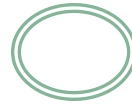


# Climate Services in support of decision-making in the health sector



**ADRIAN TROTMAN**

**ROCHE MAHON**

**CEDRIC VAN MEERBEECK**

***CARIBBEAN INSTITUTE FOR METEOROLOGY AND HYDROLOGY***

**Third Global Conference on Health and Climate Change**

**16-17 October 2018**

**St. George's, Grenada**

# Functions of the Caribbean Institute for Meteorology and Hydrology (CIMH)

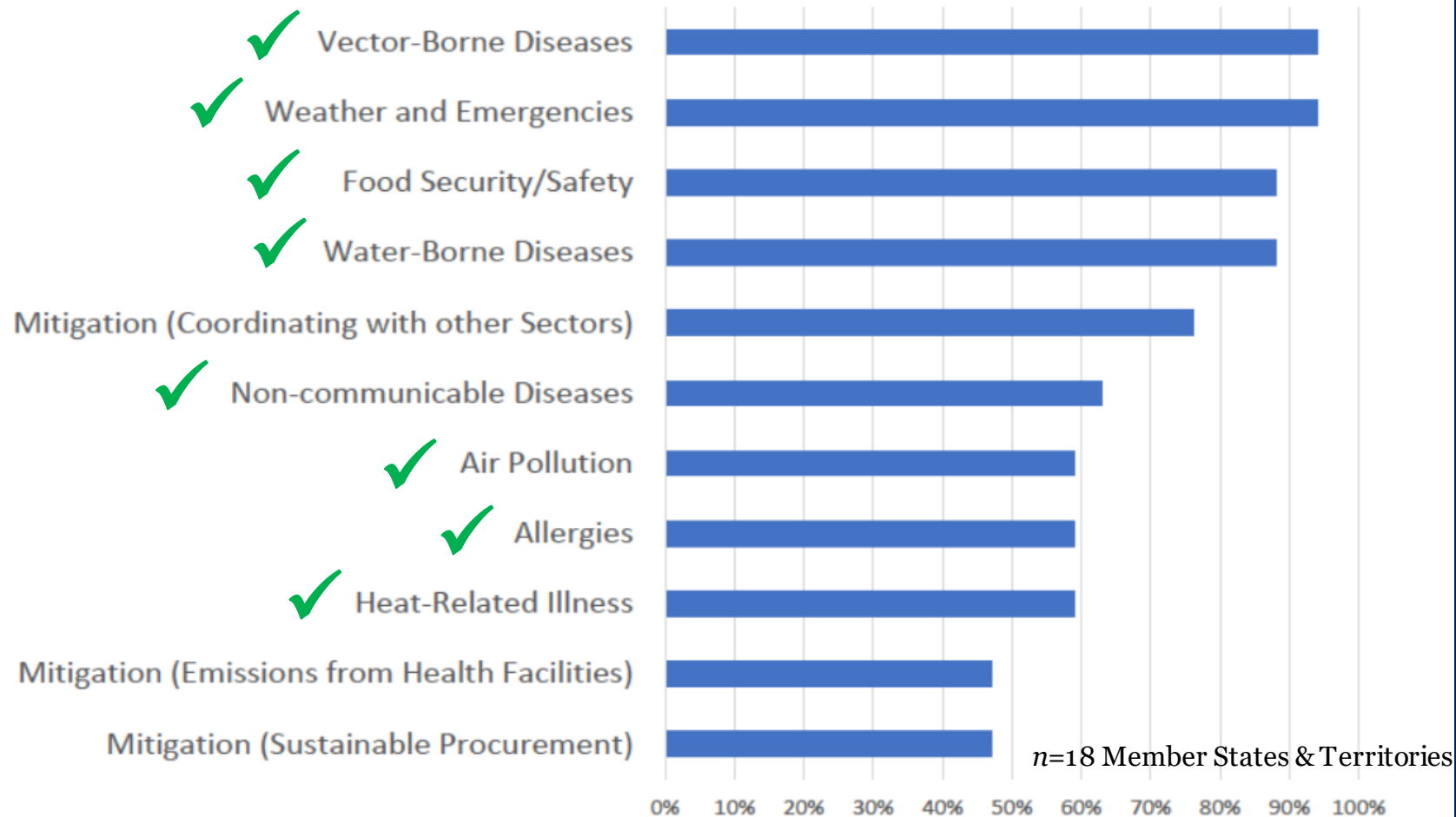


- **WMO Regional Training Centre** - Train various categories of meteorological and hydrological personnel
- Operate as a **centre of research** in meteorology, hydrology and associated sciences
- **Regional Climate Data Centre** - Data collection, storage, & dissemination
- **WMO Regional Instrument Centre** – Develop, maintain, repair, and calibrate meteorological & hydrological instruments
- Regional **Centre of Excellence for Training in Satellite Meteorology**
- **WMO Regional Climate Centre** – designated May 2017
- Caribbean **Centre for Climate and Environmental Simulations**
- WMO Pan-American **Centre for Sand and Dust Storm Warning Advisory and Assessment System**
- **Advisor to regional governments** on matters related to meteorology, climatology & hydrology
- Provide specialized **services to industry**



**An affiliate of the UWI since 1972**

# Country Priorities for Climate and Health Action



- Caribbean countries rated the following topics as “Extremely Important” or “Important” for a climate change and health agenda
- Many of these are topics where CIMH is actively doing **atmospheric monitoring and forecasting...and increasingly inter-disciplinary work**

