REPORT OF RECOMMENDATIONS

2018

Climate Change and Small Island States: A Call for Strategic Action

June 15, 2018

American University of the Caribbean School of Medicine

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Executive Summary

The *Seventh* annual Governor's Symposium **"Climate Change and Small Islands States: A Call for Strategic Action** pursued the following goals.

1. To inform invited participants about the facts and effects of climate change and the urgency for policy decisions and actions today to secure our socio-economic future.
2. To take stock of the most recent devastation caused by Hurricanes Irma and Maria in 2017 throughout the region and related risks.
3. To highlight the importance of and encourage national climate change policies and actions within the framework of effective public, corporate and social governance.

1. Approach

His Excellency, Governor drs. Eugene Holiday installed the Symposium Organizing Committee on April 23, 2018, at which time the first meeting with the Committee was held. The Committee was provided with the vision for the event, which aided in the preparations leading up to the event. The committee members respectively expressed their thanks to His Excellency for being entrusted with the organization of this great initiative.

The committee scheduled weekly meetings during which time updates on activities surrounding the core preparations of the symposium were tabled and decided upon. Extra-ordinary meetings (incl. vendors), as well as site visits, were convened approaching closer to the event.

The committee made use of modern technology such as video presentations, live interviews, as well as art to highlight the theme of Climate Change. This year's symposium included an Art Contest as a side-event. The purpose of the art contest was to encourage students (solely Secondary School students (pre-exam and exam year students were invited to participate) to express their ideas artistically in the form of art depicting this year's theme. Furthermore, a video capturing Climate Change from the perspective of our citizens was also featured during the symposium. Students representing the Charlotte Brookson Academy of the Performance Arts, the St. Maarten Academy and the Methodist Agogic Centre interviewed a cross-section of citizens of different disciplines in the community.

On behalf of the Symposium Committee responsible for organizing the 2018 Governor's Symposium, we hereby present our end report, which also contains a summary of the outcome of the presentations presented at the symposium, the plenary session as well as the question and answers session with the audience.

Organizing committee:

- Mrs. Emilia Connor-Thomas - Chair
- Mr. Patrick Trijsburg - Secretary
- Ms. Desiree Connor
- Ms. Rayan Rammo
- Ms. Dahjanarah Philips
- Mr. Silvànico Pauletta

2. Symposium

2.1. Summary of Governor's Opening Address

In his opening remarks, His Excellency Governor Holiday emphasize the fact that small island states with a one-pillar economy, such as Sint Maarten, is susceptible to the impact of global events and developments over which there is no control. His Excellency citing the 2015 drought on the island, the devastation of hurricane Irma in 2017, and the major threat of the rising sea level for low lying areas on Sint Marten as outlined in a nature foundation report stated that climate change poses an existential threat to Sint Maarten and reiterated that time for action was now. As such, Climate Change should be a strategic priority for individuals, businesses, and government. To give content to this, it is imperative to create and establish the required institutional framework and capacity. There is an urgent need to establish a national unit for Sint Maarten, which will be mandated to collaborate with regional and international partners towards the further development of our strategic climate change agenda as part of the regional and international agenda. In other words, the climate change challenge requires regional and international collaboration and cooperation. Such collaborations should seek involvement from regional institutions, such as the Caribbean Community Climate Change Centre, the University of the West Indies, and the Caribbean Institute for Meteorology and Hydrology, as well as several United Nations agencies working on climate change adaptation projects in the Caribbean, just to cite a few. Finally, attention should also be directed to Climate Change mitigation and adaptation investments. Specifically investments in greater energy efficiency (renewable energy, solar) and infrastructure resilience are critical. Further investments in environmentally sustainable solutions such as underground utilities and the telecommunications cable network are critical and should be executed without delay.

2.2. Summary of Prime Minister's Address: Government's Perspective

The Honorable Prime Minister, Leona Romeo-Marlin in her address recounted the devastation caused by Hurricane Irma on September 6, 2017. St. Maarten despite being considered desolate has displayed her resilience and is on the path of recovery and reconstruction under the theme "Building Back Better." St. Maarten as in the case of other Small Islands States are on the frontline of Climate Change and thus not immune to:

a) Limited capacity and resources;
b) Economic vulnerability due to impulsive international developments and finally;
c) Natural disasters.

The Government of Sint Maarten must continuously revisit its disaster management blueprints and socio-economic developments holistically to mitigate the effect of natural disasters triggered by Climate Change. Climate Change is a national priority and Government is addressing these obvious effects through multiple strategic approaches such as the National Recovery and Resilience Plan, the Sustainable Development Goals (SDG's), (revision of) Disaster Management and National Security. Partnership is therefore essential to ensure that technical cooperation and support are accessible from a national, Kingdom, regional and international level to promote the exchange and transfer of knowledge on environmental problems and solutions, and to foster environmental responsiveness for sustainable development. She added that the involvement of civil society through information and awareness platforms is key in the fight against Climate Change; specifically, the changes in the biosphere resulting from human and natural activities and the effects of these changes on the environment. The Prime Minister

concluded her remarks by stating that the time to act against Climate Change is now, if we are to safeguard our existence and that of generations to come.

2.3. Summary of Keynote Speaker's Address

In his speech, Dr. Leslie mentions the increasing vulnerability of the Caribbean as a result of climate change. Scientific research and observations confirm that:

- The frequency of extreme weather climate events and climate variability has increased significantly as a consequence of the warming climate;
- The number of intense hurricanes being of categories three and higher has increased;
- Hurricanes are forming at lower latitudes and further to the east of the Lesser Antilles; and
- The rate of development of hurricanes from tropical depressions is unusual.

The higher temperatures of the oceans also affect the reefs and marine life in the Caribbean area. Coral bleaching is one of the consequences. The rising of the sea level is also one of the effects of climate change that introduces another set of problems, such as salt-water contaminations of aquifers, the destruction of coastal habitats, both for plants and many forms of wildlife and the damage to coastal infrastructure and beach erosion. Further Dr. Leslie talks about the slow pace of action by the international community in addressing climate change and its effects. He also talks about adaptation as being the only option. That it is essential that development programs include the possible impacts of climate change on the long-term sustainability of the programs. That would allow SIDS to chart a resilience-building pathway for their development. He mentions two examples of adaptation initiatives. The first one is the Bermuda Energy and Climate Change Resilience Program that is supposed to contribute to the overall reduction of destruction because of the preventative measures put in place. The second one is the establishment of an Adaptation Trust Fund by the British Virgin Island that envisions the sourcing of climate finance from some entities. He points out that climate risk management is important in the decision-making processes of governments. He explains that the Centre developed an online, freely accessible tool on its website, CCORAL (Caribbean Climate Online Risk and Adaptation Tool). Finally, he addresses the issue of infrastructure in general and five critical areas, being transportation, housing, communication, water, and hospital.

Recommendations:

- **Transport**
  Resilient transport policies could decrease the impact of natural disasters on population well-being by 13 to 25% in small island countries. This could be achieved through a new strategic approach to transport asset management. It must factor in climate change and disaster risks, such as:

  - The placement of the transport infrastructure away from high-risk locations;
  - Physical protection against hazards;
  - Application of innovative materials and construction designs;
  - Infrastructure maintenance.

- **Housing**
  It is important to make the right choices during construction. Building codes can help ensure high-quality buildings. That can be some of the most affordable policy tools that decision-makers can use. He points out that strict building codes enforcement also plays a major role in reducing a region's building vulnerability.

- **Communication**
  The importance of having an alternative communication system during a disaster as an absolute necessity and that a permanent emergency communication must always be operational.

- **Water**
  For the water situation, reference was made to the Bermuda home model and the use of desalinization plants that are powered by renewable energy.

- **Hospitals**
  The safety of health facilities at risk should be of primary concern during disasters. It is therefore important that new or existing health facilities are disaster-resilient. He mentions that a retrofitted Smart Hospital would be able to function after the passage of a hurricane since it would have its renewable energy supply and potable water, two critical operational elements.

At last, he points out how important the role of education can be in developing awareness of climate change. It is important that the subject of climate change be included in all educational curricula.

(A full excerpt of Dr. Leslie's speech is included in this report).

3 Contributions

The symposium encompassed three sessions, which featured national and regional speakers and distinguished experts in their respective fields. A summary of each speaker's presentation is provided below:

SESSION 1: CLIMATE CHANGE, WEATHER, AND ENVIRONMENTAL PATTERNS

3.1. Mr. Joseph Isaac, Head of the Meteorological Department, Government of Sint Maarten

In his presentation, Mr. Isaac stated that according to IPCC (Inter-governmental Panel on Climate Change) findings, many parts of the world would be affected by climate change, including Small Island Developing States (SIDS). Such effects include livelihoods, coastal settlements, infrastructure, ecosystems and economic stability in SIDS, and rising sea levels continue to pose an increasing threat to low-lying coastal areas. Global trends have illustrated the following occurrences in the near future, viz. rising temperatures, rising sea levels, more and stronger hurricanes in the Atlantic over time, rising annual temperature and decreasing annual rainfall but heavier showers. This would, in turn, cause local effects, such as more droughts, increasing risk of brush fires, siltation of ponds, increase in flooding/flash-flooding, increased risk of heat waves, increasing demand for (cooling) power, beach erosion, greater storm surge/tsunami impacts, and increased infrastructural damage.

Recommendations:

Collaboration is needed with various entities to manage climate change issues on a local scale: IPCC, CCCCC (Caribbean Community Climate Change Center), CIMH (Caribbean Institute for Meteorology & Hydrology). Other strategic actions also include improved data collection with a network of weather stations/radar to assist in early warning systems and sea level monitoring. Heavier showers will also require stronger building codes with an enhanced drainage system. To aid in adjusting and managing climate change, it is recommended to start educating children through school programs as well as utilizing present documents or studies that have already been done (i.e., the St.

Maarten Storm water Study by UNESCO-IHE). Where cost is concerned: "for every $1 spent in mitigation, $3.00 to $5.00 is avoided in response to recovery". Hence, the recommendation is to spend some money on mitigation to avoid some of these impacts.

3.2. Dr. Cedric van Meerbeeck of Climatologist, Caribbean Institute for Meteorology and Hydrology, Barbados:

Climate Change refers to changes like global warming that happens over decades and centuries, while Climate Variability can be defined by climate patterns that vary from months to years as with El-Niño and Weather varies within minutes to weeks. In the Caribbean between 1960 and 2010, the following significant region-wide temperature and rainfall trends have been observed. Since 1960 there are annually warmer day and nights (>15%) and less cold days (-10%) and nights (-7%), whereby all are 1^{o}C warmer, resulting in heat waves being spread over a longer period of the year. No annual change of single rainfall nor dry spell has been experienced. Future Climate Change projections for the Caribbean were estimated based on temperature Change, specifically warming by the end of 21st Century of 1 to 5 ^{o}C, which far exceeds natural variability. Precipitation Change projection, on the other hand, shows a general drier wet season from June-October and a drying trend for the Caribbean Basin of 25% to 30% with April to September likely drier by the end of the 21st century. Drying exceeds natural variability. On the subject matter of Sea Level Rise, recent studies also suggest that sea level rise in the Caribbean may be more pronounced than in other regions because of its proximity to the equator (e.g. Bamber et al. 2009) with consequences of 1 and 2 m sea level rise in the Caribbean, which is considered to be reasonable estimates by the end of the century (Simpson, 2010). Hurricane Activity and hurricanes will become stronger and more frequent, with cyclones projected to become wetter. There are no clear changes in a number of named storms, but the hurricane season may become longer. Caribbean Climate Change Concerns are those related to Sea Level Rise, which will result in coastal flooding, beach and coastline erosion and Saline intrusion into freshwater aquifers.

Additionally, increased temperatures cause heat stress, coral bleaching, biodiversity loss and increased emergence of vector-borne diseases. Ocean acidification results in negative changes in marine ecosystems. Finally, the impact of more extreme weathers on damage and loss (though the rise thus far has been mostly due to increased exposure), safety and security. Warming will persist for centuries. Even if Green House Gasses emissions were stabilized now Sea Level Rise (SLR) would continue to rise beyond the end of the century, and suggest that *'the question is not if the Caribbean will face SLR of 1m or 2m under either a 2.0°C or 2.5°C global warming scenario, but rather when'.*

SESSION II: CLIMATE CHANGE EFFECTS ON SOCIO-ECONOMIC DEVELOPMENT

3.3. Mr. Derick Downes, Managing Director of the Windward Islands Bank, Sint Maarten. *"The Impact of Climate Change on the Economic Development of Sint Maarten."*

Sint Maarten possesses a narrow economic base, with limited avenues for economic diversification and heavy dependence on tourism services, resulting into a high level of economic and environmental vulnerability as the majority St. Maarten's population depends on the preservation of its natural and coastal environment. Economic development may be defined as the process of sustained advancement of the economic, social, spiritual and political well-being of a country's citizens. The impact of climate change on our domestic economy and economic development is a multi-faceted, complex

and costly issue that requires collective buy-in through the implementation of UN Sustainable Development Goals (SDG), which encapsulates climate change and environmental protection. Sint Maarten is still to address the SDG's of poverty eradication and environment protection. The impact of climate change on the economic development outcomes of small developing countries are expected to be more severe than in our developed counterparts, who are largely responsible for the problem. Immediate action is needed to reduce the vulnerabilities posed by the expected impact of climate change to avoid higher adaptation costs. Businesses and individuals are to make decisions and take actions that reduce their exposure to the effects of climate change events on their commercial and personal assets. Government's responsibility is to protect national assets, including natural environment, and services on behalf of citizens and create the enabling framework, which encourages resilience and favorable private sector involvement.

Recommendations:

- **Government Actions**

- Establish a Disaster Fund for cleanup efforts and reconstruction costs
- Improve coastal defenses
- Enhance drainage systems and flood barriers
- Improve building standards and enforce them
- Review of Environmental Protection Legislation
- Improvement in health systems
- Climate proof water storage tanks including excavation of additional wells around the island.

- **Business Actions**

- Insurance of business and commercial premises, including inventory furnishings, equipment, and business interruption insurance.
- Create a hurricane preparedness plan that can be shared with employees.
- Properly protect property and assets once there is an incoming climate change event.
- Have a backup generator. This would assist greatly in the re-opening of business if electricity is not yet available.

- **Individual Actions**

- Appraise and insure your property.
- Disaster Preparedness Plan to protect property and family for risks like climate change events.

- **Entire community:**

- Continue to pray for God's hand of protection over our island, as a common denominator among all faiths and denominations that do not need money to happen.

3.4. Dr. Michael A. Taylor, Professor & Deputy Dean Faculty of Science and Technology of the University of the West Indies, Mona Campus, Jamaica.

In his presentation, Dr. Taylor referred to the discussions about climate change after 2017, with focus on if we will experience something similar again in our lifetime or was last year an anomaly. To put matters squarely, our climate has changed, and more intense weather phenomena will continue to occur in the future. A new norm is coming into place with warmer days & nights, rainfall that is more variable, higher sea levels, and more widespread extremes (i.e., drought and hurricanes). There will be significant impacts on the things that determine the quality of life in small island states. These unprecedented changes will affect our Caribbean landscape and livelihood by threatening 16 of our 17 Sustainable Development Goals (SDG's). The challenge then becomes how to contend with the unfamiliar, while preparing for the unprecedented to come. Hence, the approach to handling such a feat is to plan from now with targeted and

transformative actions for now and the future. It cannot be done with small efforts, as our development goals are becoming unattainable and untouchable.

Recommendations:

- Adaption for change, so that we and others can live with the changing climate – concerning farming practices, building practices, water harvesting, policies, and programs. "We have to rethink the standards, norms, and bases we are using when factoring in climate change in adaptation planning."

- Mitigation so we can reduce the number of greenhouse gases we put in the atmosphere – with respect to energy, waste, forests, transportation. "We have to push for greater mitigation regionally and globally to offset the worst future possible."

- Educating citizens to become conscious, convinced, and convicted about the issue to become resilient societies who are climate-smart. "We all need to be aware of the magnitude and scope of climate change's impact on us as small island dwellers and use that knowledge to drive action for the common good."

- Finally, our climate demands change, and should be attacked with a sense of urgency, as climate change is not a distant problem, it is a NOW issue. Our climate matters!

SESSION III: INTERACTIVE SESSION

The roundtable discussion featured a distinguished panel of speakers lead by Moderator, Mr. Tadzio Bervoets gave insight into weather and environmental patterns, the effects of climate change on economic development as well as the vulnerabilities and challenges of Climate Change for Small Island States and the need for strategic action and policy. This interactive session garnered thought-provoking questions from the audience, which included high school students from the St. Dominic's High School (science division). Due to time constraint, the panel discussion was limited to a question and answer session.

4. Survey outcome

A total of 168 invitees attended the symposium. Symposium attendees were prompted during the proceedings to provide feedback. An evaluation survey form was made available through an online link. As in previous years, attendees were asked to rate the sessions in terms of presentations, facilities, arrangements and to provide input for next symposium. The scores for the ratings were from one to five, with five (5) being the highest rating and one (1) being the lowest.

Furthermore, attendees were asked to rate each presenter and provide an overall rating on the sessions. From the survey evaluation received, the overall response to the symposium, relevance on topic delivery by the presenters were rated overall as "very good." The themes suggested for future symposia were: a) Diversification of our tourism product and b) Civic participation and participatory governance. A point of recommendation for the Government, Civil Society, Private sector and media, respondents suggested the need for the creation of an "Environmental Authority."

5. Conclusion:

The governance agenda in mitigating Climate Change should be a strategic priority moving forward. There is a need to develop regional and international cooperation to tackle the effects of climate change. There is a need to increase investment in greater in energy and infrastructure resilience and environmental solutions.

Finally, there is an urgent need to secure financing for insurance, first response funding, and disaster risk facilities.

Mrs. Emilia Connor-Thomas
Chairperson

Mr. Patrick Trijsburg
Secretary

Appendices

- Opening Address - H.E. Governor Eugene Holiday
- Remarks on the Government's Perspective – Prime Minister, the Honorable Leona Romeo-Marlin
- Presentation on Climate Change, Weather and Environmental Patterns:
    - Mr. Joseph Isaac
    - Dr. Cedric van Meerbeeck
- Presentation on Climate Change effects on Socio-economic development:
    - Mr. Derek Downes
    - Dr. Michael Taylor
- Keynote address: Dr. Kenrick Leslie
- Summary/outcome of Roundtable discussions

Opening Address - H.E. Governor Eugene Holiday

Implementing Strategic Climate Change Action,

Is time running out?

Opening Address

By The Governor of Sint Maarten

His Excellency drs. Eugene B. Holiday

Delivered at the

7th Annual Governor's Symposium 2018

"Climate Change and Small Island States –

A Call For Strategic Action"

June 15, 2018

Ladies and Gentlemen,

Good Morning,

It is with great pleasure that I bid you welcome to the seventh annual Governor's Symposium. I am very pleased to see so many persons from a broad cross section of our community in attendance as well as our guests from the northern side of our island and from overseas. In particular, I wish to recognize and extend a special welcome to our regional and local speakers who have joined us today. Our keynote speaker, Dr. Kenrick Leslie, from Belize, our featured speaker Dr. Cedric van Meerbeeck, from Barbados, our featured speaker Dr. Michael Taylor, from Jamaica as well as our local featured speakers Mr. Joseph Isaac and Mr. Derek Downes. It is good to have you here at this Governor's Symposium.

Ladies and Gentlemen,

The overall objective of the Governor's Symposia is the promotion of good governance as a pillar for national development. The theme of this Governor's Symposium: "Climate Change and Small Island States – A call for Strategic Action", has been chosen because I believe that we are running out of time to implement effective climate change governance measures.

On December 12, 2015, the global community, to significantly reduce risks and impacts of climate change, signed the Paris Climate Accord. The accord is aimed at keeping the increase in global average temperature to well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. The realization of the objectives of that accord is especially important for vulnerable small island states like us.

Ladies and Gentlemen,

The goal of this *Seventh* annual Governor's Symposium is to inform our community about the facts and effects of climate change and the urgency for action today, to secure our socio-economic future. As a small island Caribbean state with a one pillar tourism economy, Sint Maarten is in general susceptible to the impact of global events and developments, over which we have no control. In that regard climate change, in terms of its causes, its effects and the responses, presents a major governance challenge. *Whereas our contribution to the cause of climate change is not significant, we are amongst the most vulnerable to the threat and effects of climate change.*

The World Travel and Tourism Council predicts that the Caribbean will become the most at-risk tourist destination in the world between 2025 and 2050[1]. *I believe that we already are.* In 2015, the UNESCO Science Report observed that 'the region would be hard pressed to deal with a major meteorological disaster,' and urged it to 'take climate change adaptation more seriously.'[2] To illustrate the reasons to do so, I have selected three Sint Maarten examples:

First, in the context of climate change we have already experienced extended dry weather periods resulting in significant drought. In that regard I can point to the drying up of the Great Salt Pond in 2015 (see photo 1).

Photo 1: Severe drought causes Great Salt pond to dry up in 2015

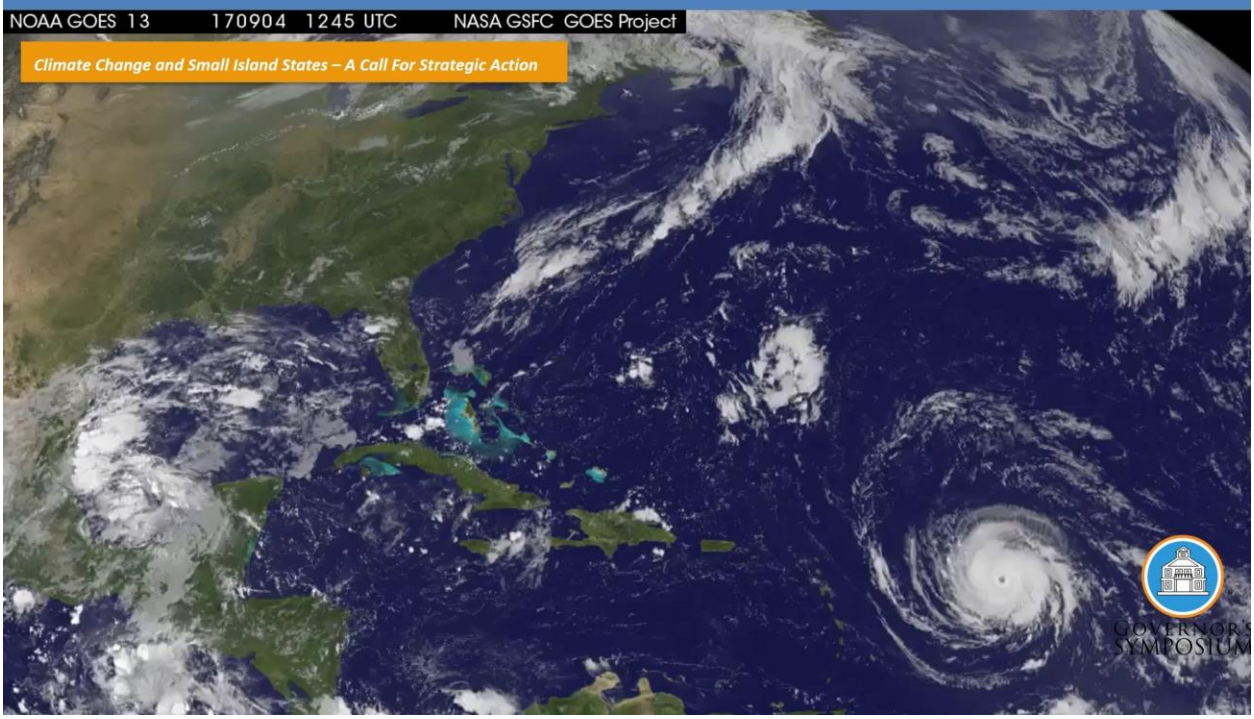
Second, last year we suffered from the impact and threat of back to back intense hurricanes (see photo 2). I need not remind you of the devastation caused throughout the region by the severity of two unprecedented category 5 hurricanes, Irma and Maria, in the span of 2 weeks in September 2017. The disruption of and impact on the lives of

[1] Report from UN Educational, Scientific and Cultural Organization Published on 20 Sep 2017

[2] Report from UN Educational, Scientific and Cultural Organization Published on 20 Sep 2017

our people is significant. The damage on Sint Maarten is estimated at USD.2.1 billion[3], almost twice the level of our USD.1.1 billion, pre-Irma GDP[4].

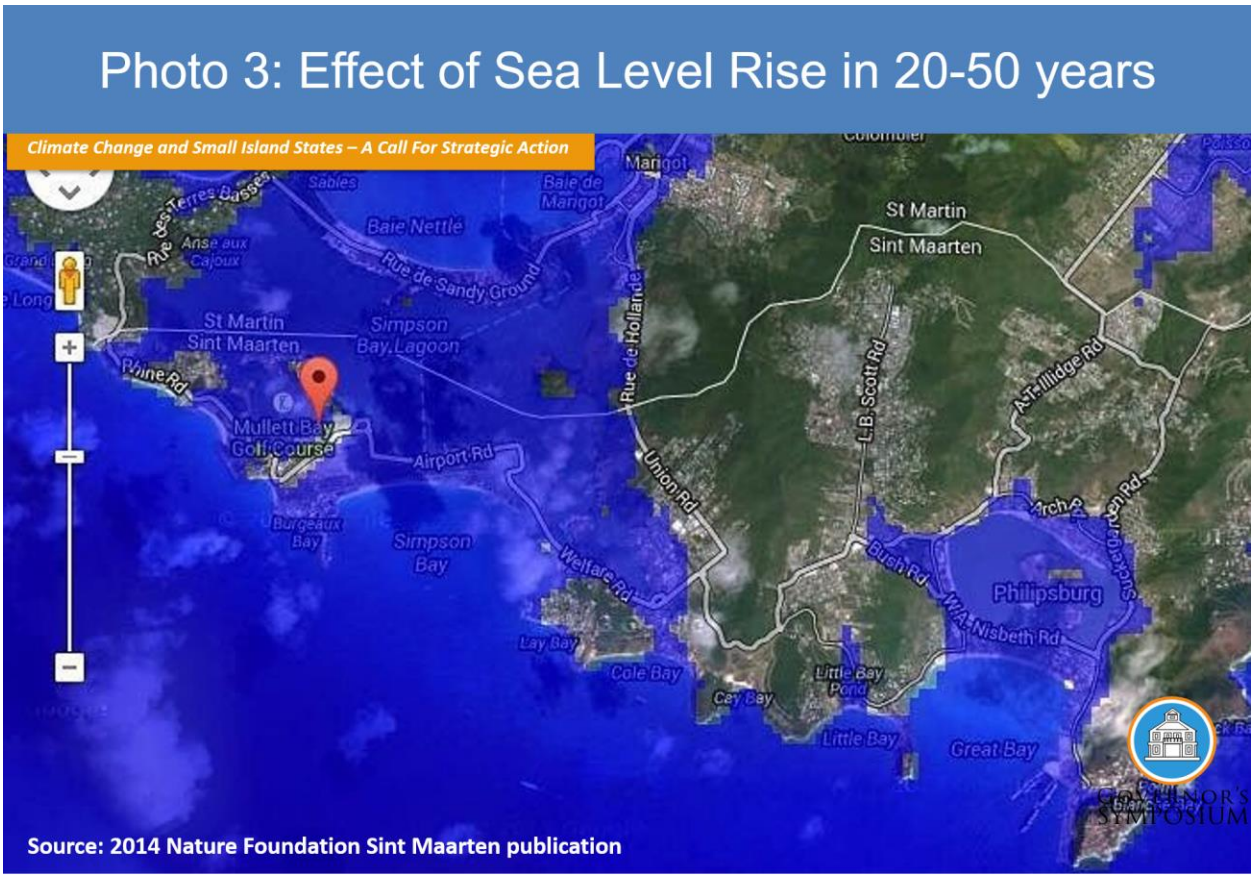
Photo 2: Hurricane Irma slams into Saint Martin, September 6, 2017



And third, our coastal and lower lying areas are increasingly vulnerable, as a result of projected sea level rise. A report published by the nature foundation in 2014, shows what Sint Maarten will look like 20 to 50 years from now, if the current estimated rise of the sea level continues (see photo 3). Our Capital Philipsburg, several of our highly populated low lying areas, our tourist area Simpson Bay, our economic gateways the airport and the harbor facilities, Marigot, Sandy Ground and all of our beaches will have disappeared under water and the Low Lands would become a separate island.

[3] Economic Commission for Latin America and the Caribbean report

[4] IMF Country Report No. 16/276, 2016 Article IV Consultations



In short, climate change poses an existential threat to Sint Maarten. Having faced two severe unprecedented climatic events, Irma and Maria, in the span of 2 weeks and considering the outlook for sea level rise, the questions now are:

- when and how bad will the next event be;
- what must we do to mitigate or address the effects of the threat of climate change; and
- do we have the time needed to effect the required strategic action?

