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Sub-Commission for the Caribbean and Adjacent Regions

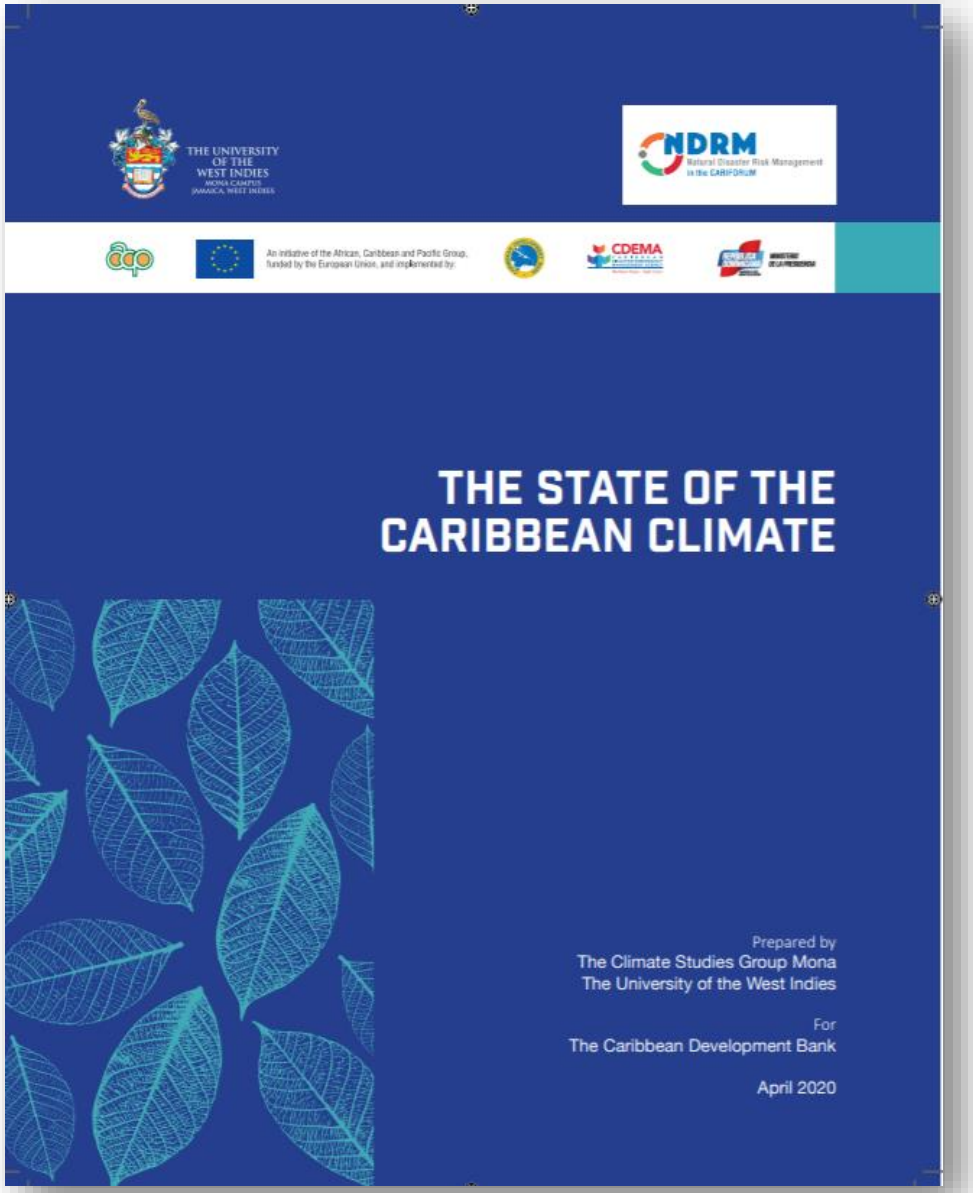
Subcomisión para el Caribe y Regiones Adyacentes

State of the Caribbean Climate

Michael A. Taylor

University of the West Indies, Mona

Brasilia, Brazil
April 23–25, 2025



Full science Report

11 Chapters
175 pages
56 Figures
47 Tables

31 Authors
3 Caribbean Institutions

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Caribbean Institute for Meteorology and Hydrology
CIMH

INSMET
Instituto de Meteorología

The Large Ocean Caribbean Island States

Some insights emerge about how climate is changing the context in which Caribbean life is occurring!

Extremely climate sensitive societies

- Daily life structured to take advantage of ambient conditions.

‘outdoor living’

Natural resource dependent

- Intimate relationship with oceans e.g. fisheries, tourism, shipping
- Climate sensitive economic & quality of life sectors agriculture, tourism and water, energy, health

