

Committee: Environment Sub - Commission 2

Issue: Rising sea levels due to global warming

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INTRODUCTION

The rise of global sea level has been tremendous over the past centuries and the rate has increased in recent decades. 2014 was a bad year for global sea level as it was approximately 7 cm above the 1993 average, which is the highest annual average in the satellite record. Sea level continues to rise at a rate of about 0.4 cm per year. The reason why sea level rise is such an important issue is that higher sea level means deadly and destructive storm surges pushing further inland than they did before, which leads to more frequent flooding. Troublesome and expensive flooding is estimated to be from 300% to 900% more often within U.S. coastal communities than it was just 50 years ago. Since ocean and atmospheric warming are non-stop, sea levels will most likely rise for many centuries at rates higher than that of the current one. In the U.S. almost half of the population lives in crowded coastal areas, where flooding, shoreline erosion and hazards from storms are affected by sea level.

Globally, eight out of the world's 10 largest cities are coastal, according to the U.N. Atlas of the Oceans. The rise of sea level may be more or less at specific locations than the global average due to local factors such as land subsidence from natural processes and withdrawal of groundwater and fossil fuels, changes in regional ocean currents. In urban settings, sea level rise threatens infrastructure necessary for local jobs and regional industries. Roads, bridges, subways, water supplies, oil and gas wells, power plants, sewage treatment plants, landfills; basically, all human infrastructure, is at risk from sea level rise.

DEFINITION OF KEY TERMS

Global Warming¹

Global warming is an increase in the earth's average atmospheric temperature that causes corresponding changes in climate and that may result from the greenhouse effect.

Global Sea Level Rise²

Global sea-level rise is the average increase in the level of the world's oceans that occurs due to a variety of factors, the most significant being thermal expansion of the oceans and the addition of water by melting of land-based ice sheets, ice caps, and glaciers.

Relative Sea Level Rise³

Relative sea-level rise refers to the change in sea level relative to the elevation of the adjacent land, which can also subside or rise due to natural and even some human-induced factors altering the coastal deposition of land based silt. Relative sea-level changes include both global sea-level rise and changes in the vertical elevation of the land surface.

Land Subsidence⁴

Land Subsidence¹ refers to land lowering in elevation due to subsurface water or oil extraction.

Rebounding⁵

Rebounding refers to land rising due to decreased pressure that can be caused by ice melt or glacial retreat.

¹ "Global Warming." *Dictionary.com*. Dictionary.com, n.d. Web. 06 June 2017.

² "2009 - Sea Level Rise Research Summary (last Update 4/2013)." *OSS Foundation*. N.p., 02 May 2013. Web. 06 June 2017.

³ "2009 - Sea Level Rise Research Summary (last Update 4/2013)." *OSS Foundation*. N.p., 02 May 2013. Web. 06 June 2017.

⁴ "2009 - Sea Level Rise Research Summary (last Update 4/2013)." *OSS Foundation*. N.p., 02 May 2013. Web. 06 June 2017.

⁵ "2009 - Sea Level Rise Research Summary (last Update 4/2013)." *OSS Foundation*. N.p., 02 May 2013. Web. 06 June 2017.

BACKGROUND INFORMATION

What we know

Sea level rise at specific locations may be more or less than the global average. There are several local factors such tectonic effects, subsidence of the land, tides, currents, storms, etc. that contribute to sea level rise. Sea level rise is expected to continue for centuries.

Due to the slow inertia, long response time for parts of the climate system, it has been estimated that we are already committed to a sea level rise of approximately 2.3 metres for each degree Celsius of temperature rise within the next 2 millennia. IPCC Summary for Policymakers, AR5, 2014, indicated that the global mean sea level rise will continue during the 21st century. It should be noted that sea level rise can significantly influence human populations in coastal and island regions and natural environments such as marine ecosystems.

