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## The Caribbean Regional Climate Outlook Forum (CariCOF)

Christ Church, Barbados

November 22<sup>nd</sup> – 23<sup>rd</sup>, 2018

Report

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Collaborators:



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## 1. Introduction

Since the 2012 Caribbean Climate Outlook Forum (CariCOF), the Caribbean Institute for Meteorology and Hydrology (CIMH) has been coordinating climate forecasting activities leading to a consistently growing body of climate forecasters contributing to the monthly production of consensus-based seasonal climate outlooks, with engagement of the user community that allows awareness-building within those sector communities. At the 2012 CariCOF, it was also agreed that the bi-annual hosting of such forums, roving across the region, just prior to the beginning of the wet and dry seasons in the Caribbean, be pursued.

Addressing climate change and increasing climate variability have been made regional and national priorities by the heads of government of the Caribbean community. Climate variability and change, as exemplified by extreme weather and climate events, such as droughts, floods and tropical cyclones, continue to pose significant risks for the Caribbean region. These make early warning information systems critical components of preparedness, risk reduction and adaptation.

In collaboration with the Climate Risk and Early Warning Systems (CREWS) Initiative, the Environment and Climate Change Canada, the USAID Office for Foreign Disaster Assistance (USAID-OFDA), US National Weather Services, the World Meteorological Organization (WMO) and, the World Bank, the International Research Institute for Climate and Society (IRI), the National Oceanic and Atmospheric Administration (NOAA) of the USA, and the Barbados Meteorological Services, the WMO Regional Climate Centre (RCC) for the Caribbean housed at the CIMH delivered the 2018 Dry Season CariCOF which will take place from 20<sup>th</sup> – 23<sup>rd</sup> November, 2018 in Christ Church, Barbados.

As has been customary for the Dry season forum, much emphasis was on agriculture and water sectors. Since there had been an El Niño watch issued for this upcoming northern hemisphere winter, which coincides with the Caribbean dry season, the potential for a severe dry season heightened the anticipation of the forecasts for the season. There was also the launch of the Climate Risk and Early Warning Systems (CREWS) Initiative for the Caribbean on the first day of the forum with some attention paid to disaster risk management.

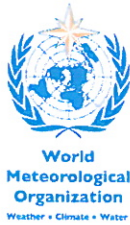
Training for meteorologists took place from 20<sup>th</sup> – 21<sup>st</sup> November with a focus on (i) sub-seasonal forecasts, of up to one to two weeks and (ii) enhancing seasonal prediction of extreme events such as flash floods and heat waves. Read more on the 2018 CariCOF Dry Season concept note at <http://rcc.cimh.edu.bb/caricof/>.

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## 1.2 Participants

Participants to the workshop were from National Meteorological and Hydrological Services (NMHSs) across the Caribbean, the CIMH, international trainers and stakeholders from the climate sensitive sectors (see [Appendix I](#)). The agenda can be viewed at <http://rcc.cimh.edu.bb/caricof/>.

## 2. Pre-CariCOF Training

Training for meteorologists and climatologists across the region took place over two days prior to the general forum. In this training session focus was on improving daily data records and diagnosing extreme events in support of the development of sub-seasonal forecasts; and quality control of daily data to identify recent extreme events. Participants were trained in preparation of sub-seasonal forecasts, of up to one to two weeks as well as enhancing seasonal prediction of extreme events such as flash floods and heat waves. The forecast for the upcoming season was also finalized for presentation to the stakeholders. The agenda can be viewed at <http://rcc.cimh.edu.bb/caricof/>.

One of the main highlights of this training was the launch of the CREWS project, captured in the following section [2.1](#).

### 2.1 CREWS Launch

#### 2.11 Hon. Edmund G. Hinkson (Minister of Home Affairs, Barbados)

The Honourable Hinkson welcomed everyone to the island of Barbados as he highlighted the awareness of the importance of early warning systems (EWSs) to reduce risks. These EWSs are critical to disaster risk reduction. He also highlighted the fact that CDEMA encourages and calls for the development, maintenance and strengthening of EWSs. Caribbean countries are highly vulnerable and there are still gaps in preparedness. The Minister is happy to endorse the CREWS initiative as it supports Small Island Developing States (SIDS) and lesser developed countries to strengthen their EWSs and reinforce national resilience through impact based forecasting. Monitoring and forecasting continues to be a challenge and there is a need for improved resilience. The CREWS project has recognised lessons learnt from previous hurricanes and Minister Hinkson is encouraged as he sees a number of agencies working together in the project.