To address these challenging questions, I invite you to inform yourself about the realities of climate change and its effects. Considering the realities before us I shall conclude by leaving you with some food for thought for a strategic climate change governance agenda.

- The first thought is, that climate change should be a strategic priority for individuals, businesses and government. To give content to this, it is imperative to create and establish the required institutional framework and capacity. The establishment of a

separate unit responsible for climate change can be an effective step in the further development and implementation of our climate agenda. It is advisable to do so within an existing government agency or ministry.

- The second thought is, that the climate change challenge is larger than any nation and requires regional and international collaboration and cooperation. It is therefor logical that regional institutions, such as the Caribbean Community Climate Change Centre, the University of the West Indies, and the Caribbean Institute for Meteorology and Hydrology, all represented here, are working on climate change and sustainable development initiatives. And there are also several United Nations agencies working on climate change adaptation projects in the Caribbean. The suggested national unit for Sint Maarten should be mandated to collaborate with regional and international partners towards the further development of our strategic climate change agenda as part of the regional and international agenda.

- The third thought is, that it is critical to increase investments in greater energy and infrastructure resilience and in environmentally sustainable solutions. Essential in this regard, is that the underground cable network project for electricity and telecommunication should be completed without delay. Together with that it is critical to invest in the transition to clean renewable energy generation, such as solar, aimed at contributing to the reduction in carbon emissions and reducing the high oil bill. Moreover, attention should also be directed to climate change mitigation and adaptation investments. This to realize a more environmentally friendly waste management as well as to make our water, hospital, telecommunication, airport, seaport and hotels infrastructure more climate resilient.

- And the fourth thought is, that special emphasis should be given to securing financing sources for mitigation, adaptation and reconstruction investments. Specifically, attention should be directed at securing an effective mix of private insurance, national first response funding and a regional disaster risk facility.

Ladies and Gentlemen,

Climate change poses a real threat to the security and prosperity of our people. We must therefore act now to further strengthen our climate change governance agenda. I say this because time is running out. But I am convinced that by acting now we can save the day for future generations.

It is my hope that this symposium will contribute to the required actions, and I hereby, declare this symposium *OPEN.*

Thank you, God Bless You

Having said that I will like to ask for your attention for the following video to help set the stage for the symposium.

Remarks on the Government's Perspective –
Prime Minister, the Honorable Leona Romeo-Marlin

Your Excellency, Governor Holiday, distinguished guests, ladies, and gentlemen,

Amidst The Devastation There Are Opportunities

September 6, 2017……a day that changed our daily routines, the day that changed our way of thinking and the day that will remain in our minds forever.

Hurricanes Irma and María devastated Sint Maarten, causing destruction to infrastructure, homes and buildings, the economy, telecommunication and utilities and ultimately devastation to the overall well-being of Sint Maarten.

Today, however, we remain hopeful and on the path of recovery and reconstruction. The buzzword for the recovery process "Building Back Better", means more resilient communities for all. This principle serves as the beacon for the government of Sint Maarten, in safeguarding sustainable development.

But how will St. Maarten fear being exposed to vulnerabilities and casualties of Climate Change?

St. Maarten as in the case of other Small Islands States are on the frontline of Climate Change and thus not immune to:

- Limited capacity and resources
- Economic vulnerability due to impulsive international developments and finally
- Natural disasters.

This phenomenon undeniably poses an existential threat to our safety, economy, environment, and, ultimately, the well-being of citizens.

As a government, therefore, it behooves us to continuously revisit our disaster management blueprints and socio-economic development on the whole to ensure that all efforts are being employed to mitigate the effects of natural disasters including those that are triggered by Climate Change.

Sint Maarten has acknowledged the consequences of Climate Change and has listed it high on its agenda. In this light, the government is addressing these obvious effects through, the National Recovery and Resilience Plan, the Sustainable Development Goals (SDG's), (revision of) Disaster Management and National Security. In this respect, Climate Change is being approached from several angles.

To elucidate further, as part of the Kingdom of the Netherlands, Sint Maarten adopted the 2030 SDG agenda. For Sint Maarten, this entails setting clear development priorities and thereby linking relevant projects to the SDGs, where we actually seek to empower lives. Together with the United Nations' ECLAC commission, an implementation strategy for the SDG's will be drafted soon.

On the other hand, the Small Islands Developing States (SIDS) also serves as a way to address climate change. The Samoa pathway acknowledges the effects of climate change on SIDS. Through the 11th EDF regional program of the Caribbean, Sint Maarten sits in the role of the Regional Authorizing Officer and thereby at the helm of a program to protect marine biodiversity, support energy and build resilience in the region.

Climate-related disasters will continue to affect Sint Maarten and we must be proactive in our approach through adaptation and by effecting change especially at the leadership levels.

As Prime Minister, Minister of General Affairs with the responsibility for Disaster Management for our nation, I am committed therefore to working diligently with our partners to ensure that technical cooperation and support are accessible from a national, Kingdom, regional and international level to promote the exchange and transfer of knowledge on

environmental problems and solutions, and to foster environmental responsiveness for sustainable development.

Furthermore, the involvement of civil society through information and awareness platforms is key in the fight against Climate Change; specifically the changes in the biosphere resulting from human and natural activities and the effects of these changes on the environment.

U.N. General Secretary Antonio Gutterres said, and I quote: “climate change is a direct threat in itself and a multiplier of many other threats. From poverty to displacement to conflict. The effects of climate change are already being felt around the world. They are dangerous and accelerating”.

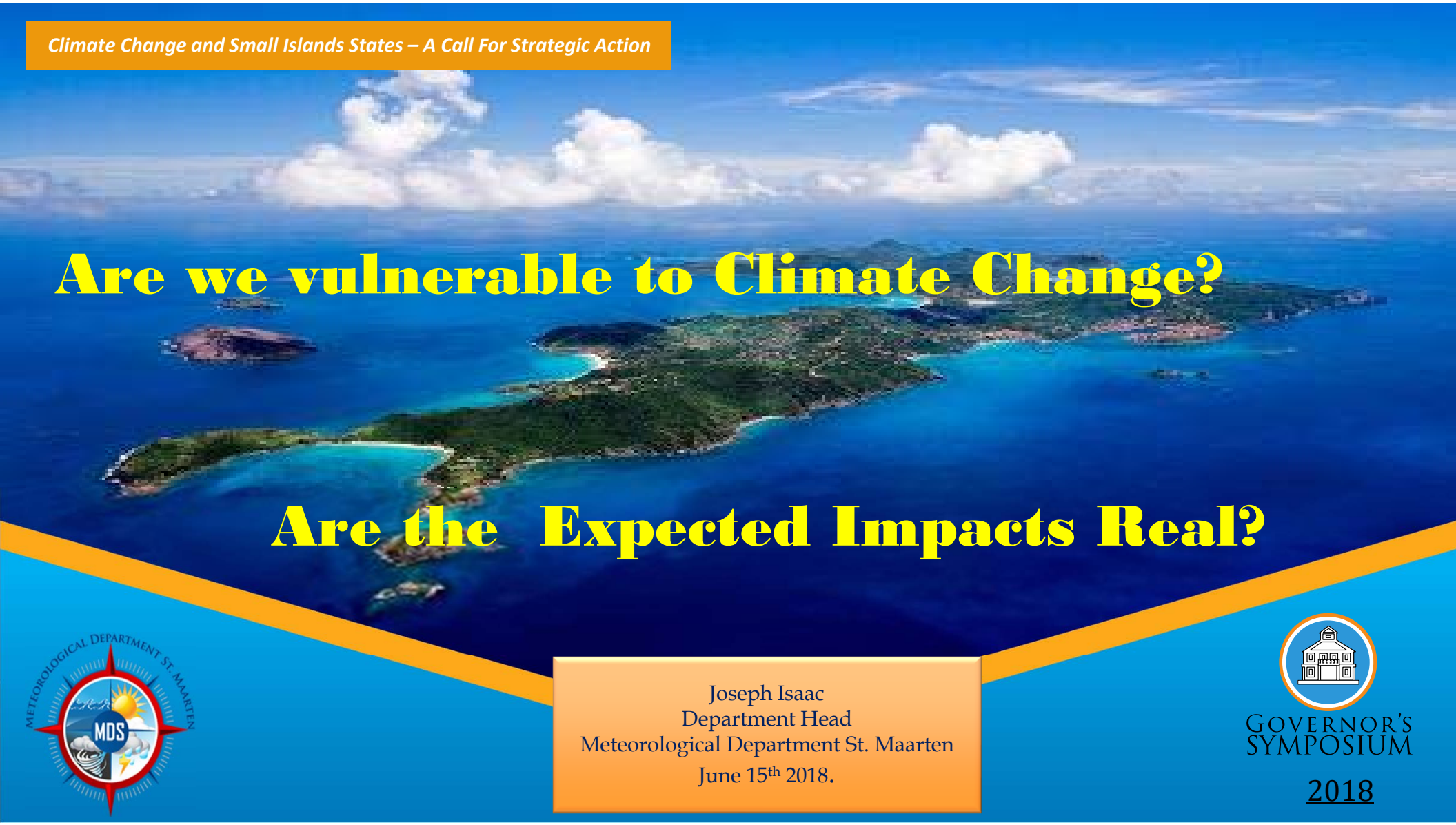
We must, therefore, ACT NOW in order to strengthen our resilience and to safeguard our existence and that of generations to come.

Thank you for your attention.

End

Presentation on Climate Change, Weather and Environmental Patterns: Mr. Joseph Isaac

Climate Change and Small Islands States – A Call For Strategic Action



Are we vulnerable to Climate Change?

Are the Expected Impacts Real?

Joseph Isaac
Department Head
Meteorological Department St. Maarten
June 15th 2018.

GOVERNOR'S SYMPOSIUM
2018

Outline.....

IPCC Findings

Global Climate Trends

Tropical Cyclone Activity

St. Maarten Climatology/ Current Trends

Impacts of Climate Change

Strategic Actions

The Intergovernmental Panel on Climate Change (IPCC)

The Fifth Assessment Report of 2014:

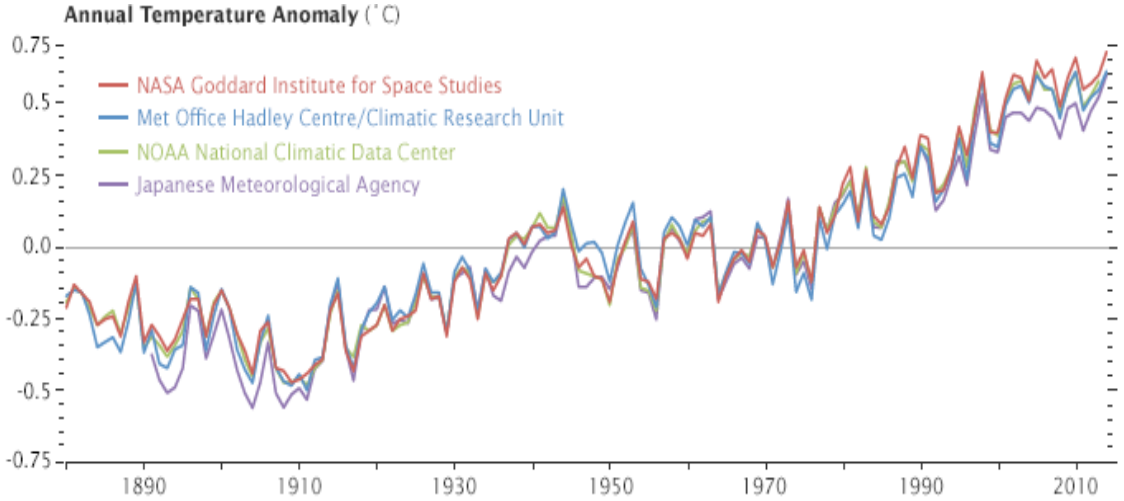
- Earth's climate is warming (0.85^{o}C since mid-19th century).
- Globally, sea levels have risen faster than at any time during the previous two millennia.
- In many parts of the world, including Small Island Developing States (SIDS), changing rainfall is altering freshwater systems, affecting the quality and quantity of water available.
- There is evidence that human activity is changing our climate.
- The impacts of climate change will affect livelihoods, coastal settlements, infrastructure, ecosystems and economic stability in SIDS, and rising sea levels continue to pose an increasing threat to low-lying coastal areas

Global Climate Trends

There is an upward trend in temperatures globally.

The January 2018 WMO report - 2015, 2016 and 2017 have been confirmed as the three warmest years on record.

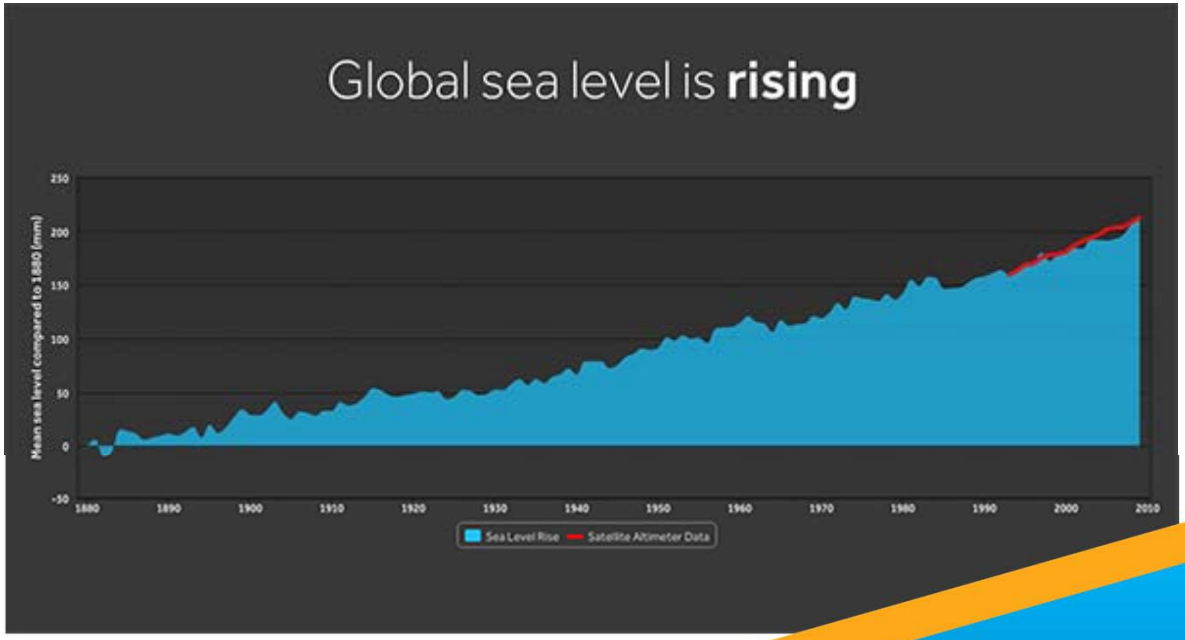
2016 still holds the global record, whilst 2017 was the warmest year without an El Niño. (El Nino can boost global annual temperatures).



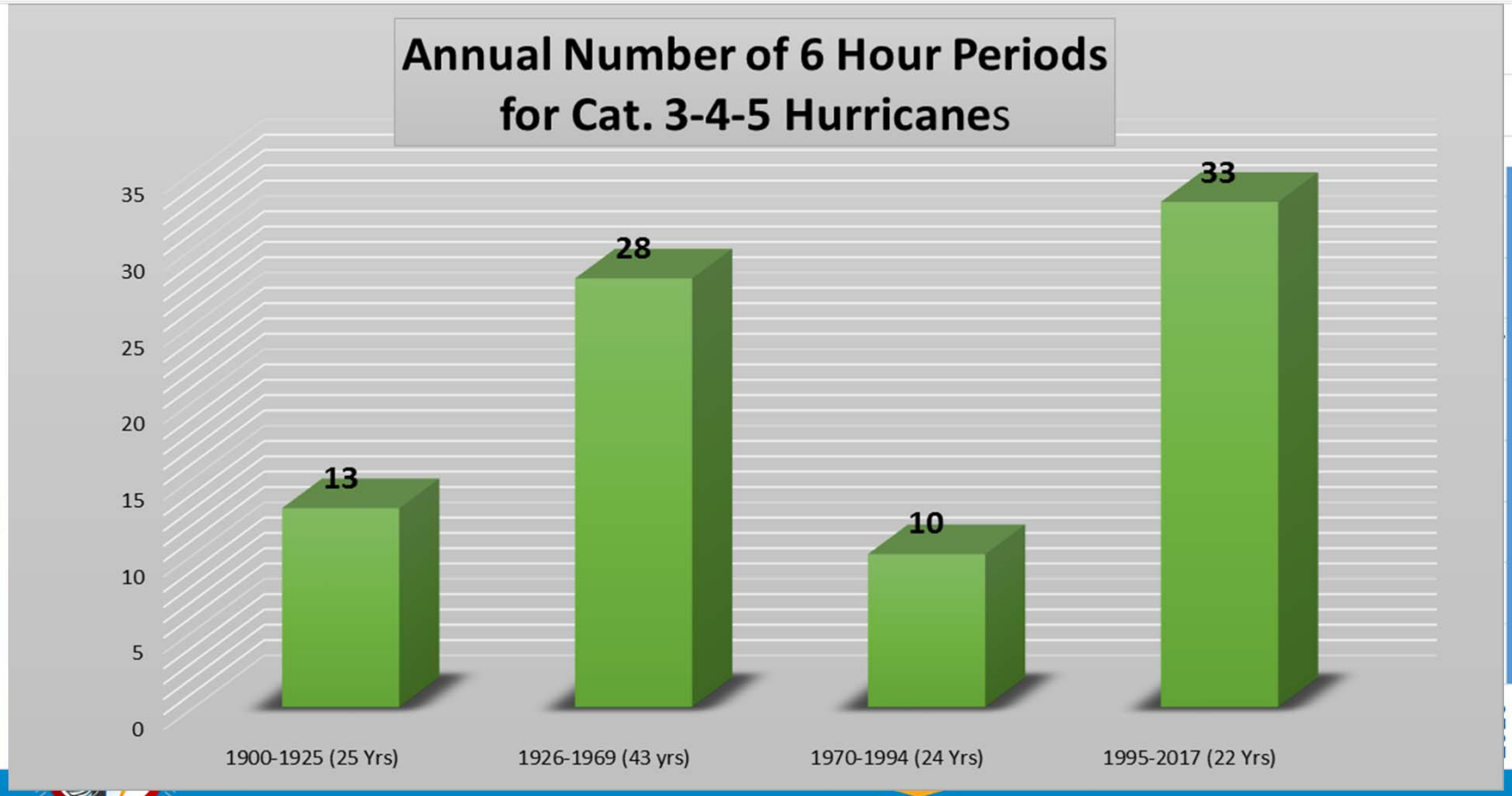
Global Climate Trends

NASA: Sea levels have risen about 8 inches since the beginning of the 20th century.

Projection: more than 3 feet by the end of the century.

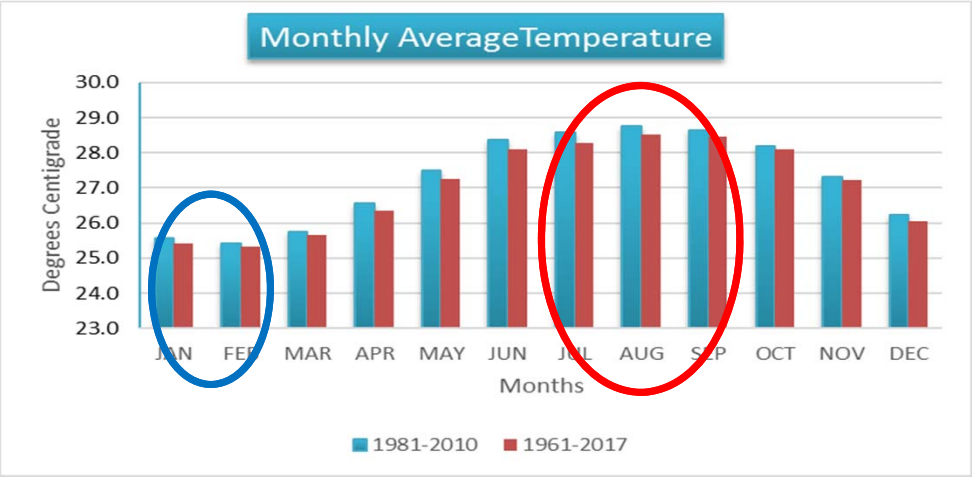


Tropical Cyclone Activity



Climatology

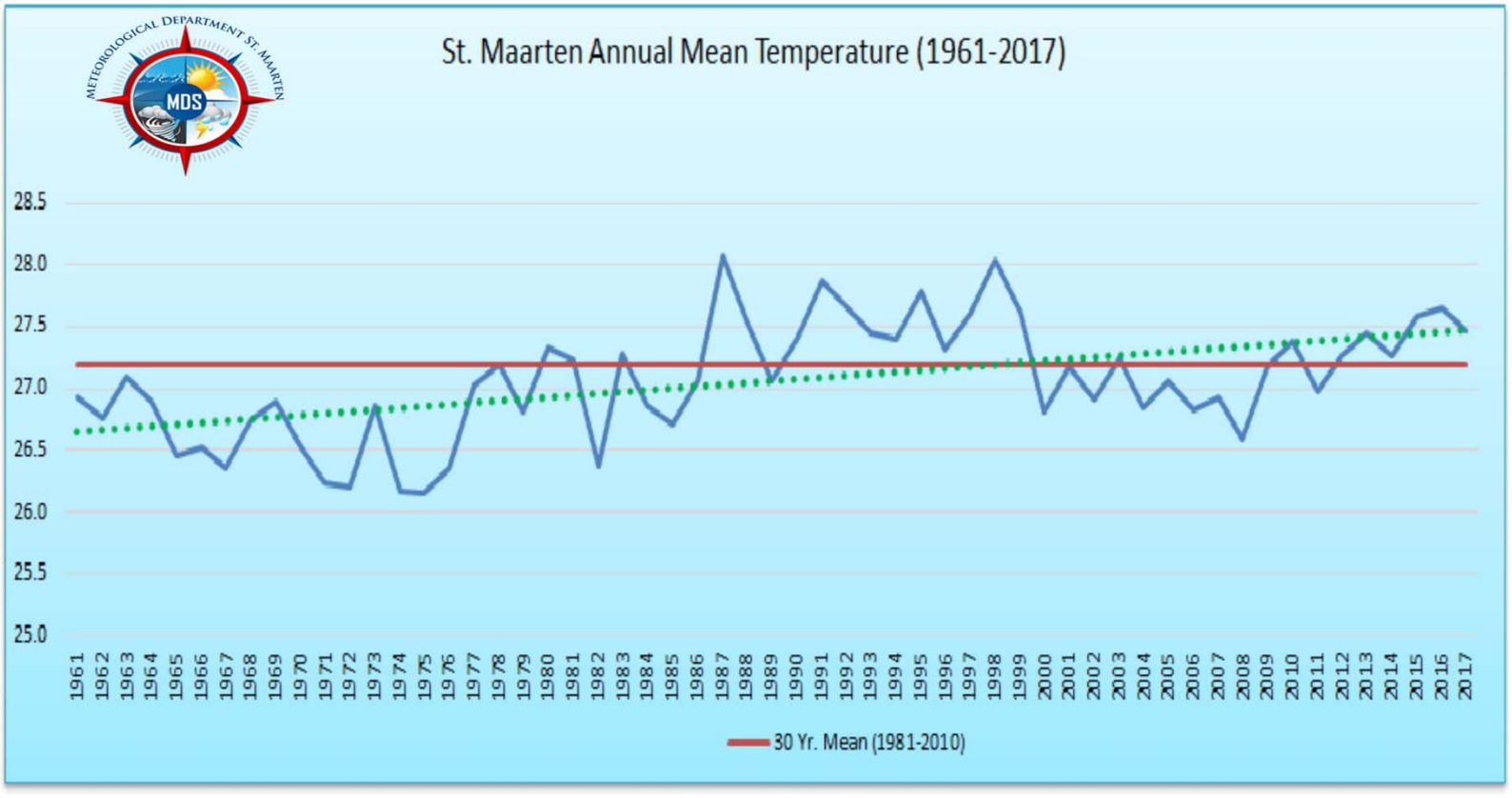
Temperature



- **Warmest** time of year: **Jul-Sept**
- **Coolest** time of year: **Jan-Feb**

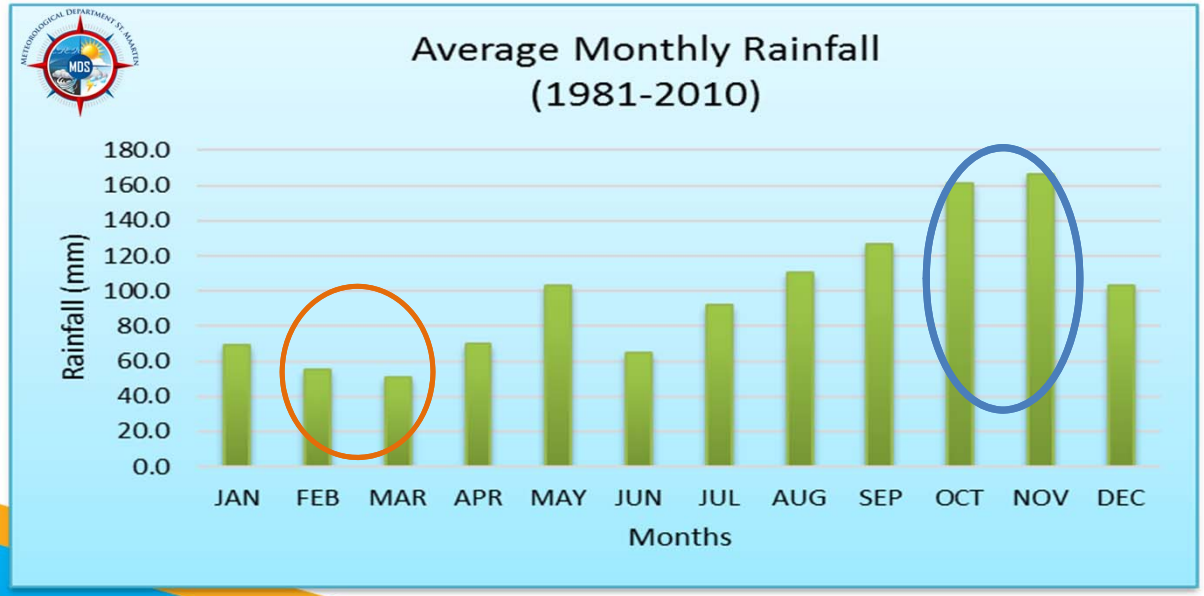
Average Max.: 31.6°C
Average Temperature : 27.2°C
Average Min.: 22.6°C

Average Temperature Trend



Climatology

Rainfall

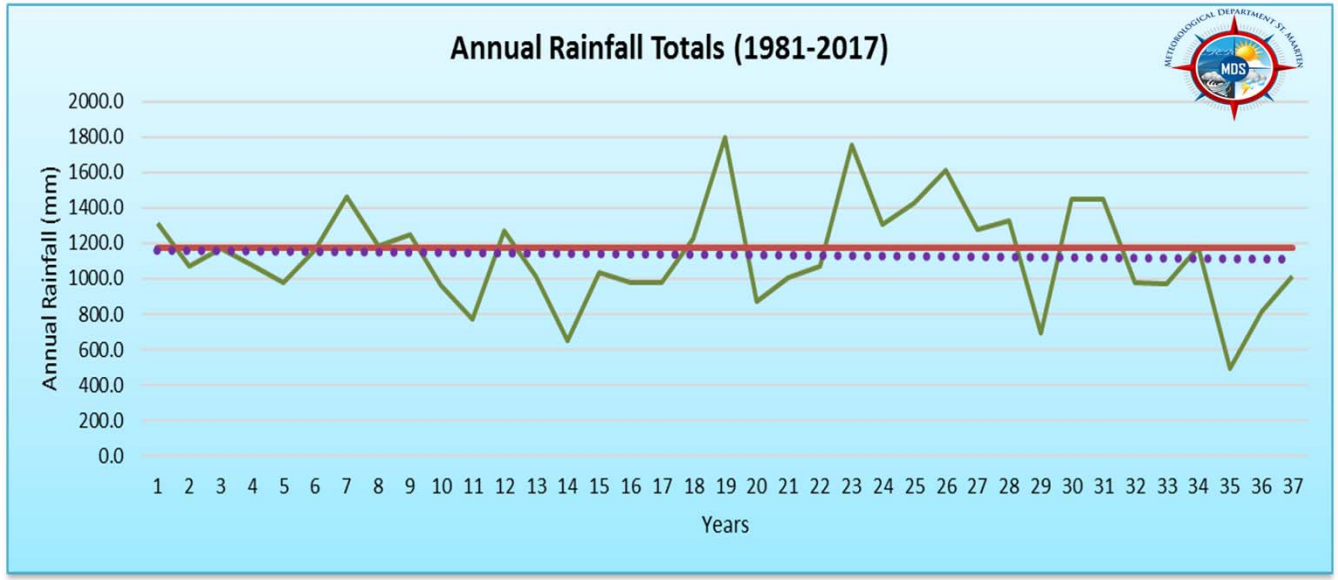


Wettest months: **Oct-Nov**.