Causes

There are three major causes for this issue, which are listed below:

1. Thermal expansion: It is anticipated that up to half of the sea level rise is deductible to thermal expansion. As the ocean warms, it expands, meaning the increase of sea level.
2. The continuing increase in the ocean's temperature. There was data in 2006 showing that Ocean's temperature began to cool down. Unfortunately, later it was shown that the trend was continuing to warm.
3. Ice melt from Arctic and glacial sources are contributing to half of the sea level rise. Antarctica will begin contributing more in the future.

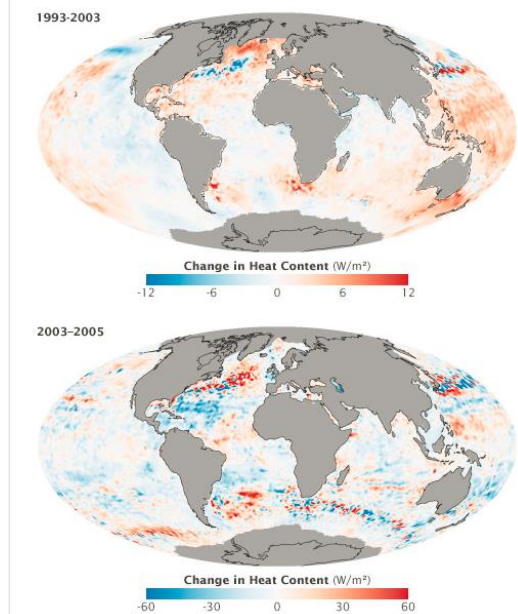


Figure 1: Robert Simmon, based on data from Josh Willis and John Lyman

Problems

The issue occurring with realistically evaluating sea level rise is that key points still need to be understood. The lack of information addressing the issue tends to lead in a non-real conservative scientific point of view. Hence, the scientific analysis of sea level rise might yield conservative appraisals of mostly constant actions and a possibly more sensible projection might be *less scientific and more accommodating of probabilities*. So what may result from sea level rise is without a doubt ambiguous and not well accepted. If sea level rise is estimated, foresight is required in order to understand likely potentials. To understand this, risk analysis is better than the use of model insurance actuary tables. The chances of an economic loss might be helpful in the examination of relevance and uncertainty regarding sea level rise.

The GHG (Greenhouse Gas)

Change Rate

As noticed in the paleo record, the GHG change rate weighed against the natural cycle between 7.000 and 14.000 times the natural rate because we are in an exceptional territory. This means that using the paleo record to predict sea level

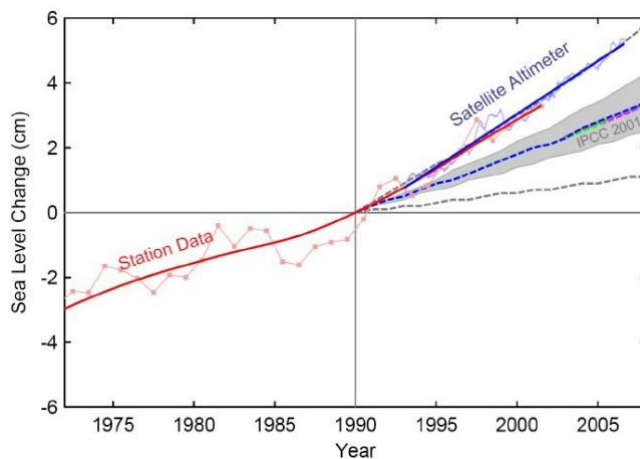


Figure 2: Graph showing the sea level rise (SLR) from 1975 up to 2005

rise fails when we are in a different territory.

Since there is a lack of comparative data the IPCC estimates are very conservative and at the same time, they do not include neutral feedback mechanisms that are noticeably needed in the observations. This has occurred due to the aforementioned problem, that we are in a new territory, so we cannot compare current changes effectively, at least for now, as the paleo record is currently understood.