# Background - GFCS Vision and Pillars

## Vision

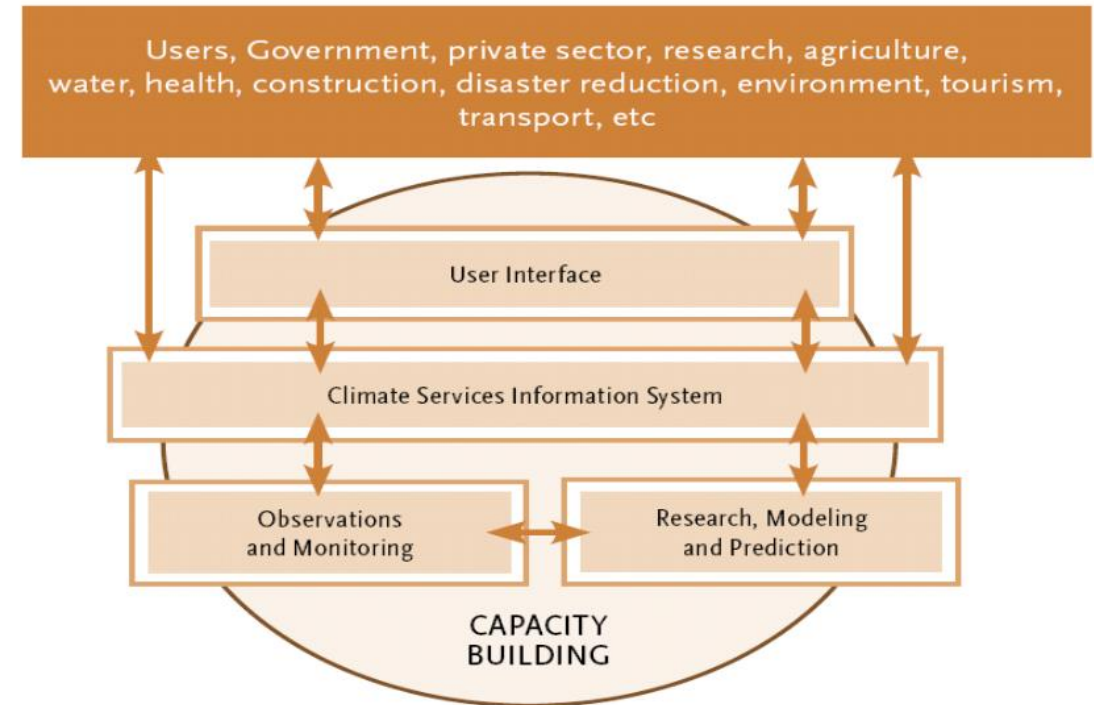
"To enable better management of the risks of climate variability and change and adaptation to climate change, through the development and incorporation of science-based climate information and prediction into planning, policy and practice on the global, regional and national scale."

Caribbean Roll Out begun in May 2013 in Trinidad and Tobago

## **REGIONAL WORKSHOP ON CLIMATE SERVICES AT THE NATIONAL LEVEL FOR THE CARIBBEAN**

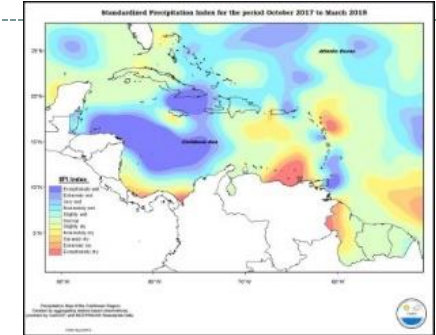
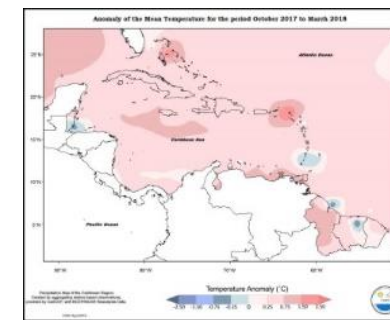
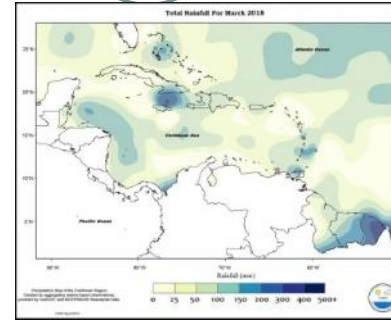
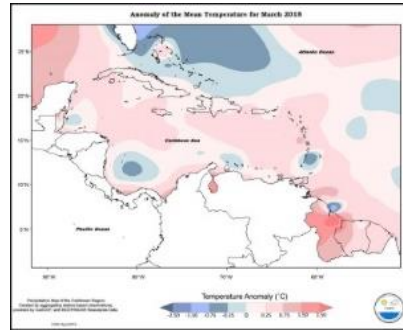
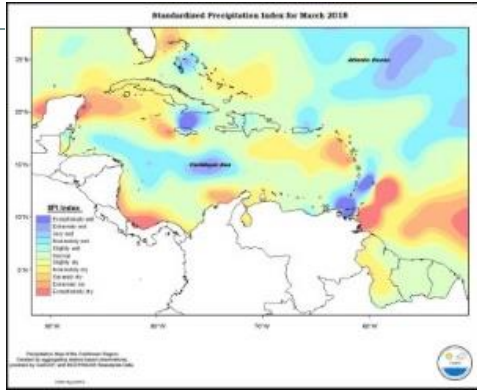
Since then national road map exercises in Belize, Trinidad and Tobago, Suriname, Guyana.

Endorsed at the 53<sup>rd</sup> Special Meeting of COTED (Environment and Sustainable Development).



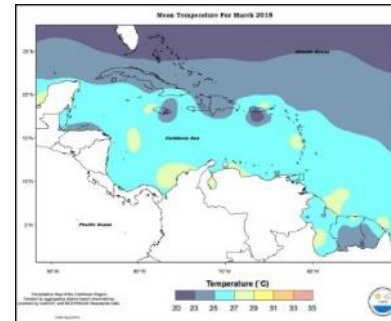
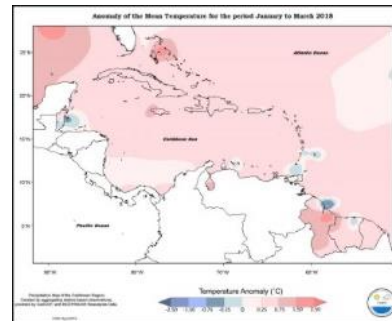
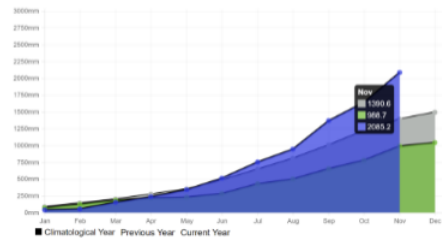
# Climate Monitoring product suite

## Drought and rainfall, temperature Supports our regional Climate Watch



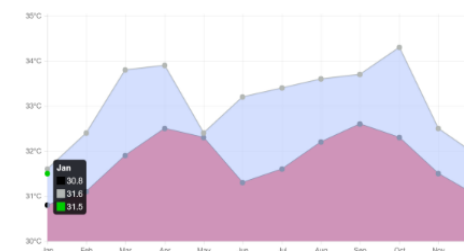
Hewanorra, St-Lucia - Accum. Rainfall Calendar Year

(Location: 13.73°N, -60.952°W)



