Sub-Seasonal to seasonal forecasting at CIMH

Cedric Van Meerbeeck

Climatologist

Adrian Trotman

Chief, Applied Meteorology and Climatology (Ag. Head of the RCC)

Caribbean Institute for Meteorology and Hydrology

First WMO Regional Climate Center – Washington Training Workshop
30 September – October 4, 2019, College Park, Maryland, USA

Functions of the Caribbean Institute for Meteorology & Hydrology

- 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
- 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 in May 2017)
- Caribbean Centre for Climate and Environmental Simulations

- WMO Pan American Centre for Sand & Dust Storm Warning Alerting & Advisory System;
- Advisor to regional governments on matters related to meteorology, climate & hydrology
- Provide specialized services to industry

Developing the Caribbean’s capacity to provide S2S prediction services

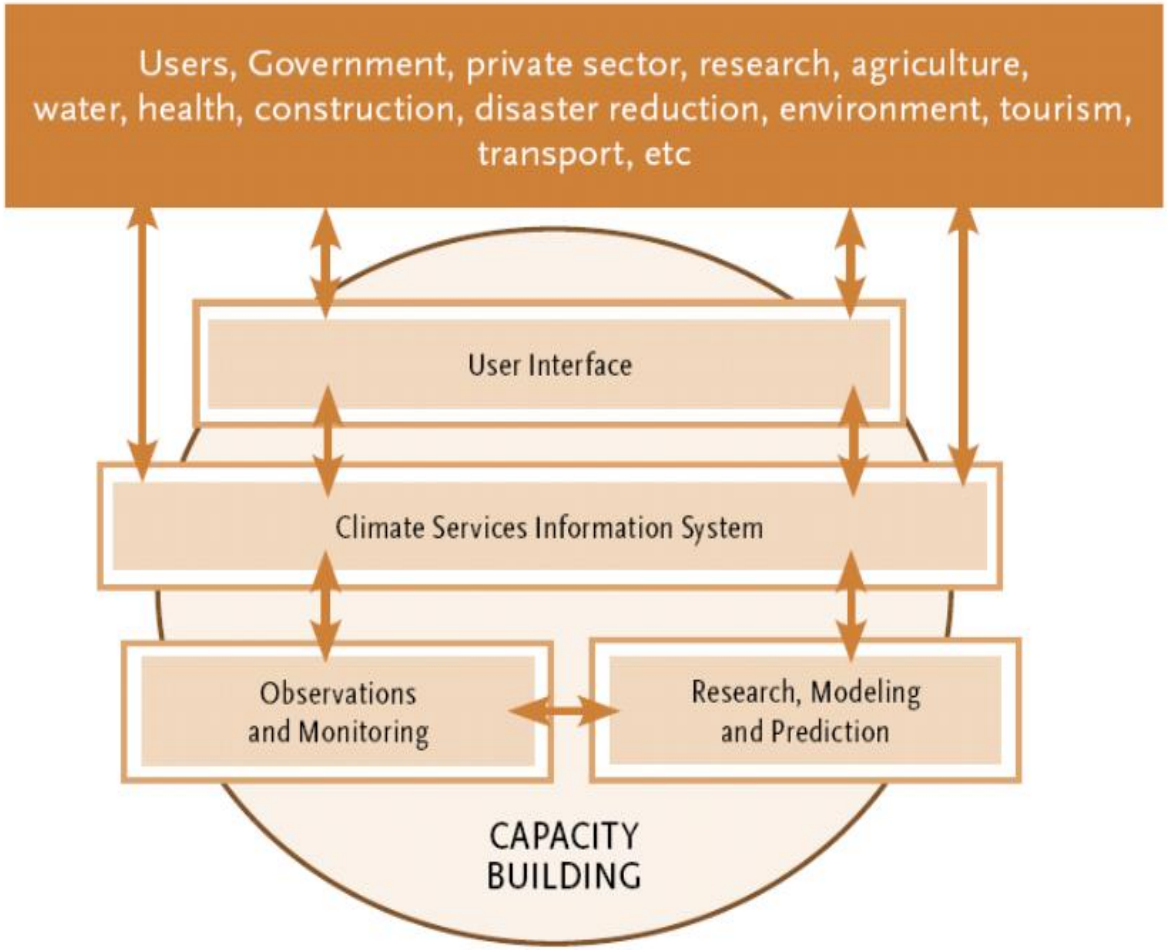
The Caribbean Embrace of the GFCS

Caribbean Roll Out 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 53rd Special Meeting of COTED (Environment and Sustainable Development).

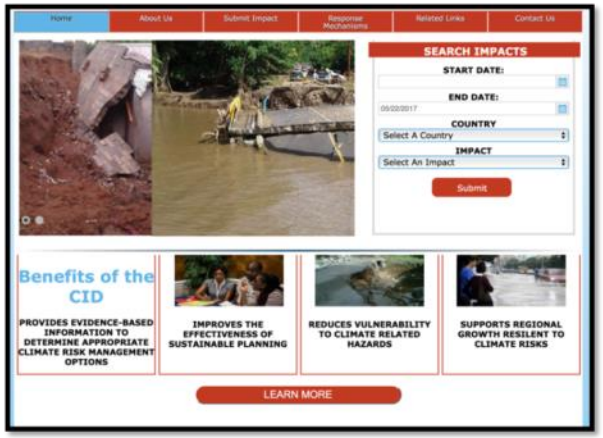


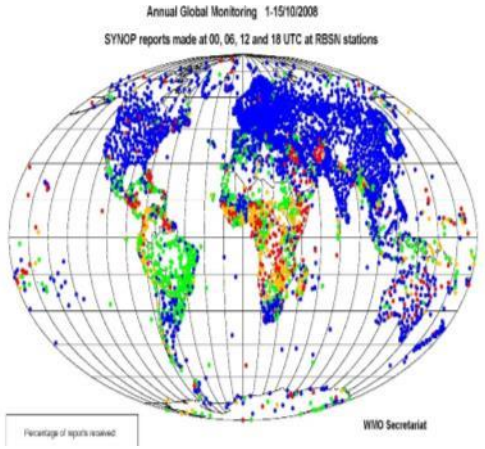
Recent and Current activity of the Caribbean RCC in Climate Services

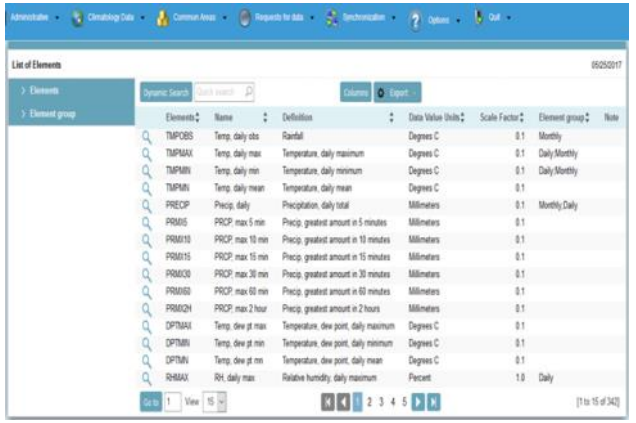
Observations and Monitoring

The essential infrastructure for generating the necessary climate data.

- Provision of observation equipment, raingauges, water level sensors, AWS; retrofitting already existing instruments
- Enhancing database and monitoring through remote sensing and GIS technology and techniques
- Data rescue exercises, and digitising
- Database release and launch of “light” synchronising version for Met Services; training
- Non- meteorological data and surveillance - CID/DEWETRA

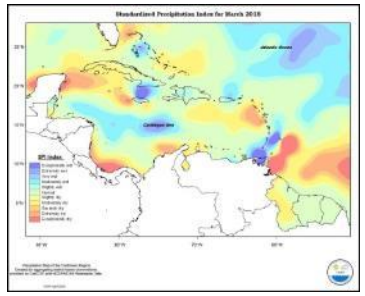


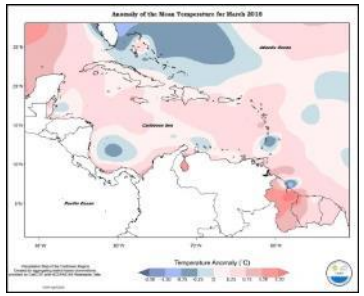


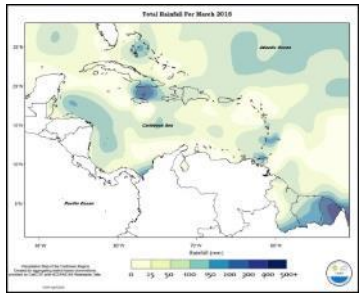


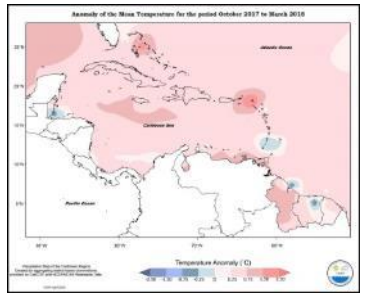
CSIS - Climate Monitoring – drought and rainfall, temperature