#### 2.12 Mr. Ronald Jackson (CDEMA)

Mr. Jackson reiterates the sentiments of Minister Hinkson in regards to the importance of EWSs. The CREWS Initiative is welcomed in the Caribbean; it will be a game-changer as it contributes to two pillars of the CDEMA strategy (2014; Pillar 2 and 4). EWSs have been prioritized at CDEMA

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and advanced with the support of Japan and is being approached from a multi-lens. Mr. Jackson advocates for investment in national institutions and their sustainability thus giving them the ability to make a greater impact.

### *2.13 Dr. David Farrell (CIMH)*

Dr. Farrell welcomed all participants on behalf of CIMH. He mentioned that the CREWS Initiative supports SIDS and lesser developed countries. However, there was a caution given that this initiative not just look at previous storms of 2017 but also look further back into the record.

The CIMH has seen much change in the region over the last 50 years in terms of building capacity – institutional capacity is being strengthened. This launch of the CREWS Initiative coincides with two CIMH activities which look at providing EWSs (CariCOF and EWISACTs). Dr. Farrell sees CREWS aligning with the long-term strategies of the CIMH.

## **3. CariCOF Forum Presentations**

### **3.1 Welcome Remarks**

#### *3.1.1 Ms. Sonia Nurse (Barbados Meteorological Service)*

Ms. Nurse, Director of the Barbados Meteorological Service, officially extended greetings to all, and praised the CIMH for the various products and services provided. She made mention of previous meetings which involved the coming together of the French, Spanish and other climate forecasters, to deal with the challenges of climate variability and climate change.

#### *3.1.2 Dr. Arlene Laing (CMO)*

Dr. Laing, Director of the CMO, greatly supported the various types of research being done to improve the region. She made mention was made of the bulletins being provided by the CIMH – these are useful as they provide sector specific forecasts. Dr Lang stressed the importance of user feedback and the importance of verification, as this would enable the climatologist to make the forecasts even better.

#### *3.1.2 Josephine Wilson (WMO)*

Ms Josephine Wilson spoke about the CREWS project which was undertaken following the 2017 hurricane season, one of the worst seasons within recent times. She stressed that we need to make

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sure that early warning information reaches persons who need it the most, by developing regional strategies to support early warning services, hence continued support to CariCOF.

### 3.1.3 Dr. David Farrell (CIMH)

In his address, Dr. Farrell's primary focus surrounded the discussions had with the energy sector on renewable energy and the impacts of drought on the energy sector. He highlighted that these sectors need a certain amount of water to generate energy. He also pointed out the impact this deficit would have on the tourism sector, and made mention as to what these forecasts mean to them, hence a need for the sustainability of CariCOF.

### 3.2 Dry Season Climatology, Dr. Cédric Van Meerbeeck (CIMH)

This presentation looked at the climatology of a typical dry season and a review of any significant aspects to the previous dry season. Dr. Van Meerbeeck stated that the dry season accounts for only 20 to 30 percent of annual rainfall and that the heart of the dry season is mainly from February to April. Careful note is to be taken that this season is not exempted from tropical cyclone activity, just that statistically they mainly happen in the hurricane season, from June to November. It was also pointed out that the historical findings on 7 day dry spells, showed that in the late dry season March to May, more 7 day dry spells occurred than in the first half of the dry season. He concluded that at present there are no areas featuring severely dry conditions, and in terms of temperature, conditions are a bit warmer than usual.

### 3.3 2018 Dry Season Forecast, Arnold King (The Bahamas Meteorological Service)

In his presentation of the 2018 Dry Season Forecast with the likelihood of a weak to moderate El Nino developing, the following is the summary of the expectations:

- Short-term Outlook (end of February 2019)
  - Chances of drought and recurrent dry spells are increased, except in The Bahamas, Cayman and Cuba, which may lead to water stress in agricultural crops, as well as accelerate water depletion in reservoirs, and increase the potential for wild fires.
  - Extreme wet spells remain possible through December in Belize and the islands, and throughout the period in the coastal Guianas, leading to concerns of flash flood potential.
  - Heat not a major concern in coming months (cool season).
- Long-term Outlook (end of May 2019)

