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The 7+ Initiative: A Measure for Global Climate Change Adaptation

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Abstract— Global climate change is a phenomenon increasingly present in everyday life of human beings on Planet Earth. There has never been controversy about its existence in the international scientific community, the controversy has been planted by very confusing news reported in the international media, but mostly national. Global climate change has many implications for human life, and it would be impossible to attack it in all its dimensions in such a small space like this. Only the implications that have to do with the melting of the ice sheets covering large areas of the earth's geography is considered. The extensions covered by ice regarded as proposed here, are those in the Arctic (North Pole) and Greenland, mainly; without underestimating those contained in Antarctica (South Pole). With the imminent rise in mean sea level in the near future, a situation that is not foreign or rare on Earth, as this situation has a large number of times occurred in the recent history of the Earth, showing a fluctuation of 100 meters below the current mean sea level and 100 meters above mean sea level today, the 7+ Initiative aims to identify: first, what the affected areas in Mexico would face a likely rise of 7 meters above the current mean sea level, since this is the level that would occur if the Arctic melted completely in Summer, which is very likely to occur by year 2020; or also the total melting of the Greenland or a substantial portion of Antarctica. The Initiative 7+ second stage, which is considered an adaptation measure, involves the placement of warning signs along +7 meters level above the actual mean sea level in height more vulnerable to the effects of sea level rise areas. The third level of action of the Initiative 7+ will be the eviction of people living in the danger zone identified in the first stage by the Initiative 7+.

Index Terms— global climate change, greenhouse effect gases, increase of mean sea level, melting of polar ice caps.

I. INTRODUCTION

Global climate change is a phenomenon increasingly present in the daily life of human beings on Planet Earth. There has never been controversy about its existence in the world scientific community, the controversy has been sown by confused news reported in the international media, but mostly national. Global climate change has many implications for human life, and it would be impossible to attack it in all its dimensions in such a small space like this. Only the implications that have to do with the melting of the ice sheets that cover large areas of the earth's geography is considered. The extensions considered covered by ice as proposed here are those housed in the Arctic (North Pole) and in Greenland, mainly; without underestimating those contained in Antarctica (South Pole).

The rise in mean sea level is imminent in the near future, as a result of the enhanced greenhouse effect and hence global warming, being the most important factor to generate global climate change in which we find ourselves immersed. This situation is not foreign or rare on planet Earth, since this has happened several times in the recent history of the Earth and has a fluctuation of 120 meters below the current mean sea level, when he presented the glacial periods, as well as 100 meters above current mean sea level, when you have melted the ice sheets caused by the glaciations and also have had very warm periods caused by various causes, mainly in periods of intense volcanic activity. To counter the devastating effects of a significant rise in sea level as close as in the 2020's, a measure of adaptation to global climate change is proposed with the name of the 7+ Initiative.

II. THE GREENHOUSE EFFECT

The greenhouse effect is named as compared with the thermal process that occurs precisely in a greenhouse, see Fig. 1, which is a building with walls and ceiling of glass or other transparent or translucent material, which is designed to catch part of the long-wave radiation and producing an elevation of the inside temperature with respect to the outside temperature of the greenhouse. This structure causes a temperature differential with respect to the outside, it is mostly used to grow flowers and various vegetable products, e.g., one can grow and harvest strawberries in Germany in winter.



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The greenhouse effect is very easy to understand through an everyday example. We can perceive the greenhouse effect to get on our car, at 2:00 or 3:00 PM- after leaving it exposed to the sun's rays all morning. When we got to the car we realized that is warmer inside than the outer space around it, this is the result of a temperature increase inside of the car produced by the greenhouse effect.