Driest Months: **Feb-Mar**.

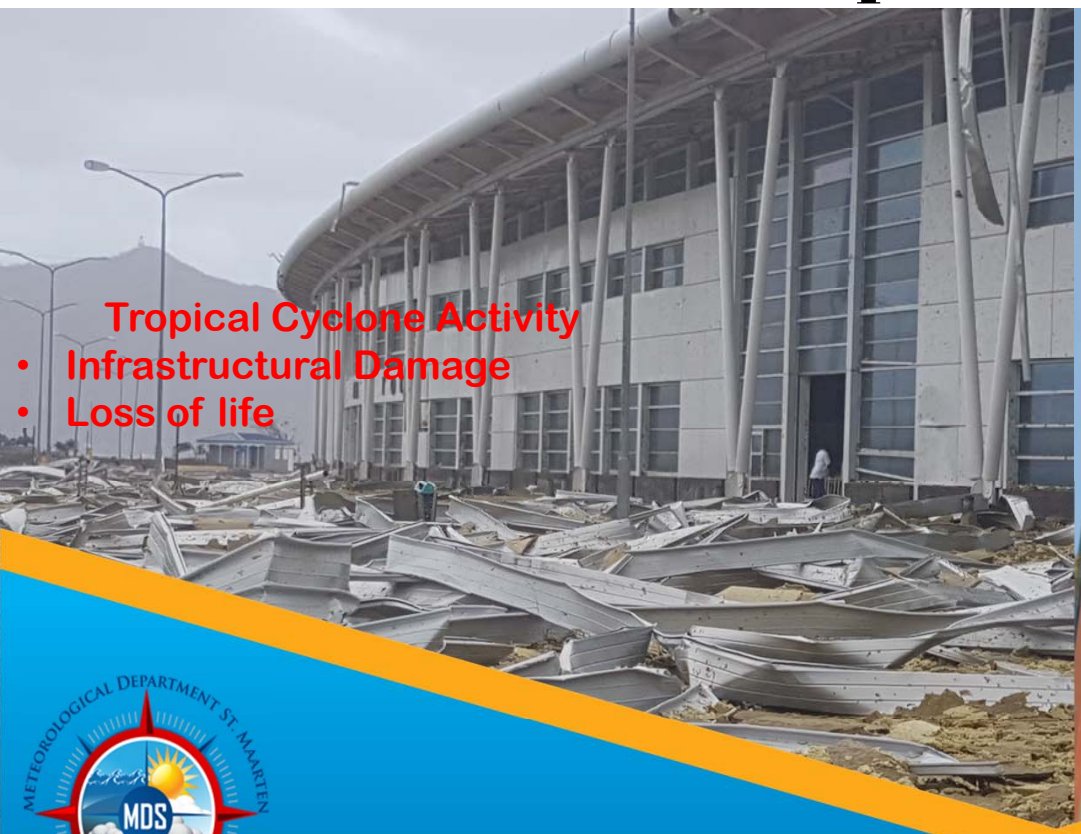
Annual Rainfall: **1170mm**

Rainfall Patterns



Annual Rainfall: **1170mm**

Local Impacts of Climate Change



Tropical Cyclone Activity

- Infrastructural Damage
- Loss of life

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2018

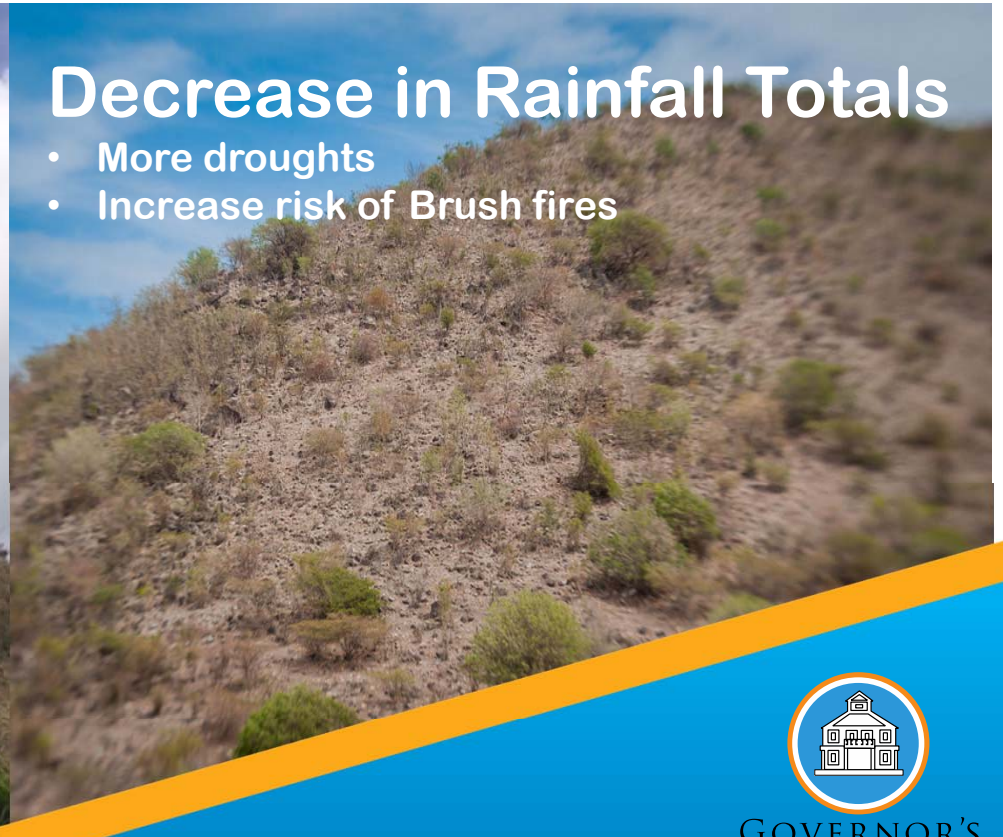
Local Impacts of Climate Change

Local Impacts of Climate Change

Increase Rainfall Intensity

- Siltation of ponds
- Flooding / Flash Flooding

Local Impacts of Climate Change



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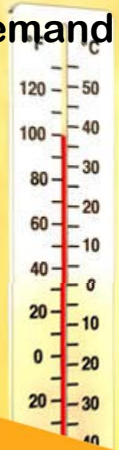
2018

Local Impacts of Climate Change

Temperature Rise

- More Heat waves
- Heat stress/Heat strokes
- Increase demand for power (cooling)



HEAT WAVE

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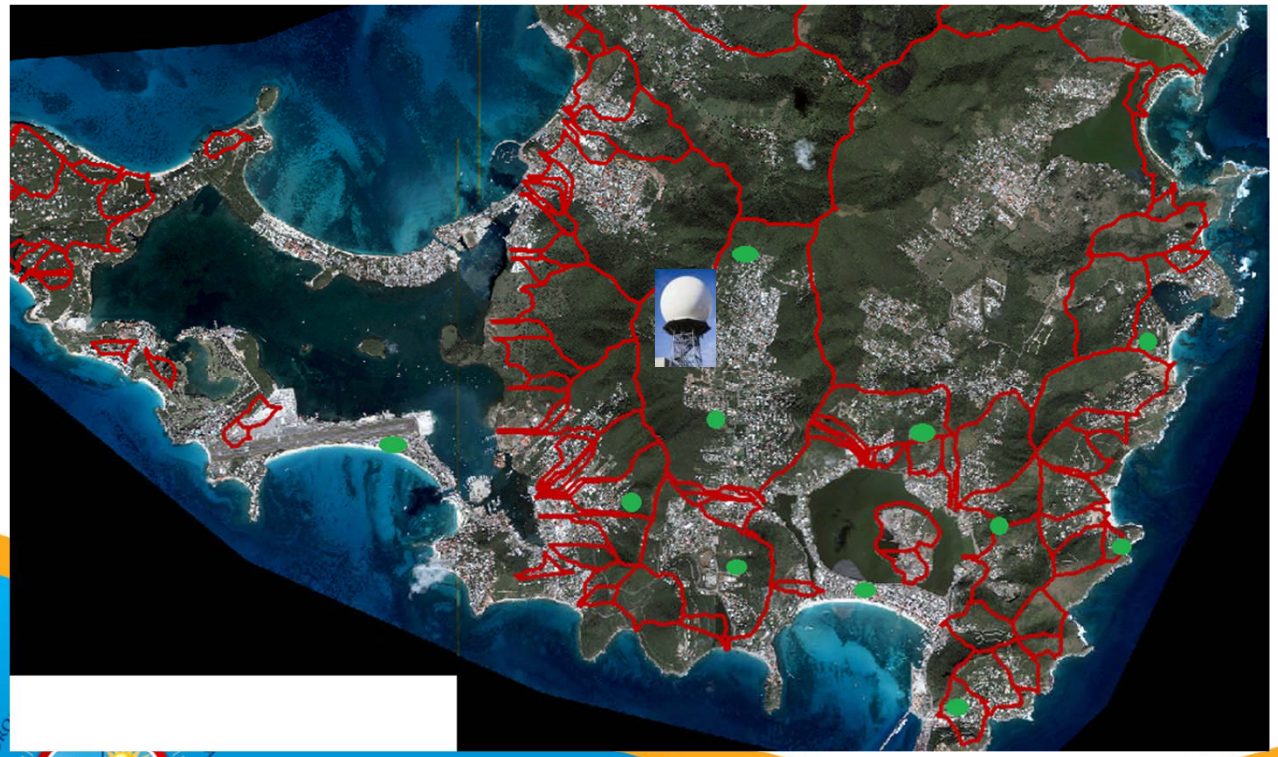
Strategic Actions

International/Regional

Collaboration is needed with various entities to manage climate change issues.

- ✓ IPCC (Intergovernmental Panel on Climate Change)
- ✓ CCCCC (Caribbean Community Climate Change Centre)
- ✓ CIMH (Caribbean Institute for Meteorology & Hydrology)

Strategic Actions



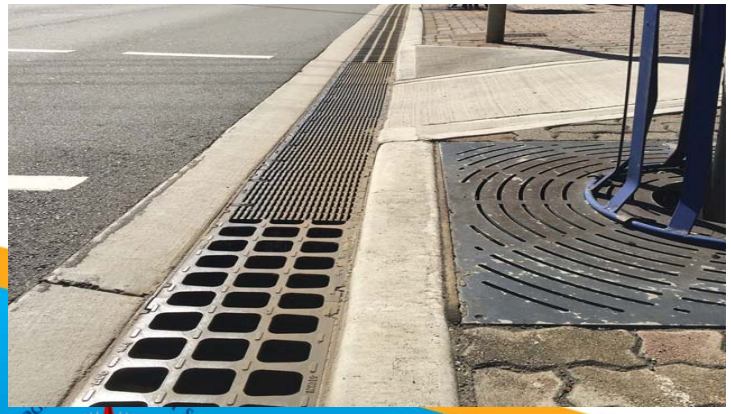
- Improve data collection
- Network of weather stations/radar to assist in the early warning systems.
- Sea Level Monitoring

Strategic Actions

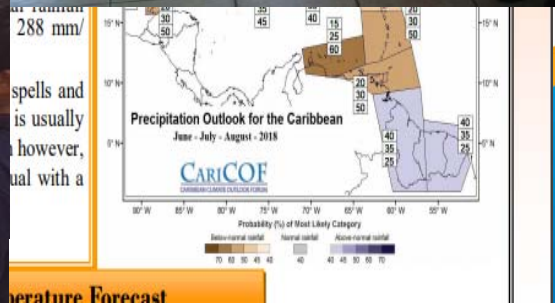
Locally….

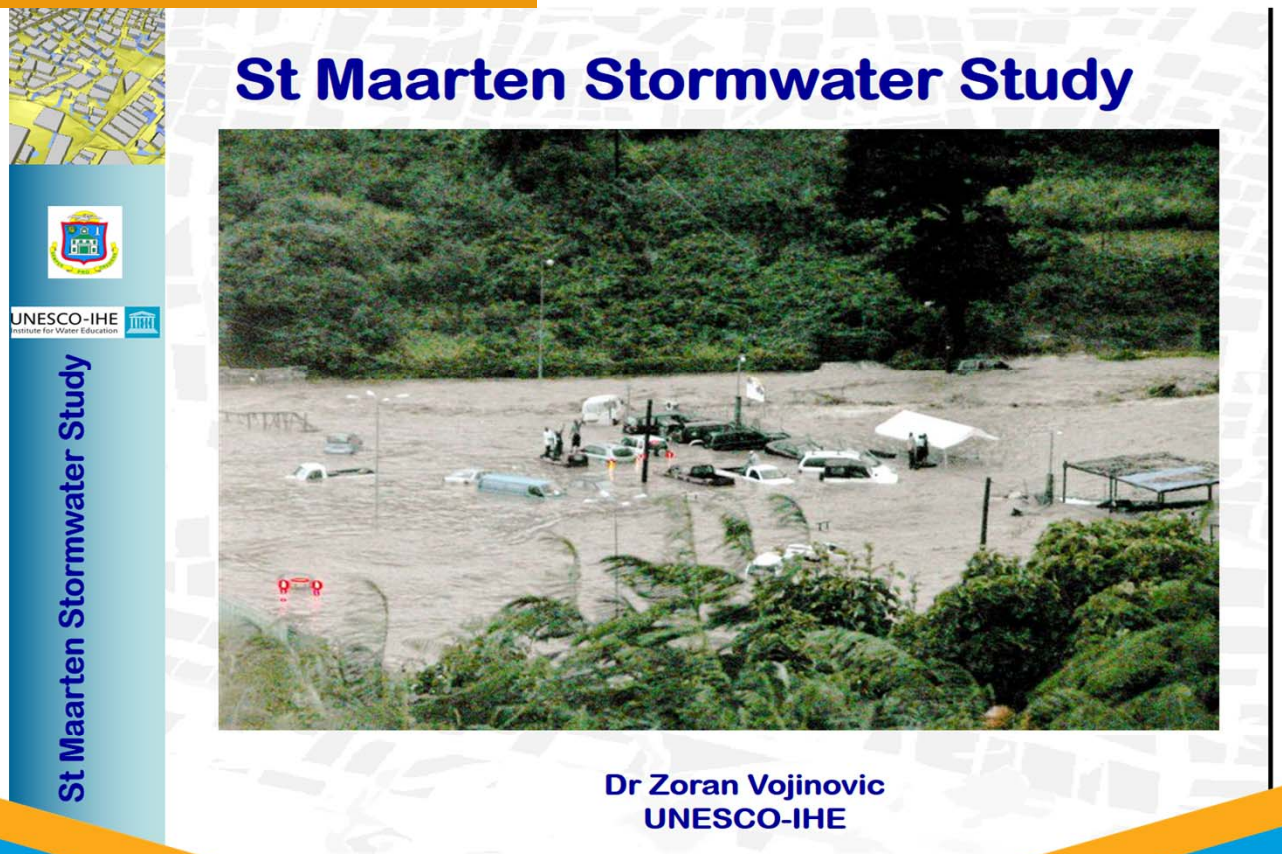
- **Land Use Planning**
- **Building codes**

- **Disaster Mitigation; sea walls , drainage systems**



Public Education




St Maarten Stormwater Study
UNESCO-IHE
Institute for Water Education
St Maarten Stormwater Study
St Maarten Stormwater Study
Dr Zoran Vojinovic
UNESCO-IHE

Climate Change and Small Islands States – A Call For Strategic Action

Are we vulnerable to Climate Change? Yes!

Are the Expected Impacts Real? Yes!

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" It's tough to make predictions, especially about the future"

However……

"You can see a lot by looking"

Yogi Berra

Climate Change and Small Islands States – A Call For Strategic Action

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Presentation on Climate Change, Weather and Environmental Patterns: Dr. Cedric van Meerbeeck

GOVERNOR'S SYMPOSIUM

Climate Change in the eastern Caribbean: historical information and projections

Dr. Cedric J. VAN MEERBEECK (cmeerbeeck@cimh.edu.bb),
Adrian R. Trotman (atrotman@cimh.edu.bb)

Caribbean Institute for Meteorology and Hydrology (CIMH), Barbados

Governor's Symposium 2018
June 15, 2018, Sint Maarten

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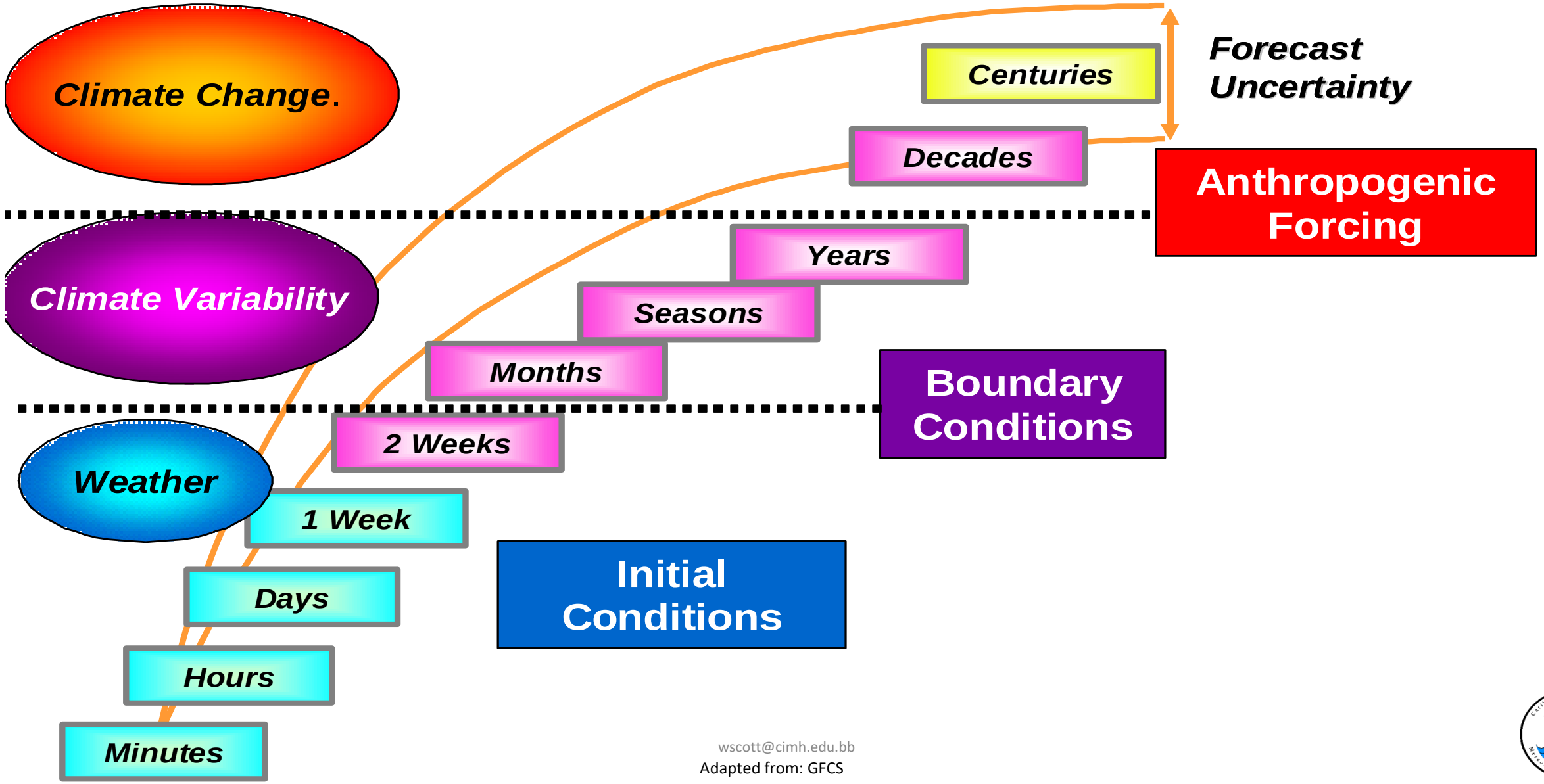
2018

Weather, Climate Variability and Climate Change



wscott@cimh.edu.bb

Adapted from: GFCS

Observed trends in temperature and rainfall extremes in the Caribbean

GOVERNOR'S SYMPOSIUM

Stephenson et al. (2014, Intl. J. Climatology)

INTERNATIONAL JOURNAL OF CLIMATOLOGY
Int. J. Climatol. (2014)
Published online in Wiley Online Library
(wileyonlinelibrary.com) DOI: 10.1002/joc.3889

RMetS
Royal Meteorological Society

Changes in extreme temperature and precipitation in the Caribbean region, 1961–2010

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[v] *Grenada Airports Authority, St George's, Grenada*
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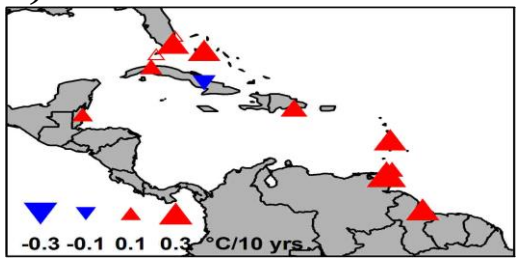
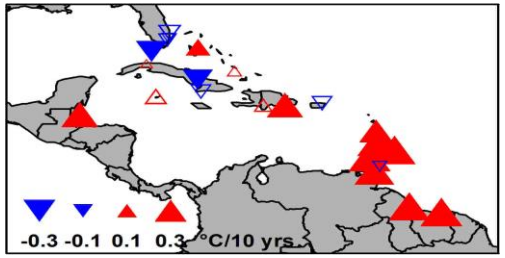
THE UNIVERSITY OF THE WEST INDIES MONA JAMAICA
Environment Canada
NOAA
NCDC
UNIVERSITY OF MIAMI

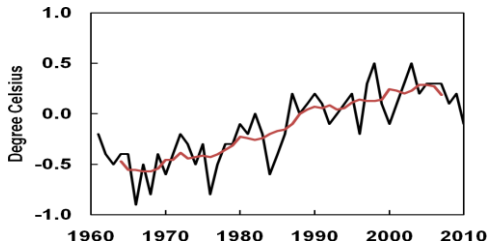
Significant region-wide temperature trends!!

1961-2010 **1986-2010**

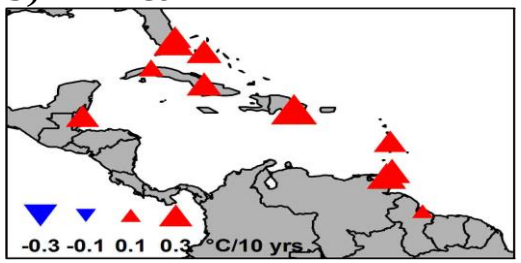
a) TXmean

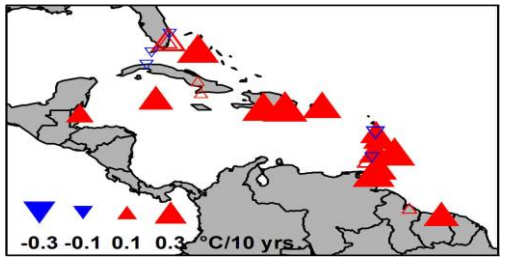


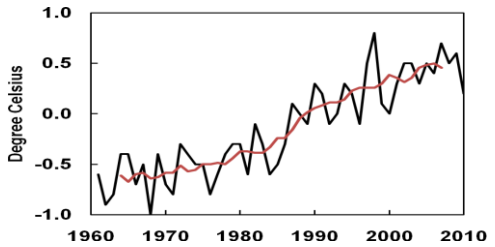




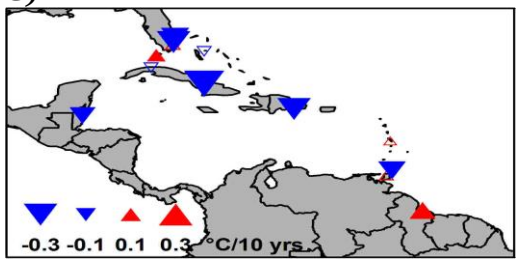
b) TNmean

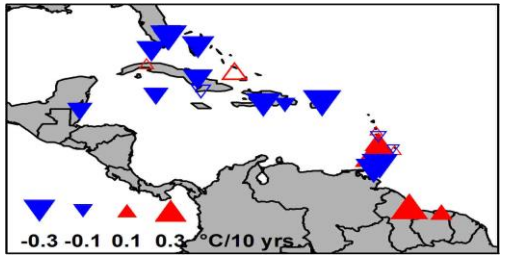


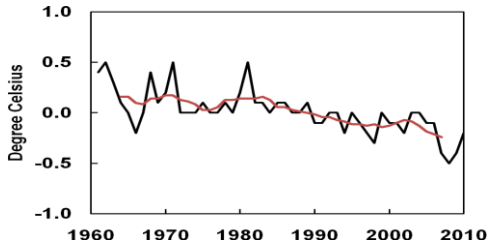




c) DTR







INCREASE of
nighttime temperatures (TNmean) +1.4°C

vs

daytime temp. (TXmean) +0.95°C

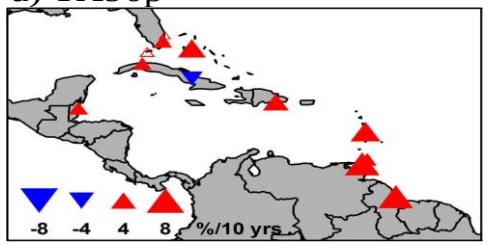
↓

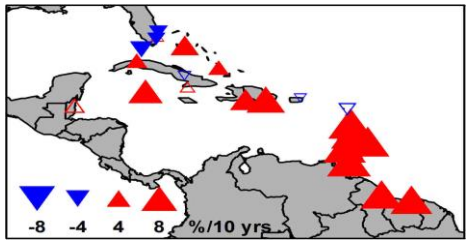
DECREASE in diurnal temperature range **(DTR)**.

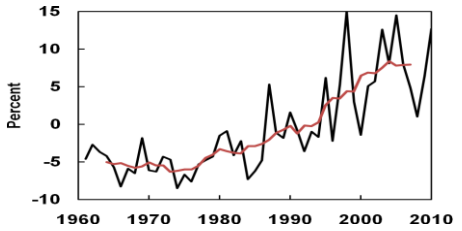
Significant region-wide temperature trends!!