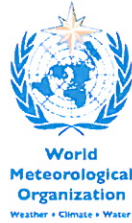
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- Region-wide, severe drought is unlikely, however, some concerns of water availability towards the end of the period.
- Heat stress may rise faster than usual towards May, with the possibility of heatwaves, particularly in Belize and Trinidad.
- Considerable uncertainty regarding rainfall during the late dry season.
- Stay tuned as information is updated each month

### 3.4 Discussion on presented forecast

*Mr. Adisa Trotter (Ministry of Agriculture, Dominica):*

Mr. Trotter asked for clarification on the 7-day dry spell forecast. He also suggested that there be a look at the economic impacts to the sectors.

Dr. Cedric van Meerbeeck (CIMH): there is no need to be worried about the 7-day dry spell across Dominica in the early dry season.

Dr. Arlene Laing (CMO): we rely on the users of the information to make a case to their government ministers for continual support.

Dr. David Farrell (CIMH): can national datasets be made available to extend work done for a national productivity forecast?

*Dr. Arlene Laing (CMO):*

During the El Nino winter in the Greater Antilles there is the potential for flash flooding events therefore disaster risk managers should pay attention.

Dr. Cedric Van Meerbeeck (CIMH): Also cautions that the potential for flash flooding in the Eastern Caribbean is still a reality before January and after March.

*Mr. Orvin Paige (Antigua and Barbuda Meteorological Service):*

There have been extreme wet spells so far for November. He was expecting that the forecast would have some adjustment with respect to drought concerns over Antigua.

Mr. Adrian Trotman (CIMH): rain that falls in the period before the month end are not captured in the persistence information.

Dr. Cedric Van Meerbeeck (CIMH): limitations with the forecast is the exclusion of what happens in the current month. Drought creeps up but can end quickly.

*Andre Innocent (Ministry of Agriculture, St. Lucia):*

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It does not seem appropriate for us in the islands suffering drought when there are technologies available. CariCOF could partner with CariCOM to utilize solar energy better. Look into renewable energy to power desalination plants.

Mr. Albert Jones (CCCCC): through funding there has been the installation of desalination plants (first in Bequia) in some critical areas in the Caribbean. It can be expanded across the Caribbean as funding increases.

Ms. Veronica Yearwood (Antigua): It is a good idea however; maintenance is extremely high.

Mr. Albert Jones (CCCCC): these drawbacks have been experienced but they have had the photo-voltaic system feed into the national grid and that money aids in the maintenance of the system.

### 3.5 Break-out Groups

Participants were grouped as they discussed the implication of the forecast to their respective sectors. Responses were captured in [Appendix II](#).

### 3.6 Reviewing Weather and Climate Extremes, Dr. Cedric Van Meerbeeck (CIMH)

As flash floods and dry spells present themselves as a challenge the focus of the CariCOF is now to use sub-seasonal climate forecast information to increase lead times to improve preparedness and mitigation. To develop seasonal flash flood forecasts a review was done on recent wet spells that triggered flash flood events. A seasonal outlook of the frequency of extreme wet spells would add some context to a rainfall forecast. With regards to heat stress prediction, a proposed solution to its forecast would be to take a look at the wet-bulb or dew point temperature.

### 3.7 Climate Information for Public Health Action, Dr. Simon Mason (IRI)

Dr. Simon Mason presented the book “Climate Information for Public Health Action”. Edited by Madaleine C. Thompson and Dr. Mason himself. This text can be obtained in the following formats:

Free electronic copy:

[www.taylorfrancis.com/books/e/9781351631112](http://www.taylorfrancis.com/books/e/9781351631112)

Exceedingly well-priced hard copy:

[www.routledge.com/Climate-Information-for-Public-Health-Action/Thomson-Mason/p/book/9781138069633](http://www.routledge.com/Climate-Information-for-Public-Health-Action/Thomson-Mason/p/book/9781138069633)

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Free access to colour images (PNG, PDF, PPT):

[cipha.iri.columbia.edu/CIPHABOOK2019/Supplementary\\_Materials/](http://cipha.iri.columbia.edu/CIPHABOOK2019/Supplementary_Materials/)

The main themes of the text include (i) the health outcomes of hydro-meteorological disasters; (ii) infectious diseases of humans and animals; and (iii) nutrition. It also speaks about the direct health impacts of increases in CO<sub>2</sub> on allergens; air pollution; and the indirect impacts on economic growth and income inequalities that affect the ability of governments to provide health services, and individuals to support a healthy lifestyle and seek care.