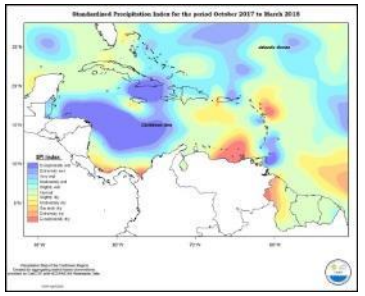
Supports our regional Climate Watch

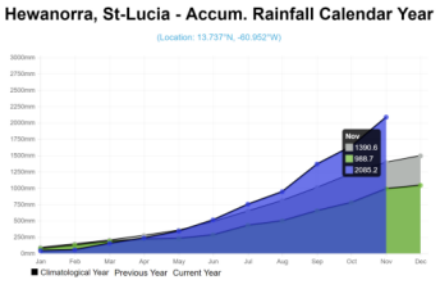


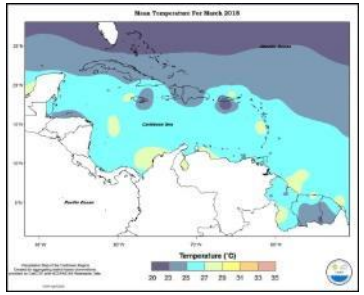


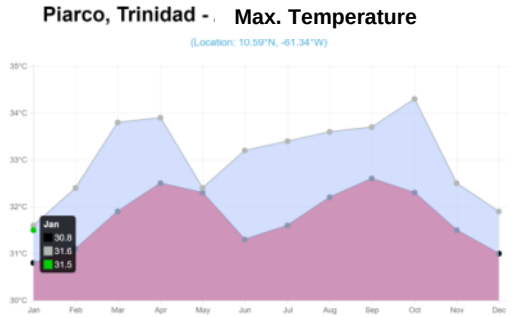


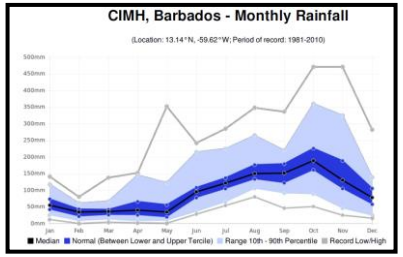


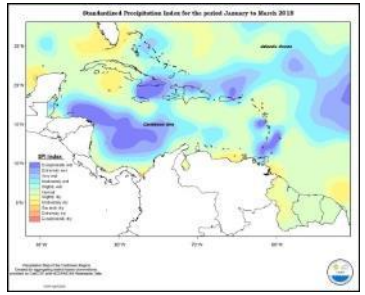


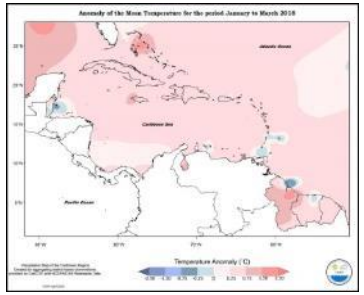


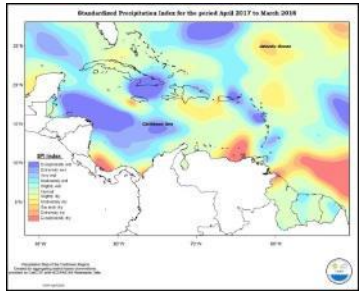


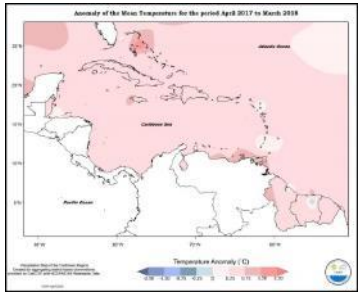


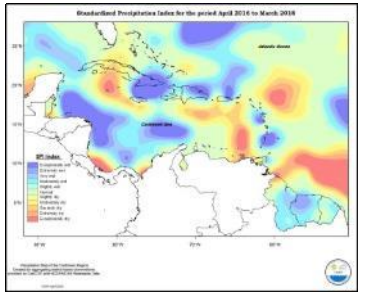








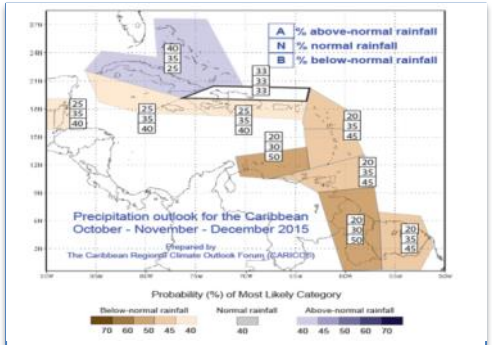


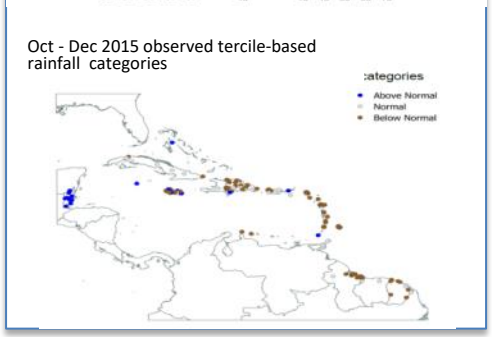


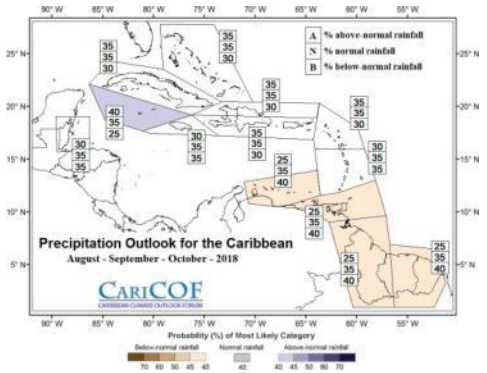
Produced through two in-house-built tools

Reference Climatologies
https://rcc.cimh.edu.bb/caribbean-climatology/1981-2010/

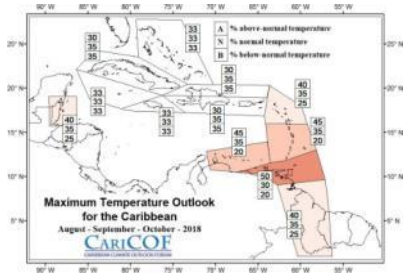
CSIS - Long-Range Forecasts – Consensus-based

