level rise		Slow warming since the last ice age; large ice melts
10 ka -8,5 ka	Younger-Dryas. Sea level rise		Rapid cooling,prolonged cold period, then rapid warming
6,3- 5,2 ka	*6,240-5,130years BP, High sea level in Sri Lanka	Tribal Community	
	5,130-4390 BP		Cold phase, lower sea level
4,4-4,2 ka	*4,390 - 3,930 years BP High sea level in Sri Lanka	Tribal Community	
	*3930-3280 BP		Cold phase, lower sea level
3,8–3,4 ka		Tribal Community	
3,3–2,8 ka	*3,280 - 2,270 years BP High sea level inSri Lanka	Tribal Community	Warm period
2,6 ka		Invader Vijaya Sri Lanka and ruled as a King (2,543-2,525 BP)	Warm period
2,3–2,1 ka		2,357-2,235 BP King Sena& Guttika; 2181-2157BP King Dutugemenu, Anuradhapura Kindom	Warm period to cold Around 2,150 B.P drought period
1,9 – 1,6 ka			Little ice age, cold period Two drought period
1,5–1,4 ka		Upatissa II (719 – 725 AC to Mugalan III (618 – 623 AC), Anuradhapura Kindom	Warm and cold phases
Drought period			
1,2–1,0 ka		Dappula III (816 – 831 AC) to Kashsha V (915 – 924 AC)	Around 1075 B.P. drought period
0,7–0,5 ka		Panditha Parakramabahu – IV, Kurunegala (1302 – 1326 AC) to Darma Parakramabahu – IX, Kotte & Kelaniya (1508 – 1528 AC)	Cold phase Around 400 B.P Drought period
	1850 AD - present		Contemporary climate, Warming trend

Source: Solomina, Bradley, Hodgson et al, (2015); *Katupotha 1995, 2016 and personal observations.

putting millions of lives and billions of dollars' worth of property and infrastructure at risk. Accordingly, high tides and storm surges riding on the high seas are more dangerous to people and coastal infrastructure. Natural protections against damaging storm surges are increasingly threatened. Barrier islands, beaches, sand dunes, salt marshes, mangrove stands, and mud and sand flats retreat inland as sea level rises, unless there are obstructions along the retreat path. If they cannot move, these natural protections are washed over or drowned. Along the coastline of Sri Lanka there are sea walls, jetties, and other artificial defenses protect roads, buildings, and other vital coastal resources. In these areas, sea-level rise increases erosion of stranded beaches, wetlands, and engineered structures. Sea-level rise can mean that salt water intrudes into groundwater drinking supplies, contaminates irrigation supplies, or overruns agricultural fields. Low-lying, gently sloping coastal areas are particularly vulnerable to contamination of freshwater supplies.

Little ice age

The term Little Ice Age was originally coined by F. Matthes in 1939 to describe the most recent 4000 year climatic interval (the Late Holocene) associated with a particularly dramatic series of mountain glacier advances and retreats, analogous to, though considerably more moderate than, the Pleistocene glacial fluctuations (Mann 2002).

Due to the tremendous heat capacity of the global oceans, it takes a massive amount of accumulated heat energy to raise the Earth's average yearly surface temperature even a small amount (Figure 4). Behind the seemingly small increase in global average surface temperature over the past century is a significant increase in accumulated heat. That extra heat is driving regional and seasonal temperature extremes, reducing snow cover and sea ice, intensifying heavy rainfall, and changing habitat ranges of plants and animals—expanding some and shrinking others. Sri Lanka has a vast coastal plain from Kelani River to the northwest, north, northeast, east to southeast up to Kumbukkan Oya. But, from here to the south, southwest and to the west, the coastal plain is somewhat narrow (Katupotha 1988c). A mountainous area in the southern and central regions is a salient feature of the country.

The coastal regions are most vulnerable to climate change and a significant proportion of the population resides in these maritime provinces. The climate in Sri Lanka supports forest growth and virtually the entire land area was once covered with forests. Deforestation has made soils less productive and badly affected the natural water supply. Much of water resources in Sri Lanka are generated by the hills in the Central Hillyland region, which intercept the moisture-laden monsoonal winds from the southwest and northeast. This creates a unique rainfall pattern and the surface water is transferred by distinct natural river basins and lagoons that cover 90%
seemingly favourable position many areas experience droughts that last two millennia. In 21 century, the available surface water is primarily used for reservoir, hydroelectricity generation and agriculture.