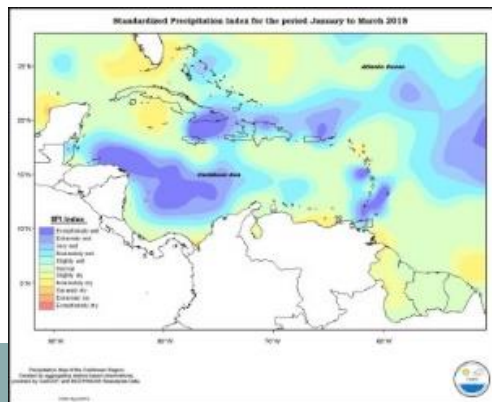
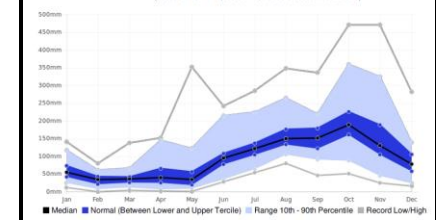
Max. Temperature 1m. Max Calendar Year

(Location: 10.59°N, -61.34°W)



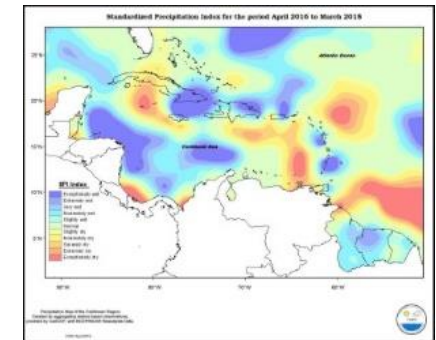
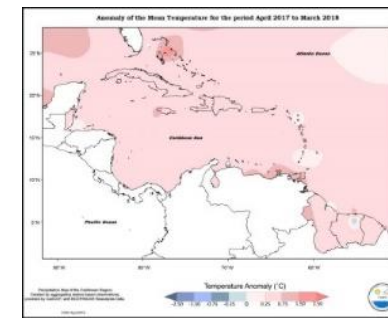
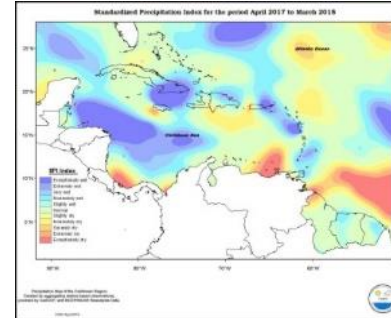
CIMH, Barbados - Monthly Rainfall

(Location: 13.14°N, -59.62°W; Period of record: 1961-2010)



Produced  
through two in-  
house-built tools

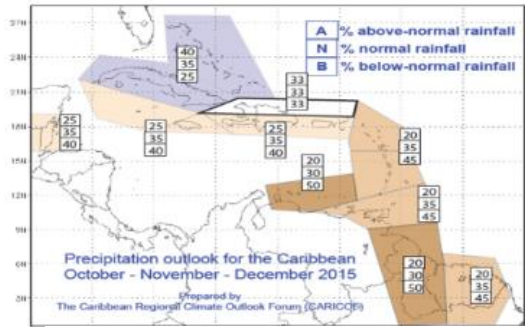
Caribbean Climate Monitor  
CariCOF Outlook  
Generator



Reference Climatologies

<https://rcc.cimh.edu.bb/caribbean-climatology/1981-2010/>

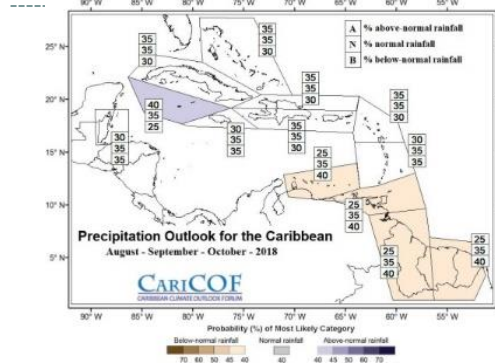
# Climate Forecasts product suite



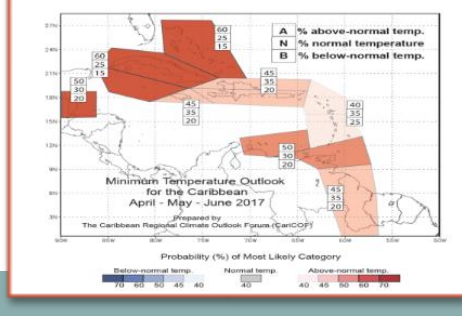
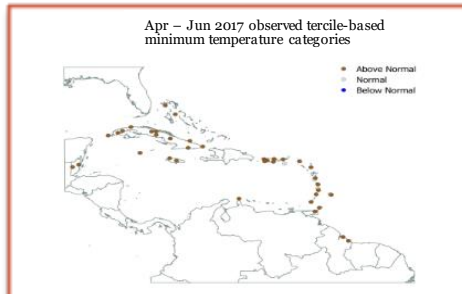
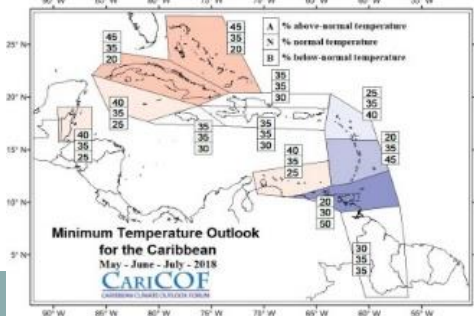
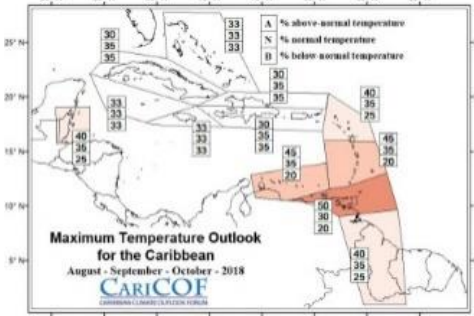
Oct - Dec 2015 observed tercile-based rainfall categories

- Above Normal
- Normal
- Below Normal

Oct - Dec 2015 observed tercile-based rainfall categories



0-/3-ml Tercile-based precip. and temp. outlooks + verification



## Climate Products

Partnering with the NMHSs

Seasonal forecasts up to 3-6 month ahead

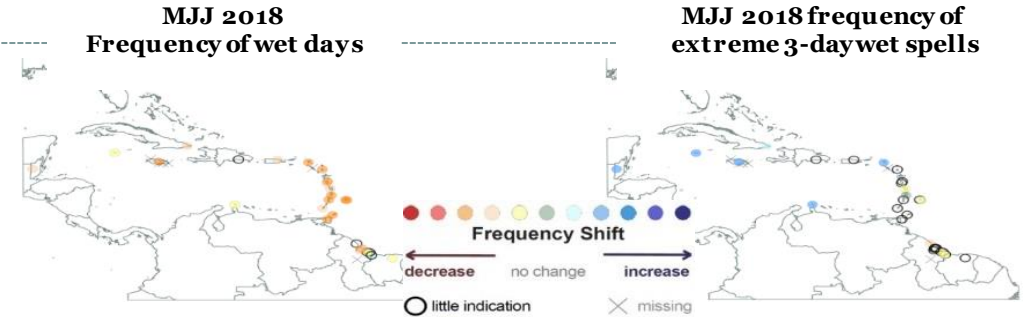
Rainfall totals  
Mean, maximum and minimum temperatures