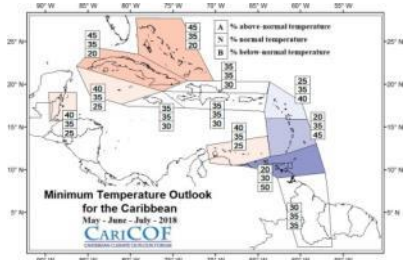


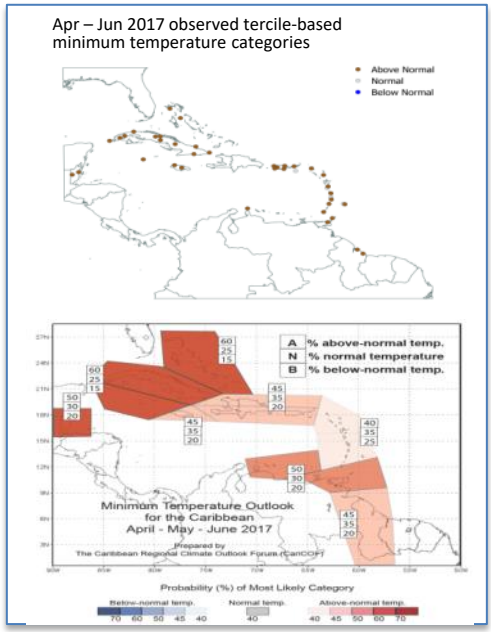




0-/3-ml Tercile-based precip. and temp. outlooks + verification







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

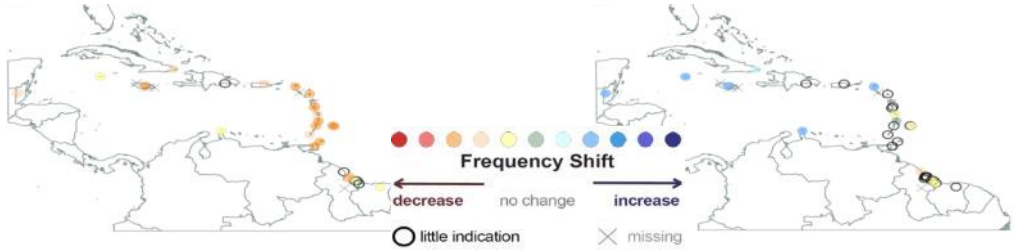
Coral bleaching

Forecast verifications

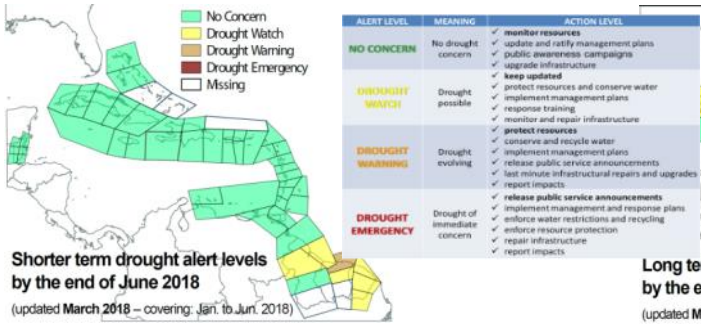
Routine analysis of GPC products

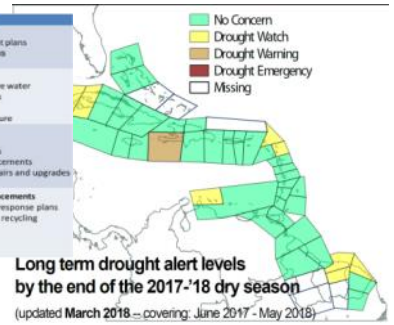
MJJ 2018
Frequency of wet days

MJJ 2018 frequency of extreme 3-day wet spells

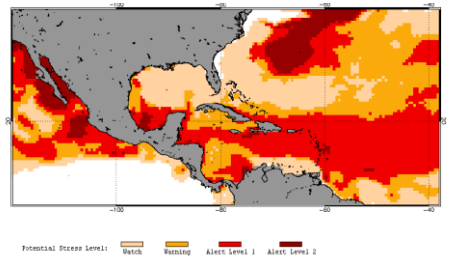


Thematic / hazard-specific outlooks

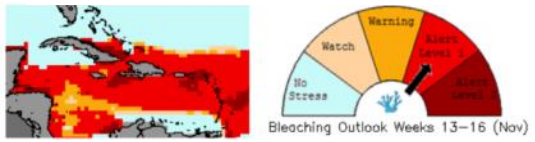




Coral bleaching thermal stress for Aug. to Nov. 2017



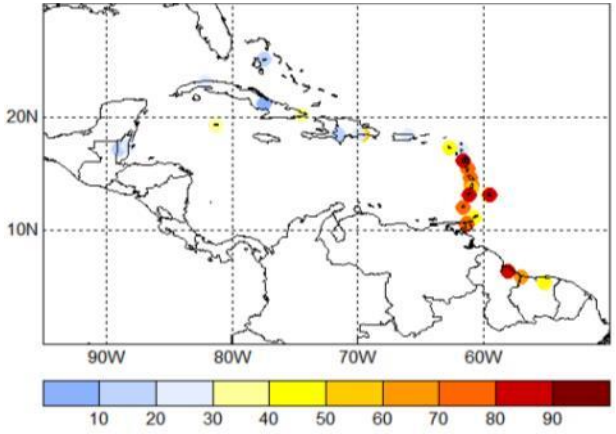
Coral bleaching alert levels (0-/4--ml)



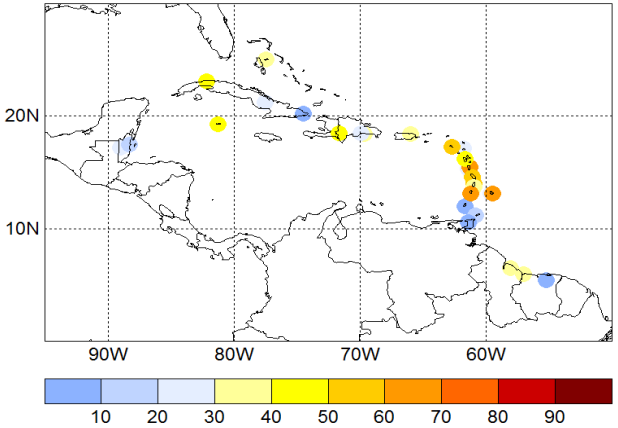
CSIS - Experimental products

Seasonal heatwave frequency outlooks (up to 6 months)

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

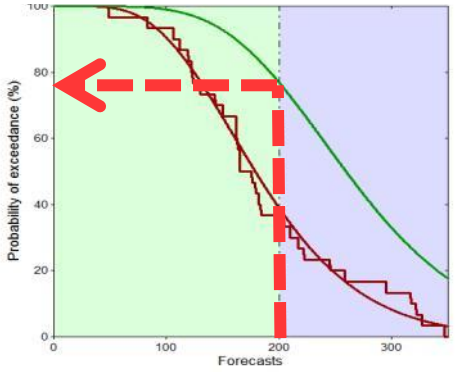


Probability of at least 60 heatwave days between Jun. & Nov.

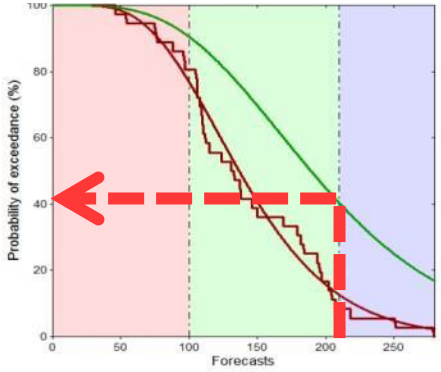


Seasonal rainfall exceedance outlooks for crop water demand (3 months)

Probability of meeting water demand for sweet potato

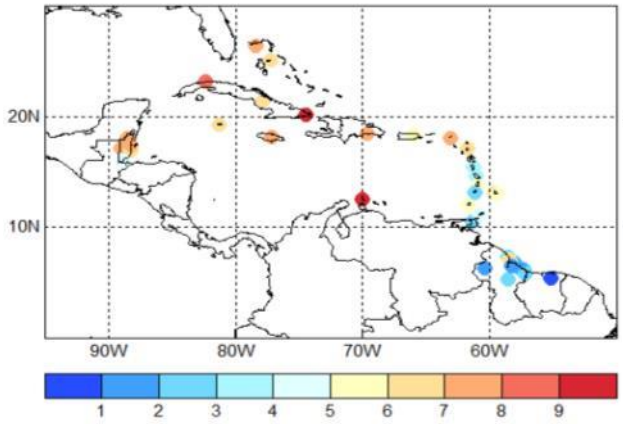


Probability of meeting water demand for sugar cane

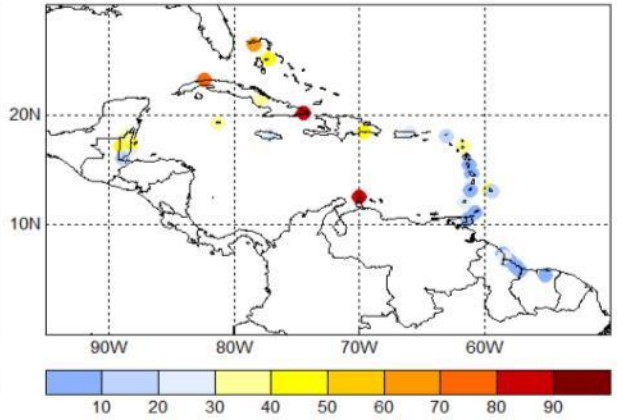


Seasonal dry spells frequency outlooks (3 months)

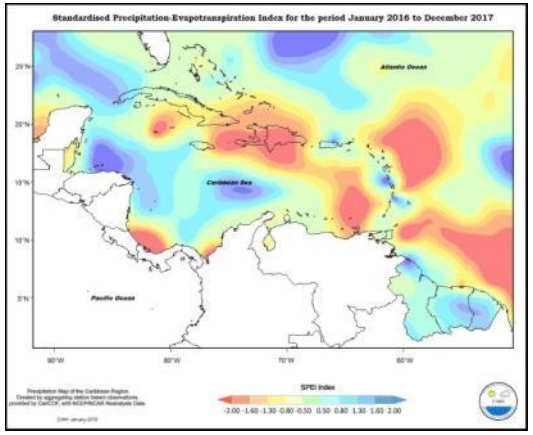
MAX. number of 7-day dry spells between May & Jul.