Economy of Sri Lanka is highly dependent on climate-sensitive sectors such as agricultural, forestry and energy production. Some adaptation measures

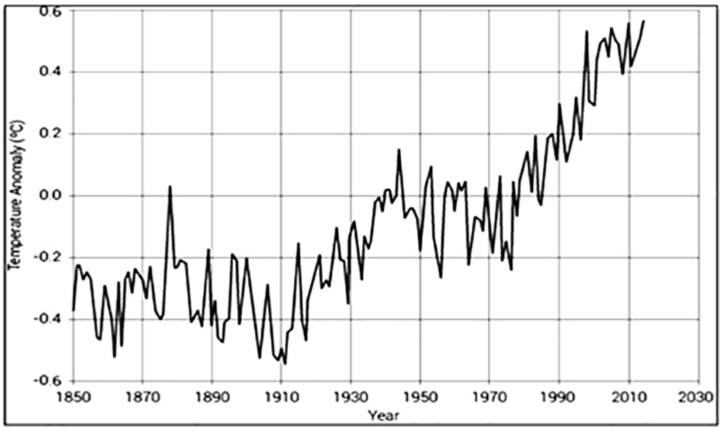

Figure 4. Yearly global surface temperature anomalies (in °C) from the 1961–1990 global average.

have already been adopted in these sectors to promote better environmental management, but they are not fully implemented. Programmes have been undertaken in the agricultural sector to manage soil erosion, support better water management and encourage the diversification of agricultural production. In the energy sector policies have been formulated to support increased energy efficiency and to reduce associated environmental pollution. In Sri Lanka's First National Communication of 27 October 2000, it is noted that to effectively respond to anticipated climatic changes the existing adaptation measures need to be extended and action needs to be taken in other areas. However, due to the political uncertainty, debility of the relevant policy formulations and the implementation of them have responsible for not to manage soil erosion, deforestation, water management ect. Due to these reasons aggravates the determine the desired ways and means of climate change. However, these tug-of-war by politicians, government officers and unsound policies have responsibilities not to outmatch the problem of the climate change. This shows the increasing of temperature, which is not possible to manage since the 1960s (Figures 5, 6 & 7).

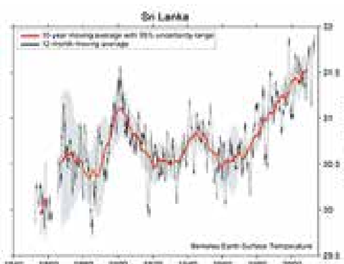

Figure 5. Mean of Daily High Temperature, Regional Climate Change: Sri Lanka (file:///D:/SEA%20 LEVELS/Berkeley%20Earth.html)

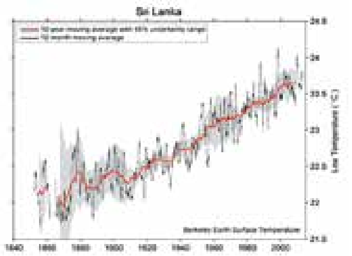

Figure 6. Mean of Daily High Temperature, Regional Climate Change: Sri Lanka (file:///D:/SEA%20 LEVELS/Berkeley%20Earth.html)

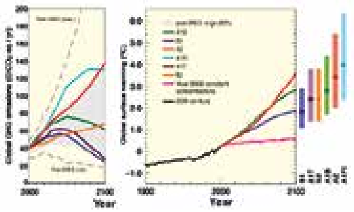

Figure 7. Senarios for GHG emissions from 2,000 yr to 2,100 yr and projections of surface temperature (From: Sea level rise, Chapter7, UNDP Book).

Climate change and coastal wetland

Coastal wetlands include saltwater to freshwater wetlands located within coastal watersheds.Wetland types found in coastal watersheds include salt marshes, bottomland hardwood swamps, brackish and fresh marshes, mangrove swamps, and shrubby depressions Coastal habitats throughout the world provide ecosystem services essential for people and the environment. These services are valued at billions of dollars.

In the Sri Lankan context,coastal watersheds include salt and brackish-water marshes, mangrove swamps, inter-tidal mud flats (Katupotha 1988a, Ratnayake et al., 2017, 2018b). All these are formed around the river estuaries, lagoon mouths and their peripheries, and are subjected to fluctuation of tidal levels. While the Highest astronomical tide (HAT) is the highest level, and the Lowest astronomical tide (LAT) includes the lowest level that can be expected to occur under average meteorological conditions and under any combination of astronomical conditions. Between these two mean spring & neap ranges as diurnal levels fallow the all river estuaries, lagoons and their associated wetlands. Similar to the world wide coastal wetlands, Sri Lankan coastal ecosystem services provided by coastal wetlands include: (1).Flood Protection and production, (2) Erosion Control, (3) Wildlife Food & Habitat, (4) Commercial Fisheries, (5) Water Quality, and (6) Recreation.