More meaningful Drought - alerting system

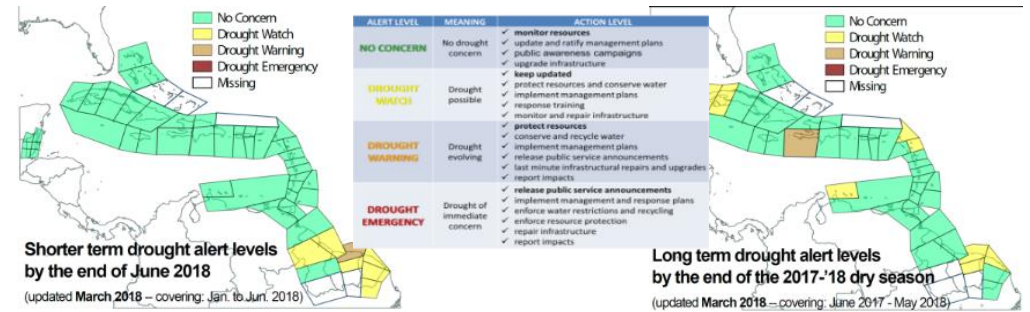
Wet days

(Extreme) wet spells

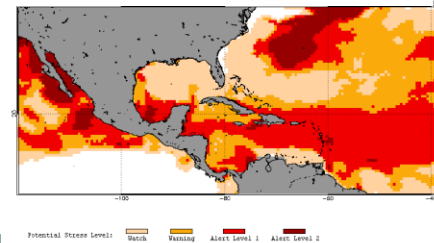
Coral bleaching



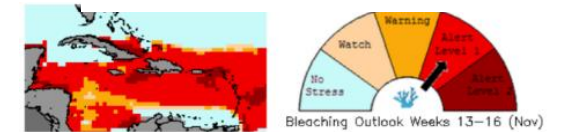
## Thematic / hazard-specific outlooks



## Coral bleaching thermal stress for Aug. to Nov. 2017



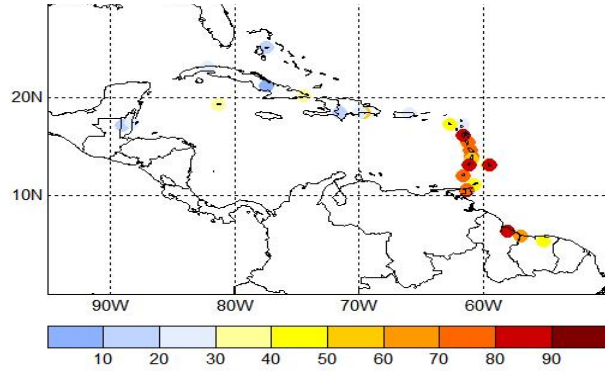
## Coral bleaching alert levels (0-/4--ml)



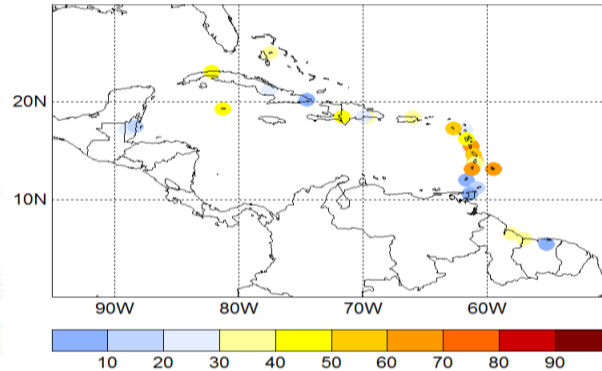
# Experimental climate products

## Seasonal heatwave frequency outlooks (up to 6 months)

Probability of at least 14 heatwave days between Jun. & Sep.

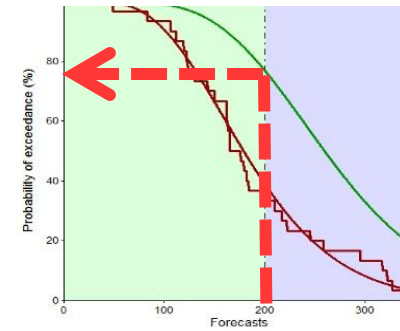


Probability of at least 60 heatwave days between Jun. & Nov.