At atmospheric scale, the greenhouse effect on Earth has existed since the appearance of water in liquid form on the planet, see Fig. 2, [1]. The main greenhouse gas (GHG) is water vapor. This compound, along with other gases such as oxygen (O_2) and carbon dioxide (CO_2), has produced an environment conducive to the emergence and evolution of life, without it the Earth's average temperature would be $-18^\circ C$ and the planet would be a sphere with ice cover; instead of this scenario, nowadays the land surface has an average temperature of $14^\circ C$. Water vapor, CO_2 and other gases whose molecules have bipolar electric moment more strongly absorb radiation of the long wavelength of the electromagnetic spectrum occupied by the outgoing terrestrial radiation (long wave) in the part occupied by shortwave solar radiation. Solar radiation then passes through the atmosphere completely free while terrestrial radiation emitted from the earth surface is absorbed and re-emitted as it passes upward through the atmosphere. In the atmospheric greenhouse scale, GHG (water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NO) and chloro-fluoro-carbons (CFCs)) crystals act as the glasses of the walls and ceiling of a greenhouse.

The levels of CO_2 , the main cause of current global greenhouse have been growing at an alarming rate since the Industrial Revolution, beginning a dizzying ascent since the late fifties to date, see Fig. 3, [2]. Since the Industrial Revolution and to the 2015 the concentration of CO_2 in the atmosphere has increased by 44%, reaching a level of concentration that has not been exceeded in the last 650,000 years and probably over the past 20 million years, [3] It is estimated that CO_2 emissions observed in year 2015 will be exceeded by 26% by year 2030, reaching a level of CO_2 in the atmosphere of 432.12 ppm. The level of methane concentration has increased, for the same period, reaching a 53% increase, while nitrous oxide has risen by 21%.

Fig. 4 shows the main human activities producing GHG, [4]. Recently, it has been mentioned that an adequate level of CO_2 concentration in the atmosphere should be kept below 400 parts per million to prevent lifting of the upper room temperature at $2^\circ C$, [5].

By the end of June of 2015 the level of CO_2 concentration in the atmosphere was 402.8 ppm, see Fig.5, [6], and it is estimated that this level is rising at a rate of 2 ppm per year. The level 400 ppm of CO_2 concentration in the atmosphere was reached by the end of year 2013, this happened three years ahead of what it was predicted.

III. THE GLOBAL CLIMATE CHANGE



Fig 1. Greenhouse

Global climate change is occurring, mainly by global warming that are leading the so-called greenhouse gases (GHG), which are mainly water vapor, carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (NO), the last three have increased their concentrations at dangerous levels from the Industrial Revolution that occurred in the mid-nineteenth century. Water vapor, the most abundant of the greenhouse gases so far, is the one that has had the most beneficial effects on Planet Earth, and that has made the average global temperature is now 14 °C and not -18 °C if there is no greenhouse gases effect exist in the upper atmosphere. The greenhouse gas emissions that are producing the associated human activities, it is accepted that it is the mechanism that is causing global warming and therefore the main cause of global climate change ([7] and [8]).