Threats to coastal communities

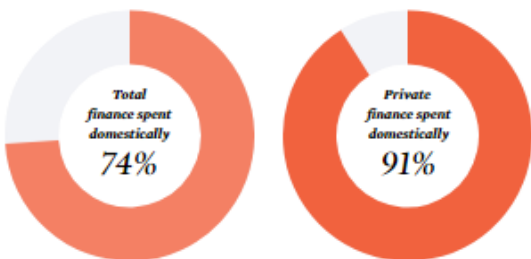
The issue of sea level rise affects a lot of coastal communities, as 40% of the world’s population lives within 100 km away from the ocean and this issue puts millions and billions of dollars’ worth of property and infrastructure at risk. The most dangerous phenomena to people and coastal infrastructures are high tides and storm surges. 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 the natural protections are stable they are washed over or drowned. Some ways to protect roads, buildings and other vital coastal resources are seawalls, jetties and other artificial defences which many shorelines have. In these areas, sea-level rise increases erosion of stranded beaches, wetlands, and engineered structures.

Saltwater intrusion

It is very common when we talk about sea level rise that salt water intrudes into groundwater drinking supplies, adulterates flooding supplies or overruns agricultural fields. Rock – bottom, pitched coastal areas are extremely vulnerable to adulteration of fresh water supplies.

Global Climate Finance

Public finance is growing steadily as it continues to drive private investment. Most earns come from institutions focusing on the development finance which provided 34% of total climate finance flows. Moving on with the private investment it grew 21% and remained the largest source of climate finance. Public support is significant but is less than a third of government subsidy fossil fuel utilisation which reached approximately \$493 billion in 2014.



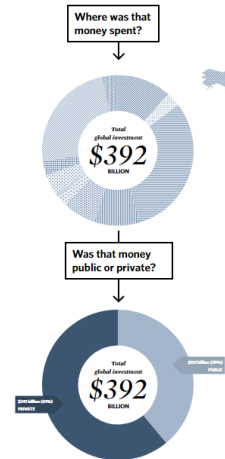
As countries globally

Figure 3: Graph showing the percentage of private and public money spent domestically

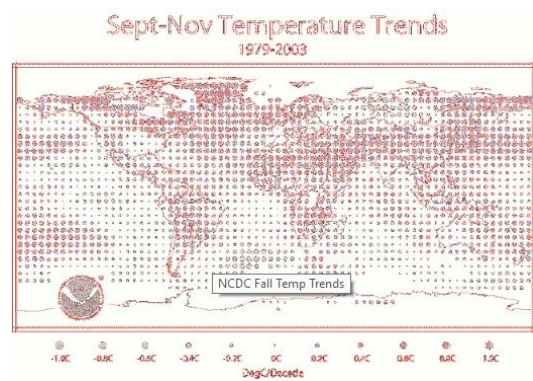
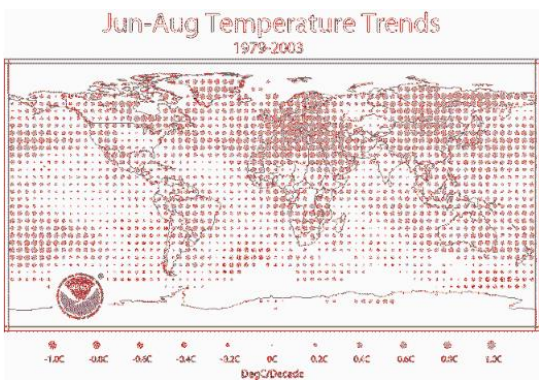
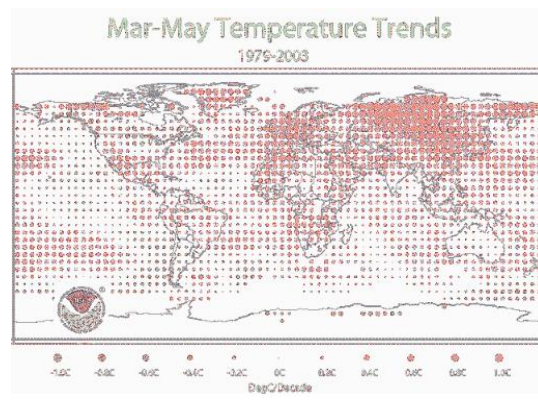
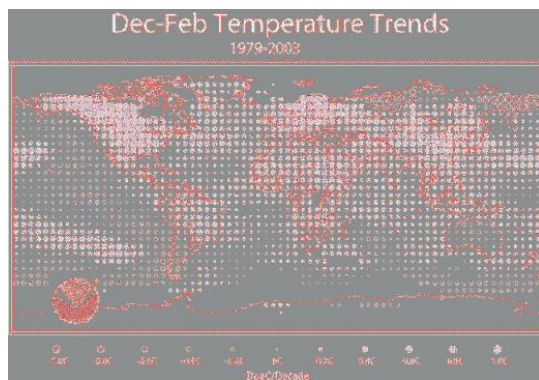
want to build their long – term prosperity they invest in climate action asking for “protection” with this action. The majority of finance was raised within the country and