Flat, low lying, mountainous

- Narrow coastal plains & hilly interior
- Limits where life can occur

Small, isolated & exposed

- In hurricane belt
- Small enough to be engulfed
- No where to run

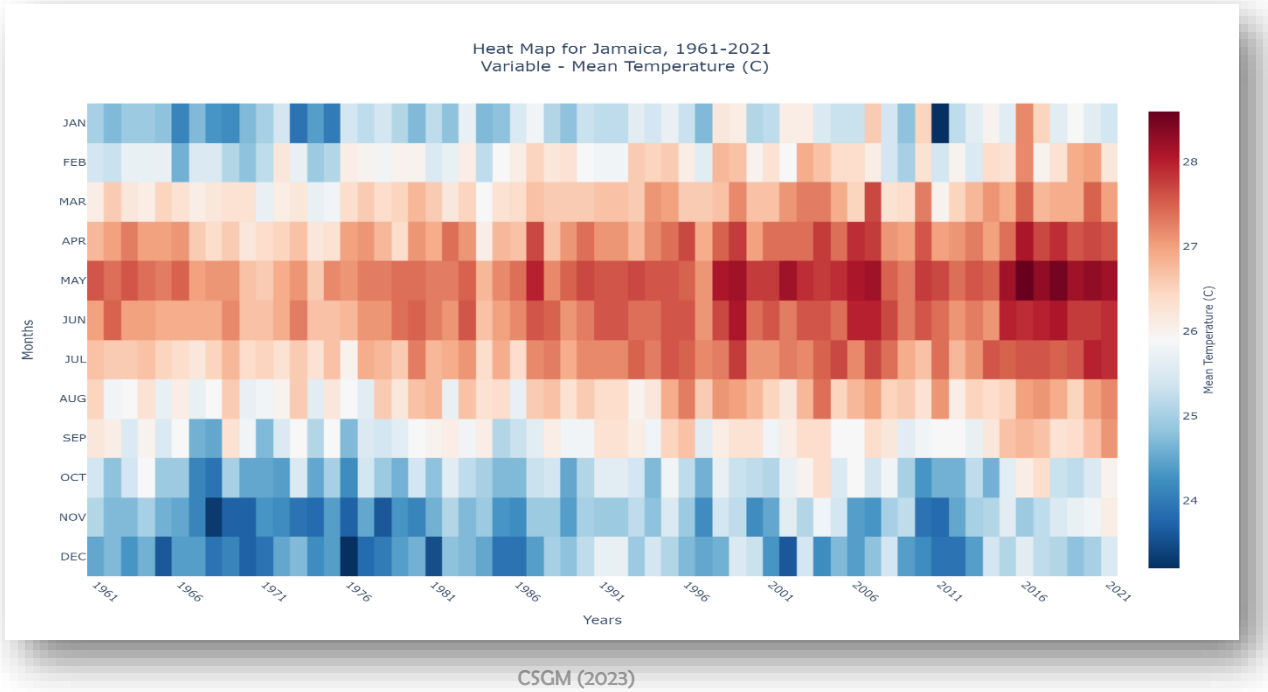
INSIGHTS

Caribbean is in an era marked by…

1

Multi-hazard climate Unpredictability

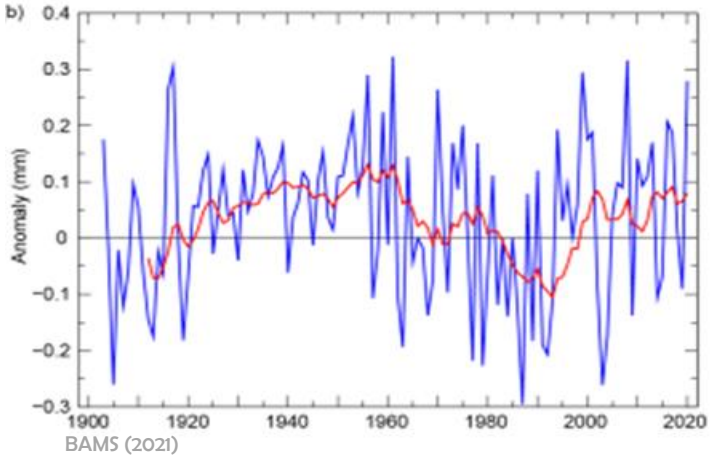
It's hotter



CSGM (2023)

- Temperature indices for the Caribbean are all increasing
- In mean just over 1 °C increase in last century
- ~23 more 'hot' days and nights i.e. earlier and longer summers
- Warming across land and ocean

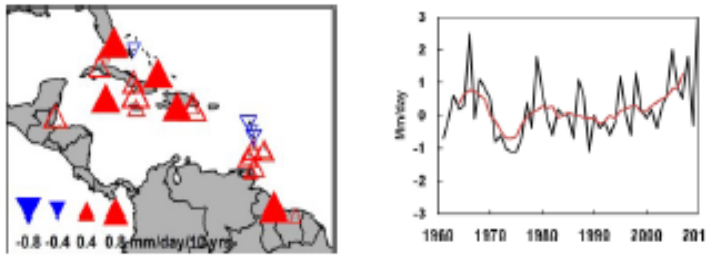
Rain is more variable



BAMS (2021)

Caribbean Rainfall

Intense Rainfall (SDII)



Stephenson et al (2014)

- Very variable rainfall pattern
- some places getting wetter, some getting drier
- 'nature' of rain is changing