Dr. Mason also noted that climate information has the potential to inform health decisions through an improved understanding of (i) mechanisms of disease transmission; (ii) spatial risks; (iii) seasonal risk; (iv) sub-seasonal and year-to-year changes in risk; (v) trends in risk; and (vi) the assessment of the impact of interventions.

### **3.8 Commonwealth Climate Services Initiative, Chris Hewitt (UK Meteorological Service)**

The UK Meteorological Service works closely with international, regional and national organisations and engages with climate sensitive communities and sectors. The Service works within the GFCS to (i) co-develop climate services to support near-term and long-term decision making; (ii) build capacity and provide training for climate service providers; and (iii) coordinate major research and operational climate service initiatives.

In the Commonwealth Climate Service Demonstrator Project, the UK Meteorological Service will be working with Commonwealth nations to support climate change adaptation in SIDS. This project runs from April 2018 until April 2020 and will include climate service centres and national meteorological services.

### **3.9 New CCRIF<sup>1</sup> Products**

An online presentation about an emerging agricultural drought risk model for CCRIF was presented by Dr Marco Antonio Negrón. Dr. Negrón spoke about his research with various cash crops, and the calculation of crop yields through vegetative growth models with the aid of climate data. He identified 2 types of drought for consideration in the model - (i) a dry spell event - 60 or more consecutive dry days and (ii) yield reduction event - a drought event that decreases significantly the crop yield due to abnormally low annual accumulated precipitation. Both events are calculated on a

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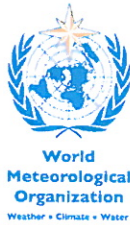
<sup>1</sup> CCRIF – Caribbean Catastrophe Risk Insurance Facility

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pixel/crop/country basis, and there cannot be yield reduction losses if a dry spell event has been declared in a location. With the dry spell event, payouts are issued whenever an exceedance of the policy attachment point takes place; however with a yield reduction event, losses are computed at the end of the policy cycle and are added any dry spell losses, with complimentary payouts being issued if required.

### 3.10 REACH Project, Daniele Barelli (FAO)

The Resilient Environment and Agricultural Caribbean Habitats (REACH) cooperative project begins December 2018 and will run for 12 months. Its main donor is the Ministry of Foreign Affairs and International Cooperation of Italy and implemented by the FAO with the CIMH, CDEMA, and CIMA as partners. The islands of Grenada and St. Vincent and the Grenadines are the beneficiary countries where farmers (both men and women) and youth; national and regional institutions responsible for agricultural extension and disaster preparedness, management and mitigation; and agri-food consumers would be the focus.

### 3.11 Exceedance Information for Agriculture, Shontelle Stoute (CIMH)

This presentation demonstrated additional information that can be provided to the farmer to better help in the on-farm decision making. The Climate Predictability Tool (CPT), developed by Dr. Simon Mason of the IRI can assess the probability of exceeding thresholds of rainfall and temperature over a given period. The information needed to produce such a probability would be the minimum crop water requirements of the crop to produce a good yield, and the season of interest (or growing cycle).

### 3.12 Advancing Sector-Specific Climate Information at the Regional Level, Roché Mahon (CIMH)

Dr. Roché Mahon reported on progress made for the period June-November 2018. The main activities and achievements for the period included:

- Updates to the new Sectoral EWISACTs webpage ([rcc.cimh.edu.bb/ewisacts](http://rcc.cimh.edu.bb/ewisacts)) - a resource hub that houses key conceptual and implementation documents, research documents and hyperlinks to sector-specific climate bulletins, among other things;

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- Updates to the Caribbean Climate Impacts Database – specifically, harvesting and synthesis of over 9000 climate-related impacts from over 100 secondary documents into Google sheets repository;
- Research and publications:

#### **Health-Climate:**

##### ***Development of a climate driven spatio-temporal modelling framework for vector-borne diseases***

###### ○ Published :

- 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>

###### ○ In press:

- Trotman A, Mahon R, Shumake-Guillemot J, Lowe R, Stewart-Ibarra AM. Strengthening climate services for the health sector in the Caribbean. *WMO Bulletin* 67 (2).