simultaneously spent within the same country. As domestic investment dominates it is vital to get national policies right.

Figure 4: Graph showing how much money (private or public) was spent on global warming finance and where was it spent on.



The maps show that as the Pacific ocean temperature begin to escalate, the potential for increased storm energy rises. Increased sea level rise will slowly increase coastal erosion. Increased storm intensity will translate to rapid coastal erosion based on event intensity and increased wave height.⁶ (Figures 5,6,7,8)



⁶ "2009 - Sea Level Rise Research Summary (last Update 4/2013)." *OSS Foundation*. N.p., 02 May 2013. Web. 06 June 2017.

MAJOR COUNTRIES AND ORGANISATIONS INVOLVED

United States of America

It is a fact that various coastal cities of the United States are affected and will be further affected by the sea level rise. Therefore, special precautions have been taken to avoid destruction. For example, New York and Boston to ensure their “protection” have made an inclusive resilience plan. It has taken a lot of actions to underrate the risks. The cities’ plan to reinforce beaches, build bulkheads, and protect sand dunes that act as natural obstructions to protect coastal areas against tidal flooding. To weaken waves associated with storms the cities may furthermore act out breakwaters offshore and straight up storm walls and levees in vulnerable areas that constitute “targets”. However, the United States decided to withdraw from the Paris Agreement questioning the causes of climate change and designating the agreement as a threat for the US economy.

Greenland



A couple of new studies published in the journal Nature undermine key assumptions about Greenland’s ice sheet – the main sight of ice melting – and provides the public with information to

Figure 9: Water is seen on part of the glacial ice sheet that covers about 80 percent of Greenland on July 17, 2013 on the Glacial Ice Sheet.

understand how disastrous sea level rise might be. The first study shows that during the last several million years, Greenland’s ice sheet lost a big part of its ice. That questions the expectation that the island’s ice sheet is stable, especially when one takes the phenomenon of global warming into consideration. There is a theory that if all of Greenland’s ice sheet melted, it would raise sea level globally neatly 7.4 meters, enough to swamp coastal cities, which, however, can be altered after recent findings.

Antarctica

Fortunately, Antarctica has yet to see dramatic change due to global warming. However, the Antarctic Peninsula, which juts out into the warmer water on the north side, has warmed up 2.5 degrees Celsius, since 1950. A broad area of West Antarctica Ice Sheet is losing a lot of mass, because of the warmer waters deep in the ocean. On the other hand, in East Antarctica, some stations appear to be cooling. Overall, scientists believe that Antarctica is starting to lose ice, but so far, the process has not been as rapid or as widespread as in Greenland.