The coastal wetlands protect upland areas, including valuable residential and commercial property from flooding due to sea level rise and storms. As well, coastal wetlands can prevent coastline erosion due to their ability to absorb the energy created by ocean currents which would otherwise degrade a shoreline and associated development, and also wetlands provide wildlife food and habitat for coastal fauna. Coastal wetlands provide habitat for many federally threatened and endangered species. The Sri Lankan's migratory bird flyways pass over coastal wetlands, where coastal wetlands provide temporary habitat for waterfowl and shorebirds. Furthermore, over 50 percent of commercial fish and shellfish species in Sri Lanka rely and obtain on coastal wetlands, e.g. from mangrove swamps, marshy areas, inter-tidal flats, lagoons and river estuaries. Beside above, wetlands filter chemicals and sediment out of water before it is discharged into the ocean.

In Sri Lanka, wetlands are a valuable natural resource for the recreational and economic opportunities in coastal wetlands, including canoeing, wildlife viewing and photography, recreational fishing and hunting as well as shrimp farming. Similarly, certain coastal wetland ecosystems, such as salt marshes and mangroves can sequester and store large amounts of carbon due to their rapid growth rates and slow decomposition. Accordingly, carbon sequestration occurs both naturally and as a result of anthropogenic activities and typically refers to the storage of the carbon that has the immediate potential to becomeCO2 gas.

The global warming may cause a sea level rise, which will have a great impact on the long-term coastal morphology, especially existing coastal wetlands, islands,beaches and barriers, as well as coastal agriculture and other economic activities and increased flooding risk. Sea level rise due to climate change is currently a hot topic widely discussed both nationally and internationally.Many countries with a sea fronts have already developed policies on sea front management to deal with possible damages and inundation from sea level rise. Sri Lanka has also attempted to assess possible damages from the anticipated sea level rise (UNDP 2007).

The Intergovernmental Panel on Climate Change (IPCC) hs predicted the possible sea level rise in its reports. The latest report published in 2007 predicts that the maximum sea level rise under the worst case would be 59 cm in 100 years. However the report states that "Because understanding of some important effects driving sea level rise is too limited, the report does not assess the likelihood, nor provide a best estimate or an upper bound for sea level rise.

The main base data for the above predictions of the sea level change is the predicted temperature rise. The temperature rise is directly due to emission and atmospheric collection of the Green House Gases (GHGs). As indicated in Table 2 and Table 3 there are two main reasons for sea level rise, namely; (1) Thermal expansion of ocean waters as they warm, and (2) Increase in the ocean mass, principally from land-based sources of ice (glaciers and ice caps, and the ice sheets of Greenland and Antarctica). Global warming from increasing greenhouse gas concentrations is as significant driver of both contributions to sea level rise.

The prediction and impacts of sea level rise in Sri Lankan coastal areas for the next 25 to 100 years using suitable models have undertaken by UNDP & DMC (2007). In order to evaluate the shoreline change from the considered scenarios and then carry out the assessments on sea level rise predictions for 2025, 2050 and 2100. Based on Geographical Information System (GIS) and Digital Elevation Model, prepared baseline inundations maps using 1:50,000 and 1:10,000 maps, the baseline maps are not trustworthy due to the inaccuracy of the contours of the above maps. However, applying the above maps with LIDAR (Light Detection and Ranging) LiDAR data processing services and ASTER data (The Advanced Spaceborne Thermal Emission and Reflection Radiometer) system, UNDP and DMC (2007) have prepared the inundation maps for 2025, 2050, 2075 and 2100 Yrs and they predicted the shoreline changes and inundation areas (ha) in the coastal district (Table 2 and 3, Figure 8 and 9).

Globally, all international and national institutions/agencies have been expected that the Global Warming, Emisison of GHG, increasing of world temperature, influence of El Nino, La Nina and ENSO on Global climate change, retreating of the Arctic, Antartic and mountain glaciers, which have been responsible for the climate change and sea level rise. Except melting of glaciers, other phenomena are common thing for our country too, and we will be faced at least about 90% - 100% or more loss of coastal wetland areas.