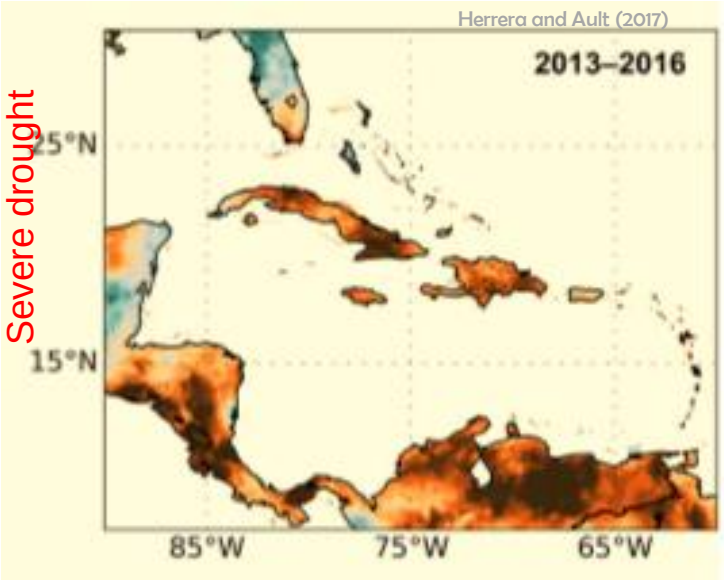
INSIGHTS

Caribbean is in an era marked by…

1

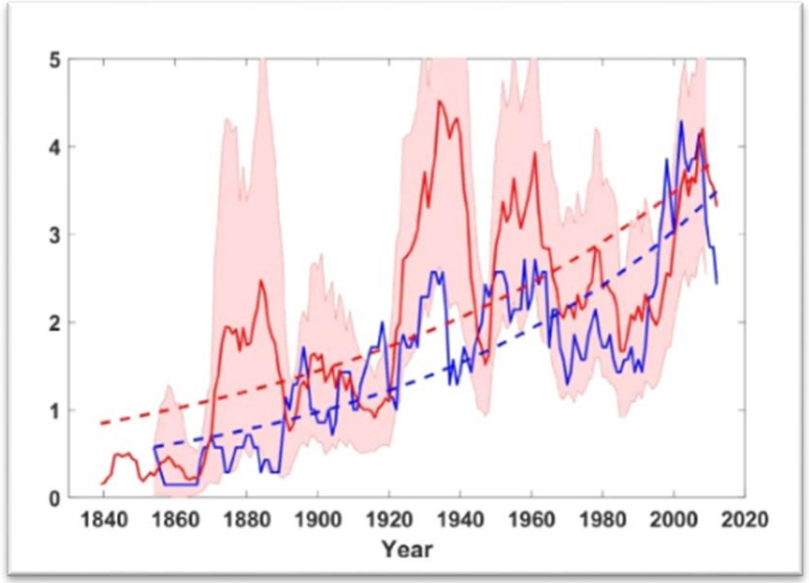
Multi-hazard climate Unpredictability

More extremes



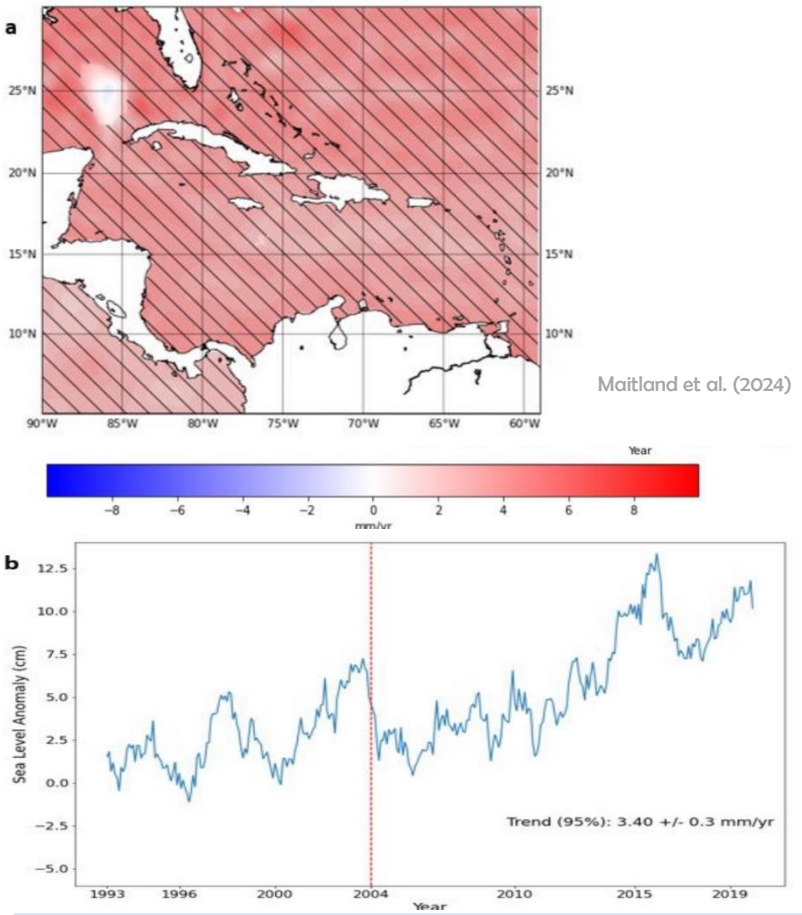
Two major region wide and mutli-year droughts in last 15 years (2009-10, 2013-16)

Atlantic hurricanes (1851-2014)



Rise in the number of the most intense hurricanes.

Higher Sea Levels



Maitland et al. (2024)

Sea levels 1.7 mm/yr (long term) or 3.5 mm/yr (post 1993) or 6.15 ± 0.5 mm/year (2004-2019), which is 67% faster than the most recent estimates of global mean sea-level rise.

INSIGHTS

Caribbean is in an era marked by…

1

Multi-hazard climate
Unpredictability

“Climate is changing the context within which Caribbean life occurs”

“…the emergence of a **multi-hazard** climate era marked by **unpredictability**”

More heat waves (days and nights; land and marine) and heat records.