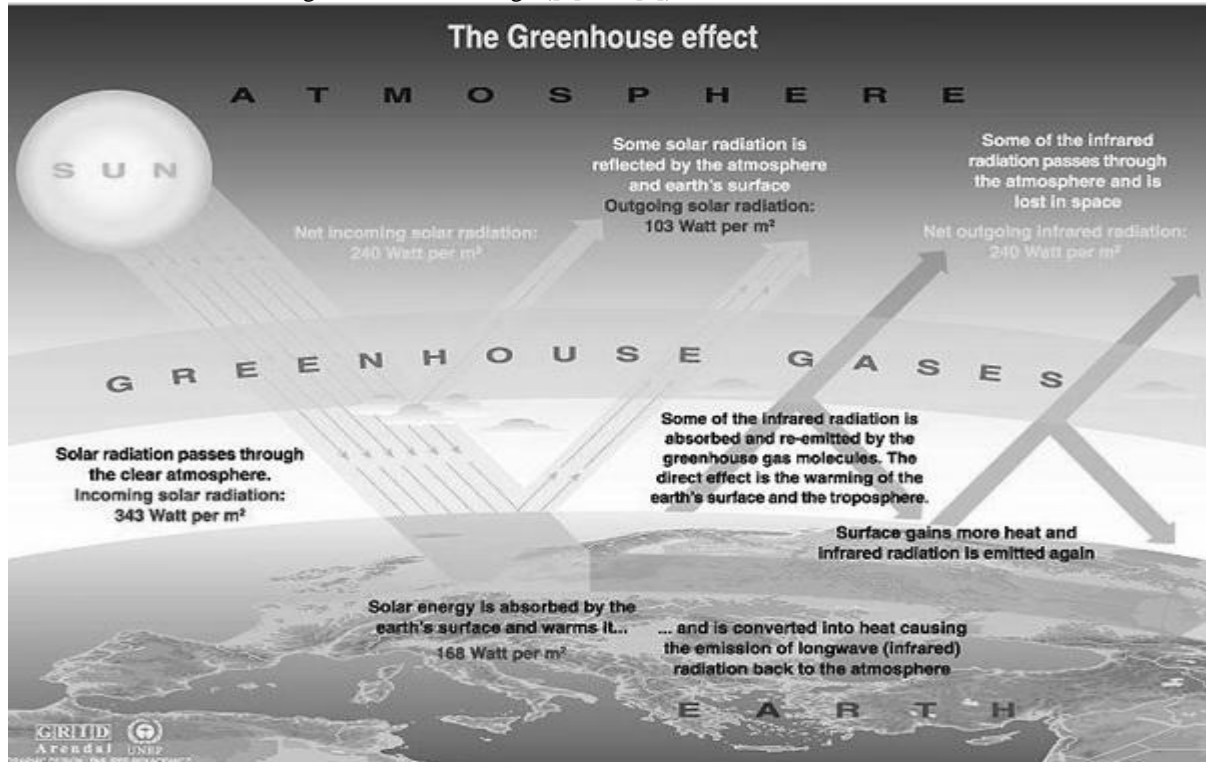


Fig 2. Greenhouse effect in the atmosphere, UNEP-GRID-Arendal, (2015)

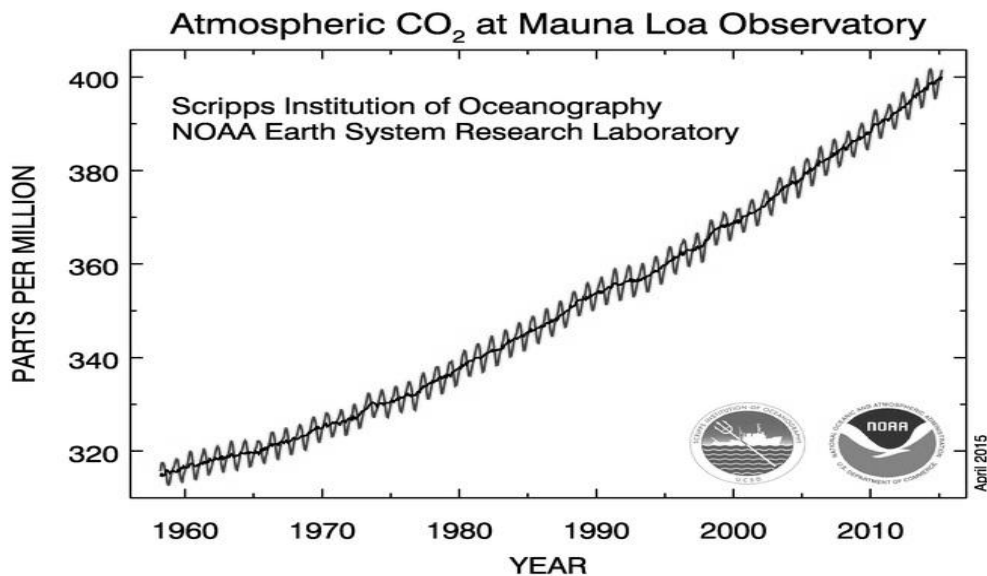


Fig 3. Carbon dioxide content in the atmosphere, [2]