1961-2010 1986-2010

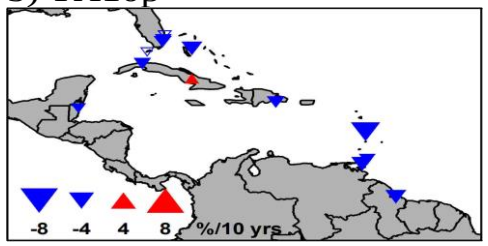
a) TX90p

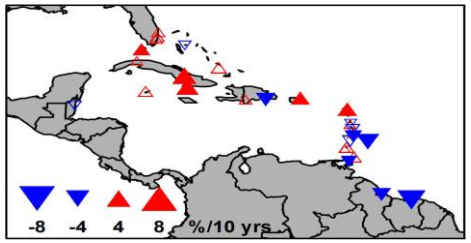


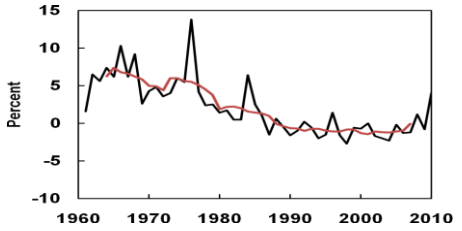




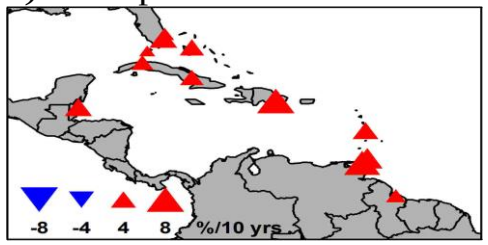
b) TX10p

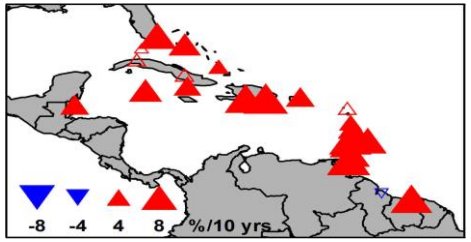


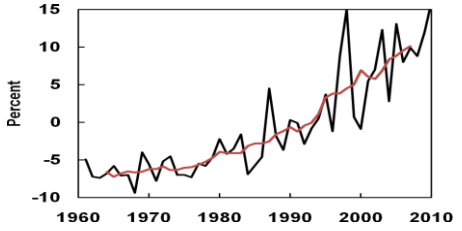




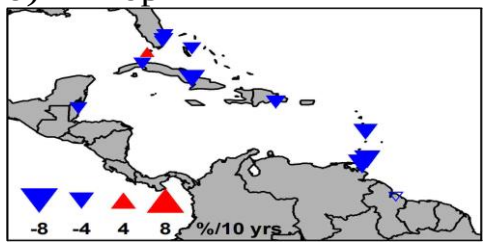
c) TN90p

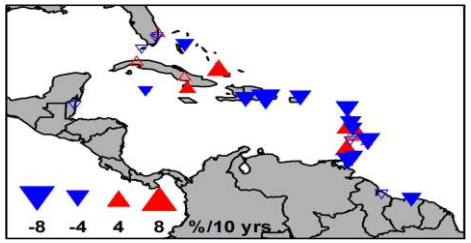


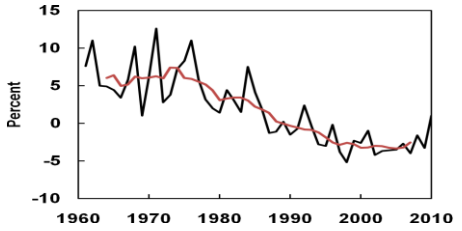




d) TN10p

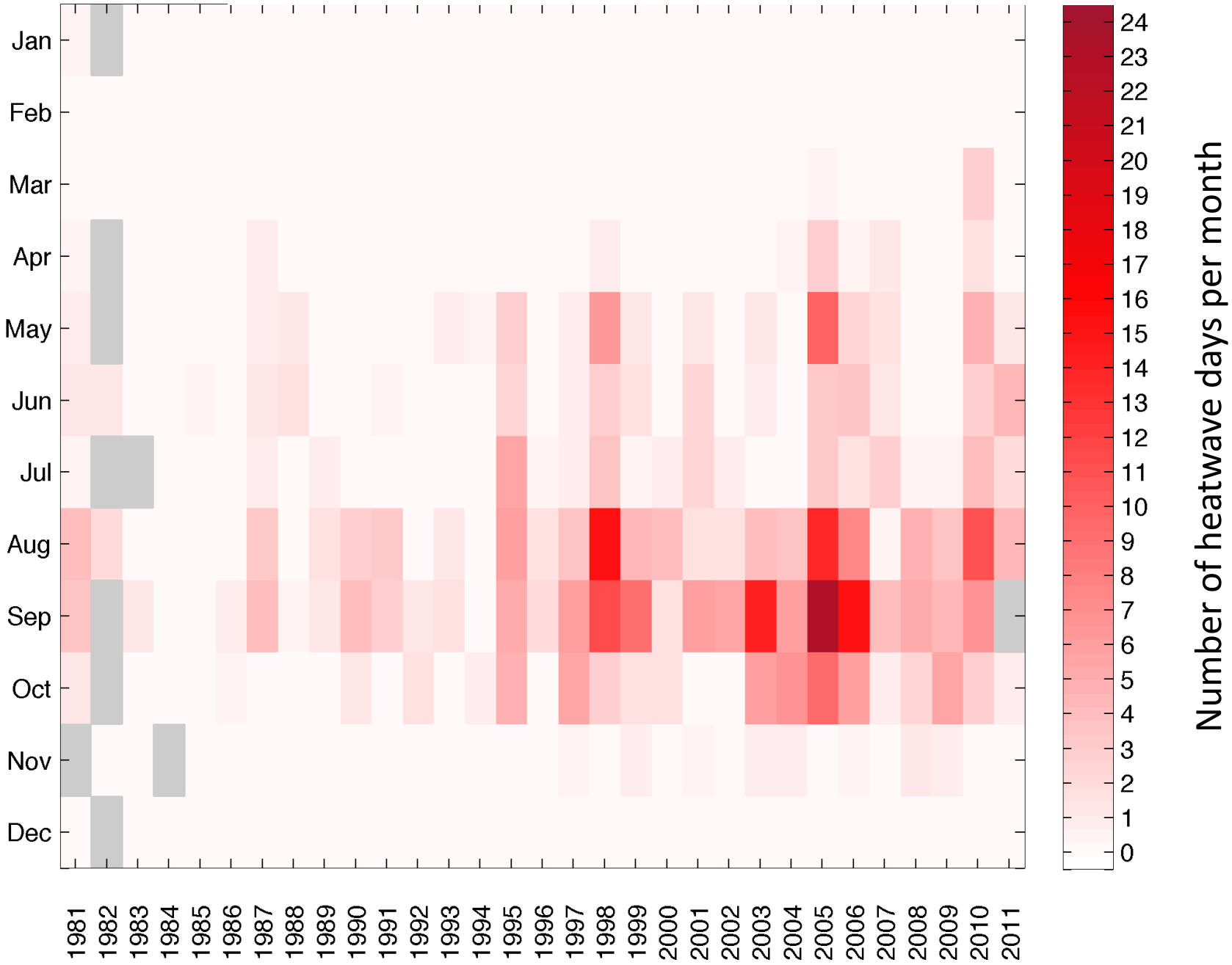






- >15% increase in frequency of warm days and warm nights
- 1°C warming of hottest days and nights and the coldest days and nights
- 7% decrease in frequency of cold days
- 10% decrease in frequency of cold nights

Seasonality of heat waves in the Lesser Antilles

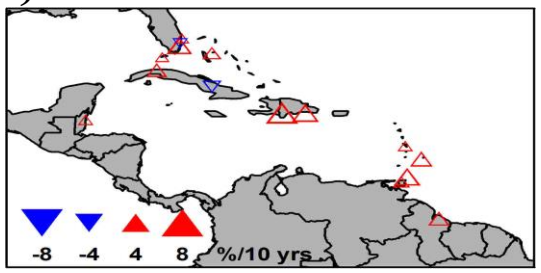


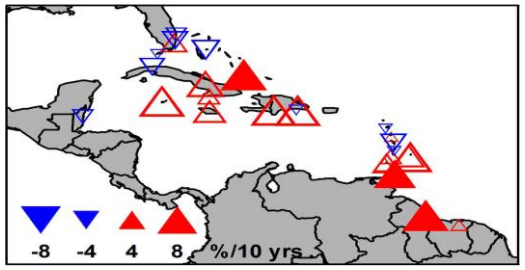
Heatwave season has become longer and more intense!

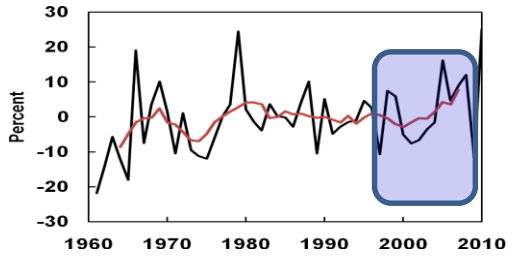
Significant region-wide rainfall trends??

1961-2010 **1986-2010**

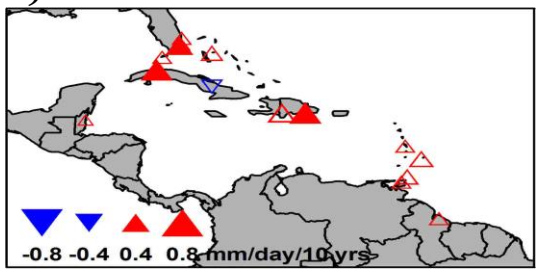
a) PRCPTOT

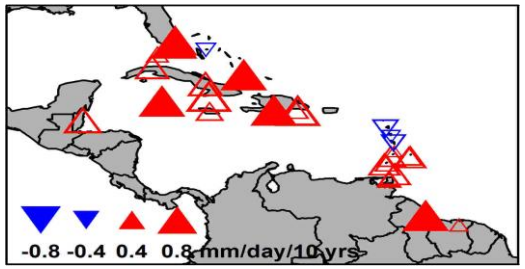


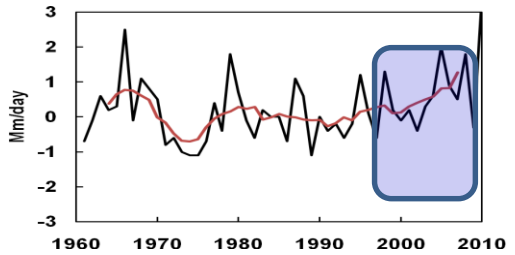




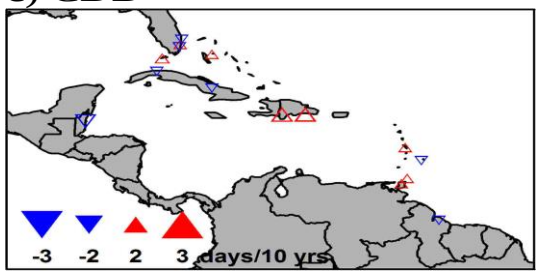
b) SDII

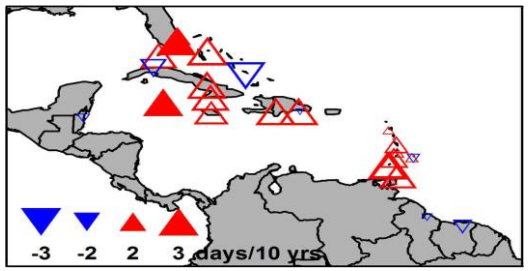


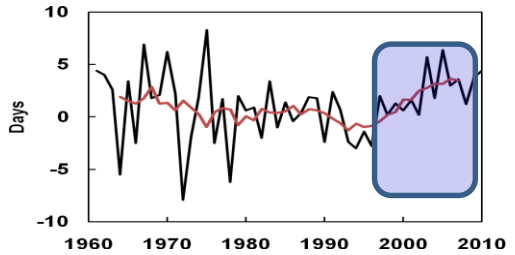




c) CDD







Despite **recent apparent rise** (boxed)

No annual RR change (PRCPTOT)

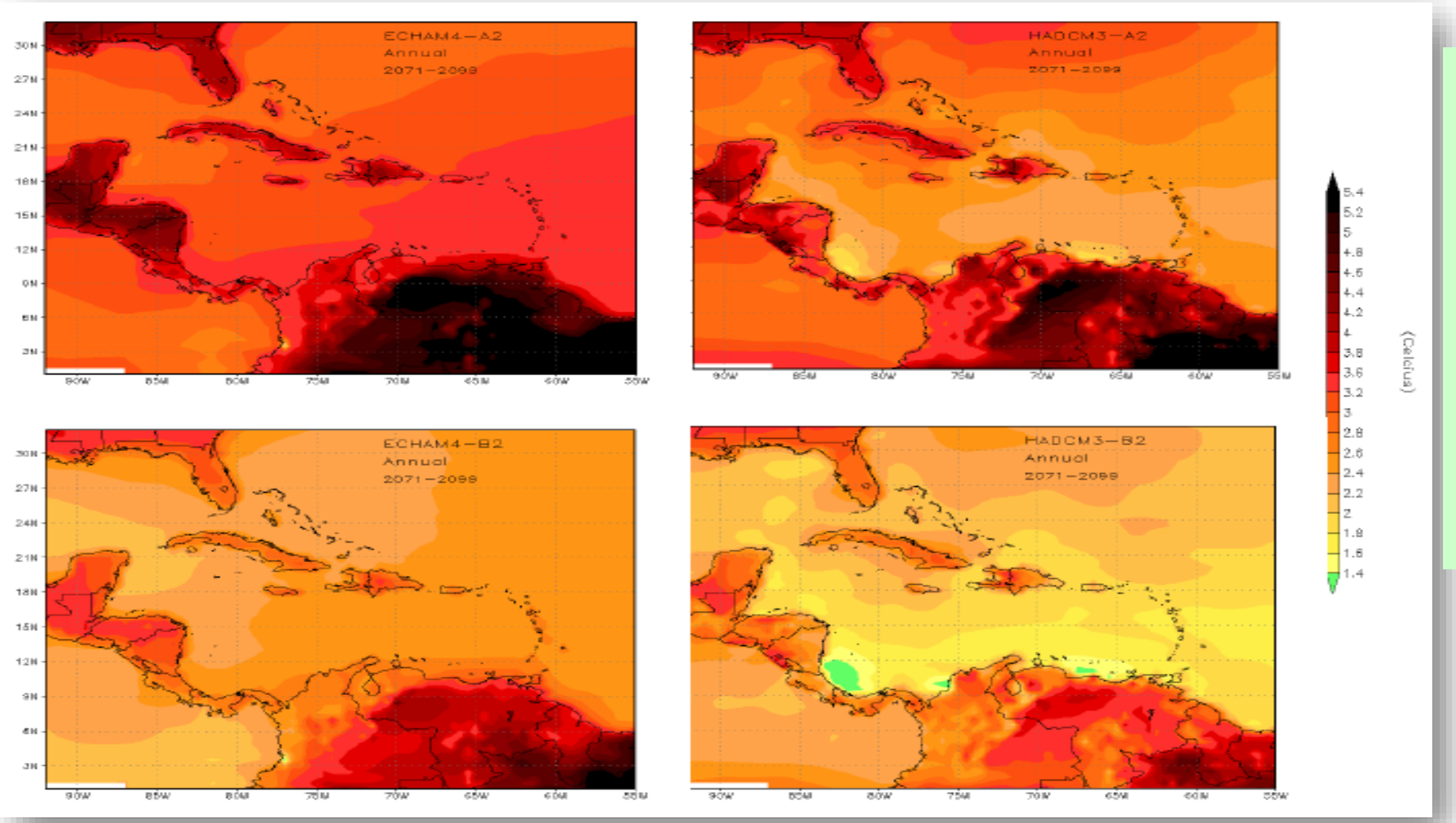
No change in single rainfall event intensity (SDII)

No change in dry spells (CDD)

Future Climate Change projections for the Caribbean

GOVERNOR'S SYMPOSIUM

Projected Temperature Change



Warming by the end of 21st Century 1 to 5ºC

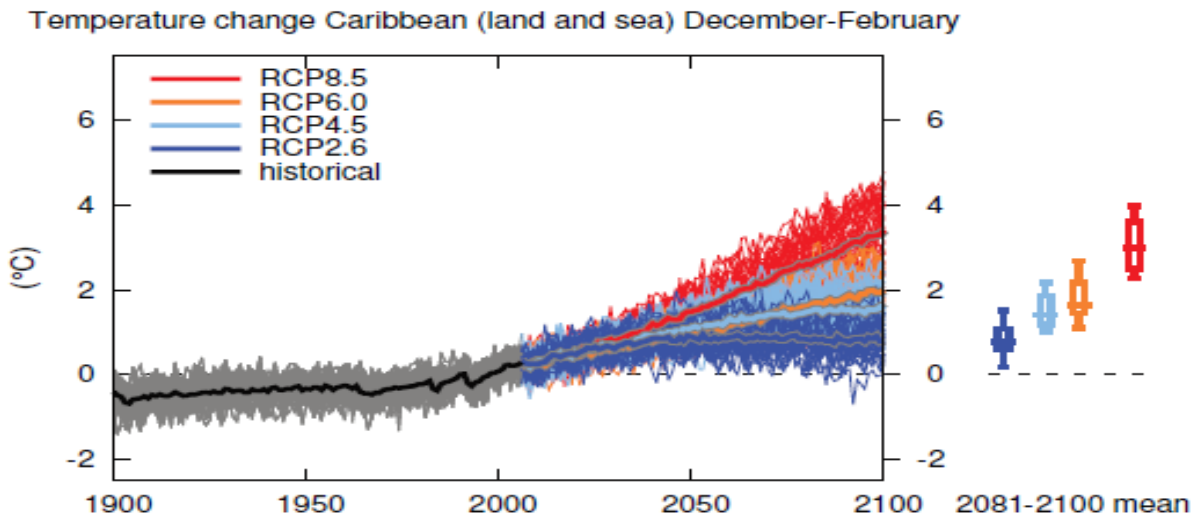
Warming consistent with projections for other parts of globe.

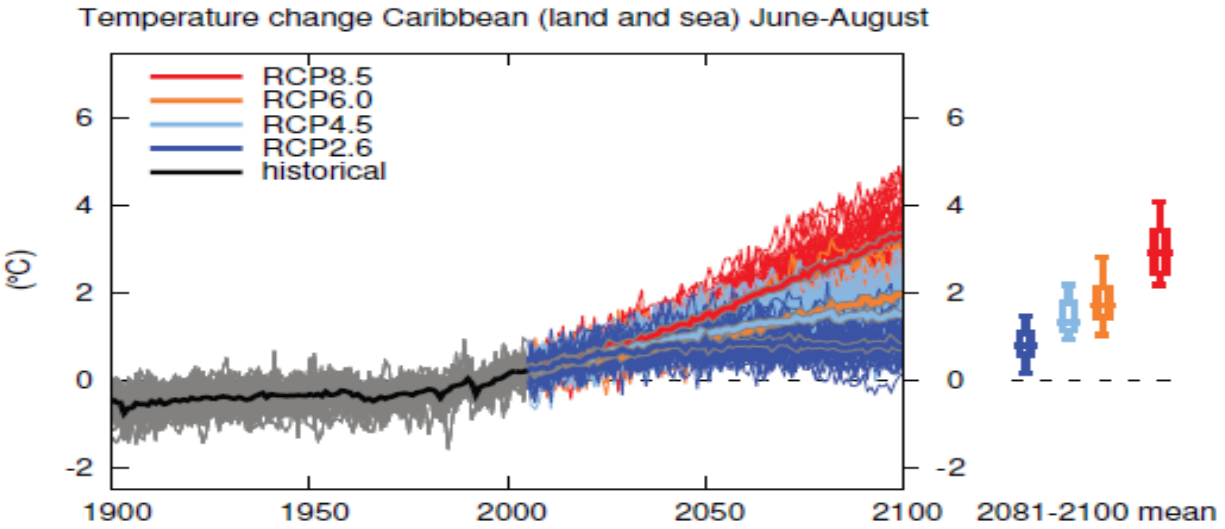
Warming far exceeds natural variability

Mean changes in the annual mean surface temperature for 2071-2099 with respect to 1961-1989, as simulated by PRECIS_ECH and PRECIS_Had for SRESA2 and SRESB2.

Adapted from: Taylor et al. (GFCS – Caribbean RWCS, Trinidad, 2013)

Projected Temperature Change





More recent climate change projections for the end of 21st Century

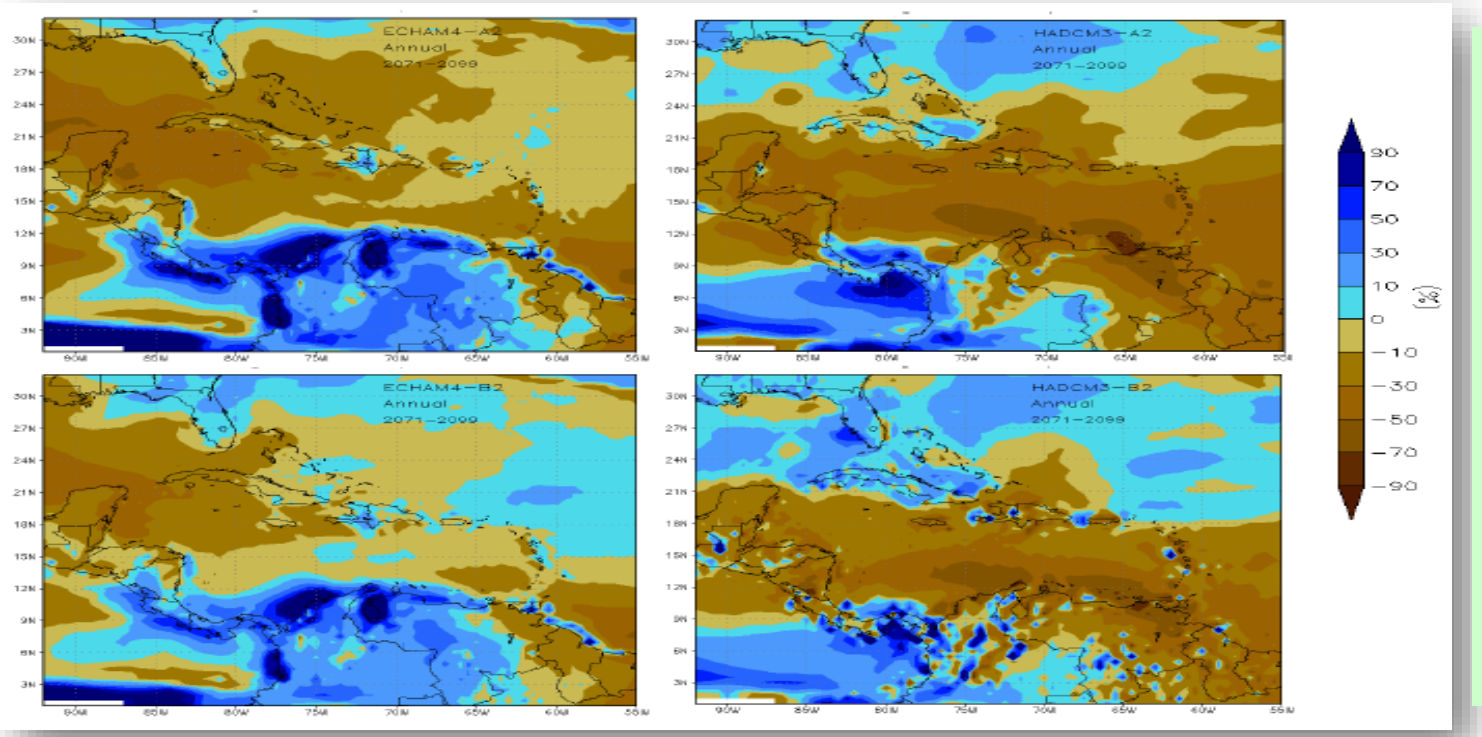
(using IPCCC RCP scenarios)

Same conclusions as before:

1°C to 5°C warming

Credit: Climate Studies Group Mona

Projected Precipitation Change



Mean changes in the annual rainfall for 2071-2099 with respect to 1961-1989, as simulated by PRECIS_ECH and PRECIS_Had for SRESA2 and SRESB2.

Downscaled climate change projections for the end of 21st Century

(using IPCCC SRES scenarios)

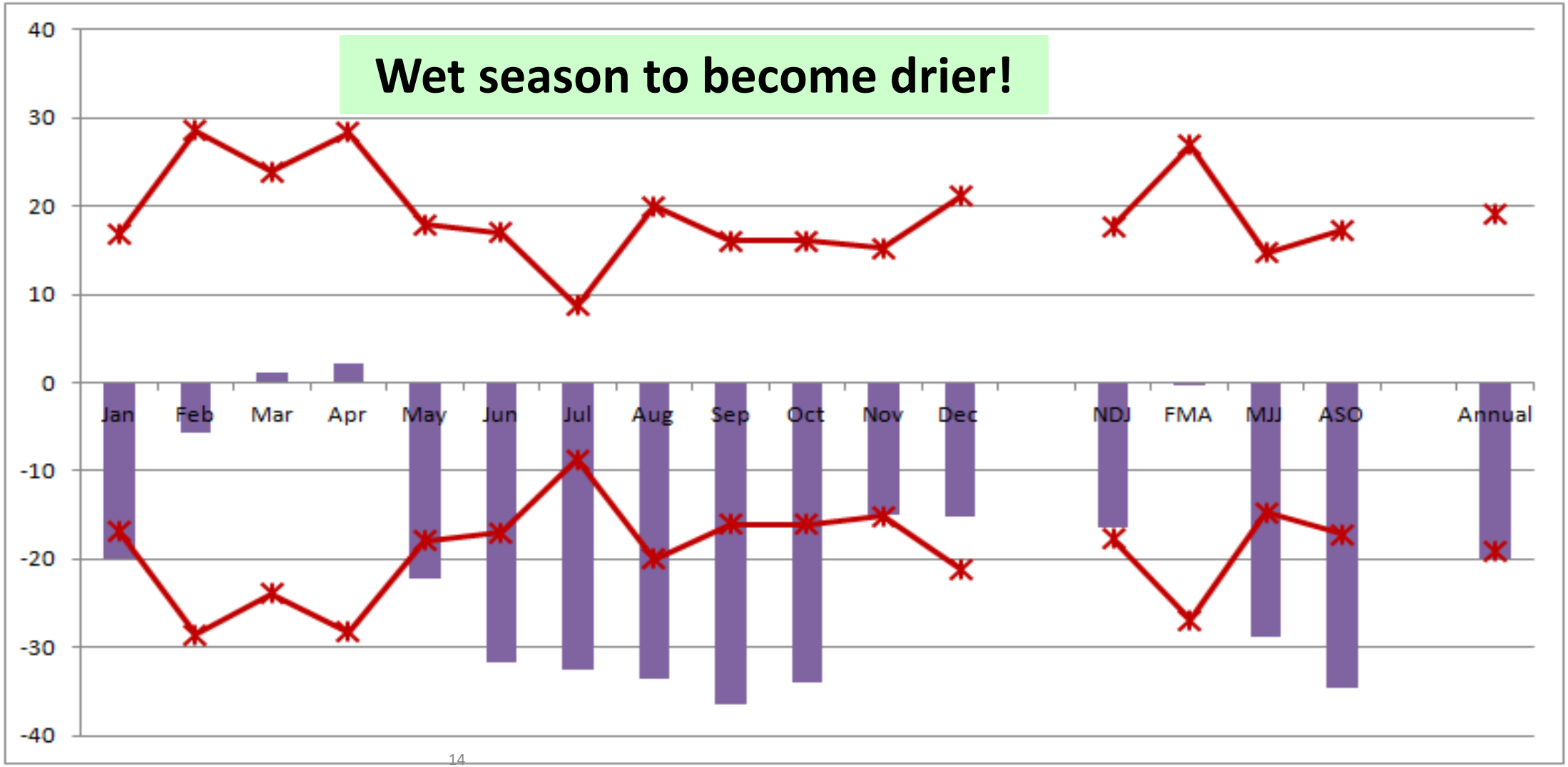
general **drying trend** for the Caribbean Basin

Drying of 25% to 30%

Adapted from: Taylor et al. (GFCS – Caribbean RWCS, Trinidad, 2013)

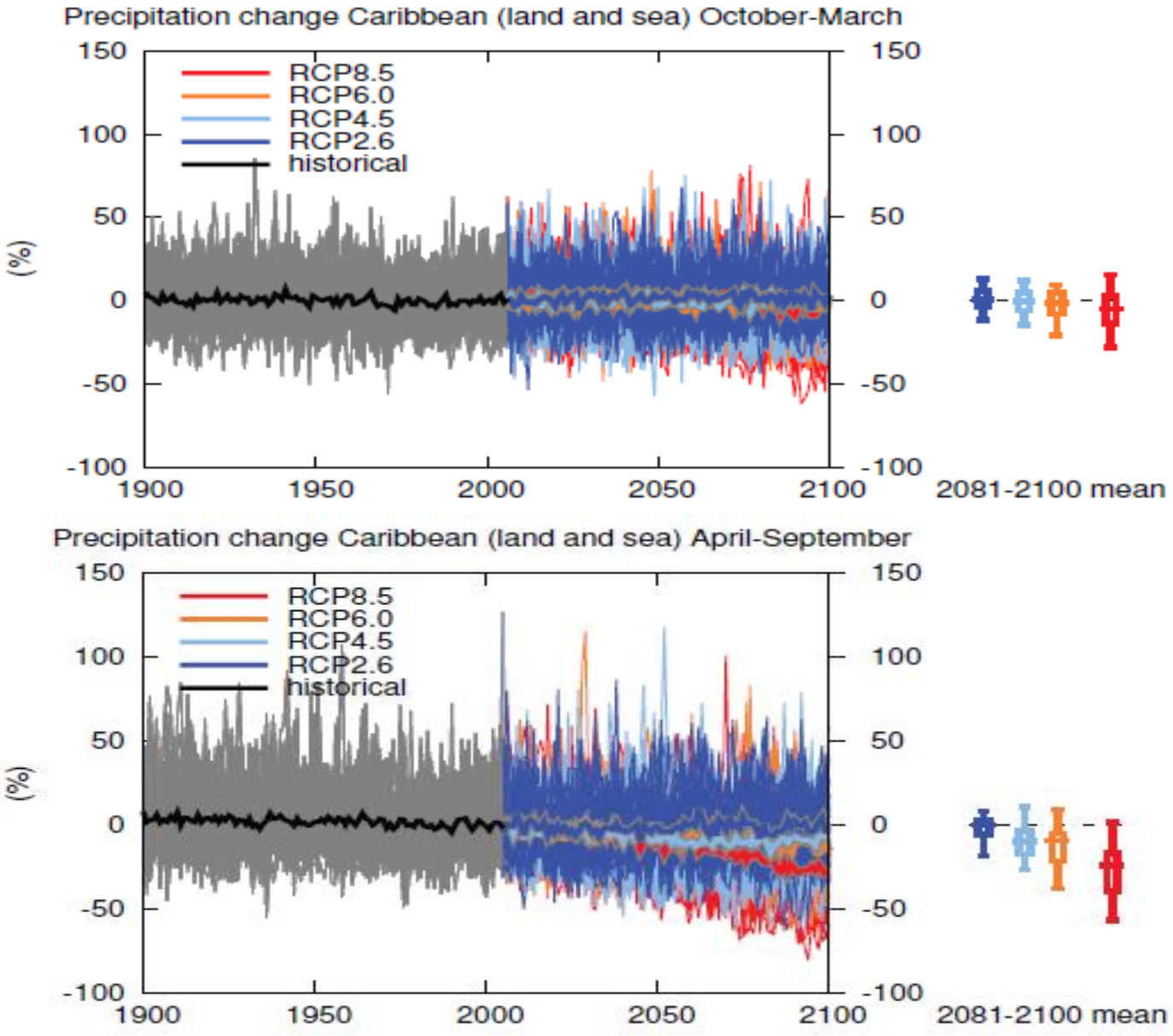
Projected Precipitation Change

EARLY WORKS – *MODEL PROJECTIONS*



Adapted from: Taylor et al. (GFCS – Caribbean RWCS, Trinidad, 2013)