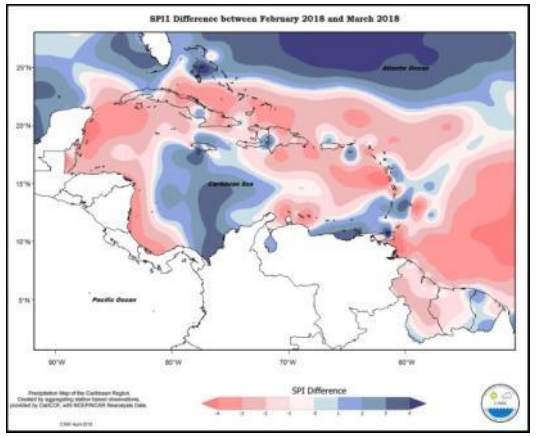


Probability of at least ONE 15-day dry spell between May & Jul.



Drought monitoring products (SPEI, SPI change)



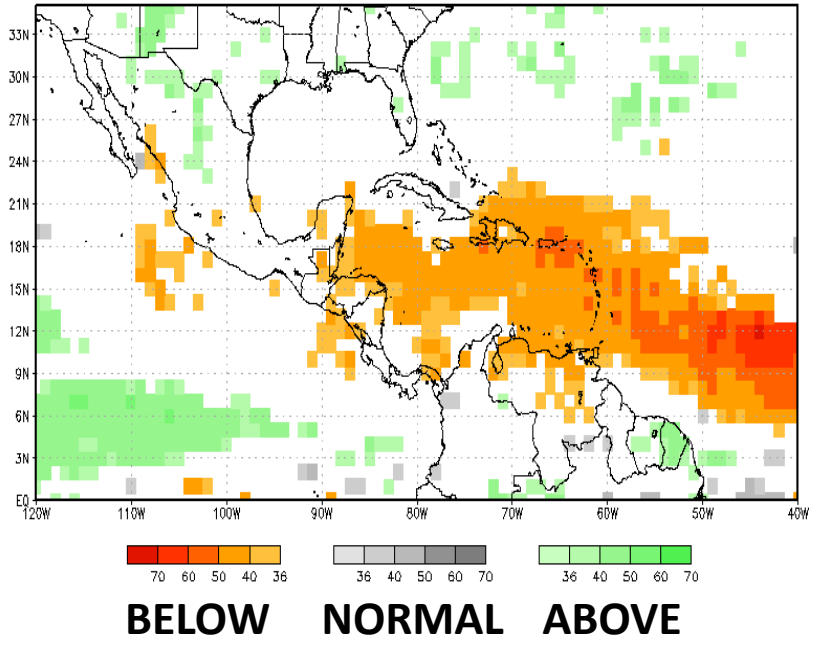


AUGMENTING SEASONAL FORECASTS – PARTNERING WITH RCC-WASHINGTON

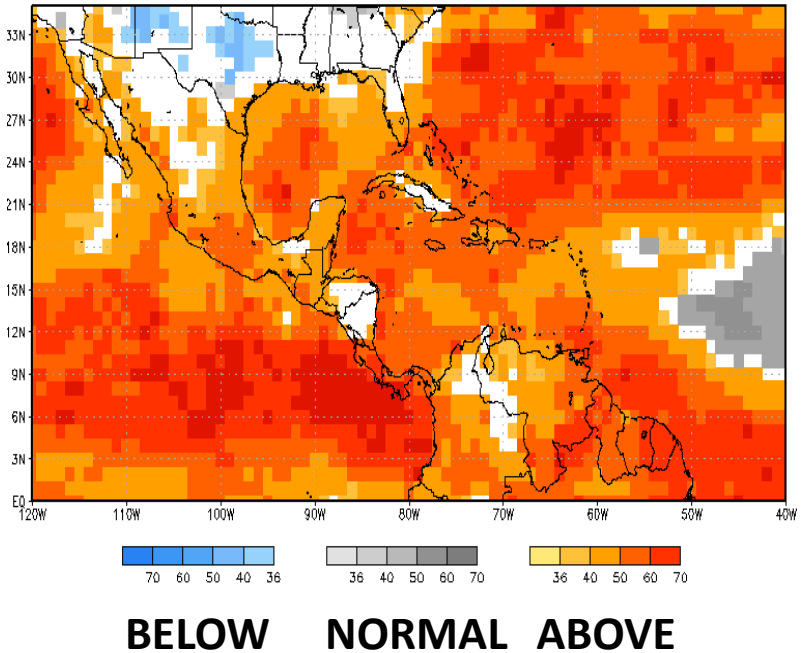
Monthly forecasts of rainfall, temperature and heatwave frequency

Monthly rainfall and temperature forecasts

June 2019



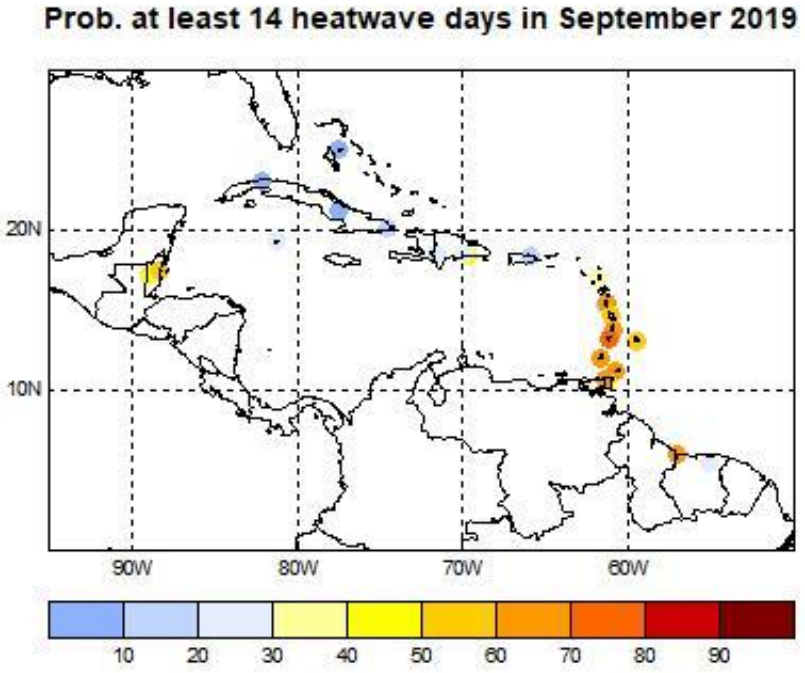
BELOW NORMAL ABOVE



BELOW NORMAL ABOVE

Forecast probability of at least 14 heatwave days

September 2019



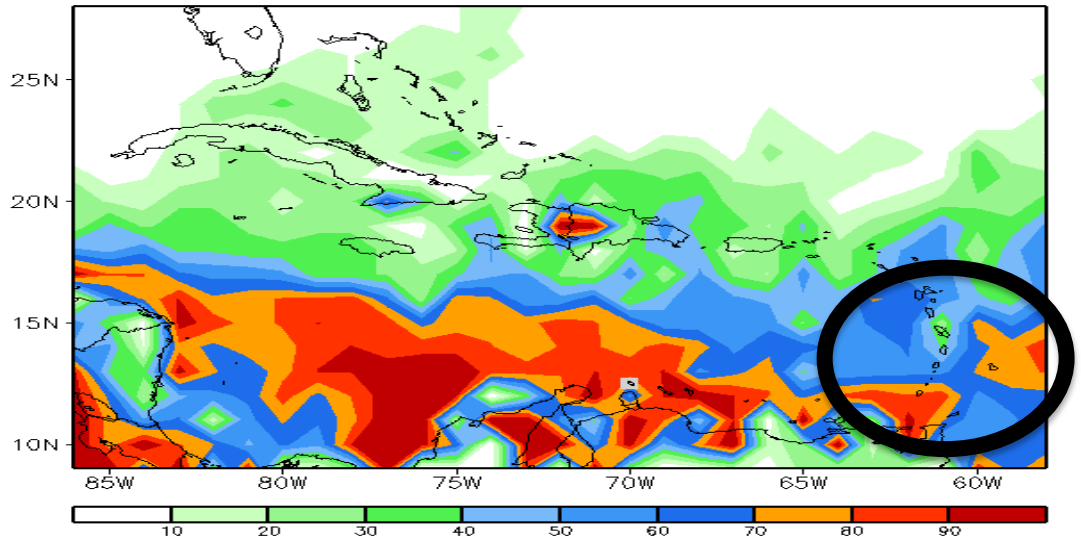
AUGMENTING SEASONAL FORECASTS – PARTNERING WITH RCC-WASHINGTON

Mid- and short-range forecasts of extreme rainfall – early warning for flash flood potential

Tropical Storm Kirk (27-28 Sept. 2018) led to near-record rainfall in Barbados, triggering widespread flash flooding.