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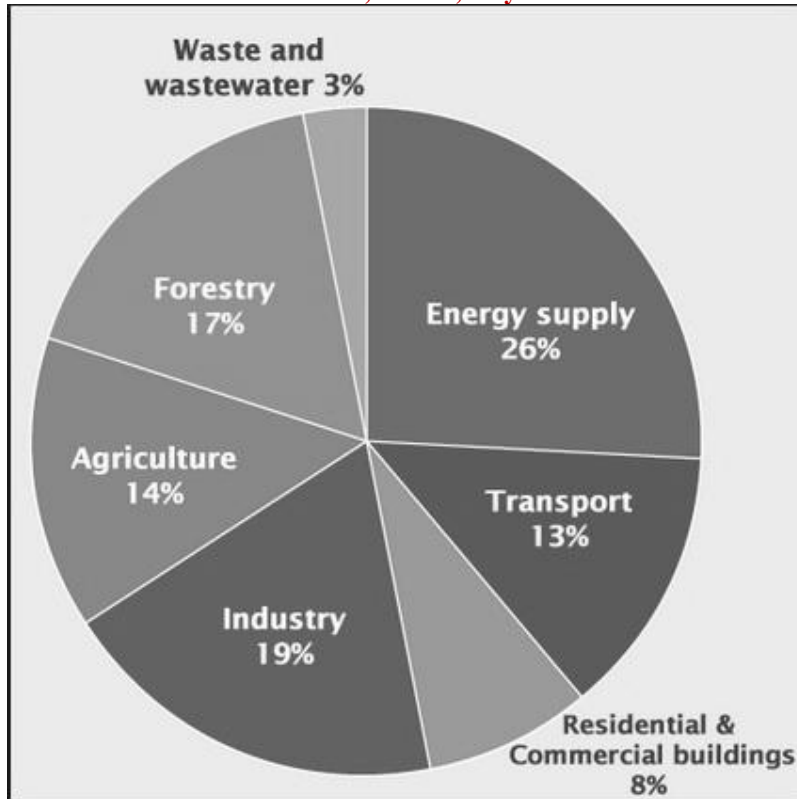


Fig 4. Greenhouse emissions by source, [4]