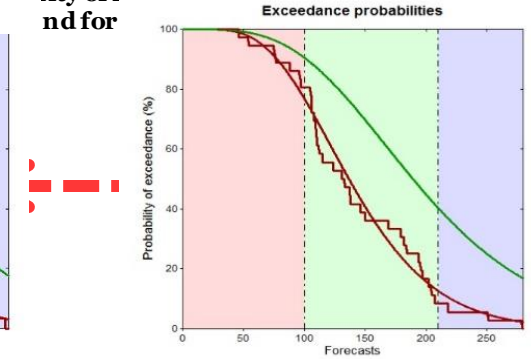


## Seasonal rainfall exceedance outlooks for crop water demand (3 months)

Probability of meeting water demand for sweet potato

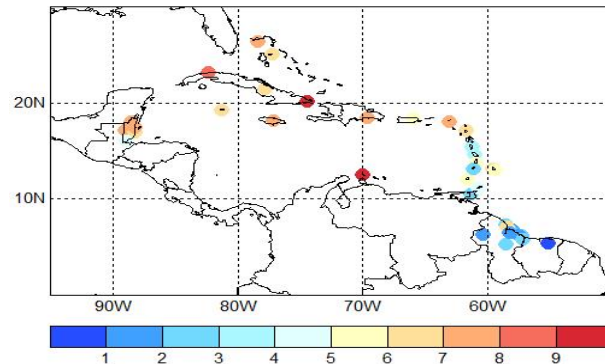


Probability of meeting water demand for

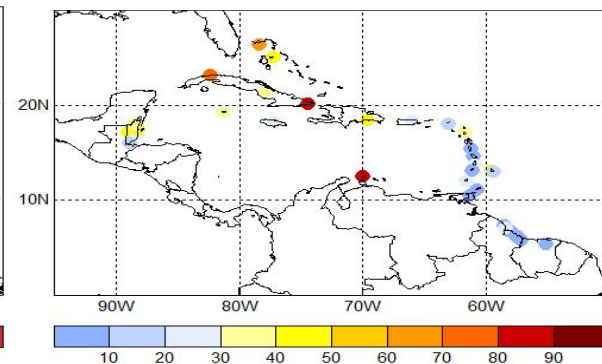


## Seasonal dry spells frequency outlooks (3 months)

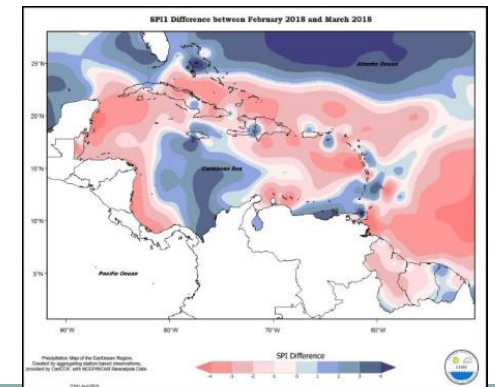
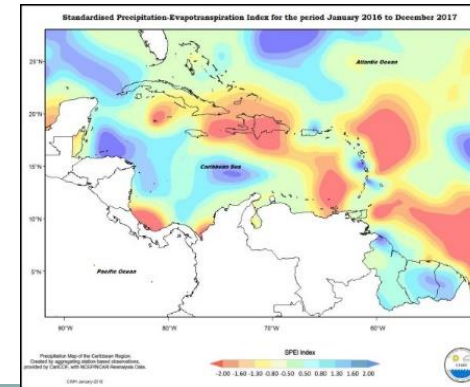
MAX. number of 7-day dry spells 7d max MJJ2018



Probability of at least ONE 15-day dry spell between May & Jul.

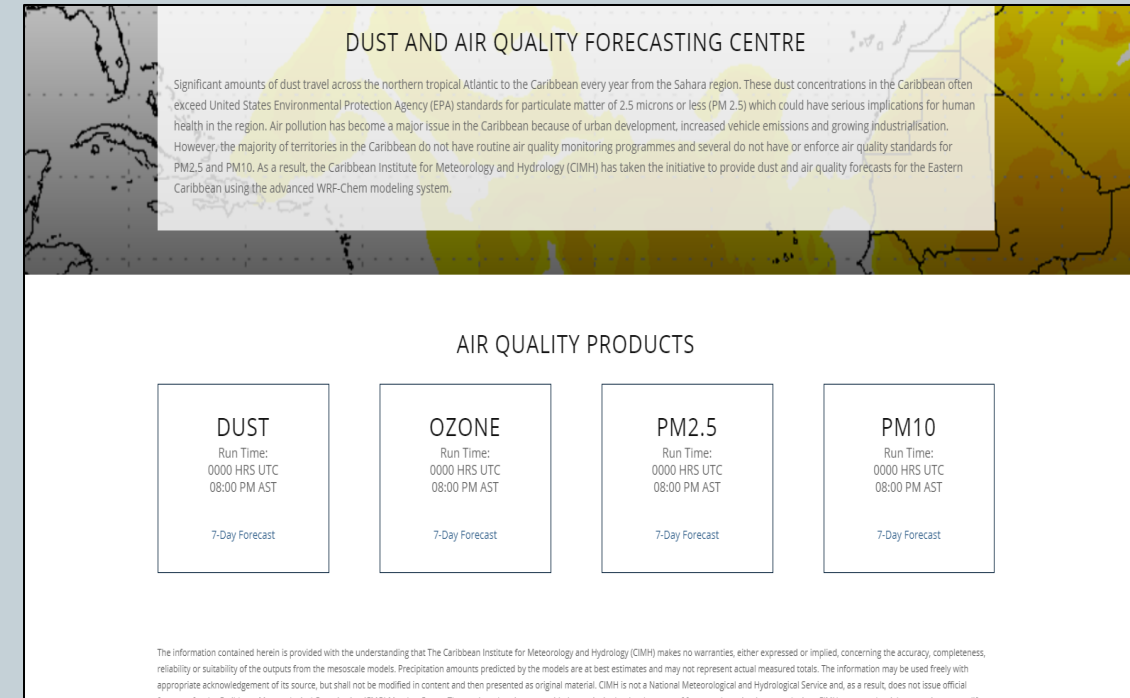


## Drought monitoring products (SPEI, SPI change)



# Sand and Dust Storm-Warning and Alerting System

- CIMH is the Pan-American node of the network
- Significant amounts of desert dust travel to the Caribbean annually from the Sahara region
  - Concentrations in the Caribbean often exceed WHO and United States Environmental Protection Agency (EPA) standards for PM<sub>2.5</sub> and PM<sub>10</sub>
  - Serious implications for human health in the region
- CIMH has embarked on providing dust and air quality forecasts for the Caribbean
  - Weather Research and Forecasting model coupled with Chemistry (WRF-Chem)
    - ✦ Coupled weather prediction/dispersion model- simulates the release and transport of constituents; Saharan dust transport and concentration
    - ✦ Coupled weather/dispersion/air quality model with full interaction of chemical species- prediction of PM<sub>2.5</sub>, PM<sub>10</sub> and ozone (O<sub>3</sub>)



**DUST AND AIR QUALITY FORECASTING CENTRE**

Significant amounts of dust travel across the northern tropical Atlantic to the Caribbean every year from the Sahara region. These dust concentrations in the Caribbean often exceed United States Environmental Protection Agency (EPA) standards for particulate matter of 2.5 microns or less (PM 2.5) which could have serious implications for human health in the region. Air pollution has become a major issue in the Caribbean because of urban development, increased vehicle emissions and growing industrialisation. However, the majority of territories in the Caribbean do not have routine air quality monitoring programmes and several do not have or enforce air quality standards for PM<sub>2.5</sub> and PM<sub>10</sub>. As a result, the Caribbean Institute for Meteorology and Hydrology (CIMH) has taken the initiative to provide dust and air quality forecasts for the Eastern Caribbean using the advanced WRF-Chem modeling system.