###### ○ In development:

- Stewart-Ibarra AM, Romero M, Hinds AQJ, Lowe R, Mahon R, Rollock L, St. Ville S, Ryan SJ, Trotman A, Borbor-Cordova MJ. Co-developing climate services for public health: stakeholder needs and perceptions for the prevention and control of Aedes-transmitted diseases in the Caribbean. Manuscript in development for submission to PLOS NTDs.
- IRI and CIMH. Variability and predictability of heat extremes in the Caribbean in support of climate services for public health. Manuscript in development

#### **Tourism-Climate:**

- ***Development of a climate driven spatio-temporal modelling framework for tourism-*** Support to Caribbean Tourism Organisation (CTO) with Research Consultancy team recruitment
- Tourism Climatic Bulletin (TCB) testing at CTO/CDB CSSTI Regional Training and Sensitisation Workshop, Oct 2018

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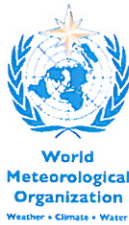
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### Social science:

- Submitted: Mahon, R., Greene, C., Cox, S.-A., Guido, Z., Gerlak, A., Petrie, J., Trotman, A., Liverman, D., Van Meerbeeck, C. J., Scott, W. & Farrell, D. A new role: Are National Meteorological and Hydrological Services in the Caribbean Fit for the Purpose of Climate Services? *Climate Services*.
  - In press: Mahon, R., Farrell, D., Cox, S., Trotman, A., Van Meerbeeck, C.J., and Garfield Barnwell (2017). Climate Services and Caribbean Resilience: A Historical Perspective. *SES*, Vol. 67: 2&3.
  - Trotman, A, Mahon R and Van Meerbeeck, CJ. Chapter 8, State of Climate Report, "Adding value to climate information through services"
- Presentations - 2 posters were presented at the American Society for Tropical Medicine and Hygiene Climate and Health Symposium Meeting (ASTMH), October 2018; CIMH participation in a panel presentation and discussion at ASTMH Symposium Meeting; CIMH presentation at the 3<sup>rd</sup> Global Conference on Health and Climate Change, October 2018; and

Dr. Mahon also gave an overview of the multi-phase participatory process underpinning the development of the Sectoral EWISACTs Roadmap and PoA 2020-2030 (RPA). She highlighted the progress that had been made two days earlier at the 5<sup>th</sup> Consortium Meeting which reviewed and validated text in Sections 1-10 of the RPA. Significant progress was particularly made on advancing Section 6 – the Plan of Action - while there was a showcase and validation of the direction of the draft Monitoring, Evaluation and Reporting (MER) framework. The 2018 Dry Season CariCOF presented the opportunity for stakeholder review and input into the Sectoral EWISACTs Roadmap and Plan of Action 2020-2030 (2018 Dry Season CariCOF) in which there was further review and editing of master document by CariCOF participants.

### 3.13 Parallel Sessions

Two sessions, Advancing Sector-Specific Climate Information at the National Level and Institutional Arrangements and Resourcing, were conducted with the objectives to (i) develop sector-specific climate information with lessons from 3 PPCR Caribbean countries and (ii) to present and discuss the draft multi-lateral Letter of Agreement (LoA) and Terms of Reference (TOR) of the Sectoral EWISACTs Regional Coordination Partners respectively.

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The progress on the implementation of the PPCR Project for the period May to November 2018 was also presented. In addition, a list of climate information products and bulletins at the national level was reviewed and validated by Met Service staff. Two draft bulletin templates were tested for enhancement by both Met Service staff and sectoral users as part of a participatory bulletin development process.

### **3.14 The Status and Future of Caribbean Climate Services, Adrian Trotman (CIMH)**

In light of the Global Framework on Climate Services (GFCS), the Caribbean regional program is well advanced. In support of the Caribbean's climate watch, there is a suite of climate monitoring and forecasting products on drought, rainfall and temperature. The monthly CariCOF newsletter, drought bulletin of the Caribbean Drought and Precipitation Network (CDPMN), and the Caribbean Coral Reef watch bulletin are also produced. The development of a Consortium of sectoral EWISACTs partners has seen new and enhanced sectoral bulletins: the Agro-Climatic bulletin of the Caribbean Society of Agricultural Meteorology (CariSAM); Health-Climatic bulletin; and the Tourism-Climatic bulletin. This is the first major result of the Consortium partnership.