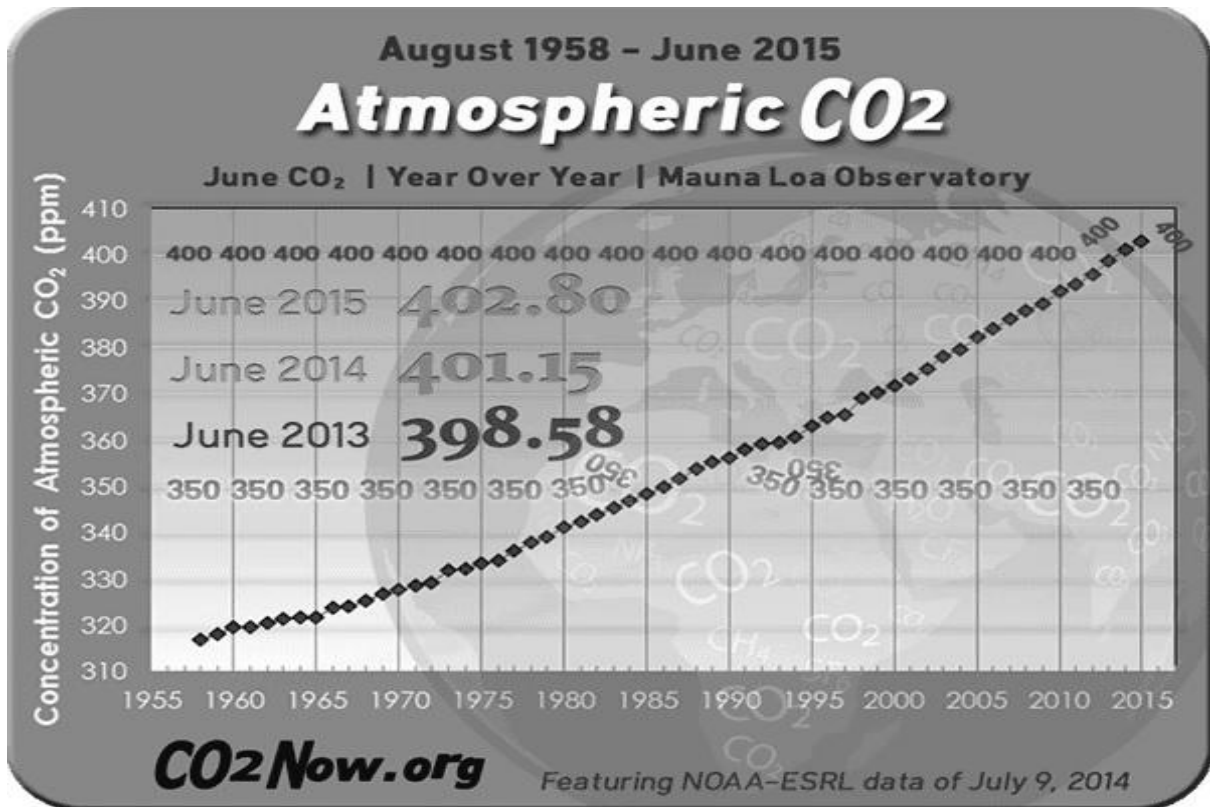


Fig 5. Level of CO₂ in the atmosphere up to June 2015, [5]

IV. THE HISTORY OF MEAN SEA LEVEL

One of the most feared effects of climate change is the rise of sea level, because a few meters up of the current mean sea level, would be a flooding disaster for all the coastal cities of the world; there would also be many islands disappearing from terrestrial maps that would be flooded by the ocean.

The mean sea level had been strongly fluctuating in the last 540 million years; see Fig. 6, [9]. About 450 million years ago it had the biggest peak in mean sea level of 400 meters above current values, the second peak occurred about 80 million years ago with a mean sea level of 250 meters above current values. In the last 600,000 years, the mean sea level had been above 100 meters and 120 meters below the current mean sea level, [10]. Sea level at the beginning of the Pliocene, 12 million years ago, it was 380 m above the present level, [10].

It has been found that at the end of the most recent ice age, sea level rose abruptly to generate a wave of more than 100 meters high, which caused an upward shift in sea level of about 120 meters. This caused more than 26 million km² remain under the waters of the oceans and seas. It is known that, [5], a rise of 1 °C in the temperature of seawater would cause the melting of perennial ice of the North Pole in an area of 1.5 million of squared kilometers. An increase of 3 °C at the North Pole would result in the long term, the total melting of the Greenland ice, [11]. It has been estimated that, if fully melted the ice that forms to Greenland, the sea level would rise by about 7 meters, [7]. It is emphasized that the volume of ice content in Greenland is an important part of the North Pole.