Projected Precipitation Change

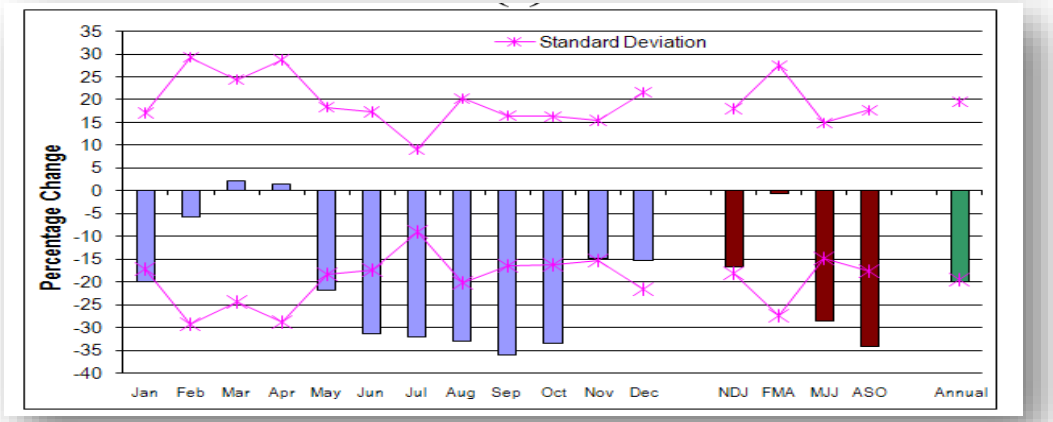


Credit: Climate Studies Group Mona

More recent climate change projections for the end of 21st Century

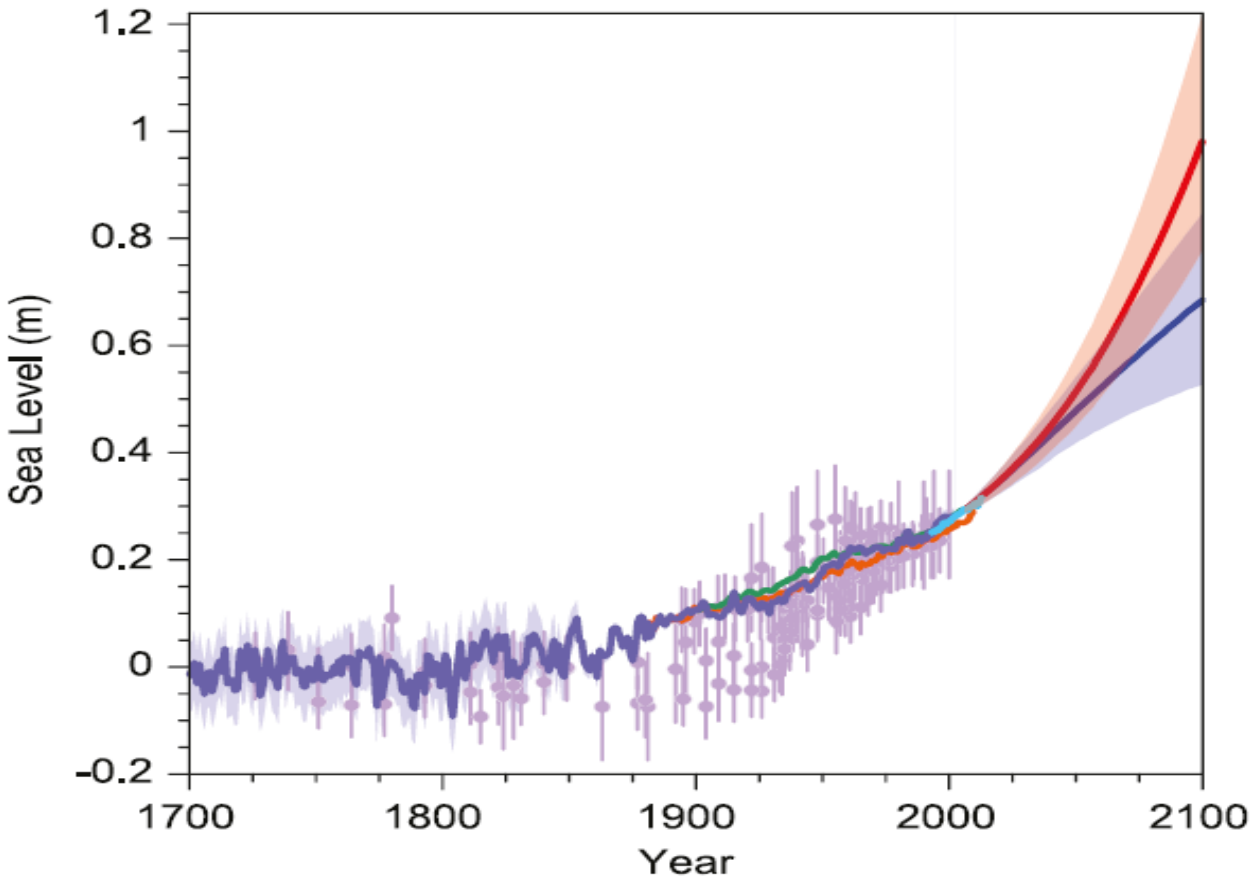
(using IPCCC RCP scenarios)

- **same drying trend for the Caribbean Basin**
- April to September likely drier



Rising Sea Levels

- **Sea level rise (SLR)** in the Caribbean may be more pronounced than in other regions (Bamber et al. 2009).
- SLR will **continue beyond 2100**, even we stabilize Greenhouse Gas emissions now.
- According to Simpson et al. (2010): 'the **question is WHEN** the Caribbean will face SLR of **1m or 2m** under either a 2.0-2.5°C global warming scenario'.



Hurricane Activity

- **Strongest hurricanes** becoming stronger and more frequent;
- Cyclones projected to become **wetter** (e.g. Gutmann et al. 2018);
- **No clear changes in number** of named storms;
- Hurricane **season may become longer**;
- Impacting on damage and loss (though the rise thus far has been mostly due to increased exposure), safety, security

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Major climate change impacts in the eastern Caribbean and their sectoral implications

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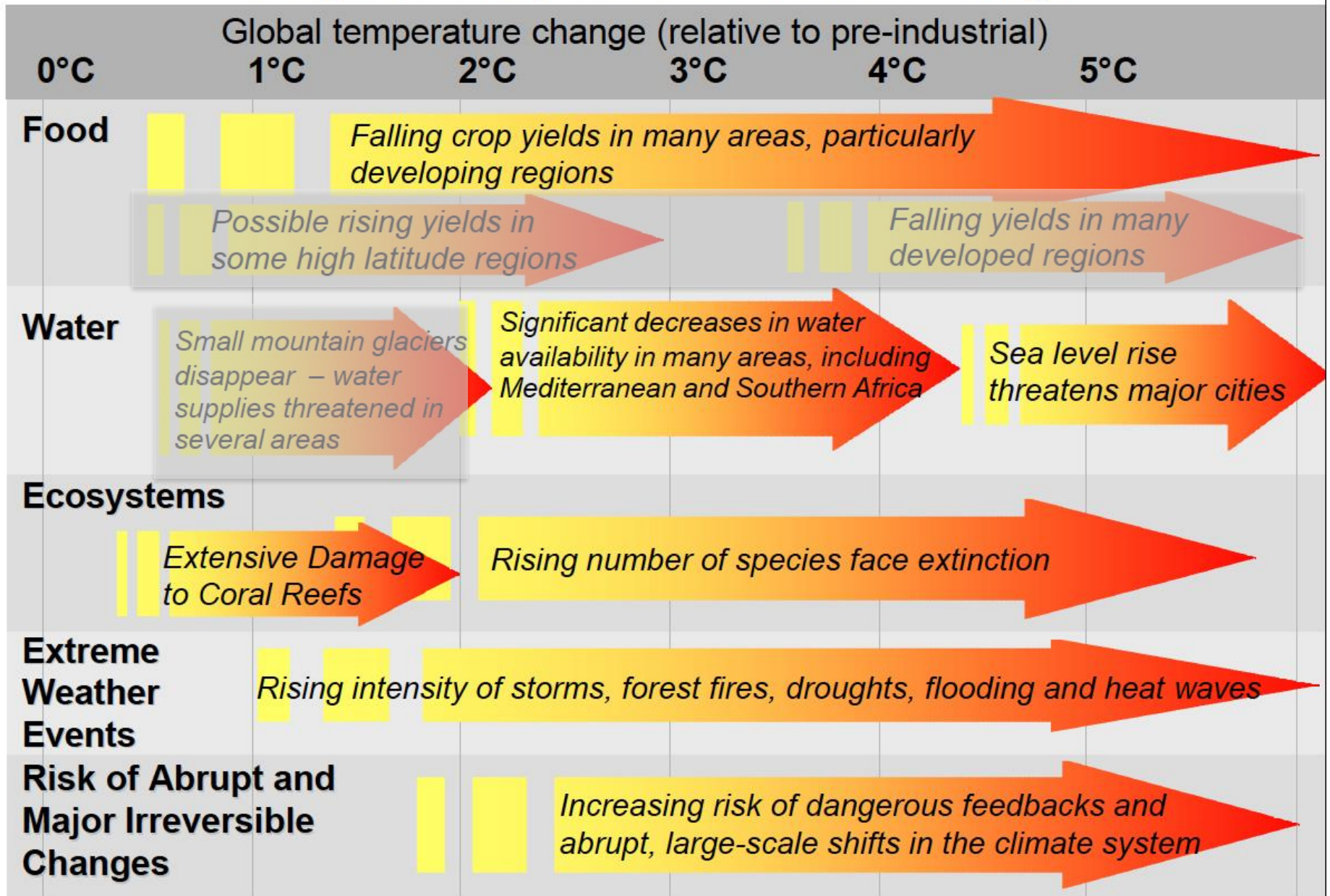
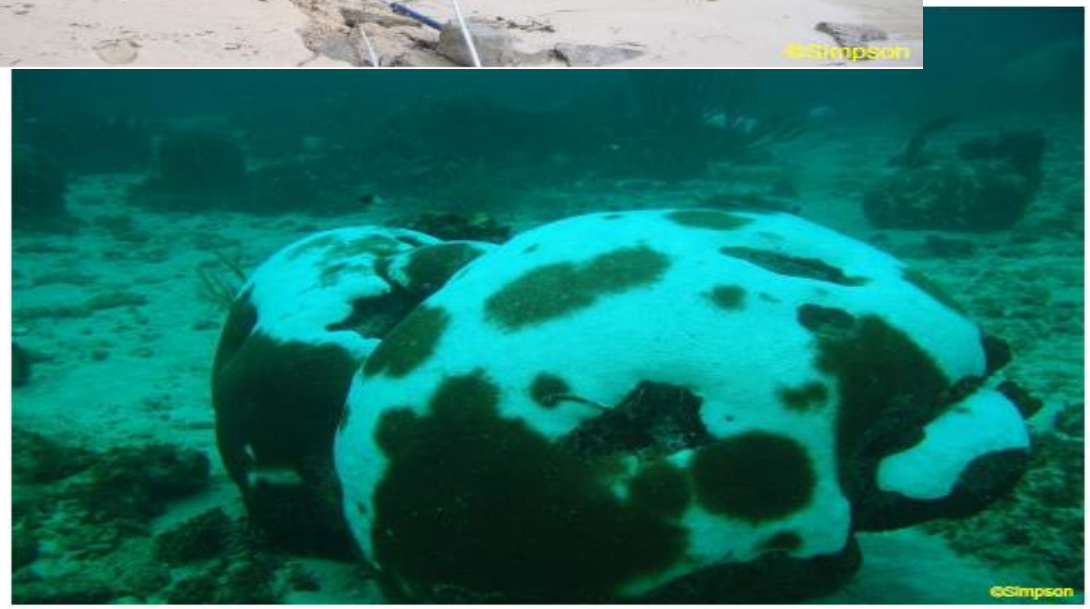
Projected Impacts of Climate Change



From UK Stern Commission Economics of climate change 2006

Caribbean climate concerns

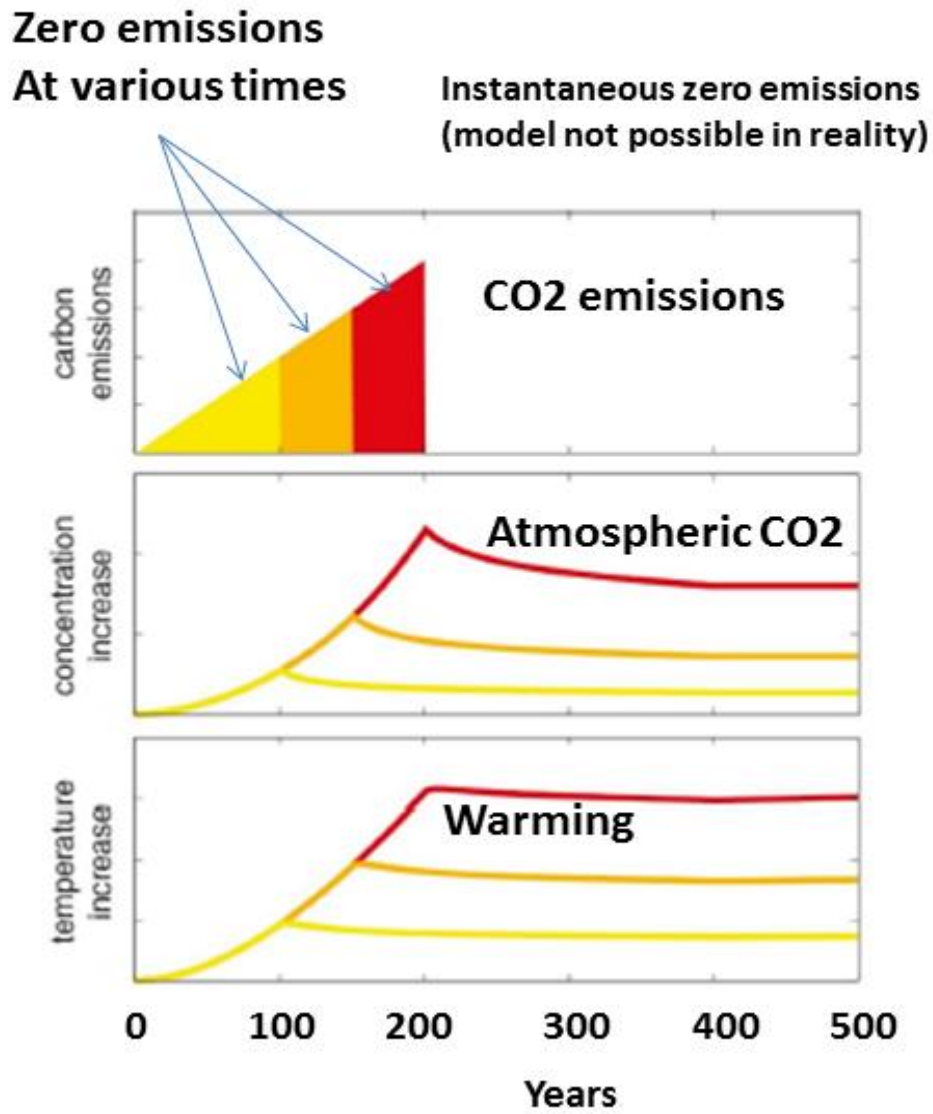
- **Sea level rise**
  - Coastal flooding and erosion
  - Saline intrusion into freshwater aquifers
- **Increased temperatures**
  - Heat stress
  - Coral bleaching
  - Biodiversity loss
  - Increased emergence of vector borne diseases
- **Ocean acidification**
  - Negative changes in marine ecosystems



Caribbean climate concerns

- **Changes in rainfall patterns**
  - Droughts or floods
  - Decreased fresh water availability
  - Increased vector and water borne diseases
- **Increased intensity of storm activity**
  - Direct damage of infrastructure
  - Loss of life

Warming will persist for centuries



- Zero CO_2 emissions lead to near constant surface temperature. A large fraction of climate change persists for many centuries.
- Depending on the scenario, about 15-40% of the emitted carbon remains in the atmosphere for 1000 yrs.
- This represents a substantial multi-century climate change commitment created by past, present and future emissions of CO_2.

Thank you

GOVERNOR'S SYMPOSIUM

Caribbean Challenges

- Although the full extent of climate change impacts in the Caribbean far from certain, mostly adverse consequences are projected.
- The combined area of the Caribbean Sea and Gulf of Mexico is 5,326,000 km^2. This area has 28 insular and coastal states and ten territories bordering the Caribbean Sea and the Gulf of Mexico. The estimated population is 40 million people – with some 70% living in coastal cities, towns and villages,
- about 38 percent of the population can be classified as poor.

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Caribbean Challenges

Inherent Vulnerabilities to Climate Change

Limited physical size and isolation of islands - effectively reduces some adaptation options to climate change and sea-level rise (e.g., retreat; in some cases entire islands could be eliminated, so abandonment would be the only option).

limited natural resources - many of which already are heavily stressed from unsustainable human activities

- **High susceptibility to natural hazards** such as tropical cyclones (hurricanes) and associated storm surge, droughts, tsunamis, and volcanic eruptions
- **Extreme openness of small economies** and high sensitivity to external market shocks, over which they exert little or no control (low economic resilience

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Caribbean Challenges

- Population - generally **high population densities**. In many cases large population settlements are located in coastal areas where they are very susceptible to flooding and storm surge.
- **Difficulty in securing requisite levels of insurance** or re-insurance due to perceived proneness to natural disasters.

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Climate change impacts from 1850: IPCC AR4 & AR5

For policy, impacts must be linked to EQUILIBRIUM warming NOT transient warming at 2100

Impact starts where text begins

Interactions will increase individual impacts

Observed & under 1.0°C | **1** | **1.5** committed | **2** | **3**

ALL IMPACTS INCREASE WITH GLOBAL TEMPERATURE (AR4, AR5)

CONCLUSION 2.0°C is catastrophic
1.5°C is disastrous
1.0°C is the danger limit – but not safe

Water

Decreasing water availability increasing drought in mid to low latitude (AR4)
100's of millions increasing water stress (AR4)
For each degree of global warming, 7% of the global population is projected to have a decrease of water resources of at least 20%. (AR5)

Ecosystems

High unadaptable vulnerability – especially relevant for indigenous people & all future generations.
Loss of ecosystem services globally

Increasing ecosystem impacts, all regions (AR5)
Increased species range shifts (AR4)
Increasing wild fires observed (AR5)
Widespread stress on temperate forests (AR5)
Amazon altered by drought, fires, on top of deforestation (AR5)
Large fraction species added risk of extinction (AR5)
Increasing coral bleaching

Not adaptable (AR5)

Most trees & herbs can't adapt (AR5)

-------- up to 30% (more) species extinction (AR4)
most corals bleached (AR4)

Widespread coral mortality

Food

These are crop model projections that do not capture a large number of very damaging impacts

Complex local negative impacts on small holders, subsistence farmers, fishers (most of world food production- (AR4) not adaptable (AR5)
Most regions adverse effect
Indigenous most vulnerable
All tropical regions crops declined, most of Africa (AR5)- least adaptable (AR5)
Most temperate region crops declined All temperate crops declined (AR5)

Many adverse effects not captured by models
Necessary adaptation to a fast changing climate, with increasing extremes, cannot be assumed effective for long (IPCC AR5 WG2 7.6)

Coasts

Increased damage from floods & storms, highly damaging to small island peoples
Annual global flood affected increase 5-7 fold (AR5)
Greenland ice – significant decay of ice sheet & at over 1.0°C total loss may be irreversible (AR5)
Millions more experience flooding (AR4,5)

Health

Increasing burden from malnutrition, diarrheal, cardiovascular, infectious, food & water borne diseases
Increasing morbidity and mortality from heat waves, floods and droughts
Changes in some disease vectors

AR4
AR5

Extreme Weather

Highly (additionally) damaging to population health, crops, infrastructure and public services
Increasing extremes, including forest fires, regional drought, tropical cyclone intensity – will continue to increase

GHGs & GHG Feedbacks – Most unaccounted in projections

Atmospheric CO2, CH4 & N2O are highest (30% above maximum) in 800,000 years (AR5)
Rate of CO2 increase is dramatic & unprecedented (AR4) Rapid increase in radiative forcing (AR5)
'Climate warming is projected by models to reduce oceanic carbon uptake in most oceanic regions' (AR5)
All large source Arctic feedbacks operant (see Arctic below) Tropical carbon sink weakens above 1.5°C (AR5)
Terrestrial carbon feedback is +ve (AR5) 'Less carbon is taken up by the ocean & land as climate warms- +ve climate feedback.' (AR5)
Ground level ozone, which damages green plants, increases with warming (+ve feedback) Major loss of Amazon (AR4, AR5)
CH4 concentration (over double 800,000 year maximum) growth since 2006 involves natural wetlands (feedback)– will increase (AR5)
Climate warming will likely amplify agricultural and natural terrestrial N2O sources (AR5)

Arctic

Arctic will keep warming fastest. Snow and summer sea ice (albedo cooling) will decline rapidly.
Arctic will emit more climate-affecting carbon from tundra, Boreal, permafrost to irreversible & subsea methane hydrate feedbacks (AR5)

Oceans

Ocean warming and acidification increase under all scenarios (AR5)
Marine organisms are being affected (AR5) 'Warming leads to decline of dissolved O2 in the oceans interior' (AR5)

Not adaptable

Tipping points

'MORE EMISSIONS COMMITS TO

Increasing likelihood severe irreversible impacts people & ecosystems. (AR5)
Tipping point risks at 0.6-1.6°C, increase disproportionately at 1.6-2.6°C (AR5)
Increasing risk with warming for crossing MULTIPLE TIPPING POINTS (AR5)

P. Carter AGU 2014

Heatwaves impacts in the eastern Caribbean and their sectoral implications

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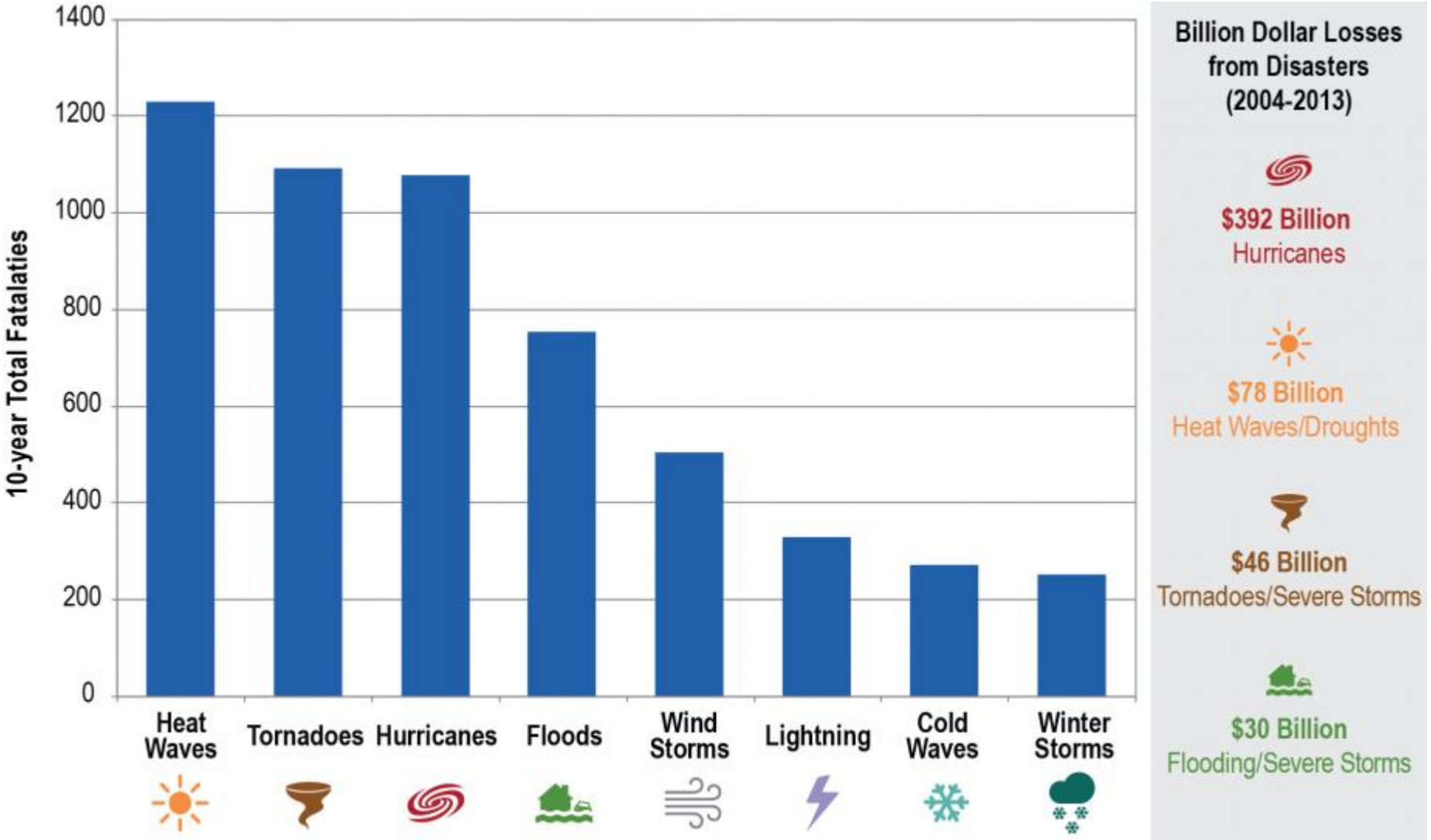
Heatwaves: The Silent Killers



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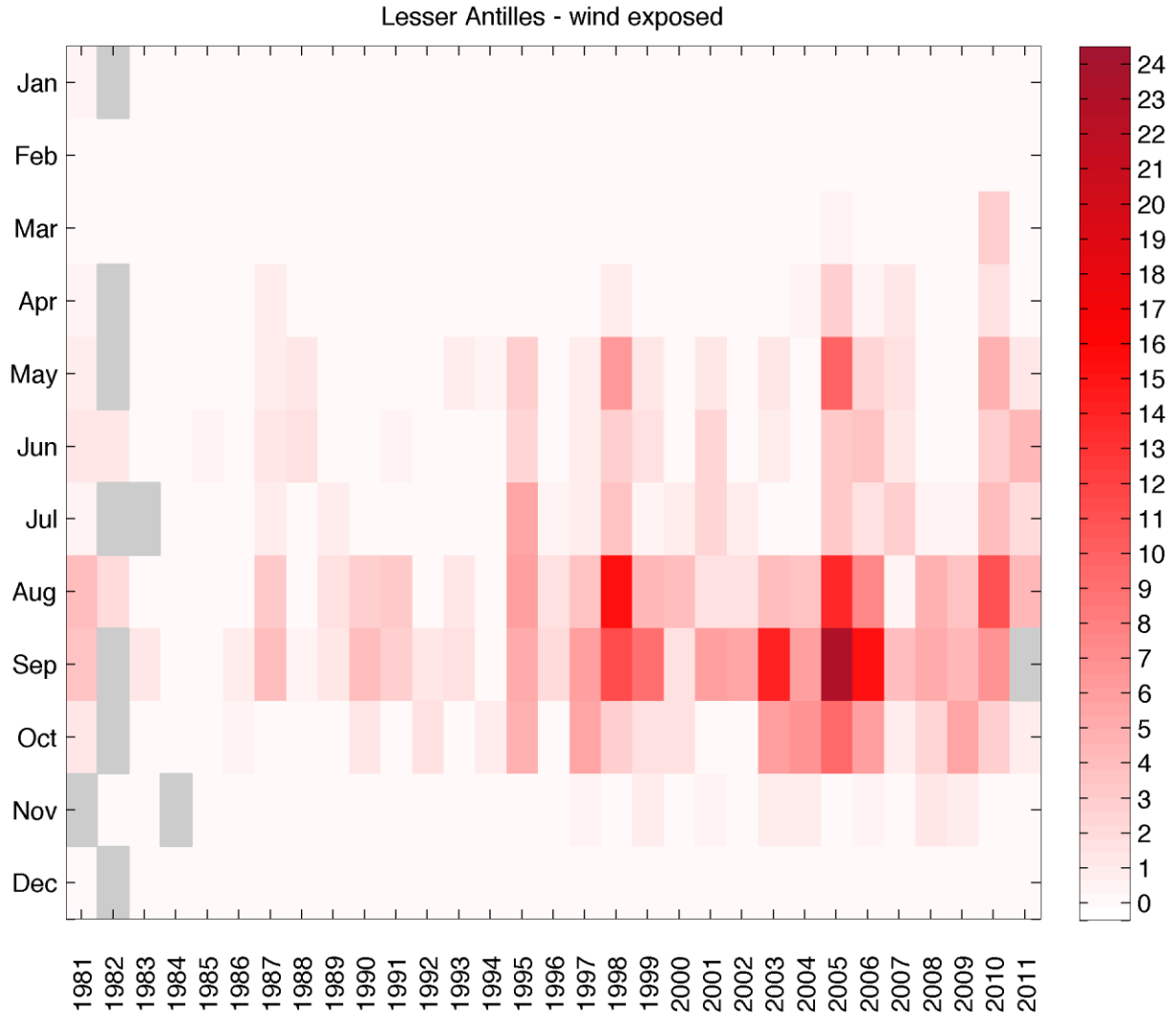
Heat Waves: The Caribbean



>15% increase in frequency of warm days

>15% increase in frequency of warm nights

1°C warming of hottest days and nights

7% decrease in frequency of cold days

10% decrease in frequency of cold nights

1°C warming of coldest days and nights

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Heatwaves: The Caribbean

We are unable to quantify the impacts of heatwaves in the Caribbean.