Mr. Trotman further expressed his personal thoughts as to how climate services can continue to advance even more meaningfully in the Caribbean. He suggested:

- Greater movement at the national (and community) levels
- Buy in from political leaders
- Greater investment in NMHSs and Climate Services – sustainability beyond donor investment.
- Investment in NMHS to include - financial, human and infrastructural (including computer/IT)
- More dialogue between NMHSs and sector practitioners
- At both the regional and national levels – engage private sector more, including financial services, energy.

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## Appendix I: Participant List

Country/Affiliation	Last Name	First Name	Country/Affiliation	Last Name	First Name
Antigua Water	Yearwood	Veronica	CCREEE	Blackman	Francene
Anguilla	Jennings	Jeffrey	CDEMA	Jackson	Ronald
Antigua Meteorological Service	Paige	Orvin	CIMH	Allen	Teddy
Aruba Meteorological Service	Tromp	Rodney	CIMH	Appelwhaite	Andrea
Bahamas Meteorological Service	King	Arnold	CIMH	Brathwaite	Cherise
Barbados Meteorological Service	McGeary	Wayne	CIMH	Depradine	Wayne
Barbados Meteorological Service	Murray	Brian	CIMH	Kirton-Reed	Lisa
Belize Meteorological Service	Smith	Michelle	CIMH	Mahon	Roche
British Virgin Islands	Castro	Miguel	CIMH	Petrie	Jodi-Ann
Barbados Water Authority	Paul	Jaime	CIMH	Stoute	Shontelle
Barbados Water Authority	Austin	Nicole	CIMH	Trotman	Adrian
Caribbean Farmer's Network (CaFAN)	Browne	Claude	CIMH	van Meerbeeck	Cedric
CARDI	Hall-Hanson	Rasheeda	CMC	Richards	Peter
CARPHA	Robertson	Lyndon	CMO	Laing	Arlene
Cayman Islands	Gall	Winston	CSGM	Whyte	Felicia
CCCCC	Jones	Albert	CTO	Smith	Sean

Country/Affiliation	Last Name	First Name	Country/Affiliation	Last Name	First Name
Curacao	Luidens	Tyrone	Martinique	Legoutte	Philippe

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CWWA	Hosein	Candi	MET	Murray	Brian
DEM	Harewood	Robert	MOH	Rollock	Leslie
Dominica Agriculture	Trotter	Adisa	Mont	Gerrald	Gerren
Dominica Water	Roberts	Brian	OECs	Isaac	Cornelius
Dominican Republic	Viloria	Cecilia	PAHO	Vlugman	Adrianus
FAO	Barelli	Daniele	Ski Water	Jeffers	Nikisha
Finance	Hyppolite	Charmaine	Slu Agri	Innocent	Barry
Grenada Agriculture	Thomas	Daryl	St. Kitts	Benjamin	Vincere
Grenada Meteorological Service	Frank	Fimber	St. Lucia	Francis	Eugenie
Guyana Hydro-Meteorological Service	Dhiram	Komalchand	St. Maarten	Etienne-LeBlanc	Sheryl
Guyana Hydro-Meteorological Service	David	Donessa	St. Vincent	McDonald	Joan
Haiti	Chery	Marie	Sur Water	Artist	Sharmaine
Jamaica Meteorological Service	Brown	Glenroy	Suriname	Kartadji	Santousha
Jamaica Water	Wilson	Michael	Svg Agri	Browne	Karomo

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World  
Meteorological  
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Weather • Climate • Water

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FROM THE AMERICAN PEOPLE

Country/Affiliation	Last Name	First Name	Country/Affiliation	Last Name	First Name
TCI	Henfield	Tiffany		Kappes	Melanie Simone
Tdad Water	Moonilal	Barry		Dani	Saurabh Suresh
Trainer	Mason	Simon		Origosa	Julia Saenz
Trinidad	Kissoon	Kaidar		Pierre	Donna
UWI	Grant	Delando		Brown	Pietra
	Arenas	Nehuel			
	Kontro	Maria			
	Craig	Kester			
	Forbes	Michelle			
	Pascal	Fitzroy			
	Hewitt	Chris			
	Osborne	Rebecca			
	McIntyre	Sylvan			
	Wilson	Jay			
	Sjaavik	Lina			