**AIR QUALITY PRODUCTS**

DUST	OZONE	PM <sub>2.5</sub>	PM <sub>10</sub>
Run Time: 0000 HRS UTC 08:00 PM AST	Run Time: 0000 HRS UTC 08:00 PM AST	Run Time: 0000 HRS UTC 08:00 PM AST	Run Time: 0000 HRS UTC 08:00 PM AST
7-Day Forecast	7-Day Forecast	7-Day Forecast	7-Day Forecast

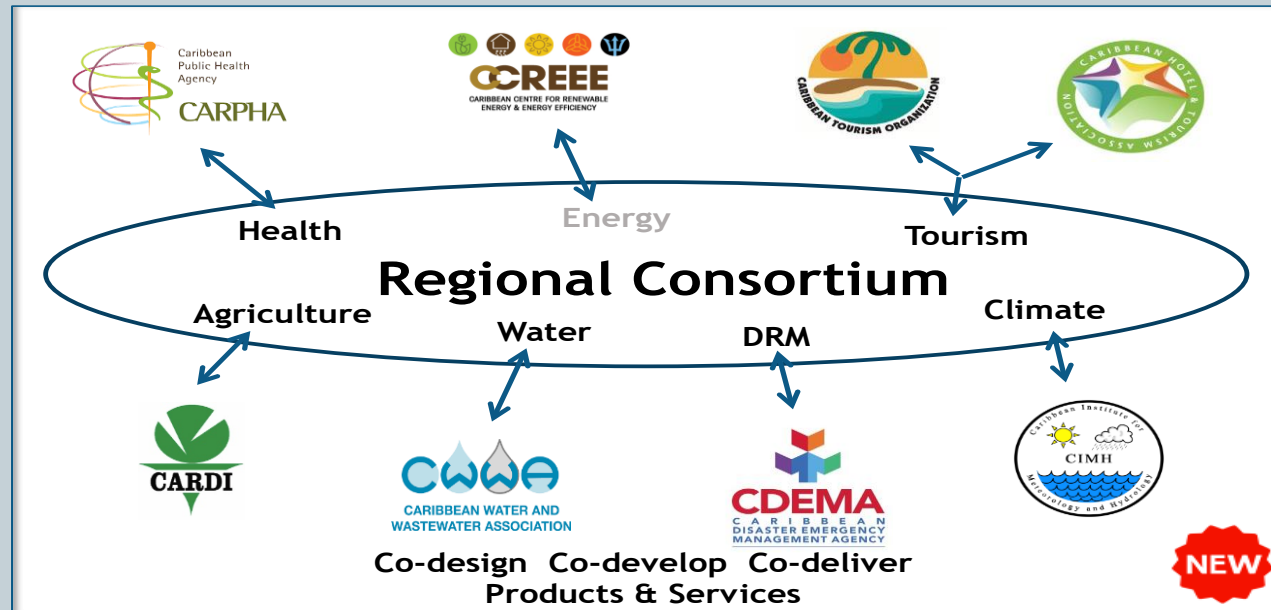
The information contained herein is provided with the understanding that The Caribbean Institute for Meteorology and Hydrology (CIMH) makes no warranties, either expressed or implied, concerning the accuracy, completeness, reliability or suitability of the outputs from the mesoscale models. Precipitation amounts predicted by the models are at best estimates and may not represent actual measured totals. The information may be used freely with appropriate acknowledgement of its source, but shall not be modified in content and then presented as original material. CIMH is not a National Meteorological and Hydrological Service and, as a result, does not issue official forecasts for the Caribbean Meteorological Organization (CMO) Member States. The products herein are provided to assist in the development of Resilient Sustainable Outcomes. CIMH reserves the right to update its models.

Find the latest 7 day forecast for dust, ozone, PM 2.5 and PM 10 here:  
<http://dafc.cimh.edu.bb/>



# Consortium of Sectoral EWISACTs Partners

The Consortium is a key regional mechanism to champion the design, development and delivery of tailored climate products and services in the agriculture and food security, disaster risk management, energy, health, tourism and water sectors.

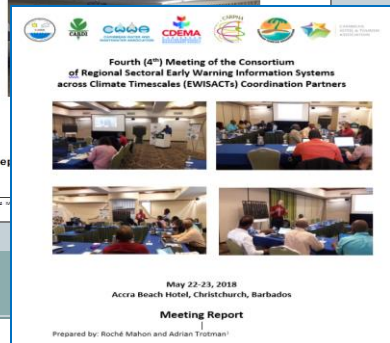
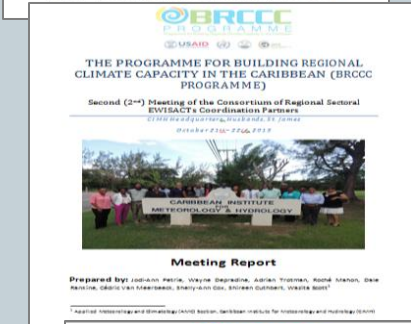


4 Consortium Meetings hosted by CIMH:

May 2015, October 2015, July 2016, May 2018

Recognised Observers – 5Cs, UWI CSGM, CCCCC, OECS

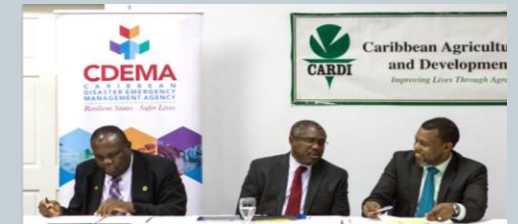
New partnerships being brokered – CCREEE



CTO and CHTA sign the LoA, September 16th, 2016



CWWA signs the LoA, October 26th, 2016



CARDI and CDEMA sign the LoA, December 6th, 2016



CARPHA and CIMH sign the LoA, April 26th, 2017

# Caribbean Health-Climatic Bulletin

# Special Saharan Dust Advisories

6 issues since May 2017

2 advisories issued in 2018

**Caribbean Health Climatic Bulletin**  
Vol 2 | Issue 3  
September 2018

This Bulletin is a joint effort between the Caribbean Public Health Agency (CARPHA), the Pan American World Health Organization (PAHO/WHO) and the Caribbean Institute for Meteorology and Hydrology (CIMH). It aims to help health professionals identify and prepare health interventions for favorable or inclement climate conditions in the Caribbean. The period covered is September 2018 to November 2018. It is recommended that health stakeholders should use the combination of monitoring (May 2018 - July 2018) and forecast (September 2018 - November 2018) climate information presented in this Bulletin in tandem with weather forecasts (1-7 days). This suite of information is intended to guide strategic and operational decisions related to health interventions and the management of health care systems.