Higher frequency of drought

Heavy rainfall events and flooding

More intense hurricanes

Higher sea levels and storm surge

INSIGHTS

Caribbean is in an era marked by…

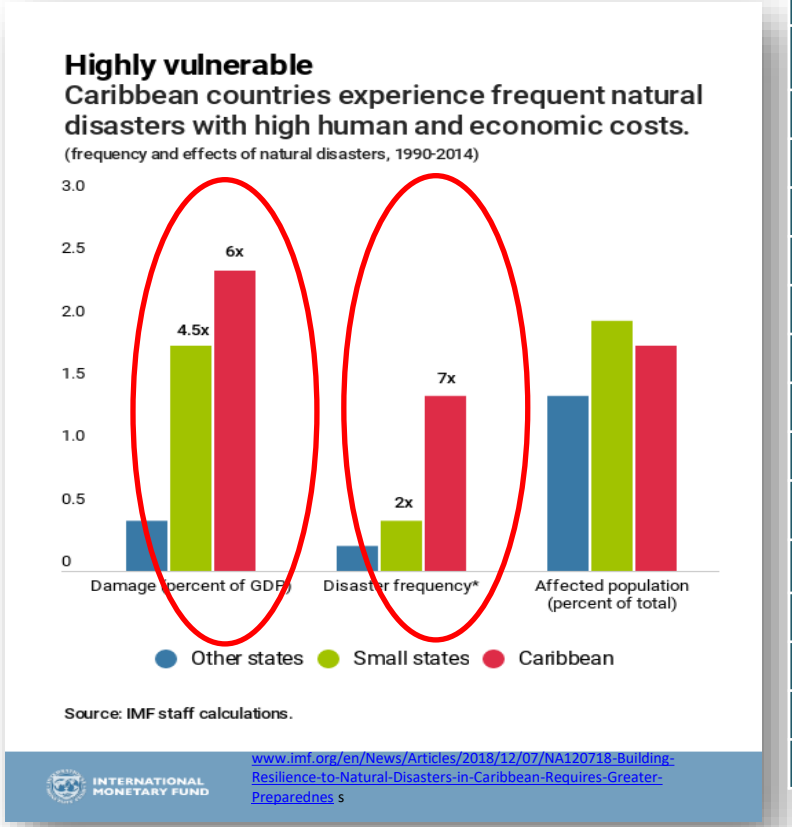
1

Multi-hazard climate
Unpredictability

"Climate is changing the context within which Caribbean life occurs"

Increasingly more
Unplanned Disruptions

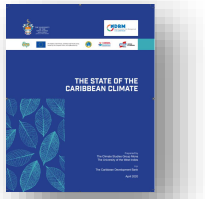
"…the emergence of a **multi-hazard** climate era marked by **unpredictability**"



JAMAICA EVENT	Year	Cat.	Cost ($JB)	GDP cost (%)
Drought	1999/ 2000	-	0.7	0.2
Hurricane Michelle	2001	4	2.5	0.7
May/June Flood Rains	2002	-	2.5	0.6
Hurricane Charley	2004	4	0.4	0.1
Hurricane Ivan	2004	3	36.9	6.8
Hurricanes Dennis & Emily	2005	4	6.0	1.0
Hurricane Wilma	2005	5	3.6	0.6
Drought*	2005		0.5	0.1
Hurricane Dean	2007	4	23.8	3.0
Tropical Storm Gustav	2008		15.5	1.8
Drought*	2008		0.04	-
Tropical Storm Nicole	2010		20.6	1.9
Hurricane Sandy	2012	2	9.9	0.8
Drought*	2014		0.9	0.1
March to June Flood Rains	2017		4.1	0.2
Tropical Storms Zeta and Eta	2020		6.7	n/a
Tropical Storm Elsa	2021		0.8	n/a
Heat	2023		??	??
Hurricane Beryl	2024	5	32.2	1.1
Total			160+ ?	

* Drought captures figures for Agriculture only. Source: Planning Institute of Jamaica

State of the Caribbean Climate



Insights

Caribbean is in an era characterized by

1. Multi-hazard climate Unpredictability

Implications

New Context for Caribbean life…

Increasingly more **Unplanned Disruptions**

Challenge

Development Interrupted

INSIGHTS

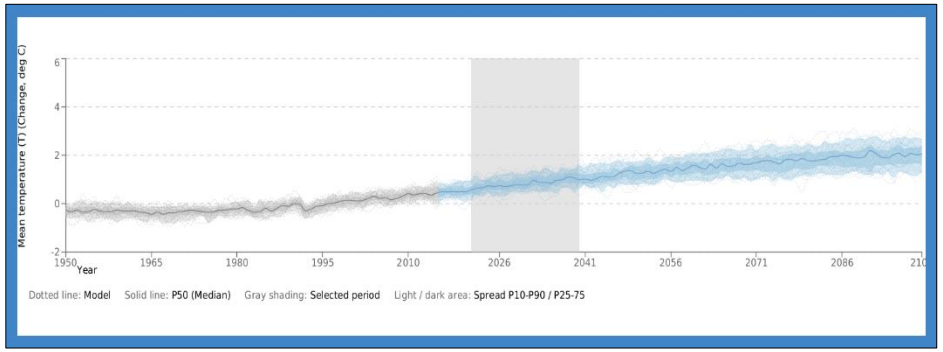
Caribbean is in an era marked by…

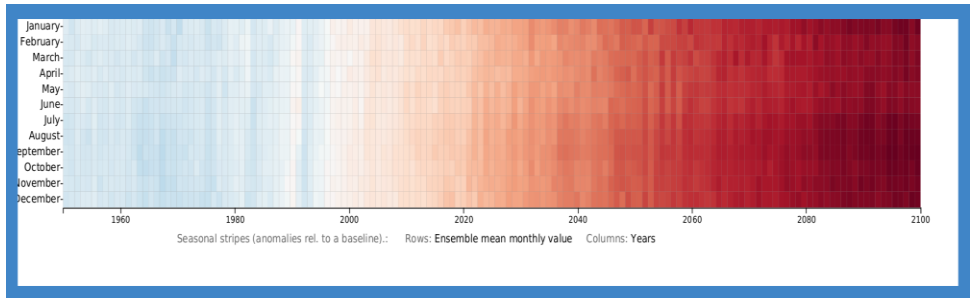
1 **Multi-hazard climate**
Unpredictability

2 **Multi-sector climate**
Undermining

Climate will continue to change

…even hotter times





Mean Temperature Change/°C relative to 1981-2010
(34 CMIP6 models)