BUT we do know that we should be concerned about heatwaves because:

- Heatwaves have a major impact on most other parts of the globe
- Heatwaves have a stronger impact than any other meteorological hazard in many places
- Heatwaves have a bigger impact than most people realise
- Dangerous levels of heat do occur in the Caribbean
- Hot days and nights are becoming more frequent in the Caribbean
- Because of global warming, hot days and nights will become even more frequent in the Caribbean

Heatwaves: Sectoral Impacts

- Human health: morbidity and mortality
- Economic: reduced labour productivity
- Energy: cooling demand
- Infrastructure: road and rail conditions
- Agriculture: crop and livestock survival and growth rates

Climate change impacts on the agriculture and food sector

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Agriculture and CC

- **Temperature** – more days above optimum threshold, shorter duration in fields
- **Temperature** – heat stress in animals
- **Increased duration of cropping season poleward** (change in markets?, increased imports to the regions of traditionally tropical products?)
- **Sea Level rise** – salinisation of agricultural soils
- **Reduced total rainfall** – lower soil water availability for crops and livestock.
- Coupled with the lower moisture regimes and higher temperature will be an **increase in evaporation** with even lower water availability
- **Increased rainfall rates** – flooding, increased soil erosion
- **Shifts in rainfed growing season**
- **Cyclones** – damage to crops, loss of animals, loss to agricultural infrastructure, increased insurance premiums

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2°C Impact on Agriculture

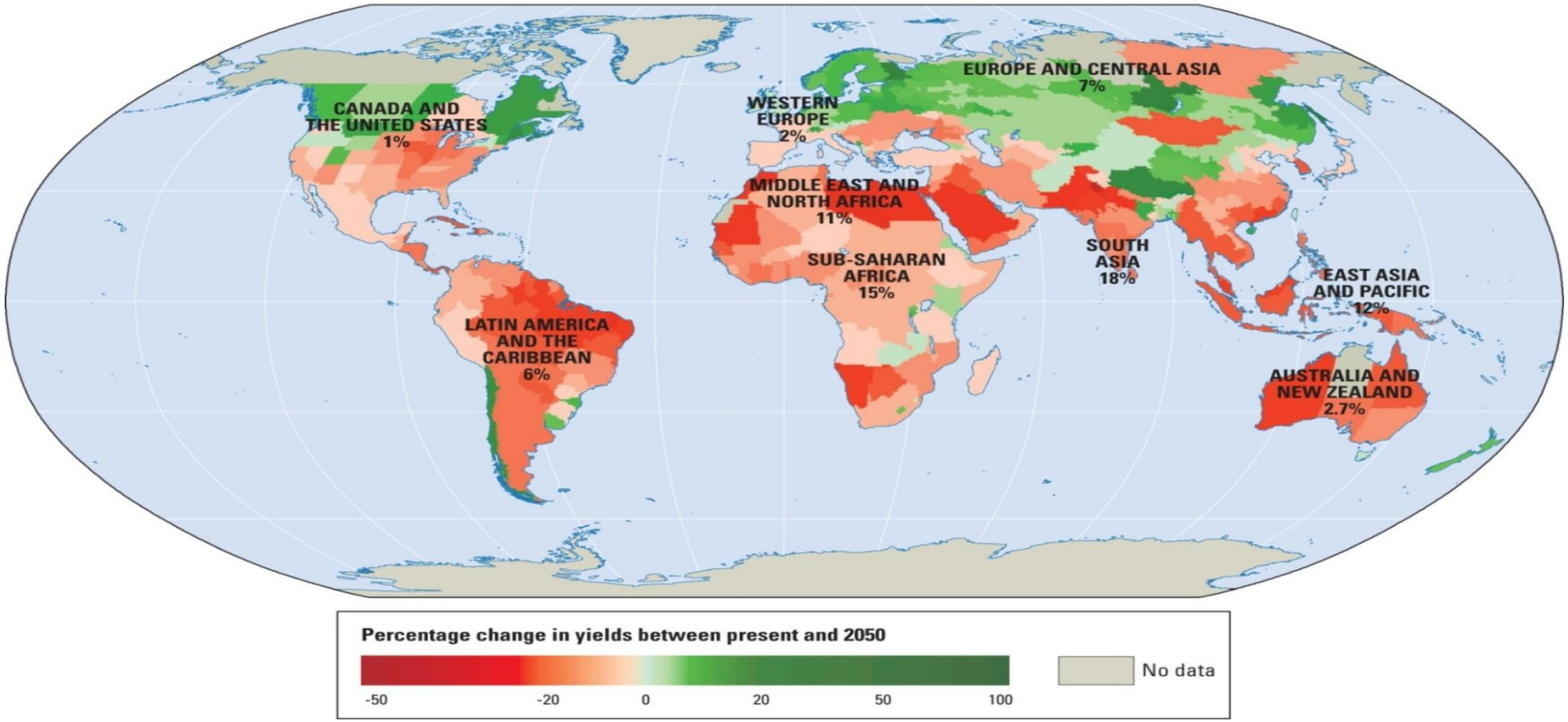
Belize: Preliminary studies on the impact to corn, beans and rice for future climate scenarios for 2°C warmer accompanied by a +/- 20% change in precipitation

Crop	Scenario Name	Season Length (days)	Temperature Change (°C)	% Change in precipitation	Yield (kg/ha)	% change in Yield
Dry beans	Baseline	87	0	0	1353.6	
C3	Carib A	85	+2	+20	1163.7	-14%
		85	+2	-20	1092.6	-19%
Rice	Baseline	124	0	0	3355.5	
C3	Carib A	113	+2	+20	3014.4	-10%
		113	+2	-20	2887.5	-14%
Maize	Baseline	104	0	0	4510.6	
C4	Carib A	97	+2	+20	3736.6	-22%
		97	+2	-20	3759.4	-17%

Agriculture in Belize

- 2008
- **PRECIS, DSSAT4** and **Cropwat**
- Sugarcane and Citrus
- 2028 & 2050
- 1 & 2.5°C rise in temp
- ± 12 & 20% change in precipitation
- Result: 12-17% decline in yields for sugarcane
- Result: 3 – 5% decline in yields for citrus

Climate change will depress agricultural yields in most countries in 2050, given current agricultural practices and crop varieties

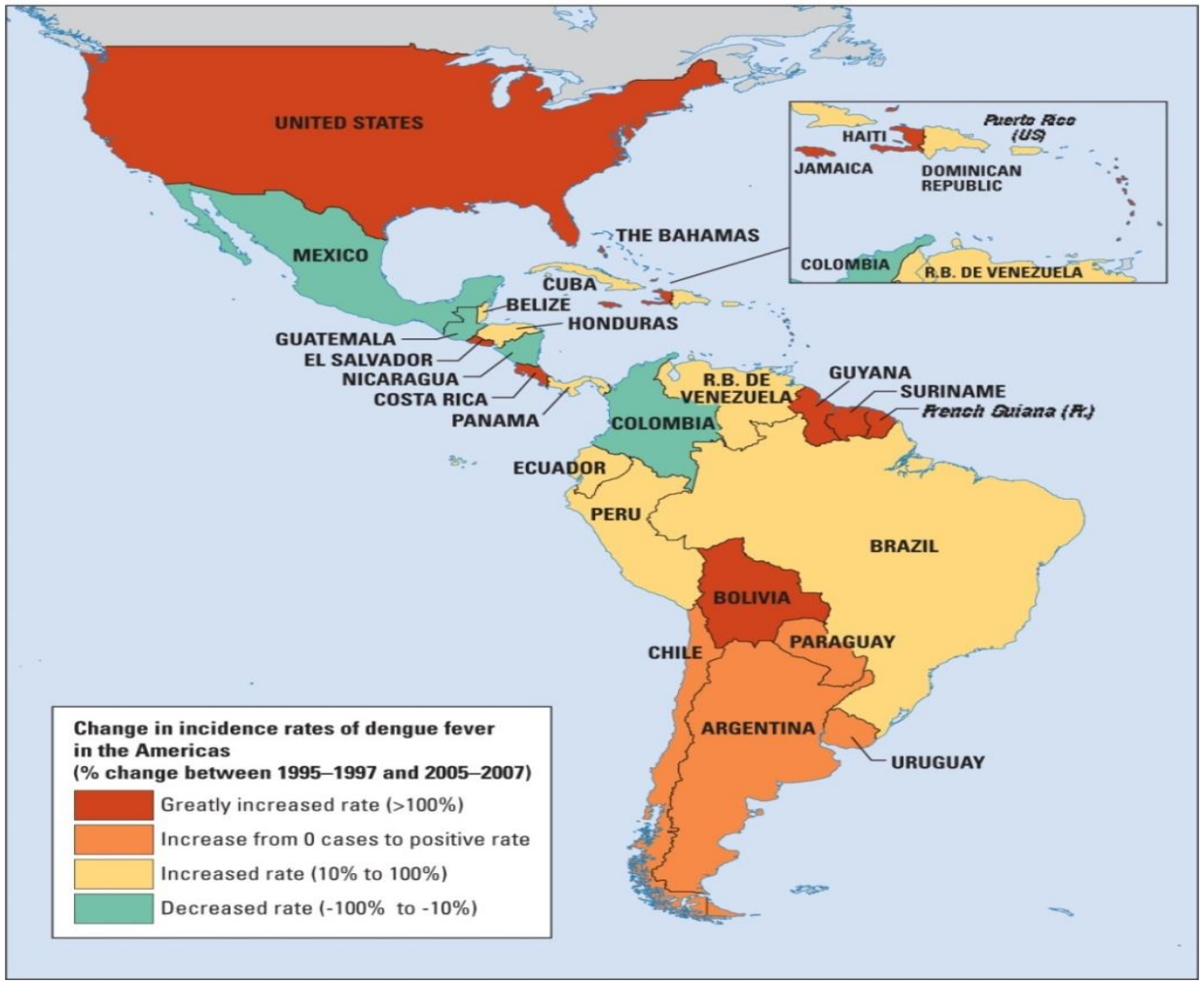


Sources: Müller and others 2009; World Bank 2008c.

Note: The coloring in the figure shows the projected percentage change in yields of 11 major crops (wheat, rice, maize, millet, field pea, sugar beet, sweet potato, soybean, groundnut, sunflower, and rapeseed) from 2046 to 2055, compared with 1996–2005. The yield-change values are the mean of three emission scenarios across five global climate models, assuming no CO_2 fertilization (a possible boost to plant growth and water-use efficiency from higher ambient CO_2 concentrations). The numbers indicate the share of GDP derived from agriculture in each region. (The share for Sub-Saharan Africa is 23 percent if South Africa is excluded.) Large negative yield impacts are projected in many areas that are highly dependent on agriculture.

World Development Report 2010

Climate change accelerates the comeback of dengue in the Americas



Source: PAHO 2009.

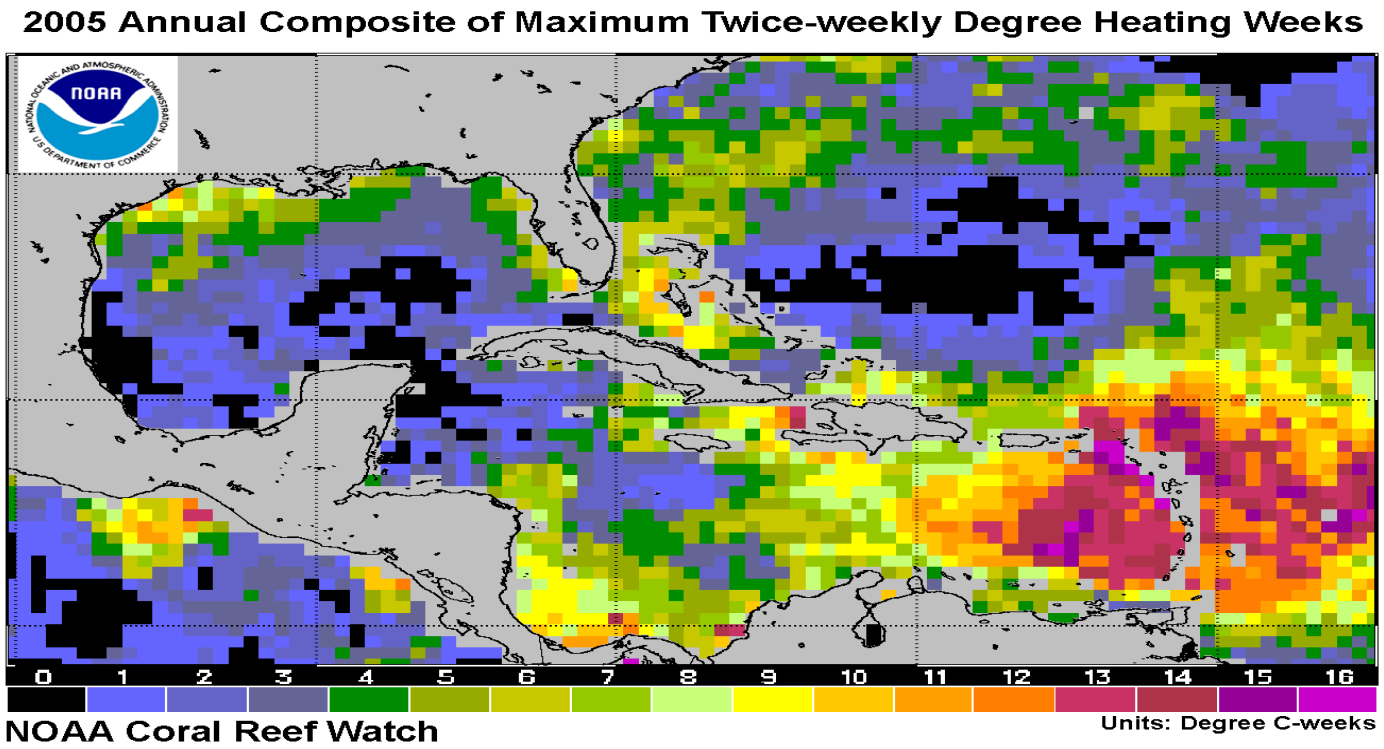
Note: Infectious and vector-borne diseases have been expanding into new geographic areas all over the world. In the Americas the incidence of dengue fever has been rising because of increasing population density and widespread international travel and trade. Changes in humidity and temperature brought about by climate change amplify this threat and allows disease vectors (mosquitoes) to thrive in locations previously unsuitable for the disease; see Knowlton, Solomon, and Rotkin-Ellman 2009.

World Development Report 2010

Coral Reef Bleaching and CC

- Coral reef bleaching mainly due to **Increased sea temperatures**
- **Freshwater influx** due to increased rainfall intensities flooding the reef and reducing salinity; or bringing with it terrestrial chemicals and diseases; or excess ammonia and nitrates. Sediments can cloud water reducing light for photosynthesis
- Any change in the intensity or frequency of tropical cyclones can increase **mechanical damage to reefs** due to rough waves
- **Sea level rise** – some corals become too deep to get light to photosynthesise

GOVERNOR'S SYMPOSIUM



Coral bleaching-T, ocean acidification,
watershed to shore runoff

Bleaching events could occur annually by 2025-2050

15-30% loss of calcification rates by 2050

Mangroves

- **Sea level Rise** – mangrove retreat inland provided area can accommodate this (due to development, seawalls etc)
- Precipitation decline and evaporation increase possibly resulting in **hyper saline conditions** that can alter mangrove distribution
- **Increased CO_2** – increased photosynthetic and growth rates
- **Temperature** can influence species composition, phenology, increased productivity up to optimum temperature, mangroves seen further poleward
- **Cyclones** - increase damage to mangroves through defoliation and tree mortality, particularly in combination with sea level rise

Marine Ecosystems

- **Sea temperature rise** – can cause migration as many fish species and their food organisms have narrow optimum temperature ranges
- **Increased influx of fresh water** and its pollutants influence species distribution
- **Ocean currents and upwelling** e.g. in ENSO affects species distribution. Likely to be an influence of CC on ENSO cycles (more frequent)
- Many species seek shelter during rough seas in **tropical storms**.

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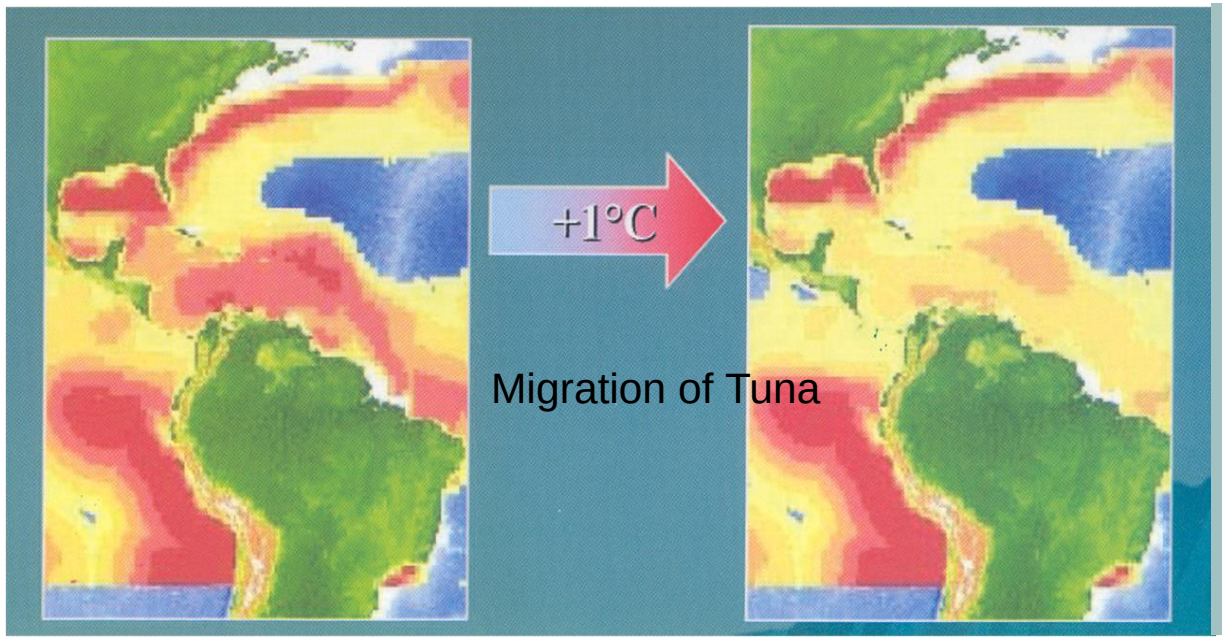
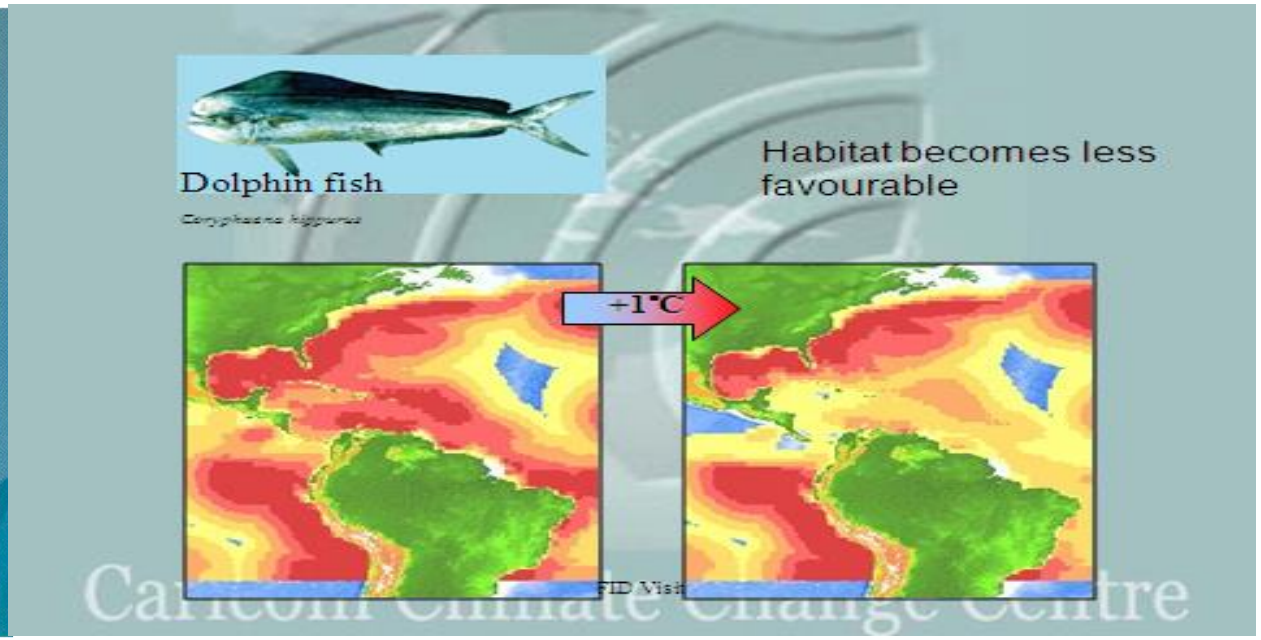
Climate Change and Fish Stocks





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Presentation on Climate Change effects on Socio-economic development: Mr. Derek Downes

The Effects of Climate Change on The Economic Development of St. Maarten

By
Derek A. Downes
General Managing Director
The Windward Islands Bank Ltd.

GOVERNOR'S SYMPOSIUM
2018

Outline of Speech

- Economic Structure and Economic Development Strategy of St. Maarten
- Nexus Between Climate Change and Economic Development
- Adaptation Strategies to Reduce Economic Development Vulnerabilities

Economic Structure and Economic Development Strategy of St. Maarten

- **Small open economy:**
  - Vulnerable to external shocks and natural disasters
  - Tourism is main export and backbone of the economy
  - Low rate of economic growth and high unemployment
  - Tourism performed credibly
  - Tourism and wider economy suffered setbacks in aftermath of Hurricane Irma

Nexus Between Climate Change and Economic Development

- Economic Development

  The sustained advancement of the economic, social, spiritual, and political wellbeing of a country.

- MDGs were replaced by the UN Sustainable Development Goals (SDGs) in 2015. SDGs yet to be prioritized.

- St. Maarten achieved progress is six of the eight identified UN Millennium Development Goals (MDGs).

- Challenges and setbacks with two MDGs – Environmental protection and extreme poverty eradication.