Sea level rise hazard profile development used the worst case scenario of maximum level of sea rise of about 59 cm in 100 years predicted in 2007 by the Intergovernmental Panel on Climate Change (IPCC). However,the literature indicates that high uncertainly in sea-level rise predictions due to the lack of understanding of the dynamics of ice sheets, glaciers and oceanic heat. The accuracy in the modelling of sea level rise depends on two parameters, namely the accuracy of sea level prediction and accuracy of ground level heights.

Potential impacts of sea level rise in Sri Lanka on coastal areas within the next 25 to 100 year period were studied. The sea level rise maps of 1:50,000 scale covering the entire coastal belt indicating the inundation areas in 2025, 2050 and in 2100 were prepared (UNDP and DMC, 2007). It is important to note that sea level rise predictions used two types of elevation data, namely the LIDAR data that are highly accurate and other sources of elevation data from multiple sources. Users should be mindful of the accuracy in the areas outside the LIDAR coverage. Modelling results indicate the highest threat in Puttalam district followed by Jaffna district.

Table 2

Total inundated area (ha)				
District	**25 yr**	**50yr**	**75 yr**	**100 yr**
Colombo	959	1133	1327	1534
Gampaha	3638	4154	4631	5071
Puttalam	11334	12583	13716	14809
Mannar	8024	8262	8518	8758
Jaffna	10321	11164	12014	12891
Mullattivu	912	1004	1092	1180
Tricomalee	2315	2529	2791	3033
Batticaloa	2325	2443	2568	2702
Ampara	1880	2175	2479	2762
Hambantota	4265	5553	6516	7322
Matara	1277	1634	1994	2401
Galle	5622	6462	7249	8014
Kalutara	1956	2370	2790	3203

Total inundated area in each district including water bodies (Sourc:http://www.-dmc.gov.lk/images/hazard/hazard/Report).

Table 3

Total inundated area (ha)				
District	**25 yr**	**50yr**	**75 yr**	**100 yr**
Colombo	201	375	569	776
Gampaha	459	976	1452	1894
Puttalam	1113	2362	3494	4587
Mannar	248	486	741	981
Jaffna	864	1706	2557	3434
Mullattivu	88	180	268	355
Tricomaalee	252	467	729	971
Batticaloa	130	247	372	507
Ampara	293	588	892	1375
Hambantota	885	2173	3136	3942
Matara	384	741	1101	1508
Galle	776	1617	2403	3169
Kalutara	417	830	1251	1664

Iinundated area in each district excluding water bodies ((Sourc:http://www.dmc.gov.lk/-images/hazard/hazard/Report).

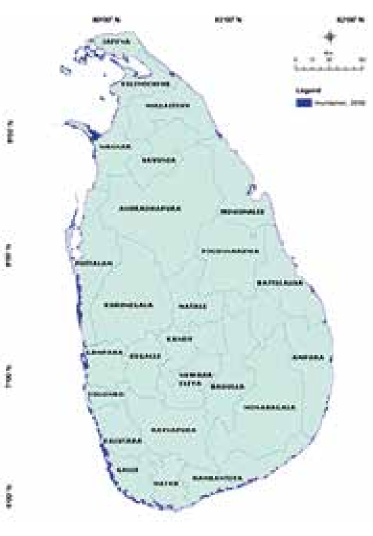

Figure 8. Predicted sea level rise in 2050 in Sri Lanka(Sourc:http://www.dmc.gov.lk/-images/hazard/hazard/Report).

Figure 9. Predicted sea level rise in 2100 in Sri Lanka (Sourc:http://www.dmc.gov.lk/-images/hazard/hazard/Report).

Conclusion

Global climate change is not a new concept, its history went back to at least Cambrian Period of the Paleozoic Era. During the long span of time, from Cambrian to Late Pleistocene, long glacial period was passed, and evolved the continents and oceans. Owing to these evolution advancing and retreating of global glacial made warm and cold phase of the climates conceding of flora and fauna as well as human growth. All these were happening as accelerated events, and by the Last Glacial Maximum the Global sea level was about 140-120m below the present level.

Due to the Post Glacial Transgression, mid-Holocene sea level rise and neo-glacial changes accomplished the increasing of temperature, cold phases, emission of GHG from time to time (by little ice ages) by human activities, industrialization as well as volcanic eruptions. These activities have aggravated last 500 year period, and they drastically accelerated since 1,960s, and by 2,100 the climate change and sea level rise will submerge the coastal wetland. This submergence is subjected to increasing of floods, population pressure, influences and damage to the coastal building, infrastructures and the economy. If we examine carefully, the past Global climate change and sea level rise of the geologic time, it is impossible to prevent the future climate change, sea level rise and the submergence of the coastal wetlands.

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