**What are the Key Climate Messages for September to November 2018?**

- The period September to November usually marks the wettest part of the year in Belize and the Caribbean Islands, with an annual peak in the frequency of wet days, wet spells and extreme wet spells. In the coastal Guianas, the dry season usually lasts until mid to late November.
- Meanwhile, the ABC Islands usually transition into their wet season at this time.
- Temperatures are usually initially high which, combined with a peak in air humidity, can feel uncomfortable until the end of September in northern parts of the region, and until October in the southern Caribbean. High temperatures are usual across the Guianas at this time.
- Rainfall totals from September to November are forecast to likely be the usual or drier across the ABC Islands, Belize, the Lesser Antilles and the Guianas.
- It is not unusual for the region to experience:

- At the same time
- Midwest/central
- Greater Antilla
- Region with
- closely in part
- Night time an
- likely more hot
- Heat waves in
- The tropical c
- forecasting in
- brought about
- Explosions of S
- the absence of
- The UV index
- more inform
- the Caribbean

**What are the new recommendations?**

- Excess (excess island) said in Guiana from he children
- NCDs
- Particulate there is present especially extreme approx
- During UV ray on sun (heat)

**Caribbean Health Climatic Bulletin**

**Contact Information**

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Dr. Celdric J. Van Meerbeek  
Email: cmeerbeek@cihm.edu.bb

**For More Health Information:**  
CARPHA  
<http://carpha.org>

PAHO  
<http://www.paho.org>

**For More Climate Information:**  
Caribbean Regional Climate Centre (CRCC)  
<http://crcc.cimh.edu.bb>

**Disclaimer**

This Bulletin provides a broad overview of climate conditions up to 3 months in advance. It is based on insights drawn from CIMH's suite of technical climate information products and is not intended as a forecast. The information is provided for informational purposes only and does not constitute a guarantee of accuracy, completeness, reliability or suitability of said information. The Bulletin is for public use and dissemination by the public with appropriate acknowledgment of its source but shall not be held liable in court and the presenter is not liable.

- Insights on typical climate conditions for upcoming season;
- An outlook (how wet, how dry, how hot etc.) for the upcoming season
- Key climate messages for that period; and
- Advises on health implications arising from seasonal climate information.

**Saharan Dust Update for March 28-April 03, 2018**

**Current event**

Models run and managed by the Caribbean Institute for Meteorology and Hydrology (CIMH) in its role as the Pan American Centre for the World Meteorological Organization (WMO) Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) are showing a dust episode in which dust concentration amounts are demonstrably high.

Cayenne, French Guiana has already seen elevated levels of PM10<sup>2</sup> over 160 µg/m<sup>3</sup> dust concentrations. This is above the outdoor air quality guidelines of 50 µg/m<sup>3</sup> 24-hour mean for particulate matter established by the World Health Organization (WHO).

**Dust forecast**

In the coming (1-3) days, we expect that dust and PM10 concentration levels will increase.

**Models predict of dust and PM10**

**Another dust**

**Implications**

There may be higher dust and it is dry.

**Stay informed**

Health stakeholders here: <http://dafc.cimh.edu.bb>

**Contact Us**

- Dr. A. Sealy
- Dr. A. Reyes

**PM10-refers**

**DUST FORECAST**

Models run and managed by the Caribbean Institute for Meteorology and Hydrology (CIMH) in its role as the Pan American Centre for the World Meteorological Organization (WMO) Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) are predicting a dust episode in which dust concentration amounts are expected to be noticeably high.

In the next 1-2 days, we expect that dust and PM10 concentration levels will increase in northeastern South America. In the next 2-3 days, dust and PM10 concentrations are expected to increase over Barbados, the Windward and Leeward Islands. Forecast models indicate PM10 concentrations up to 90-120 µg/m<sup>3</sup> over northeastern South America (especially French Guiana) and up to 60-90 µg/m<sup>3</sup> over Barbados, the Windward and Leeward Islands. This is above the outdoor air quality guideline of 50 µg/m<sup>3</sup> 24-hour mean for particulate matter established by the World Health Organization (WHO).

**IMPLICATIONS FOR RESPIRATORY ILLNESS**

Persons with asthma and those prone to allergic rhinitis may become increasingly symptomatic due to the significantly elevated dust and PM10 concentrations. Medical facilities may experience increased numbers of patients with respiratory illnesses. This situation may be exacerbated in territories where the ground surface is dry.

**STAY INFORMED**

Health stakeholders are encouraged to consult the 7-day dust forecast in the coming days. Access this product here: <http://dafc.cimh.edu.bb/dust-prediction/>

**CONTACT US**

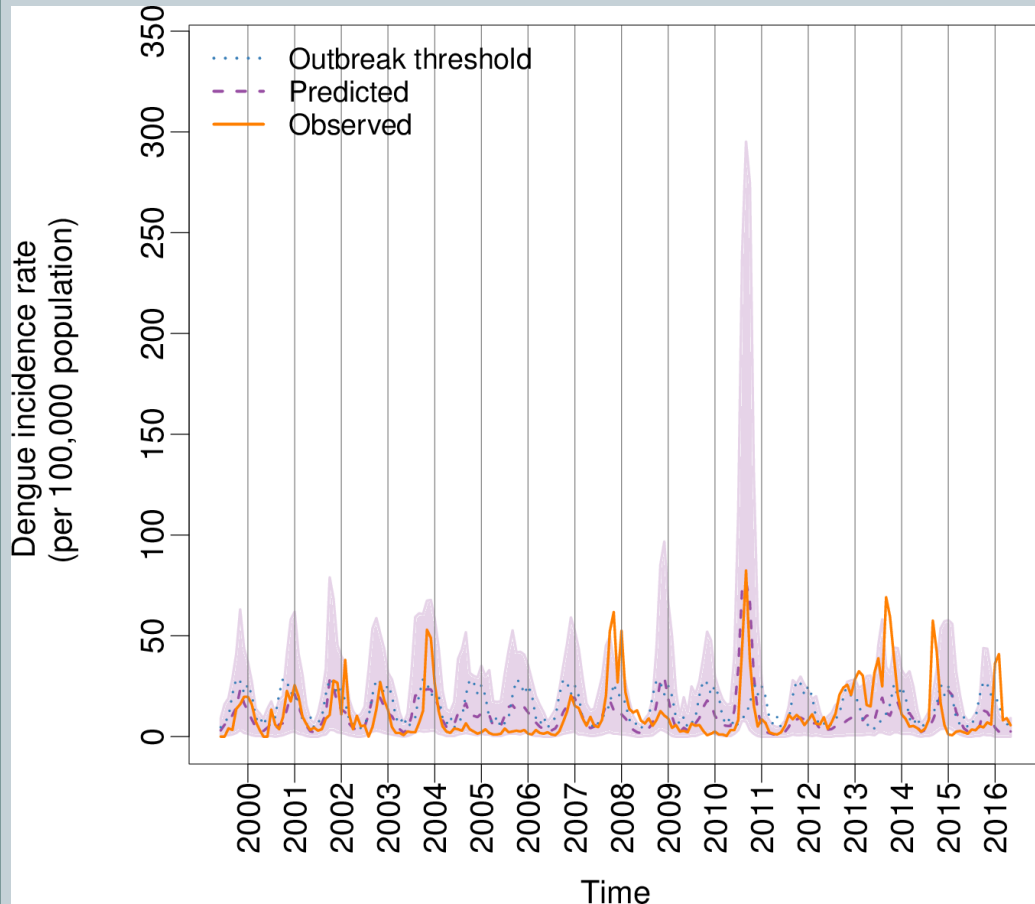
- Dr. Andrea Sealy, Meteorologist and Chair of the Pan American Regional Steering Group for the WMO SDS-WAS: [asealy@cihm.edu.bb](mailto:asealy@cihm.edu.bb)
- Dr. Ashford Reyes, Meteorologist: [areyes@cihm.edu.bb](mailto:areyes@cihm.edu.bb)