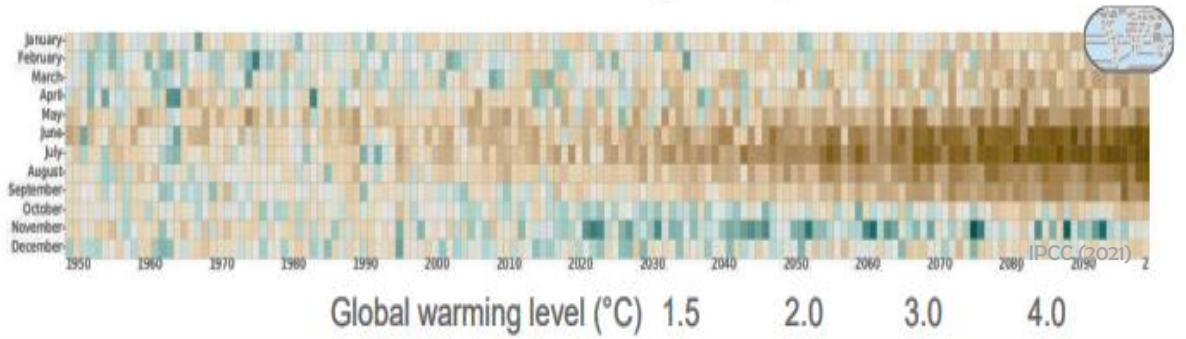
- Up to 2+ degrees by century's end
- 30-98% of days annually will be 'hot' by the 2090s
- Only 2% 'cool' by the 2080s

…even drier conditions

Caribbean (CAR)

- Declining trend in rainfall during June–July–August in CAR will continue in coming decades (*high confidence* at 2°C global warming and above).
- Higher evapotranspiration under a warming climate will result in increased aridity and more severe agricultural and ecological droughts in CAR (*medium confidence* at global warming level of 2°C and above).

Change in monthly average precipitation relative to 1995–2014 for the Caribbean under increasing warming levels



- Still variable but around a lower mean
- Up to about ~30% drier (more for some countries).
- Shorter rainy season

INSIGHTS

Caribbean is in an era marked by…

1 **Multi-hazard climate**
Unpredictability

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Undermining

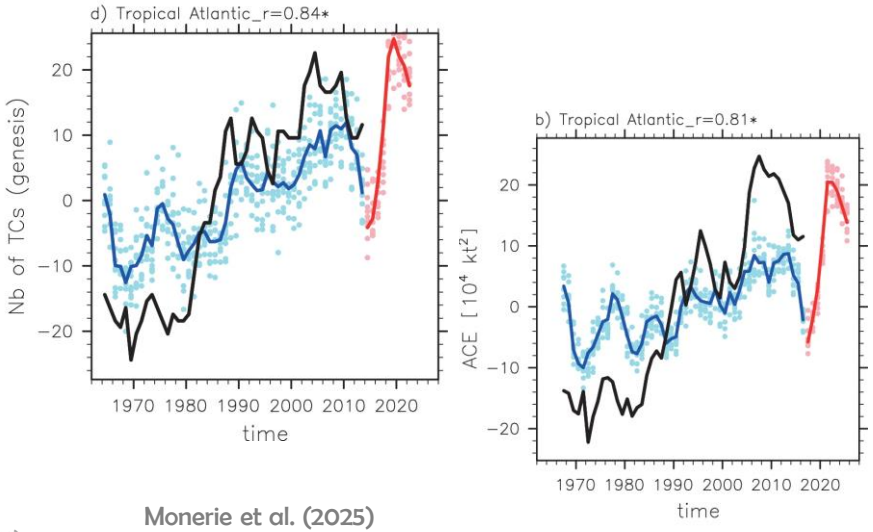
Climate will continue to change

…more intense extremes

	2030's	2060's	2090's
Moderate Drought	2	10	12
Extreme Drought	5	6	6
Severe Drought	10	10	16
TOTAL	**17%**	**26%**	**34%**

Taylor, Clarke, Centella et al. (2018)

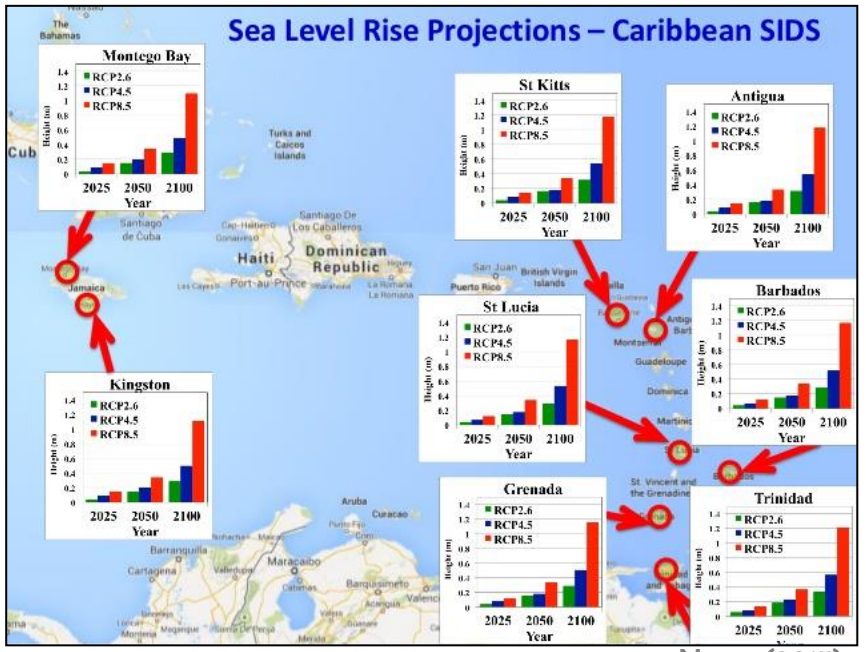
The relative occurrence (% of time sampled) per **DROUGHT** category.