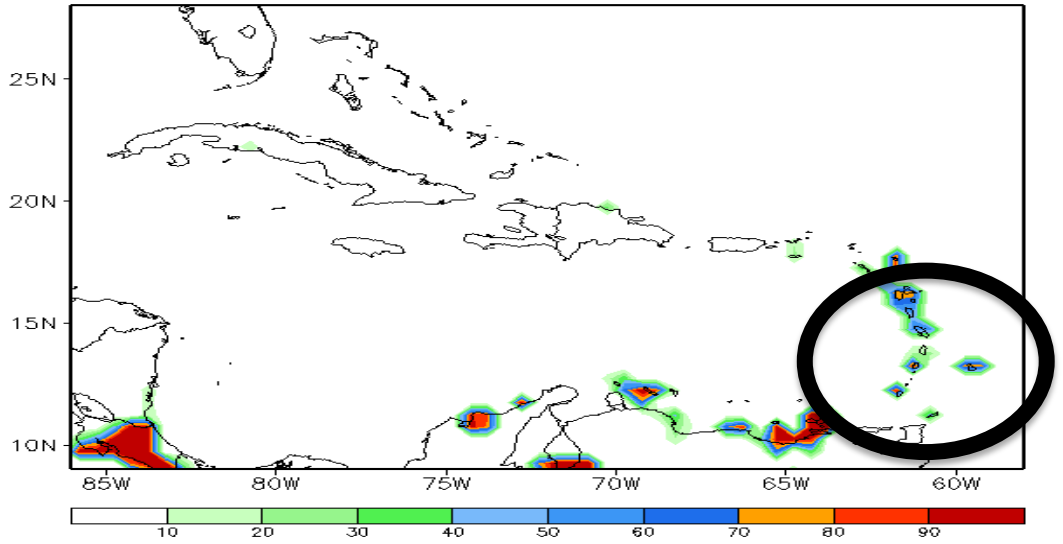
Image credit: NOAA

MID-RANGE (1 week lead time)
forecast for 24 – 30 Sep. 2018



Increased chance for extreme rainfall over Barbados in the following week.

SHORT-RANGE (1 day lead time)
Forecast for 26 – 28 Sep. 2018

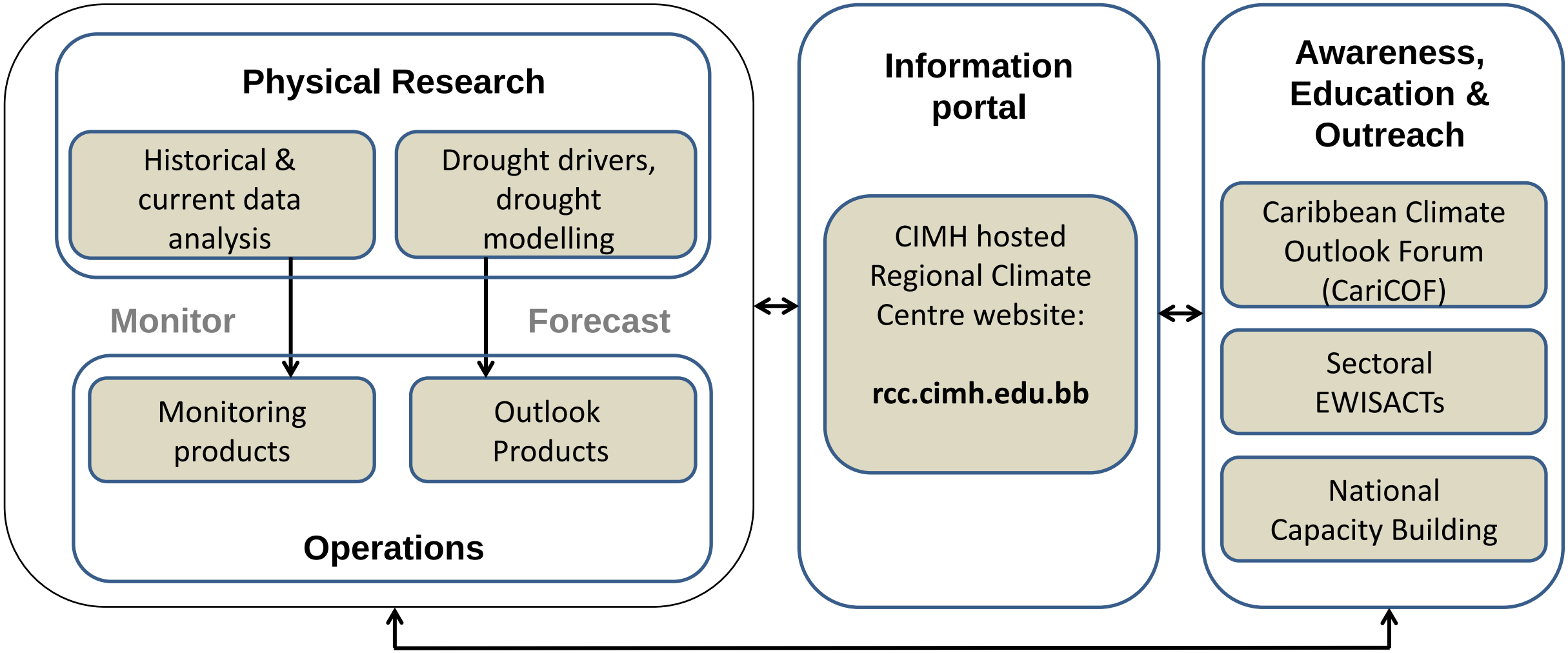


>70% chance for an extreme wet spell in Barbados over the next 3 days.

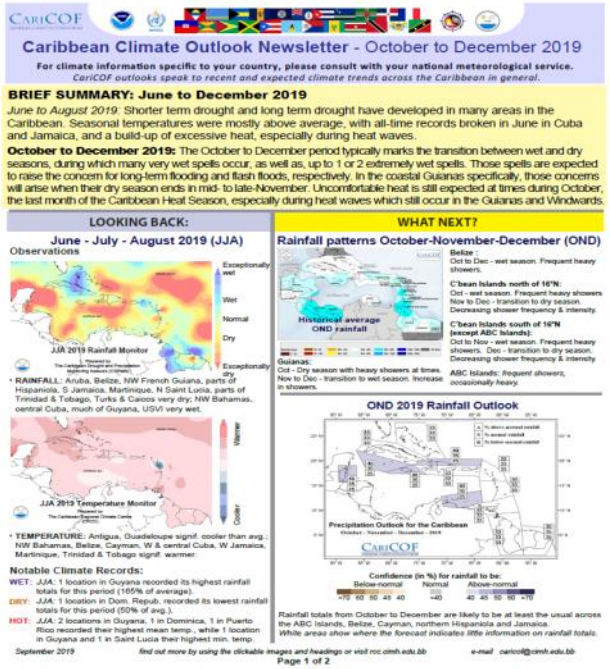
Credit: US Regional Climate Centre (*in demonstration phase*) at NOAA