Intergovernmental Panel on Climate Change (IPCC)

The Intergovernmental Panel on Climate Change (IPCC) is the superior body for the evaluation of climate change. It was established by United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO) in 1988 to maintain a clear scientific view on the ongoing state of knowledge in climate change and its likely socio-economic impacts. The IPCC reports and evaluates the current scientific, technical and socio-economic information that goes on worldwide and can contribute to understanding better the phenomenon. Other than that, the IPCC is not responsible neither to conduct any research nor to monitor climate related data and parameters.

TIMELINE OF EVENTS

The below timeline was based on the *“Timeline: Discovery of global warming”* (<http://http://history.aip.org/climate/timeline.htm>)

Date	Description of Event
1859	It is discovered by Tyndall that some gases block infrared radiation.
1896	The first calculation of global warming from human emissions of CO ₂ is published by Arrhenius.
1914 - 1918	World War I: governments learn to assemble and control industrial societies.
1920 - 1925	Opening of Texas and Persian Gulf oil fields commences era of cheap energy.
1930s	Global warming trend since late 19th century reported. Milankovitch

	proposes orbital changes as the cause of ice ages.
1957	It's discovered by Revelle that CO ₂ produced by humans can't be readily absorbed by the oceans.
1960	A downturn is reported in global temperature since the early 1940s. An annual rise in atmosphere's CO ₂ is detected.
1966	Emiliani's analysis of deep-sea cores and Broecker's analysis of ancient corals show that the timing of ice ages was set by small orbital shifts, suggesting that the climate system is sensitive to small changes.
1968	There's a possibility of collapse of Antarctic ice sheets, which would lead to a catastrophic sea level rise.
1970	First Earth Day. Environmental movement attains strong influence and spreads concern about global degradation. Creation of US National Oceanic and Atmospheric Administration, the world's leading funder of climate research.
1972	Ice cores and other evidence show big climate shifts in the past. Droughts in Africa, Ukraine, India cause world food crisis, spreading fears about climate change.
1976	Studies show that CFCs (1975) and also methane and ozone (1976) can make a serious contribution to the greenhouse effect.
1978	Attempts to coordinate climate research in US end with an inadequate National Climate Program Act, accompanied by rapid but temporary growth in funding.
1982	Greenland ice cores reveal drastic temperature oscillations in the space of a century in the distant past.
1987	Montreal Protocol of the Vienna Convention imposes international restrictions on emission of ozone-destroying gases.
1988	Intergovernmental Panel on Climate Change (IPCC) is established.

1992	Conference in Rio de Janeiro produces UN Framework Convention on Climate Change, but US blocks calls for serious action.
1995	Second IPCC report detects "signature" of human-caused greenhouse effect warming and declares that serious warming is likely in the coming century. Reports of the breaking up of Antarctic ice shelves and other signs of actual current warming in polar regions begin affecting public opinion.
2003	Numerous observations raise concern that collapse of ice sheets (West Antarctica, Greenland) can raise sea level faster than most believed.
2005	Kyoto treaty goes into effect, signed by major industrial nations except US. Work to retard emissions accelerates in Japan, Western Europe, US regional governments and corporations.
2012	Controversial "attribution" studies find recent disastrous heat waves, droughts, extremes of precipitation, and floods deteriorated due to global warming.
2015	Paris Agreement: nearly all nations pledge to set targets for their own greenhouse gas cuts and to report their progress.

UN INVOLVEMENT: RELEVANT RESOLUTIONS, TREATIES AND EVENTS

Montreal Protocol

The Montreal Protocol on Substances that Deplete the Ozone Layer is an international treaty constructed to protect the ozone layer by cancelling the production of various substances that are accountable for ozone depletion. It was agreed on 16 September 1987 and entered into force on 01 January 1989, followed by the first meeting in Helsinki, May 1989. Since then, it has undergone eight revisions. As a result, of the international agreement, the ozone hole in Antarctica is slowly recovering.