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## Appendix II: Break Out Group Responses

### Water Sector

#### Antigua Met Office:

1. From the Climate Outlook given, what would be something to take into consideration is how Long El Nino would be with us this season: because the longer that it is in effect, the harsher and drier the end of the dry season would be
2. We in the Caribbean should look at the rain/ wet spells during the next month and half and if possible we have the wet season creeping into the dry season, then we should encourage all persons impacted by a water shortage to save or store water during this time

#### Jamaica:

During the 2016-2017 period, the Jamaica Met services advised that there was a drought in certain parishes. However, the Jamaica Water Utilities did not observe a hydrological drought as they had restrictions on their abstraction rates and amounts for their groundwater supply, so they were able to supply the public without experiencing a depletion in their groundwater systems. The surface waters in some areas did experience less volumes during this time. The Met Office realised that their messages were not getting out to the public so this year they recently launched a mobile app where persons can be advised of drought areas as well as flood areas. Rainwater harvesting is encouraged in the drought prone areas of Jamaica during the wet season.

#### Antigua:

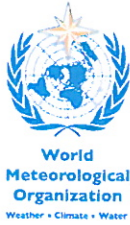
By the time the Met Office had declared drought in Antigua, the Public Utilities Company already knew and had been working as such by then. They ration water to customers and had strict restrictions applied to their groundwater abstraction amounts (8-9%). They introduced another Reverse Osmosis (RO) plant and increased their water supply from 60% to 90% desalinated water supply in Antigua. Being in a drought is nothing new to Antigua, so they will continue to conserve, ration, monitor and hope for the best. The Public Utilities Company are operating that the rain that

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fell recently was just a rain event and not the end of the drought and will not change their current mode of operations for their water sector.

### Trinidad:

They have 4 reservoirs, rivers and a number of wells. In 2010, the drought affected their aquifers so since then they have built storage tanks especially for their rural communities. During the wet season, some farmers use some of the rivers and they monitor their usage as the dry season comes to ensure that they do not over exploit or use water that is too muddy. They also advise the farmers to switch to drip irrigation during the dry season. Rationing of water to the customers are done 24/7 for 3 days in certain areas. Ongoing project to fix leaks along the distribution systems in country to reduce water wastage in dry season. They work closely with the Met Office and use the 3 month projections given to calculate the 3 month projections for their reservoirs.

### Dominica:

They do not experience drought events. However, after the hurricane, their trees/forestry are depleted and bare. They are forecasting that during the dry season, without the tree coverage that evaporation and evapotranspiration of their surface waters will cause less volume of waters in their rivers and surface water sources. They are currently building water storage tanks just in case these impacts are felt.

### Suriname:

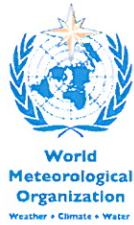
They do not experience drought events and have freshwater supplies. However, they are investing in projects to increase the number of surface water treatment plants just in case the dry season is severe.

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### Haiti:

They do not experience drought events but are very concerned about flash flooding. Their water resources are rationed.

### St. Kitts:

During the dry period, the customers are rationed. The water supply is off from 8pm until 5am every day. They encourage home owners to have their own water storage tanks built from new construction. The tourist ships are not given water during the dry season. In the tourist belt region, water supply is not rationed. Marriott has their own desalination plant so they do not get water from St. Kitts Water Utilities. During the dry season, they have conservation campaigns: no use of hoses, buckets to wash cars. Currently there are drilling wells to increase their water supply from groundwater sources.

### Barbados:

More communication to public regarding water conservation and rain water harvesting. Will be working closely with the partners met at this forum to develop a national COF and response for all sectors impacted during the dry season.

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## CariCOF Disaster Management and Health, Tourism, Finance

### Disaster Management

#### Concerns

1. Barbados - Main Hazard concern regarding wildfires (mostly bush fires) and some construction encroachment (impacts on infrastructure)

Instances of Cowitch - airborne spreading can lead/have led to school closings due to exposure. In an attempt to eradicate the cow-itch plants, persons attempt to burn, which often results in bush fires

Preparedness measure - Firefighters may need to pre-position water tankers/storage to support their efforts

2. St. Vincent noted that besides low-average rainfall, there are also concerned about flash floods at the end of rainy season. Also see a need to emphasize those problems that were associated with strong winds and high waves in the dry season. Need to send alerts to coastal community.