Monerie et al. (2025)

An increase in the number and intensity of TCs over the tropical Atlantic Ocean in the next decade (2023–2030) due to warmer ocean surface temperatures and changed wind patterns.

…even higher sea levels



Nurse (2015)

Up to 1 m by century's end

INSIGHTS

Caribbean is in an era marked by…

1 **Multi-hazard climate**
Unpredictability

2 **Multi-sector climate**
Undermining

"…the entrenchment of the **unpredictable multi-hazard** climate era now marked by the **unprecedented**"

"Climate is changing the context within which Caribbean life occurs"

Climate will continue to change

Already	1 degree hotter	Variable	More extremes	3.5-6 mm per year
To Come	Up to 2+ degrees hotter	Variable + up to 30%+ drier	More intense extremes	> Up to m sea level rise

INSIGHTS

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Undermining

"…the entrenchment of the **unpredictable multi-hazard** climate era now marked by the **unprecedented**"

"Climate is changing the context within which Caribbean life occurs"

More Unreliable Determinants of Quality of Life

Threatened by climate change

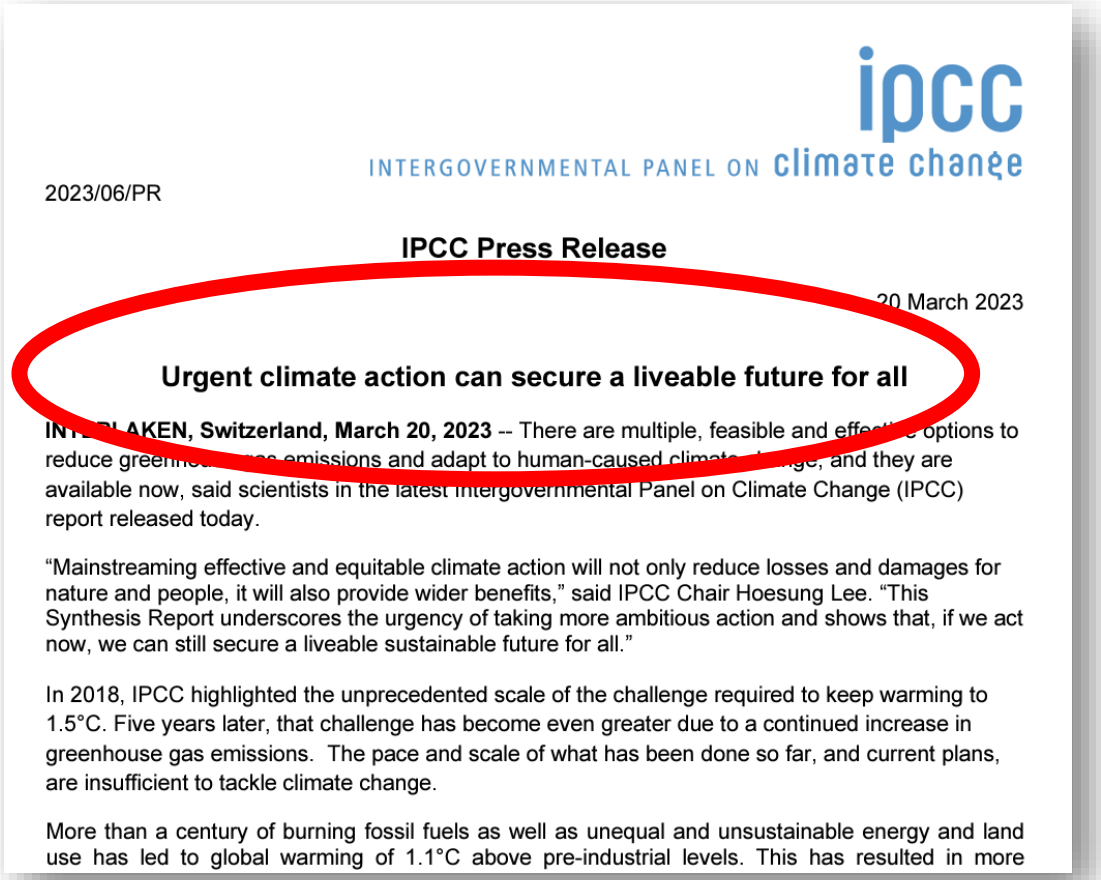
State of the Caribbean Climate

Insights	Implications	Challenge
Caribbean is in an era characterized by	***New Context for Caribbean life…***	
1 Multi-hazard climate Unpredictability	Increasingly more **Unplanned Disruptions**	Development Interrupted
2 Multi-sector climate Undermining	Increasingly more **Unreliable Determinants**	Development Delayed

INSIGHTS

Caribbean is in an era marked by…

1. Multi-hazard climate **Unpredictability**
2. Multi-sector climate **Undermining**
3. Multiplied climate **Urgency**



ipcc
INTERGOVERNMENTAL PANEL ON climate change

2023/06/PR

IPCC Press Release

20 March 2023

Urgent climate action can secure a liveable future for all

INTERLAKEN, Switzerland, March 20, 2023 -- There are multiple, feasible and effective options to reduce greenhouse gas emissions and adapt to human-caused climate change, and they are available now, said scientists in the latest Intergovernmental Panel on Climate Change (IPCC) report released today.

"Mainstreaming effective and equitable climate action will not only reduce losses and damages for nature and people, it will also provide wider benefits," said IPCC Chair Hoesung Lee. "This Synthesis Report underscores the urgency of taking more ambitious action and shows that, if we act now, we can still secure a liveable sustainable future for all."

In 2018, IPCC highlighted the unprecedented scale of the challenge required to keep warming to 1.5°C. Five years later, that challenge has become even greater due to a continued increase in greenhouse gas emissions. The pace and scale of what has been done so far, and current plans, are insufficient to tackle climate change.