Kyoto Treaty

The Kyoto Protocol is an international treaty which extends the 1992 United Nations

Framework Convention on Climate Change (UNFCCC) that calls State Parties to eliminate greenhouse gas emissions, based on the scientific unity that firstly, global warming is happening and secondly, that is intensely likely that manmade CO₂ emissions have especially caused it. The Kyoto Protocol was signed in Kyoto, Japan, on December 11, 1997, and entered into force on February 16, 2005.

Paris Agreement

The Paris Agreement is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC) handling greenhouse gas emissions mitigation, adaptation and finance starting in the year 2020. In this agreement, each state party determines, plans and regularly reports its own contribution to minimising global warming. There is no mechanism to push a country to set a specific target for a specific date, but each target should go beyond previously set targets. The U.S. announced its withdrawal from the Paris Agreement in June 2017.

PREVIOUS ATTEMPTS TO SOLVE THE ISSUE

European Climate Change Programme

As a response to the Kyoto Protocol the European Union established the European Climate Change Programme. The aim of the Programme was the development of a unilateral environmental strategy for the EU States to implement the necessary measures and achieve the goals set by the Kyoto Protocol. Simultaneously, individual states implemented their own domestic measures following the action plan of the ECCP.

G8 and G20 Climate Change Action Plans

Apart from the UN, further intergovernmental organizations have decided to take active actions to combat the phenomenon of climate change. Both the G8 and the G20 have discussed the issue and have taken serious actions to handle it. First, in 2008 the G8 adopted in Osaka the “Action Plan for Climate Change to Enhance the Engagement of Private and Public Financial Institutions”. Recently also the G20 adopted an Action Plan as a response to the Paris Agreement and the decision of the US to withdraw from it. In 2017 in Hamburg the

assembly of the G20 leaders decided on the adoption of G20 Hamburg Climate and Energy Action Plan for Growth.

POSSIBLE SOLUTIONS PREVIOUS ATTEMPTS TO SOLVE THE ISSUE

To address the issue, we must see it all over. Firstly, enhancing tracking efforts will help to improve transparency, comprehensiveness and consistency bookkeeping approaches. The creation of an Agreement on what results and on how it should result will probably help to strengthen trust and on the same time international cooperation, something vital for this issue. Thus, we need to ensure that finance is used efficiently and where is needed the most, so a convenient measurement, tracking and reporting system is a critical building block. Secondly, it is essential to get domestic investment policy right so as supporting frameworks. Defective frameworks can restrict the lure for investment by, sending unclear and uncertain policy signals. Improved tracking at the national level can help strengthen climate change policy-making processes and ensure effective management of public resources to deliver on national climate change policy goals. Lastly, we should build differently. We should implement expediting Everglades restoration. Rehydrating Biscayne Bay is perfect for protecting water from saltwater intrusion which is one of the biggest threats from sea level rise.

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Pictures' and Graphs' Bibliography

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Figure 2: <http://ossfoundation.us/projects/environment/global-warming/sea-level-rise#section-1>

Figure 3:

http://www.climatefinancelandscape.org/?gclid=CjwKEAjwgtTJBRDRmd6ZtLrGyxwSJAA7FyhDw0z0xUmP35Rgdot-TEOCi_9mK4xFovrf3UML0RG7hoCbrXw_wcB

Figure 4:

http://www.climatefinancelandscape.org/?gclid=CjwKEAjwgtTJBRDRmd6ZtLrGyxwSJAA7FyhDw0z0xUmP35Rgdot-TEOCi_9mK4xFovrf3UML0RG7hoCbrXw_wcB

Figure 5: <http://ossfoundation.us/projects/environment/global-warming/sea-level-rise#section-1>

Figure 6: <http://ossfoundation.us/projects/environment/global-warming/sea-level-rise#section-1>

Figure 7: <http://ossfoundation.us/projects/environment/global-warming/sea-level-rise#section-1>

Figure 8: <http://ossfoundation.us/projects/environment/global-warming/sea-level-rise#section-1>

Figure 9: <http://time.com/4592866/greenland-ice-sea-level-rise-climate-change/>