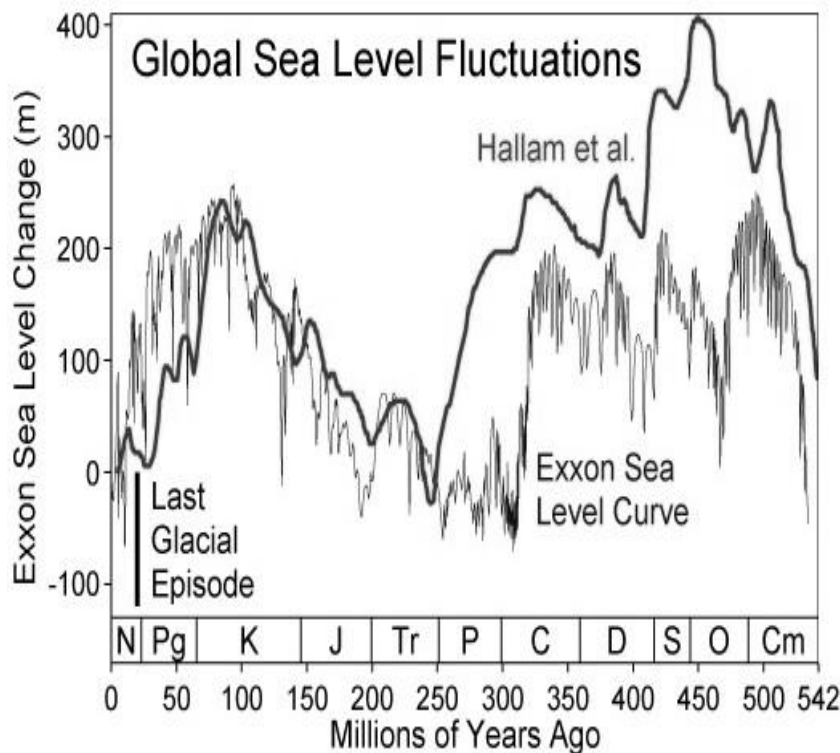


Fig 6. Mean sea level variations in the last 542 millions of years, [12]

On the other hand, it follows that, under current trends, the melting of the North Pole would imply a rise in the current mean sea level of 7 meters above actual conditions, and this fact it is considered to occur in the summers from 2040 and beyond. Currently, the earlier date was considered very optimistic and now the expected date is between years 2020 and 2030 for the first occurrence of complete melting of the North Pole in the summers, [12]. Using a software available at internet, [13], inundation maps were developed and they are shown in Figs. 7 and 8, where the flood maps corresponds to the southern coastal areas of the Gulf of Mexico and Caribbean Sea where they are displayed in darker color that inland the areas that would be submerged if a 7 meters rise in sea level, above the mean current sea level, would be presented sometime in the near future. As shown, Mexico would lose much of Cozumel, the largest island of the country, much of the coastal areas of the Yucatan Peninsula and the states of

Veracruz, Campeche and Tabasco, all of them would be greatly affected by this big change in the current mean sea level, as a negative consequence from global warming and global climate change.

V. THE 7+ INITIATIVE

The Initiative 7+ is to identify first, which coastal areas would be affected by facing a likely rise of 1 meter, 3 meters, 5 meters and 7 meters, see figures 8, 9, 10 and 6, respectively, in the current mean level sea, since the latter is the rise in sea level that would occur if the North Pole is completely melted in the summer, situation that is expected to happen from the year 2020 and beyond; or total melting of Greenland or a substantial portion of ice melting of Antarctica. The Initiative 7+ considers a second level of measures, like putting warning signs along the 7+ meters contour in height to show the more vulnerable area to the effects of sea level rise. The third level of action of the Initiative 7+ will be the evacuation of people who inhabit the inundation prone zones identified in the first stage by the Initiative 7+. The Initiative 7+ consists of the following stages:

- 1) Identify the sites at most risk from sea flooding in coastal areas, in this paper the case of Mexico is depicted
- 2) Zoning all coastal areas according to their flood risk and considering the level of high tide
- 3) As a greater increase than the IPCC prediction by the end of century begins to materialize, placing warning signs of impending flood areas is a must
- 4) If necessary, evacuate the population in areas with high risk of imminent flooding
- 5) Identify areas subject to continuous and / or permanent flooding to classify them as uninhabitable with the subsequent declaration of protected natural areas
- 6) Relocate the population inhabiting the areas that are subject to continuous and / or permanent flooding
- 7) Develop and exploit natural protected areas, due to the declaration of protected natural areas cited above, for rational exploitation by people evicted from these areas, in the case of Mexico, the coastal plains of Tabasco and Campeche could be used by constructing several aquatic parks, like the ones of Xcaret and Xel-ha
- 8) Investing the financial resources be allocated to support people affected by floods from the flood contingency programs in the creation of jobs



Fig 7. Veracruz, Tabasco and Campeche inundation maps with sea level rise of 7 meters with respect to actual levels, [13]