DROUGHT EARLY WARNING

CIMH coordinated regional Drought Early Warning Information System

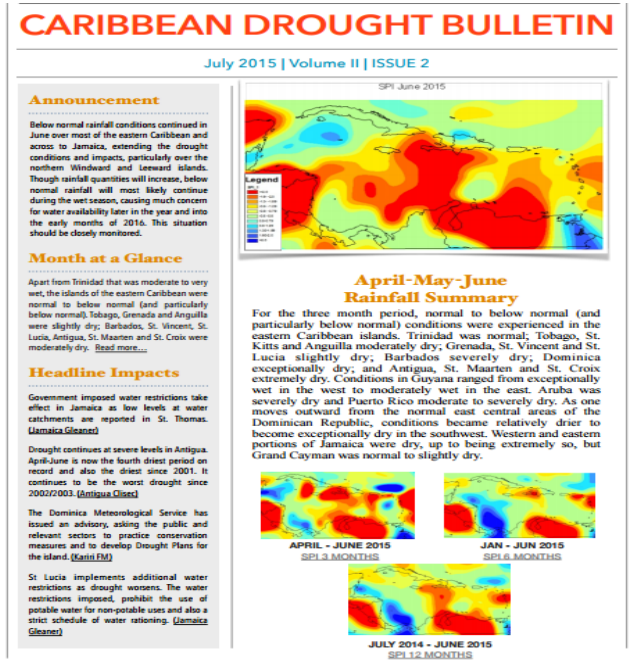


CSIS – Dissemination Newsletters/Bulletins

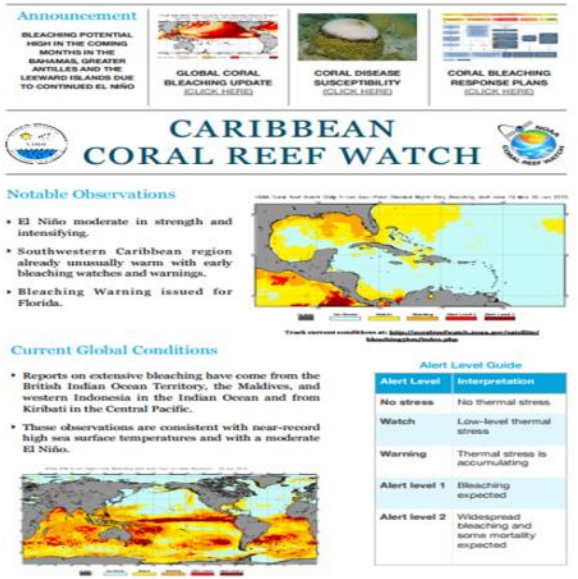


Monthly CariCOF newsletter

Partnering with NMHSs in CariCOF



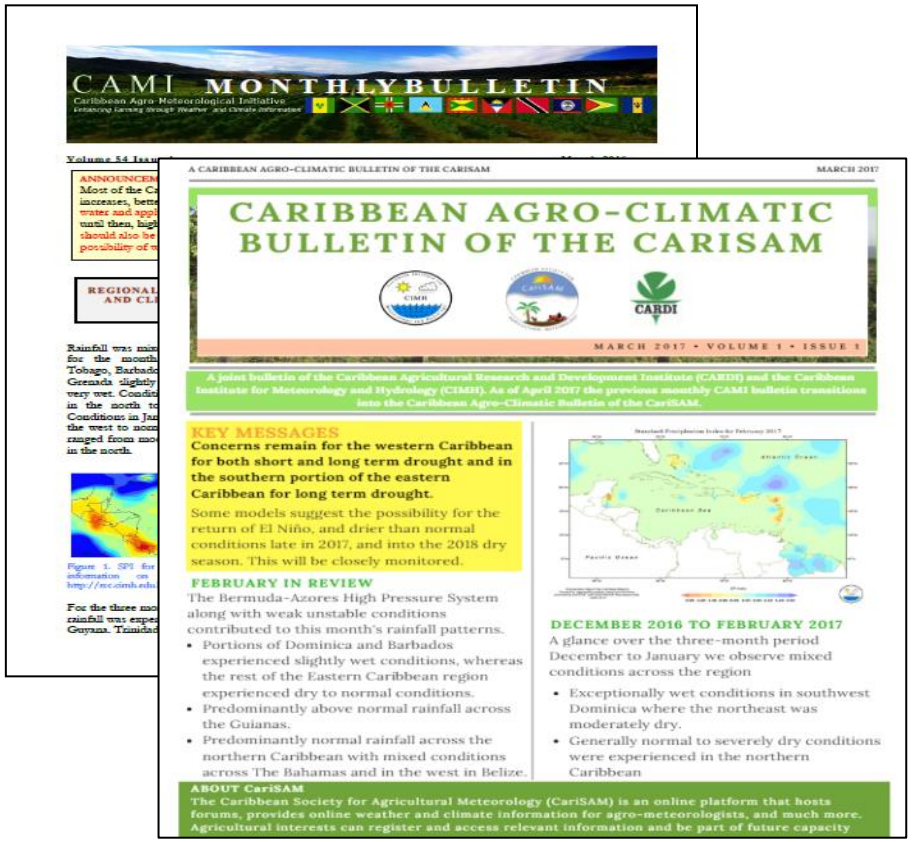
Monthly Bulletin of the Caribbean Drought and Precipitation Monitoring Network



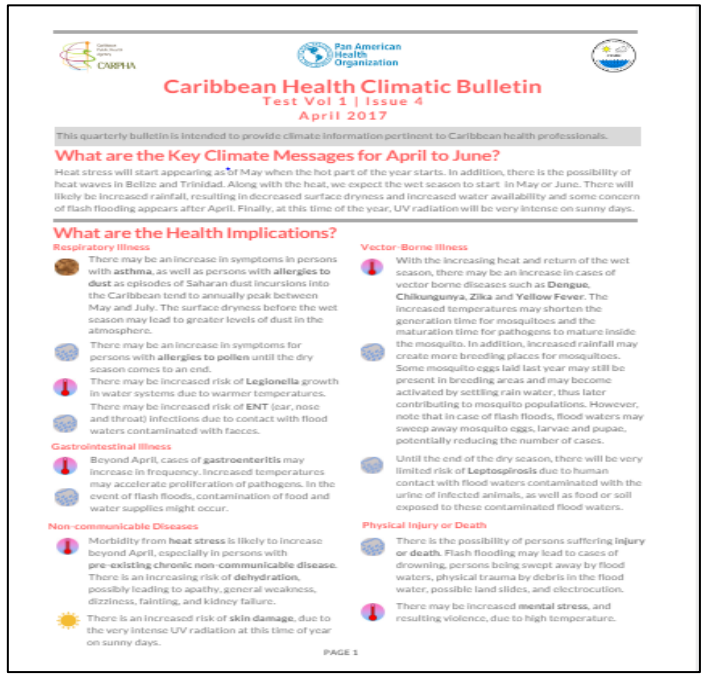
Monthly Caribbean Coral Reef Watch (May to December)

Partnering with NOAA, USA

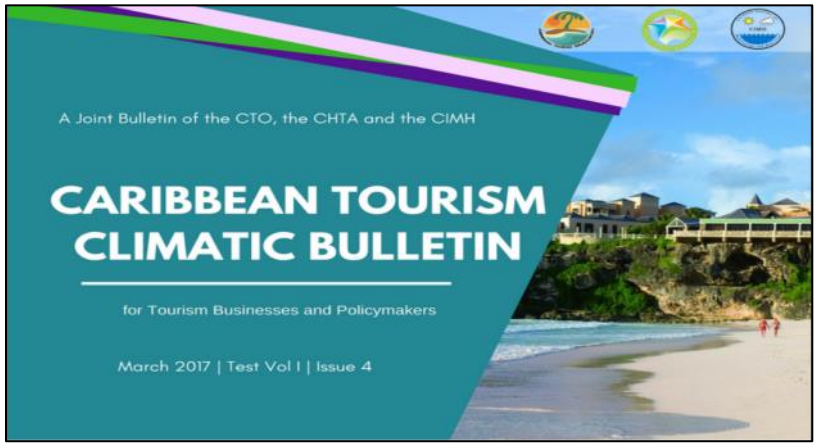
CSIS – Co-developed Sector-specific Bulletins



Regional CAMI Bulletin (since 2011), now the Caribbean Agro-Climatic Bulletin of the CariSAM

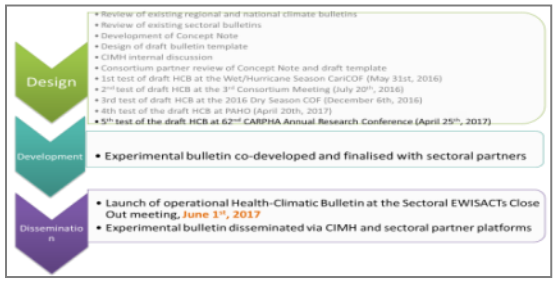


New Health-Climatic Bulletin (since May 2017)



New Tourism-Climatic Bulletin (since May 2017)

Typical Bulletin development process



Testing exercises across the 3 bulletins

Health focus group (2016 Dry Season COF. Photo credit: IRI

USER Interface Mechanisms

Forums with the farming community and agricultural extension agencies to promote a better understanding of the applications of weather and climate information. Now PICSA.