Adaptation Strategies to Reduce Economic Development Vulnerabilities

- **Government:**
  - Establish an Environmental Disaster Relief Fund
  - Improve/Build Coastal Defenses
  - Enhance Drainage Systems
  - Improve and Enforce Building Standards
  - Modernize and Enforce Environmental Protection
  - Improve Health Care Systems
  - Climate-proof Water Storage Facilities

Adaptation Strategies to Reduce Economic Development Vulnerabilities

- **Businesses:**
  - Insure Premises, Inventory, Equipment
  - Purchase Business Interruption Insurance
  - Create Hurricane Preparedness Plan
  - Protect your Property and Assets
  - Invest in a Back-up Generator

- **Individuals:**
  - Appraise and Insure Your Property
  - Do not Under-insure Your Property
  - Be prepared for Climate Change Events

Adaptation Strategies to Reduce Economic Development Vulnerabilities

- **Everyone join in prayer**

Thank You For Your Attention

Presentation on Climate Change effects on Socio-economic development: Dr. Michael Taylor

Michael A. Taylor
University of the West Indies

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small islands & BIG development agendas

…why climate matters

Michael A. Taylor
University of the West Indies

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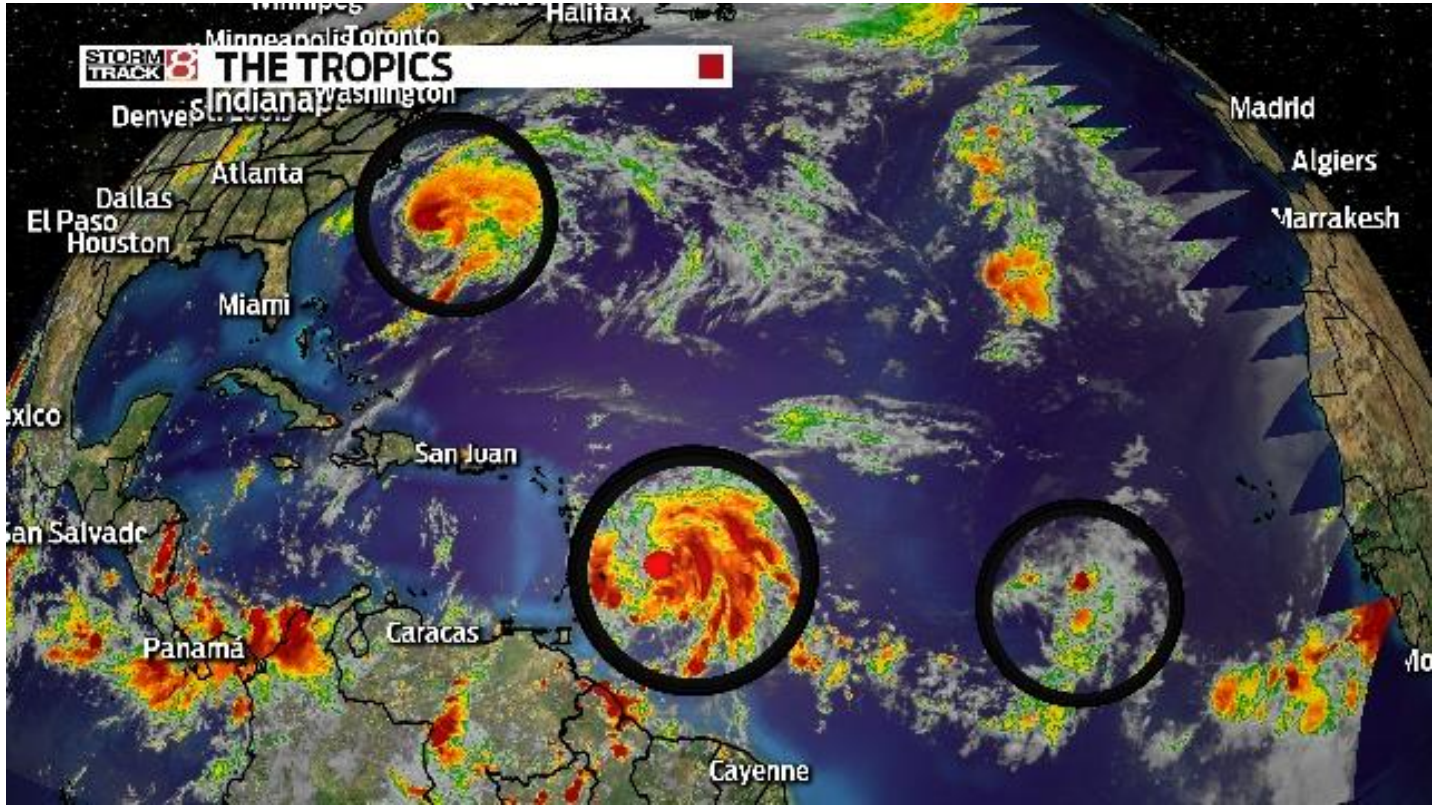
2018

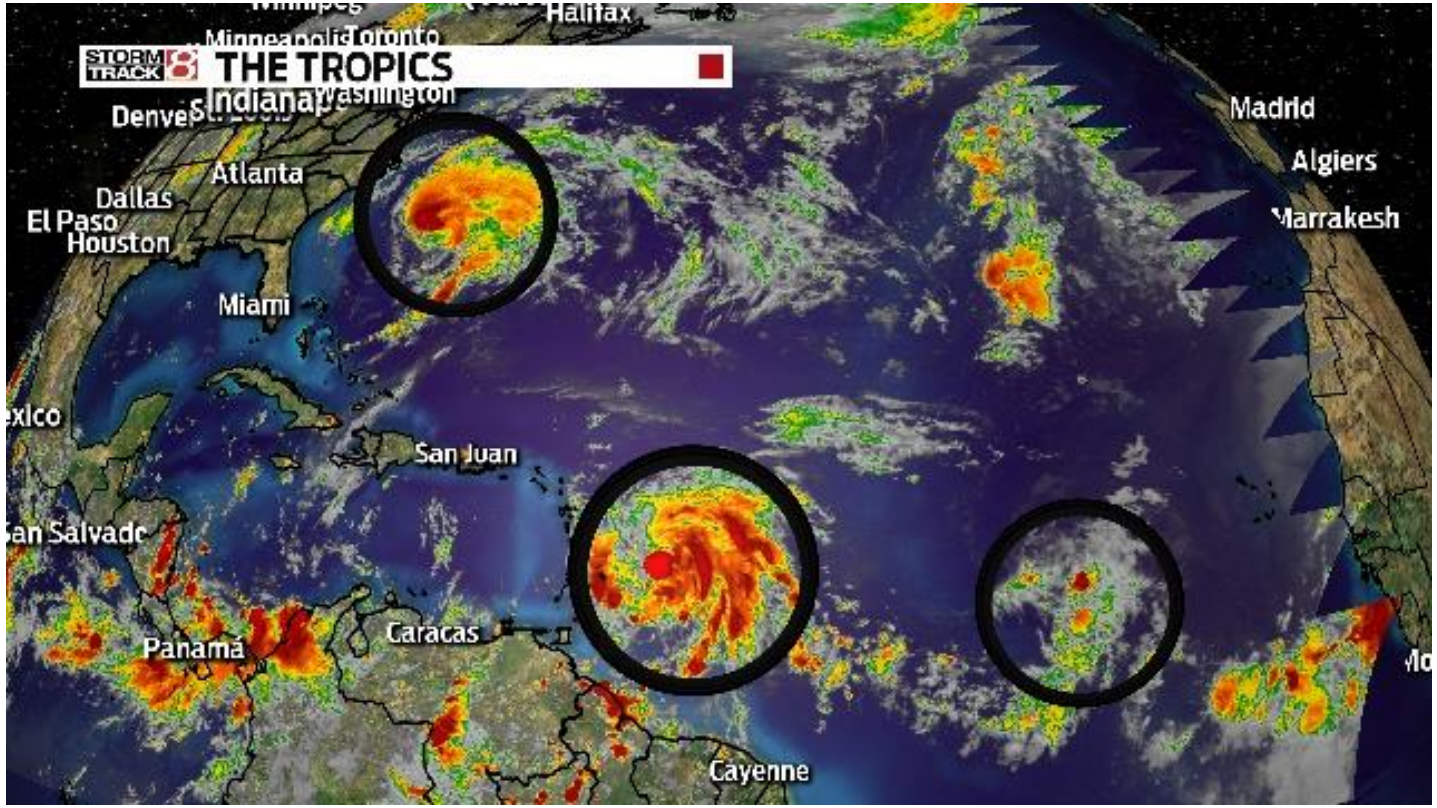


Lots of discussion about climate after 2017

Dominica

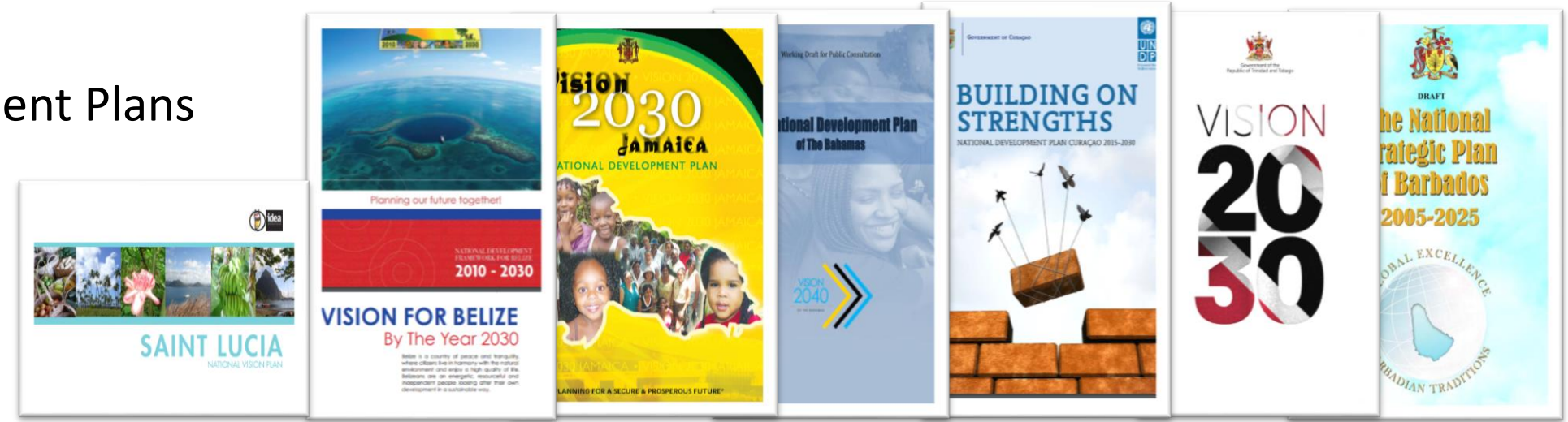
Puerto Rico

Barbuda



Lots of discussion about climate after 2017

National Development Plans



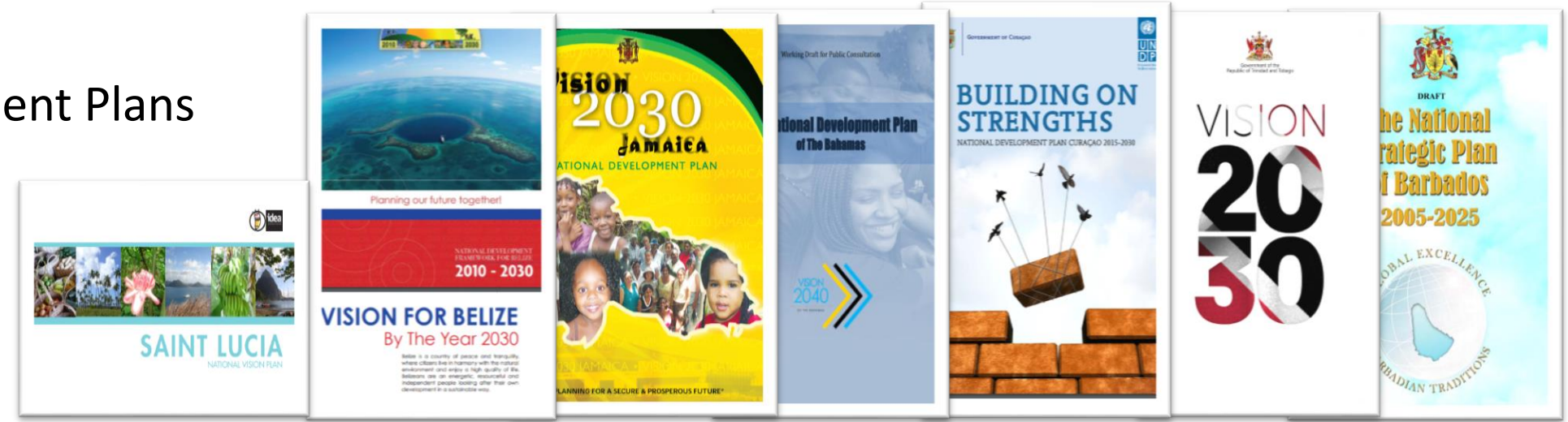
…does climate matter?

YES!

3 reasons…

Lots of discussion about climate after 2017

National Development Plans

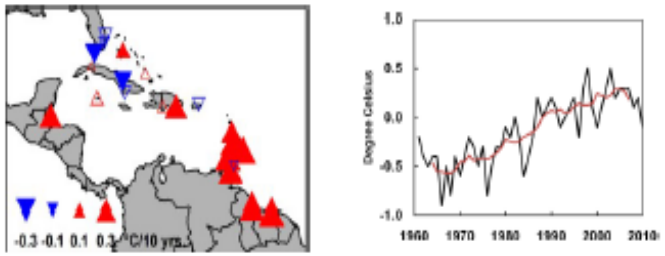


Our climate has changed…

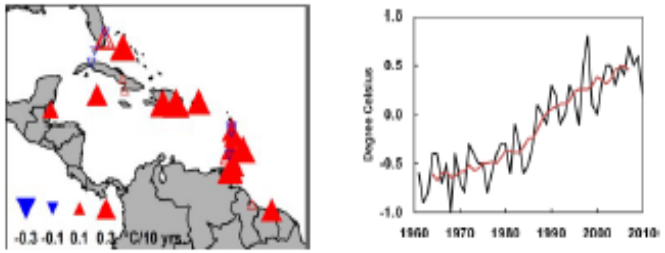
1

It's hotter

Hot days



Hot nights

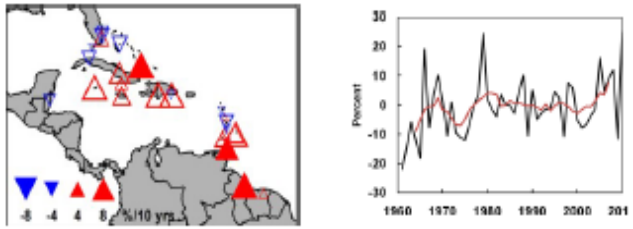


~ 1 degree rise since pre-industrialized times.

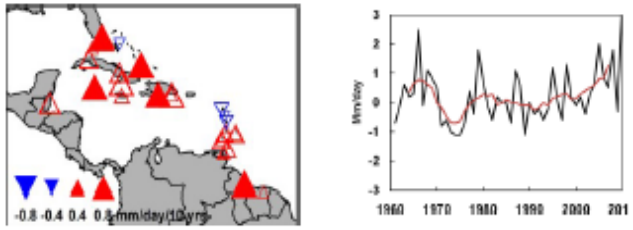
Earlier and longer summers

Rain is more variable

Total Rainfall



Intense Rainfall



(1) Very variable rainfall pattern + some places getting wetter, some getting drier + (3) 'nature' of rain is changing

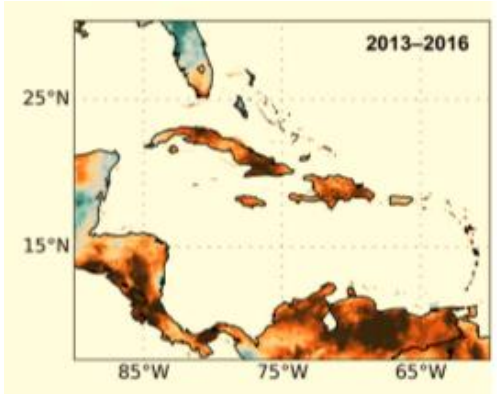
Stephenson et al (2014)

Our climate has changed…

1

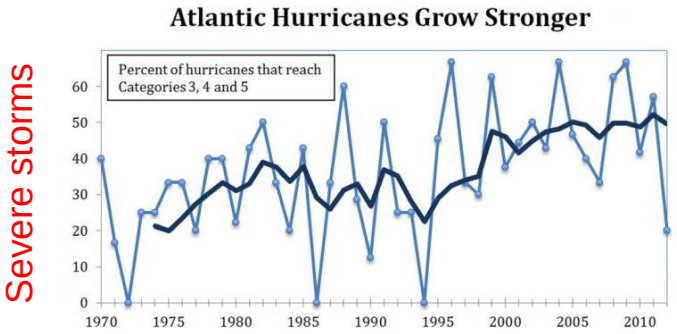
More extremes

Severe drought



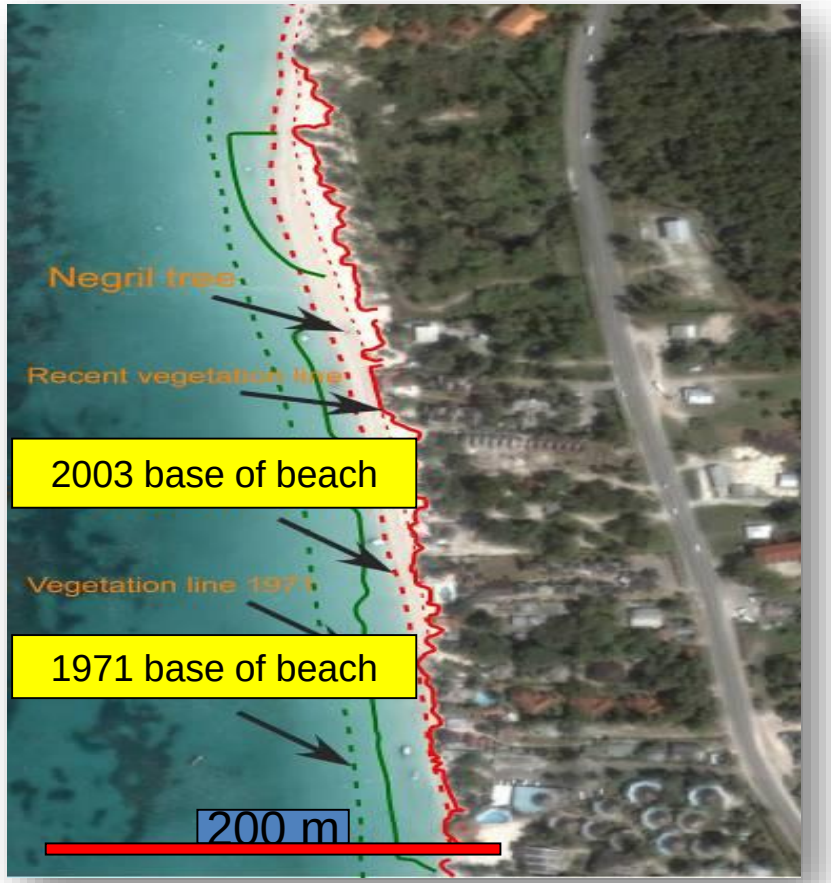
Two major region wide drought in last decade (2009-10, 2013-16)

Severe storms



Changing climate leads to changing weather and extreme events.

Higher Sea Levels



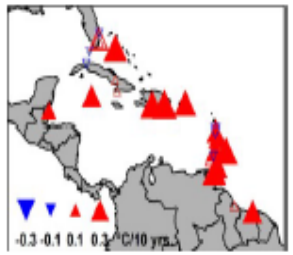
Sea levels are rising at about a rate of 3.5 mm/yr (post 1993)

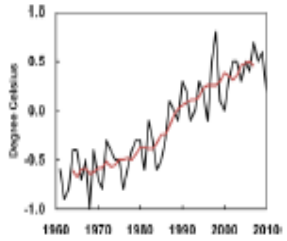
Our climate has changed…

1

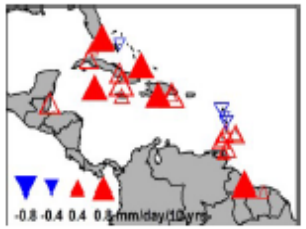
It has become unfamiliar

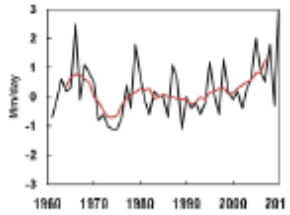
It's hotter



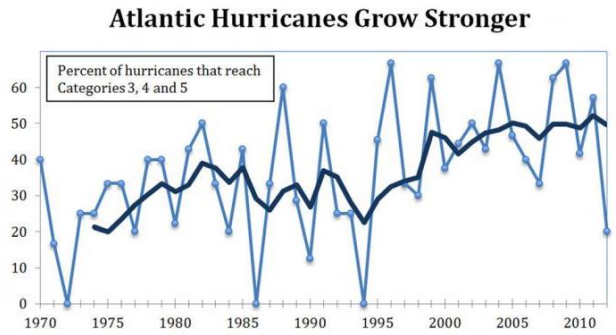


Rain is more variable

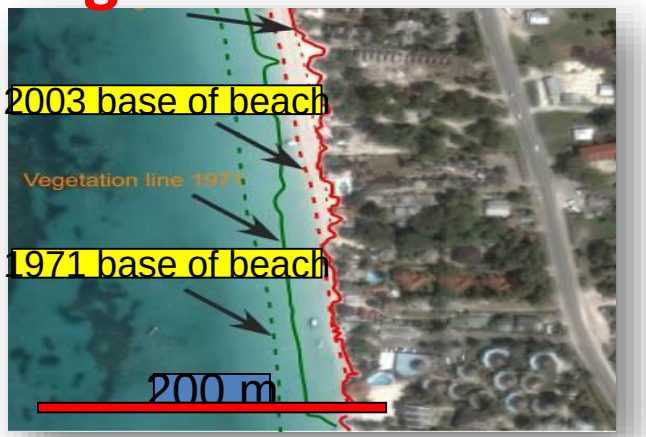




More extremes



Higher Sea Levels



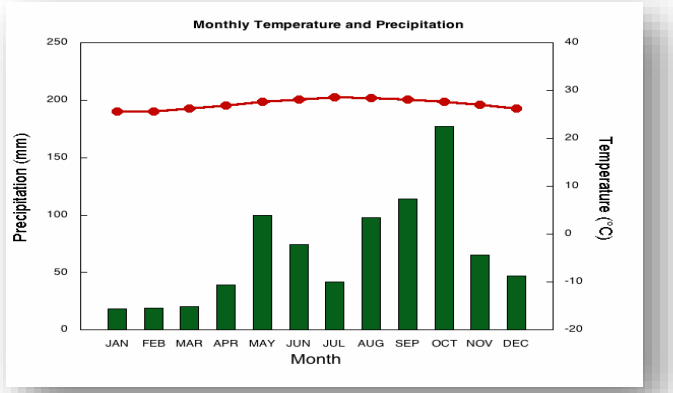
Our climate has changed…

Small islands are extremely climate sensitive

1

Embedded Climate Patterns

We pattern our lives around climate.



Topography and size

We live on steep slopes or on limited coastal plains.

Productivity & Quality of Life

Economy (Agriculture, Tourism, Fisheries, Mining)
Health and Wellbeing (diseases and recreation)
Critical livelihood sectors (Water and Energy)

Our climate has changed…

1

Small islands are extremely climate sensitive

World Travel & Tourism Council (WTTC)

THE IMPACT OF THE 2017 HURRICANE SEASON ON THE CARIBBEAN'S TOURISM SECTOR

The impact was significant, and while the islands which were directly hit were worst affected, *other islands which were not in the path of the hurricanes also suffered*.

The hurricane season resulted in an estimated (loss) in 2017 of *826,100 visitors* to the Caribbean, compared to pre-hurricane forecasts.

These visitors could have generated *US$741 million* and supported *1,005 jobs.*

Research suggests that recovery to previous levels could take *up to four years*, and if this is the case, the region will miss out on over US$3 billion over this timeframe.

Our climate has changed…

1

Climate change is introducing the challenge of the ‘unfamiliar’

Regional development is predicated on ‘familiar’ climate.

It is getting harder and harder for climate sensitive sectors in their current form to consistently deliver national growth.

Our climate has changed…

1

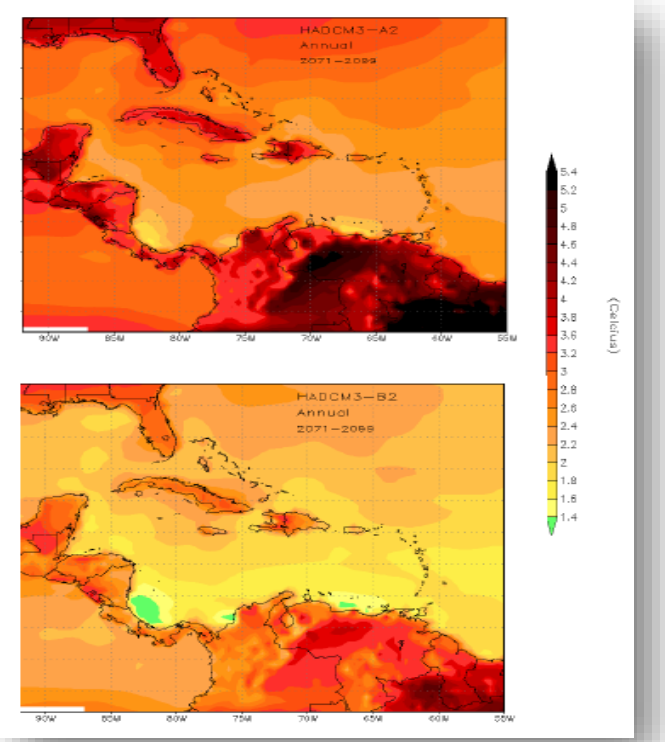
Our climate has changed → **Challenge of the Unfamiliar** → **Development Pillars are becoming ‘Unreliable’**

Our climate will continue to change…

1

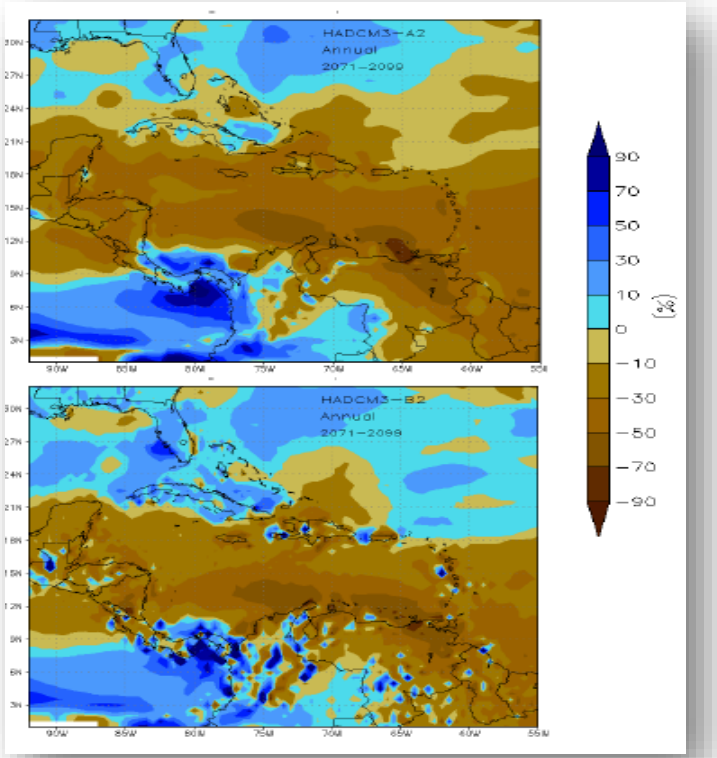
2

…even hotter times



- 1-4 degrees by century's end
- 30-98% of days annually will be 'hot' by the 2090s
- Only 2% 'cool' by the 2080s

…even drier conditions



- Still variable but less
- ~40% drier.
- Shorter rainy season
- Longer, more severe droughts

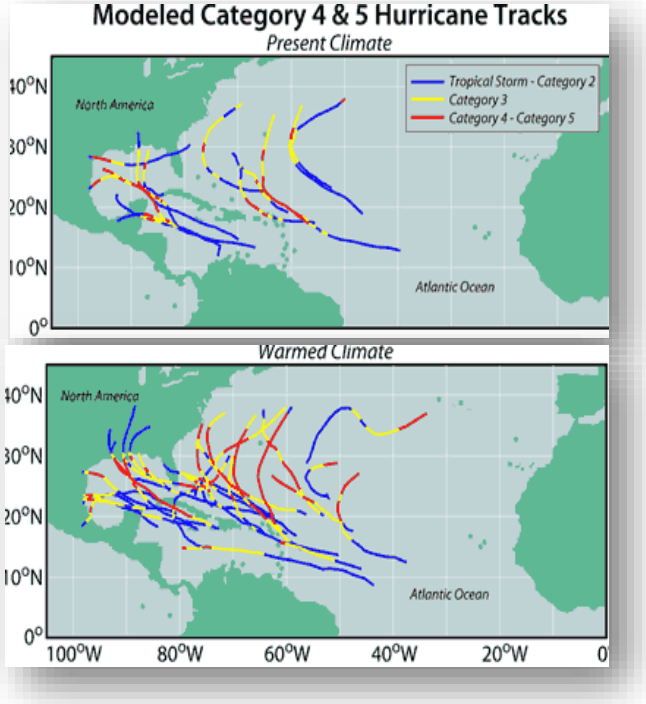
Taylor et al (2013)

Our climate will continue to change…

1

2

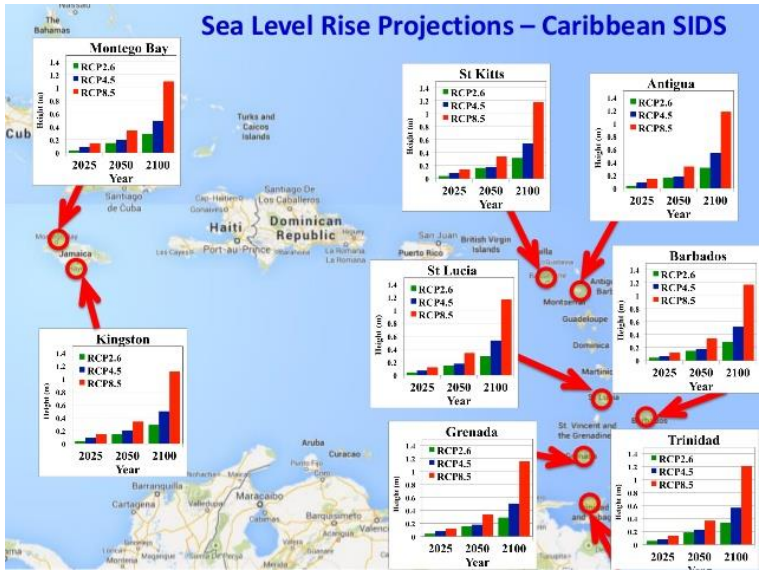
…more intense extremes



Storms, with higher rainfall rates and stronger winds.

Bender et al. (2010)

…even higher sea levels



Nurse (2015)

Impacts of 2 m SLR on Antigua
Land area lost (5%). People displaced (6%). Damage or loss to power plants (50%) Tourism resorts damaged or lost (18%). Loss or damage of airports (100%). Loss of roads (6%). Loss or damage to port structures (100%)

- CARICOM & UNDP (2010)

Our climate will continue to change…

1

2

The future Caribbean climate will look a lot different!

Already	1 degrees hotter	Variable	More extremes	3.5 mm per year
				
To Come	Up to 4 degrees hotter	Variable + up to 30% drier	More intense extremes	1-2 m sea level rise

We will see '**unprecedented**' climate change

Our climate will continue to change…

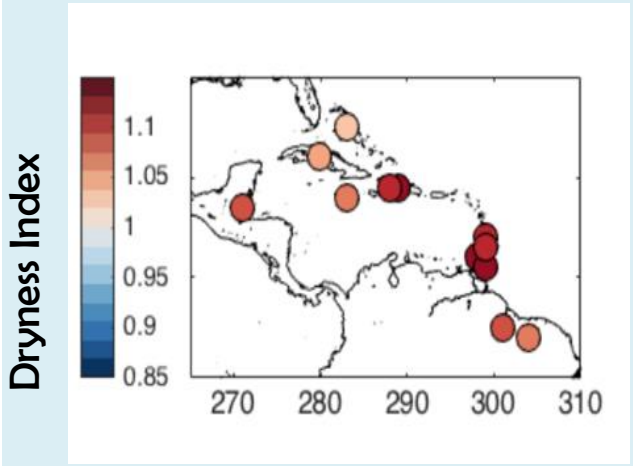
1

2

Unprecedented climate = unprecedented impacts!