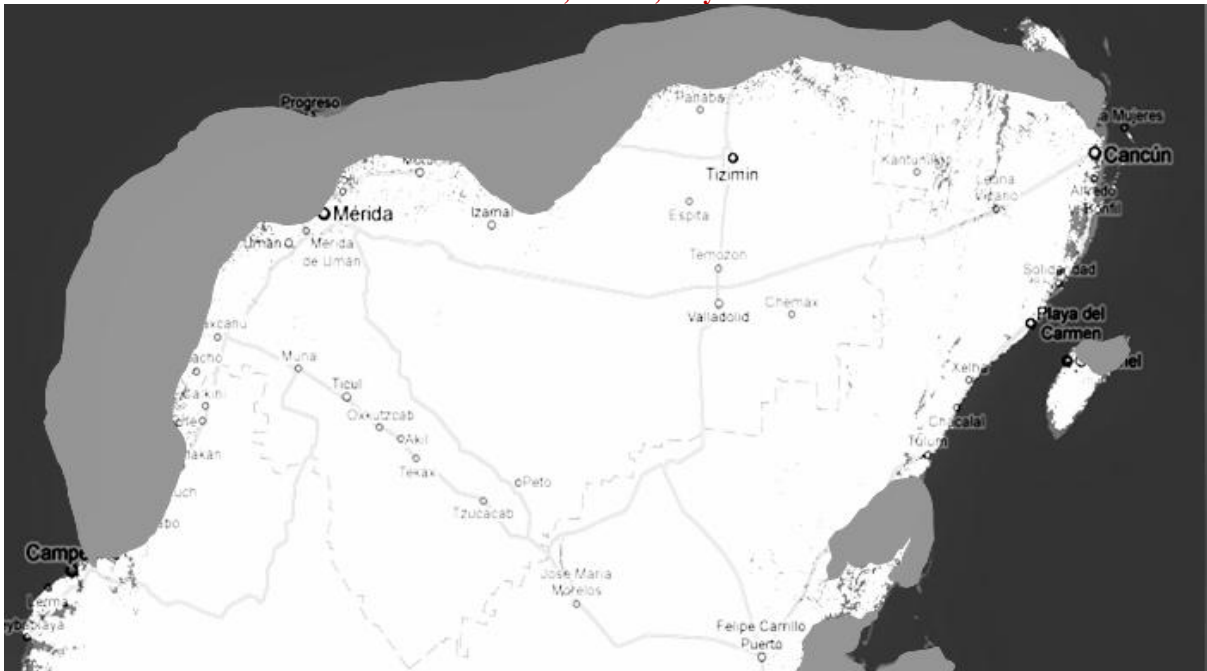


Fig 8. Campeche, Yucatán and Quintana Roo inundation maps with sea level rise of 7 meters with respect to actual levels, [13]