Webinars and forums also with the health and tourism sectors

CariCOF – Wet/Hurricane (DRR) and Dry Season (agriculture, water), but participation from all sectors NCOFS in Guyana, Trinidad and Tobago, Belize, Suriname

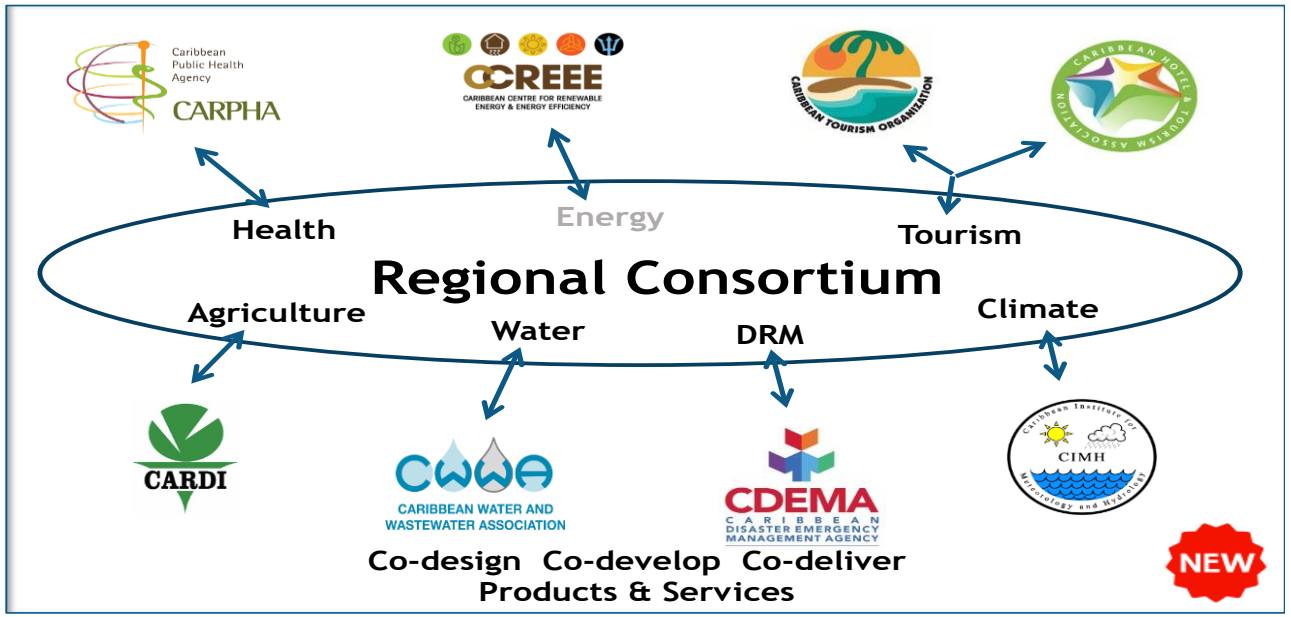
Stakeholder meetings bring meteorologists and climatologists and the user-community together to discuss climate forecasts and other information; and provide feedback. Builds trust and understanding

On-Line e.g. Portal of the Caribbean Society for Agro-Meteorology (CariSAM)

Also webinars for the health and tourism sectors

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.



6 Consortium Meetings hosted by CIMH:

May 2015, October 2015, July 2016, May 2018, Nov 2018, May 2019, 7th Consortium Meeting (Nov 2019)

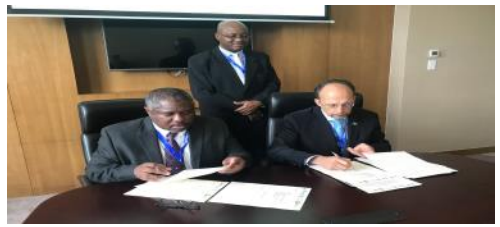
Recognised Observers – 5Cs, UWI CSGM, CCCCC, OECS

New partnerships being brokered – CCREEE

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

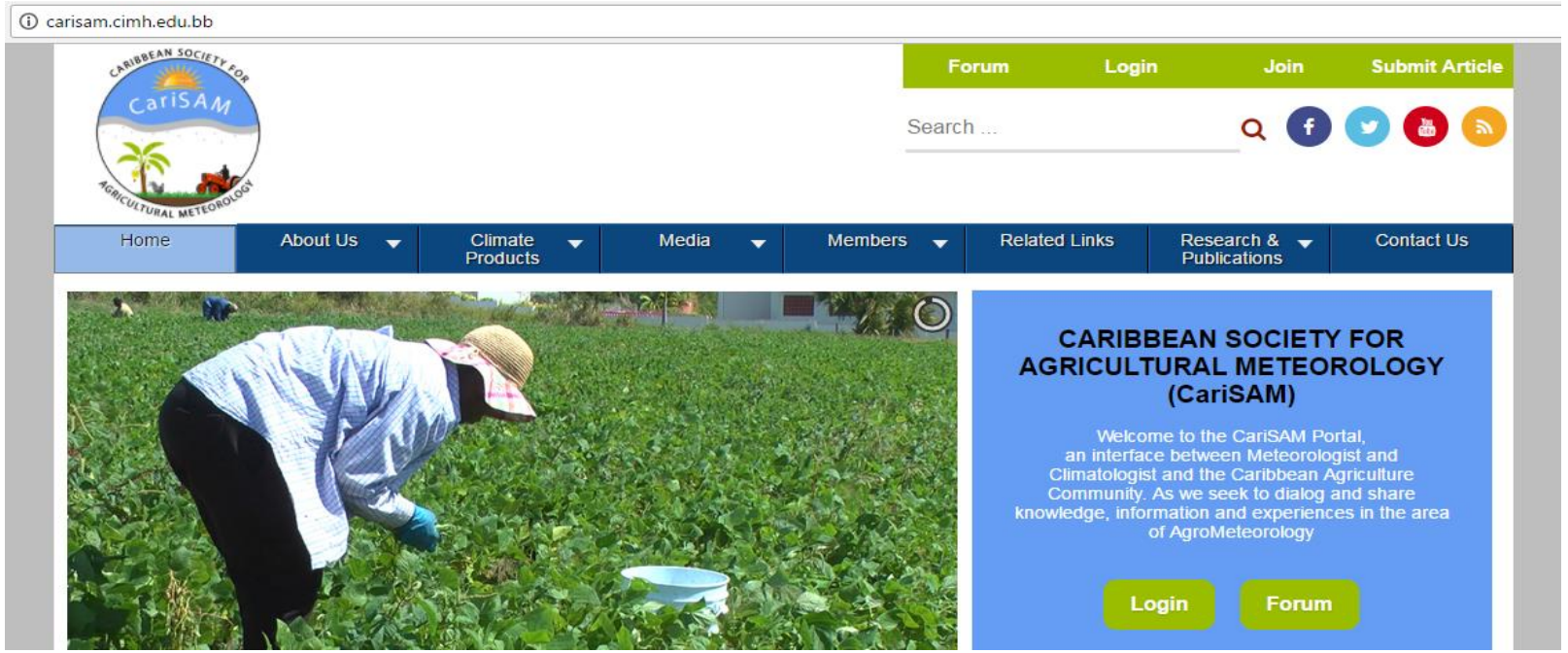
CWWA signs the LoA, October 26th, 2016

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



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

CariSAM Portal



- **weather and climate data resource**
- **tailored climate information products**
- **publication hub**
- **discussion forum**
- **online training**

www.carisam.cimh.edu.bb

A professional community supported by an *interactive online portal* which is designed to enhance collaboration and dialogue between the Caribbean agricultural and food security community (including forestry), and meteorologists and climatologists.

Builds the capacity of agricultural practitioners to use climate information and links them to key agencies and specialists at national, regional and international levels

CAPACITY BUILDING FOCUS

Training programme enhanced with upgraded classrooms and video conferencing facility

For Climate Services Provider

- Pre-CariCOF training- Since 2012
- Seasonal forecasts, verification, tools, Caribbean climate
- Drought and rainfall monitoring, Caribbean rainfall climate, instruments, remote sensing, statistical methods.
- National – Seasonal Forecast training for Guyana (supported by Government of Guyana), Belize
- Internship programme for undergraduate and graduates
- Communications training

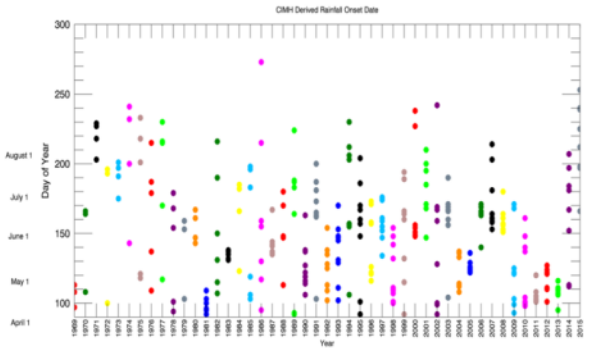
For User Community

- CariCOF Stakeholder Forum - Dry Season (agriculture and water); Wet Hurricane Season (DRM); 2016 strong health focus, 2017 Heat products
- Drought monitoring, management and planning
- Agriculture Extension Officers training, including through the PICSA approach
- Webinars for health and tourism sectors
- Media – Dry Season CariCOF 2015; Special media event February 2016; Wet Season CariCOF 2017.