More than a century of burning fossil fuels as well as unequal and unsustainable energy and land use has led to global warming of 1.1°C above pre-industrial levels. This has resulted in more

"We have seen some changes. We have seen some initiatives taken, but the problem is that the temperatures are moving faster than we are making changes. If that is the case we …have a bigger problem than we anticipated." -
PM Mia Mottley

"Climate is changing the context within which Caribbean life occurs"

More Unavoidable Decisions

INSIGHTS

Caribbean is in an era marked by…

1. Multi-hazard climate **Unpredictability**
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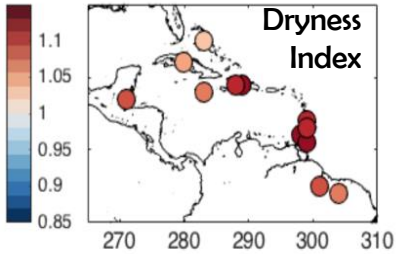
Caribbean climate science:

Even at 1.5ºC…

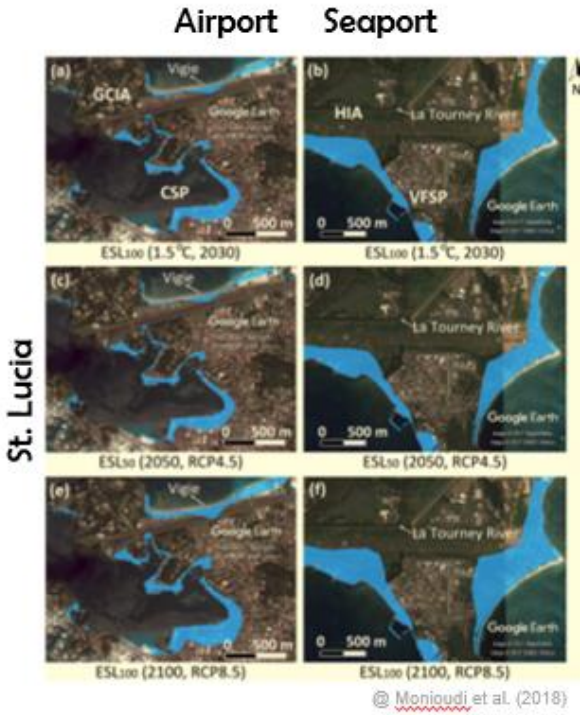
40% Less Hydropower potential (Suriname)

Regional Cost of damages 2-3 x higher

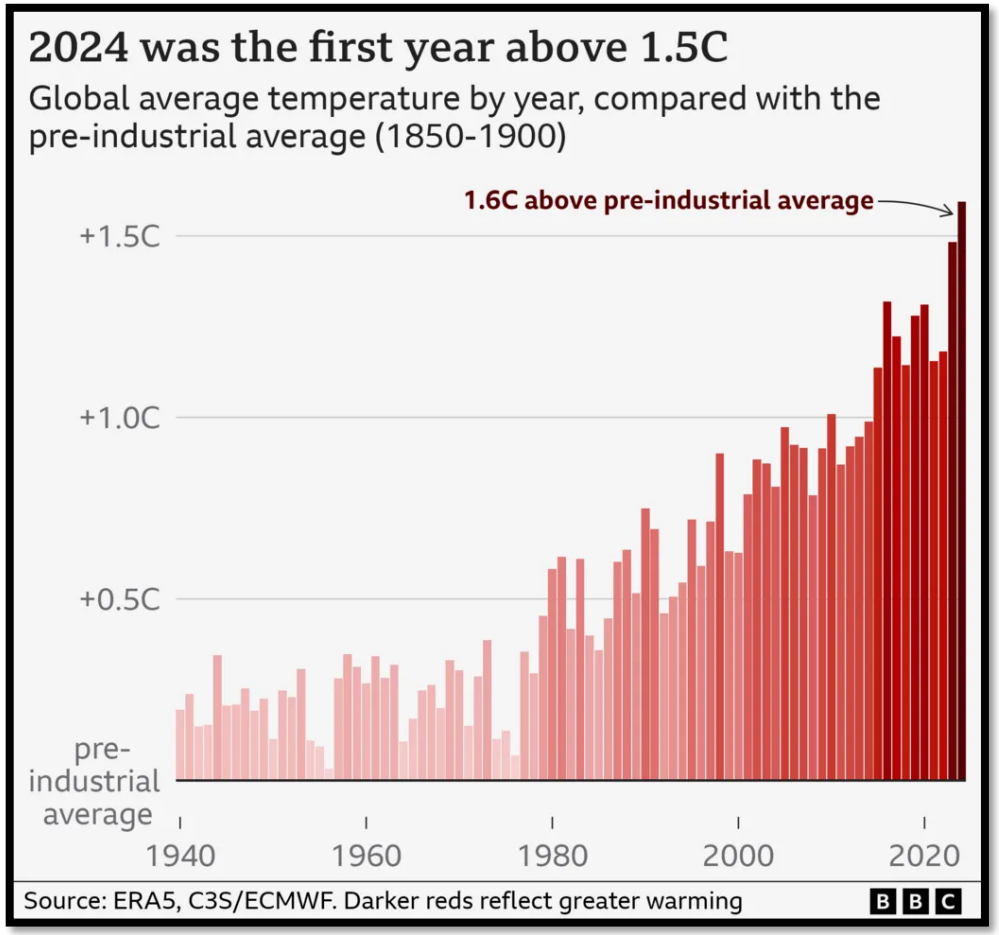
Diminished agricultural productivity (Jamaica)



Median increase in aridity of 4%



Inundation of coastal infrastructure



Rhiney (2018); Donk et al. (2018); Lallo et al. (2018); Burgess et al. (2018); Monioudi et al. (2018); **Karnauskas et al. (2018)**