Our climate will continue to change…

1

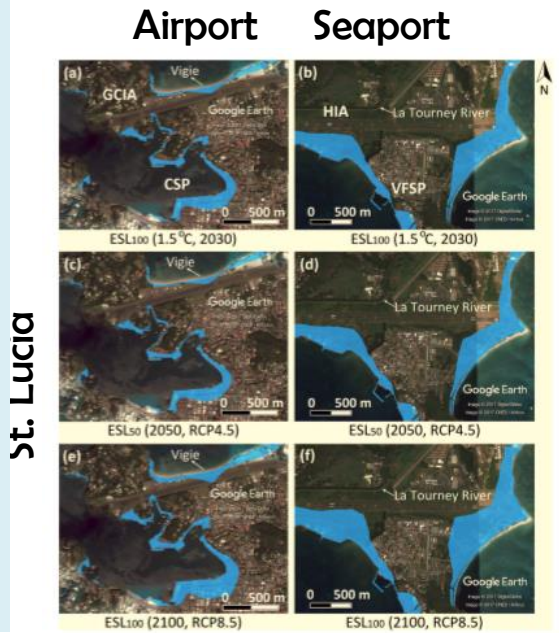


Karnauskas et al. (2018)

Water

2

We are heading towards a water deficit.
Challenge to deliver safe & adequate water to all.



Monioudi et al. (2018)

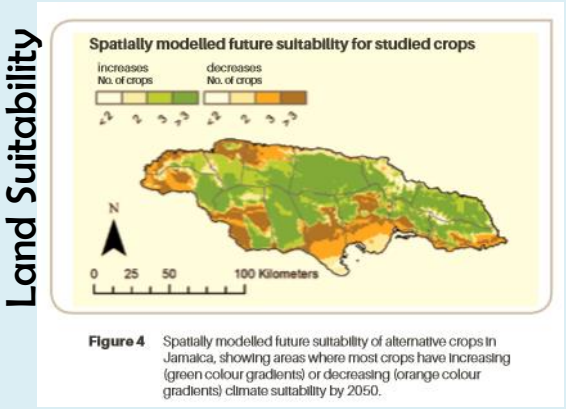
Coastal infrastructure & livelihoods

Caribbean coastal infrastructure will be under increasing threat from higher sea levels, more intense storms and coastal erosion. **Challenge to defend coastal assets and livelihoods they support.**

Health

Ebi et al. (2018)

Increasing risk from high ambient temperatures, undernutrition, vector borne diseases, storm related injury and death.
Challenge to deliver adequate health care in an already over-burdened system.



Food Security

Competition for suitable land areas for agriculture especially in potentially harsher climate. **Challenge of food security & nutrition.**

Eitzinger et al. (2015)

Our climate will continue to change…

1

2

Threatened development goals

Our climate will continue to change…

1

Continued climate change will introduce the challenge of the ‘unprecedented’

2

There will be significant impacts on the things that determine quality of life in small island states.’

Challenge of how to contend with the unfamiliar now while preparing for the unprecedented to come.

Our climate will continue to change…

1. Our climate has changed → Challenge of the Unfamiliar → Development Pillars are becoming ‘Unreliable’

2. Our climate will continue to change → Challenge of the Unprecedented → Development Goals are becoming ‘Unattainable’

Our climate demands change…

1

Attitude to climate

"…not a distant problem. It is a now issue."

2

Approach climate

" …not something to be responded to, it is something to plan for from now"

3

Act with respect to climate

" …not small efforts but targeted and transformative actions for the now and the future"

Adaptation

'…changing in order that we and others can live with the changed climate'

Challenge of Urgency

Our climate demands change…

1

Mitigation

‘…changing so we reduce the amount of greenhouse gases we put in the atmosphere’

+

Adaptation

‘…changing in order that we and others can live with the changed climate’

2

3

2017’s lesson

“We have to rethink the standards, norms and bases we are using when factoring in climate change in adaptation planning.”

Our climate demands change…

1

Mitigation

‘…changing so we reduce the amount of greenhouse gases we put in the atmosphere’

2

2017’s lesson

“We have to push for greater mitigation regionally and globally (1.5 to stay alive) to offset the worst future possible.”

3

Adaptation

‘…changing in order that we and others can live with the changed climate’

2017’s lesson

“We have to rethink the standards, norms and bases we are using when factoring in climate change in adaptation planning.”

Education

‘…climate smart citizenry’

Conscious, convinced & convicted about the issue

Our climate demands change…

1

Mitigation

'…changing so we reduce the amount of greenhouse gases we put in the atmosphere'

2

2017's lesson

"We have to push for greater mitigation regionally and globally (1.5 to stay alive) to offset the worst future possible."

3

Adaptation

'…changing in order that we and others can live with the changed climate'

2017's lesson

"We have to rethink the standards, norms and bases we are using when factoring in climate change in adaptation planning."

Education

'…climate smart citizenry'

2017's lesson

"We all need to be aware of the magnitude and scope of climate change's impact on us as small island dwellers and use that knowledge to drive action for the common good"

Resilience

Our climate demands change…

1. Our climate has changed → Challenge of the Unfamiliar → Development Pillars are becoming ‘Unreliable’

2. Our climate will continue to change → Challenge of the Unprecedented → Development Goals are becoming ‘Unattainable’

3. Our climate demands change → Challenge of Urgency → Development Agenda will be ‘Untouchable’

small islands & BIG development agendas

Climate Matters!

Thank You

GOVERNOR'S SYMPOSIUM

2018

GOVERNOR'S SYMPOSIUM

Keynote address: Dr. Kenrick Leslie

THE GOVERNOR'S ANNUAL SYMPOSIUM 2018

CLIMATE CHANGE AND SMALL ISLAND STATES – CALL FOR STRATEGIC ACTION

KEYNOTE ADDRESS
BY
KENRICK R. LESLIE PHD, CBE

Your Excellency E. B. Holiday other Distinguished Guests, Members of the Diplomatic Corps, representatives of the Media, Ladies and Gentlemen.

I feel it is a distinguished honour and a pleasure to address you today. I also feel this Conference is timely. I plan on speaking on the challenges posed by Climate Change on Small Island States and propose a call for strategic action.

I would like us to be mindful of two well-known quotations which apply directly to the topic at hand during our deliberations:

"Those who cannot remember the past are condemned to repeat it."

and,

"Failing to plan is planning to fail".

What makes our small island states so attractive to visitors on the one hand and yet so vulnerable on the other hand to the natural forces of nature? I seek to provide some perspective on these issues below.

The Caribbean Sea is a lake-like body of water which is approximately 2.8 million km² (1 million square miles). Its latitude band and the lake-like configuration cause its average water temperature to be **around 27°C (80°F)** generally, but during the summer months to as high as 31°C. The formation of tropical storms requires a sea temperature of at least 26.5°C. The warmth of the Caribbean Sea attracts tourists to the Caribbean. However, that same warmth is also ideal for fomenting tropical storms developing and for maintaining their intensity once formed.

The Caribbean is comprised of 26 island countries with an estimated population of 47 million people and some 70 percent live in coastal cities, towns, and villages. Of the total, approximately 38 percent of the population can be classified as poor.

The economy of most of the islands in the Caribbean is dominated by tourism, marine activities, and specialized agriculture. Most economies have failed to keep pace with population growth. This is further exacerbated by the challenges of globalization and loss of traditional preferential markets.

The very natural environment that makes the region so alluring also contributes to its vulnerability. The region is susceptible to six months of hurricane activity, significant climate variability, and several active volcanoes, both on land and underwater, and significant seismic activity.

Vulnerability is also increased through our own practices, such as poor land use management, poor marine practices, and damage to the natural ecosystem. Climate change compounds these problems.

Scientific research and observations confirm that:

1. As a consequence of the warming climate, the frequency of extreme weather events, climate variability has increased significantly.
2. Globally the average number of hurricanes occurring annually remains about the same, but the number of intense hurricanes being of categories three and higher have increased.
3. Hurricanes are forming at lower latitudes and further to the east of the Lesser Antilles. This is a new phenomenon being experienced.
4. Another unusual factor is the very rapid rate of development of hurricanes from a tropical depression to that of a category five in less than twenty-four hours.

These new observed factors correlate well with the warmer sea temperatures scientists have been reporting. Scientific measurements have shown that the ocean temperatures are much higher and extend to deeper depths. This means that stored energy in the oceans is much greater, and available for supporting the rapid development of more intense hurricanes and other extreme weather events. The lower atmosphere has also shown this warming trend. This means it can support much higher water vapour content which in turn supports higher rates of precipitation. The inevitable results then are flash floods and landslides.

The extreme weather events on Christmas Eve 2013 which devastated Saint Vincent and the Grenadines, Saint Lucia and Dominica, the destruction and loss of lives caused by tropical storm Erika in Dominica in 2015, and the devastation caused by Hurricanes Irma and Maria over so many islands are harbingers of the types of extreme weather conditions we can expect in the Caribbean. Economic gains achieved over a number of years can often be destroyed by events such as those

in a few hours with recovery requiring decades. As a result, some Small Island Developing States could be in a perpetual cycle of recovery. Grenada, for example, has still not fully recovered from Hurricane Ivan which occurred in 2004. Sint Maarten has had three major hurricanes in less than six decades: Donna in 1960, Luis in 1995 and Irma just last year. The other islands of the Caribbean have suffered from the same experience. After each event, plans to develop resiliency are proposed, but never fully implemented. That leads to a high level of unpreparedness for the following disaster, year after year.

The higher temperatures observed in the oceans also spell disaster for the reefs and marine life in the Caribbean area.

Significant bleaching of coral reefs was first observed during the 1970s. By 1998 coral reefs around the world were being affected by the most extensive and severe bleaching and subsequent mortality in modern record. During that year, sea surface temperatures in the tropics were the highest, topping off a fifty year trend in tropical oceans. It is projected that the repercussions of the 1998 mass bleaching and mortality events will continue to be far reaching in time and space. Scientific studies continue to confirm this projection.

The conditions continue to grow worse and so vulnerability increases. The oceans absorb a substantial proportion of the CO_2 emitted into the atmosphere by human activities. When CO_2 dissolves in seawater, the water becomes more acidic and thus not good. The acidity of the oceans has increased by 26 percent since the 1850's, a rate of change roughly 10 times faster than any time during the last 55 million years. As a consequence, the associated chemical reactions make it difficult for marine calcifying organisms, such as coral, crustaceans and some plankton to form shells and skeletons, so existing shells become vulnerable to dissolution. The impacts of acidification will extend up the food chain to affect economic activities such as fisheries, aquaculture,

and tourism. Wherever there are marine calcifying organisms, there are risks from ocean acidification.

Sea-level rise has begun to introduce another set of problems. New measures will have to be put in place to treat the salt water contamination of aquifers, the destruction of coastal habitats, both for plants and many forms of wild life, damage to coastal infrastructure, and beach erosion.

The existential threat of these phenomena to the SIDS is a result of the excessive emission of greenhouse gases (GHGs) into the atmosphere, primarily by the industrialized and larger developing countries. Any mitigation efforts must, therefore, originate in those countries since SIDS emit less than 0.05% of the global GHGs.

Let me now turn to another aspect of my presentation. The old adage "Whilst the grass is growing the cow is starving" seems most apt to describe the slow pace of action by the international community in addressing Climate Change and its effects.

It will be recalled that negotiations on action to address Climate Change originated at the United Nations Conference on Sustainable Development (UNCED) convened in Rio de Janeiro, Brazil in June 1992. Developed countries began reducing their emissions in 2008 as a result of the Kyoto Protocol. However, emissions in the larger developing countries continue to rise. Thus offsetting any gained from the developed countries reduction in their GHS emission under the Kyoto Protocol. It was not until the Paris Agreement in 2015 that the first significant decision was made. ALL countries agreed to reduce their emissions. The Agreement was signed and ratified by 190 countries. The Paris Agreement came into effect in October 2016, but less than a year later one of the world's major GHG emitting countries withdrew from the Agreement.

Under the Agreement countries voluntarily agree to reduce GHG emissions so as to limit the global rise in temperature to below 2°C which is above the pre-industrial level. Any rise above 1.5°C is an existential threat to the sustainability and survival of all SIDS. The majority of climate scientists believe that the first commitment under the Paris Agreement did not go far enough and will result in temperature rise in excess of 3°C.

A recent study by climate modelers from the University of the West Indies and the Cuban Institute of Meteorology highlight the difference in impact that would be experienced between a 1.5°C and a 2°C rise in temperature. The study reveals that in the present Business As Usual (BAU) scenario the 1.5 degree target should be reached by the mid 2020s. The study also reveals that the region would face devastating and unprecedented risks should the warming reach 2 or 2.5 degrees. We are reminded that on our present track, global temperatures will rise by about 3.0 degrees or more by the end of the current century.

To say that the impacts we would face could be devastating is an understatement. To say that we can begin to experience the unprecedented changes in the next decade or two is cause for much concern or alarm

Your Excellency, ladies and gentlemen, if SIDS are to reduce the impacts of Climate Change, Sea Level Rise, and Ocean Acidification, **then adaptation is the only option.** This fact has long been recognized, but there has also been a consciousness that economies of the SIDS cannot support the entire cost of adaptation.

Under the United Nations Framework Convention on Climate Change the Green Climate Fund (GCF) was established to assist developing countries, and in particular SIDS, in implementing adaptation and

mitigation practices which would counter some of the negative effects of Climate Change. The financing of the Fund is expected to be donated from the developed nations for distribution to the developing countries. Such financing should help offset the cost of mitigation and adaptation to the effects of Climate Change. Unfortunately, the level of financing to the fund, so far, has not been meeting the level of commitment by the developed countries. SIDS, therefore, cannot rely solely on the GCF or other bilateral donations to meet their adaptation needs in a timely manner. SIDS, should therefore, consider using some of their own limited resources for initiating its adaptation programmes.

It is essential that development programs include the possible impacts of Climate Change on the long-term sustainability of the programs. That would allow the SIDS to chart a resilience-building pathway for their development. Such could only be achieved through good policy development, which is perhaps one of the most cost effective and transformative approaches to Climate Change action.

I will now share two excellent examples of adaptation initiatives which were developed and implemented by Caribbean SIDS using their resources.

The first is the Bermuda Energy and Climate Change Resilience Program.
The program is supposed to contribute to overall reduction of destruction because of preventative measures put in place as mitigation measures. Additionally, the program would, as a result, reduce recovery time after an event. Unconventional but practical measures include:

i. Placing 100% of the transmission cables underground
ii. Locating 50% of the distribution cables underground with plans for 100% placement

iii. Designing street light poles to withstand category 5 hurricanes
iv. Adapting building codes to be Climate Change resilient
v. Designing roofs for water harvesting
vi. Encouraging solar generating power
vii. Using mobile electric units powered by renewable energy
viii. Protecting the command and control Centre from storms and floods
ix. Storm proofing schools that can operate during and after a storm without experiencing power and water outage

The second is the establishment of an Adaptation Trust Fund by the British Virgin Islands.

The concept of the Fund originated on the sidelines of the 15th Conference of Parties of the United Nations Framework Convention on Climate Change (UNFCCC) in Copenhagen in 2009. COP15 was a turning point in the life of the Convention and for the British Virgin Islands. It was then that the BVI resolved to directly tackle the unique position it found itself in, as a Small Island Developing State, and, at the same time as an Overseas Territory of the United Kingdom. While facing the same urgent and severe impacts from Climate Change, due to its political status, the BVI is currently barred from accessing the major global sources of climate finance and other forms of assistance available under the UNFCCC, and unfortunately does not receive any sustainable climate financing directly from the United Kingdom. They must, then, be creative and resourceful in order to meet their Climate Change challenges.

The Adaptation Trust Fund envisions the sourcing of climate finance from a number of entities, including already instituted local levies, bi-lateral support, private donations, support from foundations, market-based mechanisms and, hopefully, international funds.

Such are the types of measures that the Centre has encouraged and promoted across the Caribbean. Further, to assist our Members in recognizing their vulnerability and developing appropriate adaptation measures in reducing the vulnerabilities, the Centre has developed region-specific tools. The two most advanced are – the Caribbean Climate Online Risk and Adaptation Tool (CCORAL) and an Airborne LiDAR.

Climate risk management is important in the decision-making processes of Governments. As a response, the Centre developed an online, freely accessible tool on its website, CCORAL to aid decision makers to see all kinds of activities through a 'Climate' or 'Climate Change' lens. The tool identifies actions that can minimize climate-related loss. Additionally, it suggests how governments and the private sector can take advantage of opportunities and build climate resilient development in their countries.

Engendering a risk management ethic in decision making, CCORAL takes a pragmatic approach, promoting the right tools and techniques to fit the context of Caribbean decision making.

By using CCORAL, decision makers are able to demonstrate to financial intermediaries (banks and insurance companies), investors and development partners that climate resilience has been considered and integrated into relevant activities.

Both Grenada and Saint Kitts and Nevis have adopted CCORAL as a mandatory tool for the screening of projects in the water sector and for use by their Public Sector Investment Programme, respectively.

Key to sustainable development is effective environmental management. Safeguarding the coastal zone is essential for the development of the countries.

It is well-known that the resources of the coastal zone (marine and terrestrial) are the main contributors to most of the SIDS economies and support much of their livelihoods. The contribution from tourism and the fishing industries are substantial. Tourism, for instance, contributes in excess of US$30 billion to the GDP. The fishing industry provides in excess of 300,000 jobs. The preservation of the natural environment supporting these industries is, therefore, essential for maintaining their sustainability. For this to happen it is important that the state of the coastal environment be protected, accurately assessed and documented.

With the support of the Governments of the United States of America, Italy and the Caribbean Development Bank, the Centre has acquired an Airborne LiDAR. It has the capacity to accurately assess and provide the required information which can assist in informed coastal management decision-making across the region. Under the program, the first surveys will be conducted over the CARICOM Member States. The service will also be available to all other Caribbean SIDS at an affordable cost.

The program will provide extensive, high-resolution coastal bathymetric and topographic data needed to improve coastal/marine zone management by providing:-

i. vulnerability risk maps for proper land use planning and management,
ii. improvement in navigational charts,
iii. improved coral reef monitoring and
iv. critical inputs needed for assessing the impacts of sea level rise, storm surge, flooding projections, and beach erosion.

Products from the surveys will significantly advance the early development of appropriate adaptive strategies, as well as help

determine:

i. Revenue derived from the various coastal zone environmental and eco-system assets
ii. The projection of changes in revenue due to changes in environmental and eco-system assets (beach erosion, salt water intrusion in costal habitats, acidification, etc) resulting from the impacts of Climate Change and sea level rise.
iii. Cost benefit analysis for the implementation of the adaptive measures

Resources will be needed to implement any SIDS adaptation initiatives. Depending on the initiative the resource needed could come from local resources, grant-aid financing, or from a combination of grant and concessional low interest loans.

The Centre is mandated to assist members of the Caribbean Community to meet the costs of their adaptation. And, we routinely implement projects along with the national governments in a variety of areas. For instance, with the support of the Government of Italy, the Centre is supporting projects in five Eastern Caribbean countries. The projects range from an Electric School Bus and Renewable Energy Charging System to PV powered- Salt Water Reverse Osmosis systems.

A project was implemented, *Enhancing the Capacity for Adaptation to Climate Change in the UK Caribbean* for the Overseas Territories of Anguilla, BVI, Cayman Islands, Montserrat and Turks and Caicos. The intent was to establish national Climate Change committees, support public education programs and conduct vulnerability and Climate Change assessments and the development of policy documents, from 2007 to 2011.

Initiatives like those can be duplicated across the region through financing windows such as the European Development Fund where your domestic agencies can access resources to support your Climate Change adaptation and mitigation measures.

Although the Centre is mandated to support CARICOM Member States, we have never limited our support to those 14 countries, and we remain ready to work with all Caribbean SIDS in the development of appropriate adaptation strategies, implementation programmes and the sourcing of funds to support such activities.

Earlier in my presentation I mentioned to the use of renewable energy as one of the measures in the Bermuda programme for resilience-building. The use of renewable energy is not just for resilience-building, but also an important factor, if sustainable development is to be achieved.

Small Island Developing States have been designated as the most energy intensive countries in the world. This means for each unit of GDP they generate the input of energy required is extremely high. That translates into their services; manufacturing and other productive sectors being rendered uncompetitive in the global market. As a result costs for domestic use of energy are high. It is imperative that change be encouraged from a fossil fuel-based economy to one that takes advantage of the exploitation of the abundant indigenous renewable energy sources – solar, wind, geothermal, Ocean Thermal Energy Conversion (OTEC), tidal – as we plan to build resilience across the region.

Aruba is doing just that. In a 2011 document titled "The Green Gateway," the Government of Aruba presented its plan for economic development, which included promoting clean energy. In 2012, during the Rio +20 United Nations Conference on Sustainable Development,

the country announced its 100% renewable energy use by a 2020 goal. It may be useful if other SIDS look at the Aruba renewable energy policy for possible adoption.

Finally, I will now briefly address the issue of infrastructure, in general. I will discuss five critical areas. The areas include transportation, housing, communication, water, and hospital.

If properly addressed through the implementation of appropriate policies, damage can be minimized and recovery time relatively shortened following the passage of an extreme weather event.

The importance of transportation to SIDS is only now being addressed by the international community. An announcement from COP22 in 2016 was the Declaration on Adaptation in Transport from the Paris Process on Mobility and Climate Change (PPMC). It identified the urgent need to integrate adaptation and disaster risk management in transport planning and deployment. However, a funding source to support such program is still to be identified. Notwithstanding, in the meantime, it is possible to significantly reduce the recovery cost to transportation infrastructure and its impacts on the economy and the population. For instance, resilient transport policies alone could decrease the impact of natural disasters on population well-being by 13 to 25% in small island countries. To achieve this, a new strategic approach to investments in transport asset management must be adopted. It must factor in climate change and disaster risks, such as:

i. the placement of transport infrastructure away from high risk locations
ii. physical protection against hazards
iii. application of innovative materials and construction designs
iv. infrastructure maintenance

I now move to buildings which are long-term investments—they last for generations. Therefore, it's important to make the right choices during construction. Building codes can help ensure high-quality buildings. Such well constructed buildings are some of the most affordable policy tools that decision-makers can use when attempting to reduce a country's tropical cyclone vulnerability. But the codes mean nothing if they are not enforced. Strict building codes enforcement plays a major role in reducing a region's building vulnerability.

Communication immediately after a natural disaster is usually disrupted as a result of the loss of power, down landline, tower loss and other technical difficulties. Even though we live in an extremely technological age, an alternative communication system during disaster is an absolute necessity. Decision-makers should ensure that a permanent emergency communication system (ECS) is always operational. There are many ECS that are available including satellite-based communication systems.

The water situation can be addressed using the Bermuda home model and the use of desalinization plants that are powered by renewable energy. The Centre has piloted this type of system which is currently being replicated in a number of islands.

Finally hospitals,

The Caribbean region is prone to a wide variety of natural hazards and at risk from the impact of climate change. The safety of health facilities at risk should be of primary concern during disasters. Structural damage to such facilities leaves a void in during the recovery phase after a disaster.

We need to be mindful that health care facilities are also leading consumers of energy, with a large environmental footprint.

The Pan American Health Organization (PAHO) has developed a concept known as a "Smart Hospital". Health care facilities are 'smart' when they link their structural and operational safety with green interventions, at a reasonable cost-to-benefit ratio. PAHO provides a Toolkit that offers a variety of instruments, including the Hospital Safety Index, which many countries are currently using to help ensure that new or existing health facilities are disaster-resilient; a Baseline Assessment Tool to collect reliable information on the building's performance and operations and how it measures up against current code, regulatory requirements and zoning regulations. There is also a Green Checklist that outlines feasible areas in which to introduce "smart" measures.

A retrofitted Smart Hospital would be able to function after the passage of a hurricane since it would have its own renewable energy supply and potable water, two critical operational elements.

After all the afore-mentioned information I need to draw your attention to how important the role of education can be in developing an awareness about Climate Change. Despite the very real threat Climate Change poses to human health and habitats, the level of public awareness and concern varies greatly. According to a study published in *Nature Climate Change,* education is the strongest predictor of the level of Climate Change awareness. The study suggests that improvements in basic education, climate literacy, and understanding how Climate Change affects local temperatures are key factors in increasing public support in limiting the devastation that elements of Climate Change can cause. Knowing that Climate change is real is not quite the same as recognizing the extent to which it will affect human beings as time passes. It is of utmost importance that the populace realize how Climate Change will affect life, property, and the very survival or existence of man.

Governments and other entities can plan and implement well-defined policies, but if communities are not aware of the reasons and purposes of such, they cannot be as effective as they could be.
The communities can contribute to reducing the damages and so lessen the recovery time by doing what they independently can. They can, for example, improve construction of homes, retrofitting existing homes, consider water harvesting and even invest in utilizing some form of renewable energy.

It is important, then, that the subject of Climate Change be included in all educational curricula. A Climate Change educated populace will positively impact the successful implementation of Climate Change Adaptation Policies.

In conclusion, Your Excellency, Distinguished Guests, Ladies and Gentlemen. I have attempted to highlight some of the factors making the Caribbean SIDS a most vulnerable region to the projected impacts of global warming and sea level rise. I have also highlighted that adaptation to the impacts of Climate Change and sea-level rise is imperative. I have also indicated that our Governments should be more proactive in addressing the possible impacts as has been done in the case of Bermuda, Aruba, and the British Virgin Islands.

Finally, the Caribbean Community Climate Change Centre stands ready to work with all SIDS in planning their Climate Change adaptation initiatives.

Thank you

Summary/outcome of Roundtable discussions

Summary of the Round table discussion

- The eco-system plays a vital role in mitigating the effects of Climate Change. Sea reefs, coral reef, and mangroves reduce the energy and impact or surge of the waves in the inland areas. From an ecosystem perspective, sea life will be reduced considerably if they are not protected.

- The impact of Climate Change will affect "cultural heritage," specifically in the trades of fishermen and farmers whose traditional craft or occupations stand to be displaced in the wake of this phenomenon. There are also physical examples (following hurricanes Irma & Maria) that can serve as a means to adapt to Climate Change viz. small wooden structures that emerged unharmed due to their architectural traditional. From an educational perspective, the historical and adaptive actions surrounding the construction of the Simpson Bay bridge in the 19th century, which were the result of changing cultural and physical environments on the island following a hurricane. Finally, Government's urgent attention to make serious investments in the area of Climate Change. Reference was made to significant investments made in the 18th century surrounding the Freshwater and saltwater construction project.

- Other cultural impacts that are being threatened are the loss of traditional livelihood, traditional practices, and coastal infrastructure and livelihood.

- Historical assets (viz. building) and cultural traditions are all under threat because of a changing climate. Some cultures need to be revisited as they already possess their anthropological resilience. Water harvesting was also a tradition used to ensure continuous availability of water or reduced vulnerability of water scarcity.

- Making cultural cultivation of crops during more temperature resilient periods (Amerindians have been practicing these methods).

- How to respond in the past (historical occurrences) and how to react now (current events) is essential in the discussion of Climate Change.

- Greenhouse gasses being emitted from Landfill can be tackled through expertise and capacity building and hence further collaboration with other entities that will help to broaden the scope regarding mitigating these emissions are ongoing. Climate Change is already impacting St. Maarten and changes are inevitable.

- The country should consider commercial solutions by using renewable energy sources, which will help the economy of the country to reduce the cost of doing business; thus enabling the government to have access to more resources in adaptation activities. A prime solution is to implement a waste-to-energy conversion system that will generate energy as opposed to fossil fuel-based power that will ultimately reduce waste. The government should ensure that the proper policies are enacted to support these type of activities and entrepreneurship.

- As SIDs, we should never consider ourselves too small to effect change. Reference was made in this regard to the outcome and agreements made in the "Paris Agreement," which has mobilized the efforts of Climate Change tremendously. There is a need for vigilance and consistency in our collective message about "Climate Change".

- Coastal protection (assets, Tourism and the economy) regarding developing of "Delta Plan," a project that is being pushed by the Netherlands to protect the coastal lines will be a costly approach and a continuous investment because sea level will continue to rise. The solution needs to be re-engineered going forward.

- Many buildings have suffered from the onslaught of hurricanes Irma and Maria. Recommendations for resilient construction methods lies with the enforcement of building codes and allocation of adequate use of land by Government.

- On the issue of "under-insured and over-insured," which became a major concern following the hurricanes of 2017, property owners are being advised to provide an updated valuation of their property and use the replacement cost of value as the insured value. Underinsurance can have severe consequences for homeowners, especially on their earnings or finance. Policymakers must equally look into the level of risks in all areas, which will bring down the cost for the insurer.

- Constant volcanic activity globally contributes to Climate Change as they bring many aerosols in the stratosphere (ozone layer). Tropical volcanic eruptions also causes the global temperatures to be reduced temporarily; however, global warming continues nonetheless after these explosions have subsided.