Cooperation with South Pacific on RCOFs and other training workshops

RESEARCH, MODELLING AND PREDICTION

- Climate extremes, indices, forecasting and early warning (e.g. drought, heat waves, flash floods), forecast verification,
- Statistical modelling of climate and associated hazards
- Heat and human health; other applications in livestock and poultry health
- Social Sciences research to enhance climate services… In progress, research on capacities of NMHS and User Needs Assessments
- Climate and vector borne diseases; *Aedes aegypti* proliferation



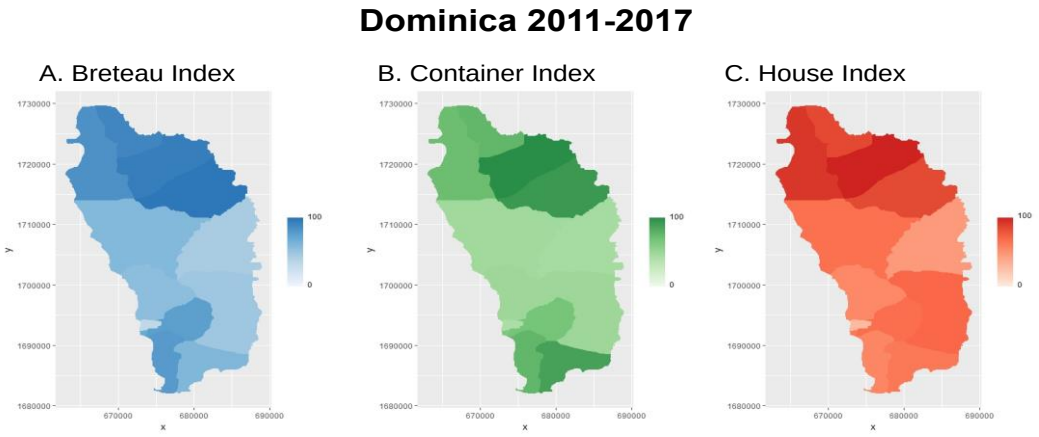


Figure 16. Average *Aedes aegypti* larval indices for Dominica over the study period (2011-2017) per environmental health district.

Publishing in 2016-2019

Published:

- Trotman A, Mahon R, Shumake-Guillemot J, Lowe R, Stewart-Ibarra AM. 2018. Strengthening climate services for the health sector in the Caribbean. WMO Bulletin 67 (2)
- Stewart-Ibarra AM, Romero M, Hinds AQJ, Lowe R, Mahon R, Rollock L, St. Ville S, Ryan SJ, Trotman A, Borbor-Cordova MJ. (2019). Co-developing climate services for public health: stakeholder needs and perceptions for the prevention and control of Aedes-transmitted diseases in the Caribbean. Available on: https://www.biorxiv.org/content/10.1101/587188v1. Accepted in PLoS NTDs, September 2019.
- T. S. Stephenson, M. A. Taylor, A. R. Trotman, C. J. Van Meerbeeck, J. D. Campbell, A. Brown and J. Spence (2018). Caribbean In: State of the Climate in 2017. Bull. Amer. Meteor. Soc., 100(9), (*in press*)
- 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
- T. S. Stephenson, M. A. Taylor, A. R. Trotman, C. J. Van Meerbeeck, V. Marcellin, K. Kerr, J. D. Campbell, J. M. Spence, G. Tamar, M. Hernández Sosa, and K. Stephenson (2018). Caribbean In: State of the Climate in 2017. Bull. Amer. Meteor. Soc., 99 (8), S200-203.
- Ryan SJ, Carlson CJ, Stewart-Ibarra AM, Borbor-Cordova MJ, Romero MM, Cox S, Mahon R, Trotman A, St. Ville S, Ahmed S. 2017. Zika Virus Outbreak, Dominica, 2016. Emerging Infectious Diseases. 23(11).
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- A. Trotman, A. Joyette, C. Van Meerbeeck, R. Mahon, S.-A. Cox, N. Cave and D. Farrell (2017). Drought Risk Management in the Caribbean Community – Early Warning Information and other Risk Reduction Considerations. In: Wilhite and Pulwarty (Eds.) Drought and Water Crises - Integrating Science, Management, and Policy. Second Edition. CRC Press. 592 pp. ISBN: 978-1-1380-3564-5.
- T. S. Stephenson, M. A. Taylor, A. R. Trotman, C. J. Van Meerbeeck, A. O. Porter, S. Etienne–LeBlanc, M. Hernández, I. T. Gonzalez, V. Cutié, D. Boudet, C. Fonseca, S. Willie, J. M. Spence, K. Kerr, A. P. Aaron-Morrison, G. Tamar, R. Stennett-Brown, and J. D. Campbell (2017). In: State of the Climate in 2016. Bull. Amer. Meteor. Soc., 98 (8), S182–S185.
- Ryan SJ, Carlson CJ, Stewart-Ibarra AM, Borbor-Cordova MJ, Romero MM, Cox SA, Mahon, R. Trotman A, St Ville S, Ahmed S. Outbreak of Zika virus infections, Dominica, 2016. Emerg Infect Dis. 2017 Nov [*date cited*]. https://doi.org/10.3201/eid2311.171140
- Gerlak, A.K., Guido, Z., Vaughan, C., Rountree, V., Greene, C., Liverman, D., Trotman, A.R., Mahon, R., Cox, S., Mason, S.J., Jacobs, K.L., James L. Buizer, C.J. Van Meerbeeck (2017). *Building a framework for process-oriented evaluation of Regional Climate Outlook Forums*. Weather, Climate and Society, 0. https://doi.org/10.1175/WCAS-D-17-0029.1
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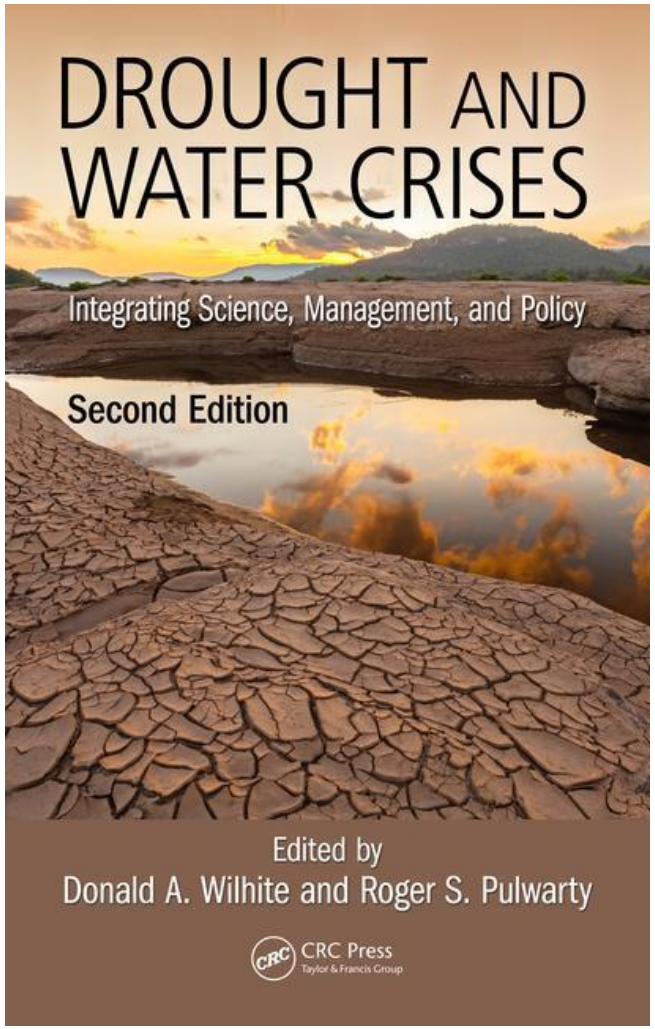
Submitted:

- CSGM and CIMH (*final draft*) The State of Caribbean Climate in 2017 – Chapters 6 (Climate Extremes and Early Warning) and 8 (Adding Value to Climate Information through Services).



Thank you!

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For climate monitoring information, climate outlooks and climate bulletins, please visit:
rcc.cimh.edu.bb