Find the latest HCB here: <http://rcc.cimh.edu.bb/caribbean-health-climatic-bulletin/>

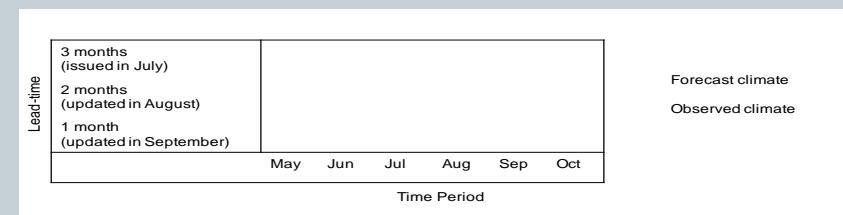
# Climate services for *Aedes aegypti* borne diseases

Annual dengue costs to Caribbean: **approx. \$321.4 million USD** excluding costs of vector control and other prevention programmes (Shepard et al, 2011)

## Climate driven spatio-temporal model to support dengue early warning



- Statistical model to test whether dengue outbreaks in Barbados could be predicted using weather station data for temperature and a precipitation index.
- Risk of dengue outbreaks increased with increasing minimum temperature ( $T_{min}$ ; up to  $25^{\circ}\text{C}$ ).
- Disease outbreaks more likely to occur 4 to 5 months after periods of drought and 1 month after periods of excess rainfall.
- Results suggest that a drought period followed by intense rainfall 4 to 5 months later could provide optimum conditions for an imminent dengue outbreak.
- Probabilistic dengue outlooks could be included in the Caribbean Health-Climatic Bulletin.



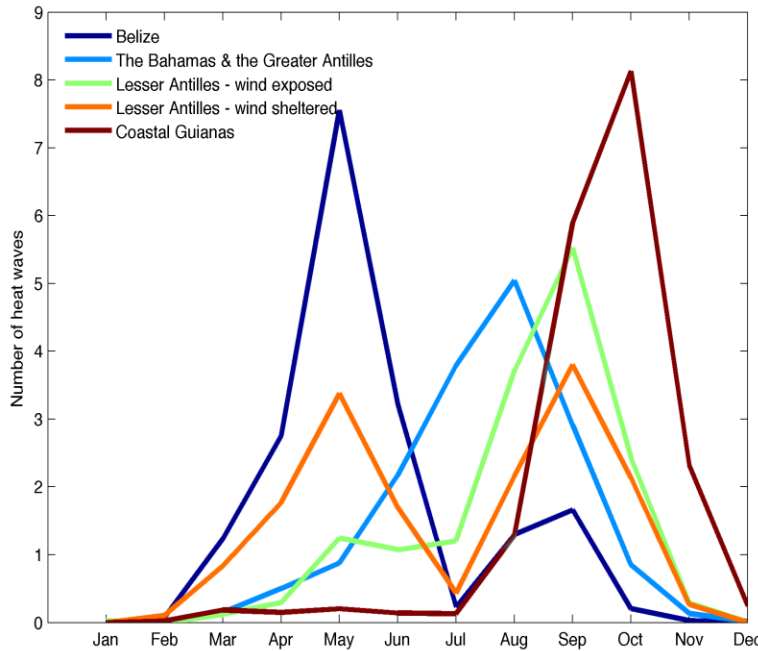
Type of climate information needed to produce a dengue forecast in Barbados for the target month of October

Model able to successfully predict months with dengue outbreaks versus non-outbreaks in most years...overall proportion of correct predictions (hits and correct rejections) of 86% (81%:91%) compared with 64% (58%:71%) for the baseline model

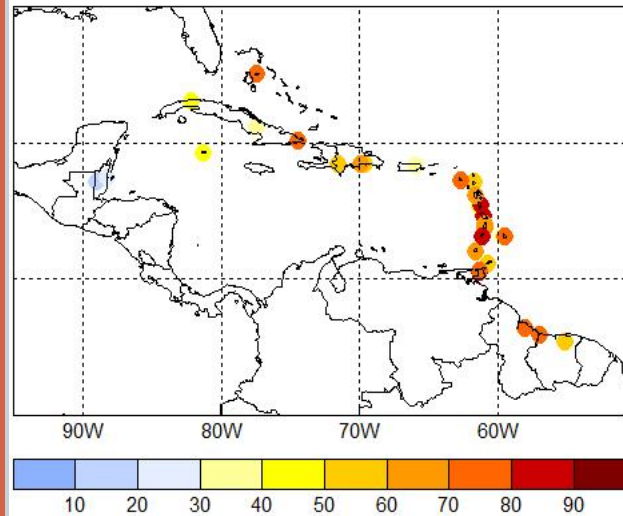
Source: Lowe R, Gasparrini A, Van Meerbeeck CJ, Lippi CA, Mahon R, Trotman AR, Rollock L, Hinds AQJ, Ryan SJ, Stewart-Ibarra AM (2018) Nonlinear and delayed impacts of climate on dengue risk in Barbados: A modelling study. *PLoS Med* 15(7): e1002613. <https://doi.org/10.1371/journal.pmed.1002613>

# Climate services for heat related non-communicable diseases

## Historical seasonality of heat waves



## Forecast probability of exceeding 14 heatwave days between Aug & Nov 2017



## Climate change

Increased frequency & intensity of heat waves already observed in the Caribbean (Stephenson et al., 2014) and projected to worsen in future

- Excessive heat exposure, especially during **heat waves**, engenders NDCs from heat stress.
- Heat waves **deadliest meteorological hazard** in USA (Smith and Katz, 2013).
- **Excess mortality** in the thousands during major heat waves (e.g. 2003 Europe, 2010 Russia, 2015 & 2016 South Asia).
- Early warning information relying on historical occurrences and climate predictions can **help improve preparedness** to heat waves.
- **1-month to 6-month heat wave forecasts** experimentally delivered by the Caribbean RCC since 2017.



[rcc.cimh.edu.bb](http://rcc.cimh.edu.bb)

*Thank you*