INSIGHTS

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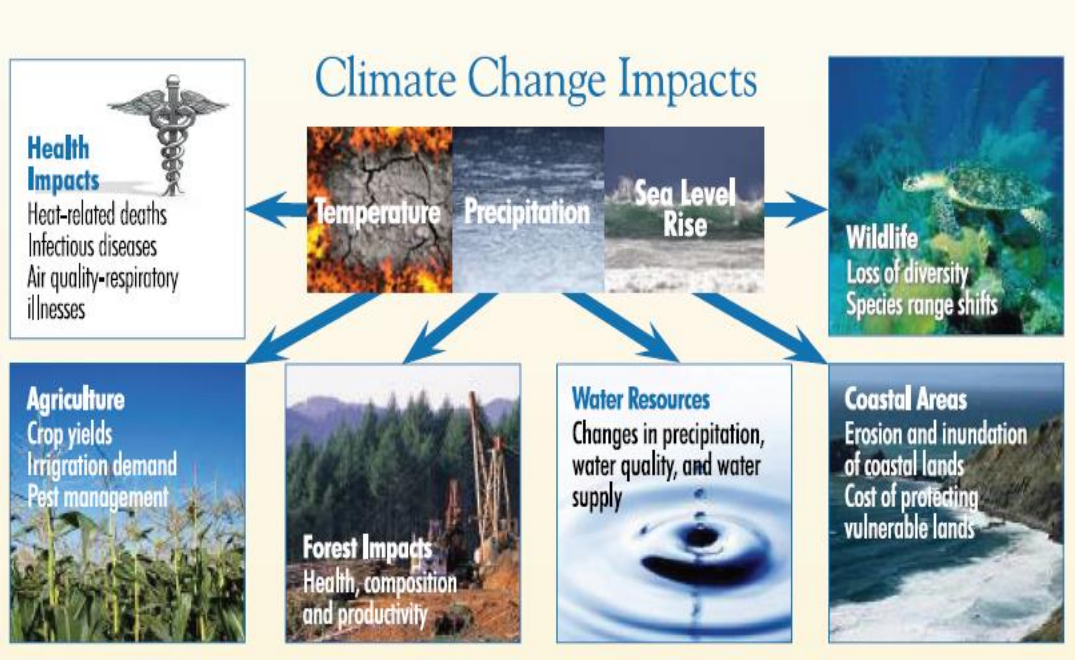
Adaptation



@ U.S. EPA

Across all areas of Caribbean life…

Mitigation

"Climate is changing the context within which Caribbean life occurs"

More Unavoidable Decisions

INSIGHTS

Caribbean is in an era marked by…

1. Multi-hazard climate **Unpredictability**
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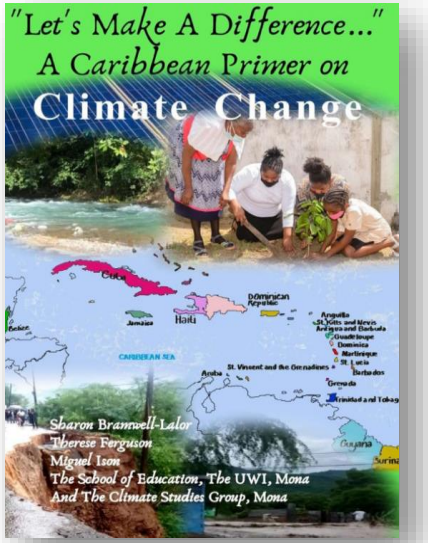
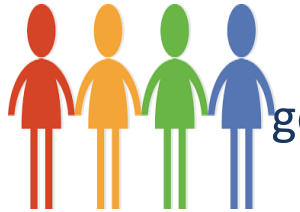
Education



- Curricula
- Caribbean Texts
- Workshops
- Training
- Formal and self paced
- Public Education
- Traditional media
- Social media
- Indigenous knowledge

Collaboration



International + government+ academia + private sector + community + civil society + ….

Finance

"Climate is changing the context within which Caribbean life occurs"

More Unavoidable Decisions

INSIGHTS

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1. Multi-hazard climate **Unpredictability**
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Establishes and makes clear the priorities & co-benefits & trade-offs when pursuing mitigation and adaptation in the Caribbean

Prioritizes data collection to account for the inhomogeneity of climate impact on Caribbean life resulting from differences in physical, socio-economic and cultural realities.

Proposes new models (including leadership and governance) for national to regional, private and public sector, financing including of research

Produces Innovation & new technology for the Caribbean reality

Supports advocacy and make the regional case for its global demands e.g. loss and damage, just transition, tech transfer etc.

Rethinks sustainable technologies and infrastructure to facilitate climate resilient systems

Enables the Integration of early warning, risk monitoring, emergency preparedness and management.

Research

"Climate is changing the context within which Caribbean life occurs"

More Unavoidable Decisions

INSIGHTS

Caribbean is in an era marked by…

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2. Multi-sector climate **Undermining**
3. Multiplied climate **Urgency**

- Mitigation
- Adaptation
- Research
- Education
- Finance
- Collaboration

Resilience

"Climate is changing the context within which Caribbean life occurs"

More Unavoidable Decisions

Climate resilient development integrates all of the above to advance sustainable development for all. The choices and actions implemented in this decade will have impacts now and for thousands of years. - IPCC

State of the Caribbean Climate

Insights	Implications	Challenge
Caribbean is in an era characterized by	***New Context for Caribbean life…***	
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2 Multi-sector climate Undermining	Increasingly more **Unreliable Determinants**	Development Delayed
3 Multiplied climate Urgency	Increasingly more **Unavoidable Decisions**	Development Demanded

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THANK YOU
MUCHAS GRACIAS
MERCI BEAUCOUP

MICHAEL.TAYLOR@UWIMONA.EDU.JM