- Wind swells - More modeling guidance needed, particularly as the tourism infrastructure along the coast was affected

We noted that the CIMH provides outputs from Wave Watch III but needs to be given to the national public through the Met Services. Noted that the Weather Ready Nation Project is helping with collaboration between Met Service and Emergency managers in Barbados for Impact-Based Forecasting.

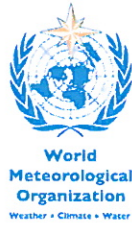
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- Belize and Disaster Management and Met were in same ministry - will pass on the message from the COF

- Bahamas and Emergency Manages also collaborate closely

St. Maarten - Bulletin with sections for each sector disseminated monthly.

### *Next Steps*

- Will be looking at implementing better mitigation measures
- Barbados Emergency Management Stakeholders meeting - next meeting will raise issue or send a note out

### **Public Health**

PAHO/Caribbean Public Health - Have standard protocols for drought

Implication for:

Sanitation, air pollution, water quality, vector-borne diseases, respiratory issues, heat stroke, dehydration, mental health, intestinal illnesses, and the like

Question about focus on elderly and heat? Will come into play in the late dry season

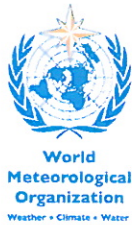
Paradoxically, with less rain - more mosquito borne diseases because of storage of water being done incorrectly.

### *Next Steps*


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- Adjust the sectoral bulletin for health

## Tourism

Tourist will like the sunshine. Dehydration can be an issue.

Water availability for tourists. Storage of water brings risks of contamination. Complaints of diverging water to tourists rather than residents during dry spells.

Complement to CIMH for the CariCOF

## Next Steps

- Report to the standing committees in country that deal with drought
- Still a gap in communication between Met Service information and the layman's language.
- Public Health issues alerts but those are not connected to the Met Office information. Met Services distribute information on website. Then Public Health sector gets that information from the website. Met Services need to be more proactive in dealing with stakeholders directly.

## Agriculture

December 2018- February 2019:

1. Flash Flood Potential
2. Soil Erosion (water and wind generated)
3. High Winds (Damage to Crops)
4. Increase demand of water to irrigate crops (Northern Islands)
5. Cost implications for Agronomic Activities


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6. Increase in Dry Spells (impact crops e.g.; tomatoes)
7. Proliferation of pest and Diseases associated with the increase of Wet Spells
8. Saline Intrusion

March/May 2019:

1. Insufficient Water
2. Low Yields of crops
3. Crops and Livestock- Water Stress/Heat Stress
4. Increased Prices
5. Health Issues for Farmers: Heat Related Issues, Hypertension (High Pressure), Heat Stress
6. Low Productivity
7. Excessive Dust
8. Reduced Soil Moisture leading for Farmers having to irrigate their crops.
9. Decrease in Bio-diversity (eg. Fishes)
10. Decrease in water quantity in lakes and other water catchments
11. Fires (Forest, Bush)
12. Crop Lost
13. Saline Intrusion
14. Proliferation of pest and Diseases associated with drier conditions

Opportunity:

Implementing Early Warning Actions

- Water Harvesting (DJF)- ground water harvesting, rain water harvesting
- Change in crop choices
- Livestock (preparation of hay, silage, avoid overcrowding, pasture management)
- Farmers investing in the requisite technologies to combat droughts
- Recycle water
- River damming

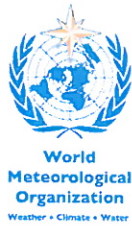
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- Increased public awareness and sensitization
- Agricultural Insurance
- Desalinization plants
- Water conservation
- Reduce usage of chemical and improve soil management techniques

#### Recommendations:

1. Increase research:
  - Increase research on dust and agriculture
  - Increase research on winds and agriculture
  - Increase research on Sargassum Sea Weed
2. Increase usage of Meteorological Information from CIMH, and local Hydrometeorological Services in the Region.
3. Engage fire Departments in the various Territories.
4. Revisit and refine CariCOF Theater to suit school children and other stakeholders.
5. Improved delivery of Information.

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