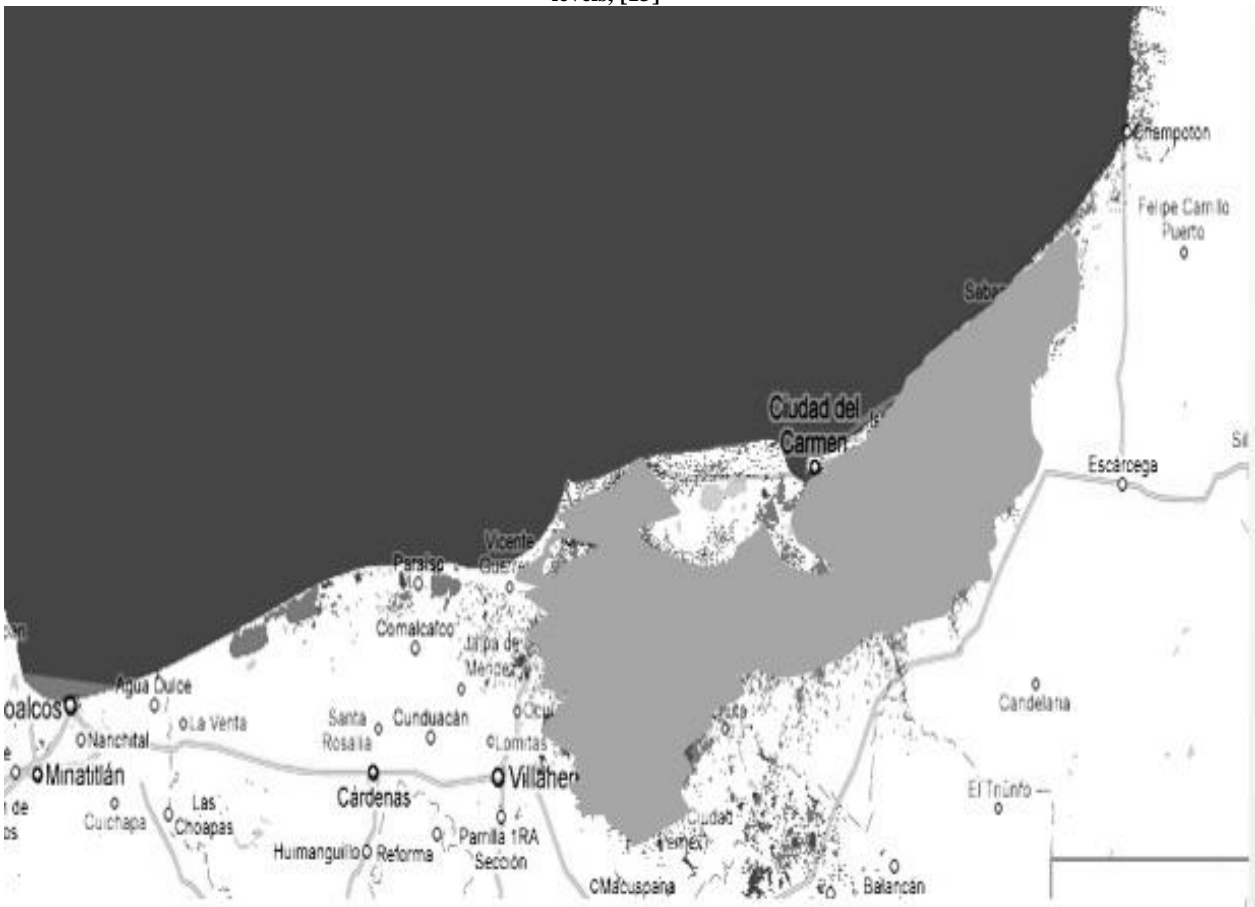


Fig 9. Veracruz, Tabasco and Campeche inundation maps with sea level rise of 1 meters with respect to actual levels, [13]



Fig 10. Veracruz, Tabasco and Campeche inundation maps with sea level rise of 3 meters with respect to actual levels, [13]



Fig 11. Veracruz, Tabasco and Campeche inundation maps with sea level rise of 5 meters with respect to actual levels, [13]



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VI. FEW POPULAR WAYS TO REDUCE THE EMISSION OF GREENHOUSE EFFECT GASES

Given the possible future scenarios for mean sea level rise mentioned before, it is required to take actions as individuals to mitigate the effects of global warming and try to make that global climate change is not so adverse to future generations. A non-exhaustive list of actions that can be taken in daily life are:

- 1) If possible, buy an electric or a hybrid car.
- 2) Change all incandescent filament bulbs in our homes by cold light lamps. Incandescent light bulbs consume up to 80% of electricity just for heating the filament.
- 3) If possible change old household appliances with more modern equipment which use energy more efficiently
- 4) Reduce energy consumption by having a more efficient use in the production of hot water in our homes
- 5) Reduce energy consumption by having a more efficient use of machines in the production of energy needed for heating and air conditioning in our homes

VII. CONCLUSIONS

Given the imminence of the rise in sea level above the current mean sea level, which in the first worst case scenario would produce an elevation of 7 meters above the current mean sea level, resulting from global warming and its consequent influence on the melting of polar ice, it is urgent to implement procedures for zoning the prone areas in serious danger of maritime flood; and develop contingency plans that allow an orderly and timely evacuation of the population living in the most vulnerable places to permanent flooding by rise in mean sea level. If no action is taken, at least those measures outlined before to reduce the production of greenhouse effect gases in our homes, we will not be make any contribution to make a future world more livable, and stop compromising future generations to live in a very different planet that the one we enjoyed throughout our lives. We must always remember that we are not the owners of the natural resources of planet Earth, we are only users of these resources and we have the moral obligation to inherit such natural resources to future generations at least with the same level of quality and quantity of such natural resources that we received from the previous generation to ours.

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