Implementing Drought Early Warning Information Systems (DEWIS) in the Caribbean

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Key Messages

1. **2015-2016 regional drought: 2015 driest year on record. Rainfall deficits subsiding since April/May 2016 for many.**
   Drought impacts similar to major drought of 2009-2010.
2. **How to: Effective drought risk reduction?**
   Drought early-warning information systems (DEWISs)
   + national drought management policies and plans.
3. **Capacity building led by CIMH, engaging water sector stakeholders:**
   - **Since 2009:** Building regional DEWIS capacity – drought monitoring, forecasting, education and research;
   - **Since 2011:** Building In-country drought management capacity – drought risk awareness, drought policy and plan drafting;
   - **2016:** Formalised regional partnership between climate sensitive sectors

Caribbean Institute for Meteorology & Hydrology (CIMH)

Mandate

"... to assist in improving and developing the Meteorological and Hydrological Services as well as providing the awareness of the benefits of Meteorology and Hydrology for the economic well-being of the CIMH member states. This is ***achieved through training, research, investigations and the provision of related specialized services and advice***".

Functions of the Caribbean Institute for Meteorology & Hydrology

- WMO Regional Training Centre – meteorology, hydrology and associated sciences
- 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 Satellite Meteorology
- Advisor to regional governments on matters related to meteorology, climate & hydrology
- Provide specialized services to industry
- **WMO Regional Climate Centre** (Demonstration Phase) – a natural extension in function

An arm of the Caribbean Meteorological Organisation (CMO) and an organisation of the Caribbean Community (CARICOM)

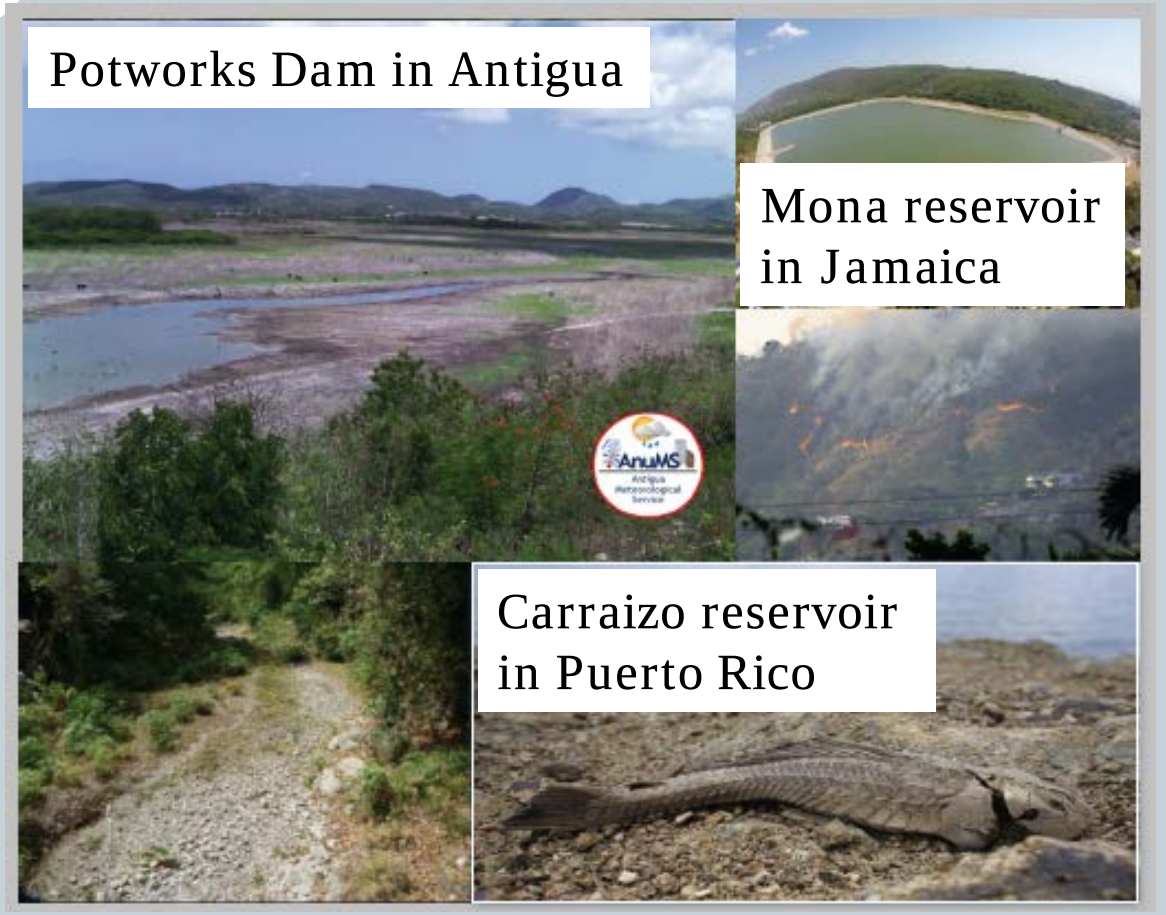
Sixteen Member States

What has happened in the recent past (2014-’16)?

In the news – drought!!

2015: record dry in many places

- *Antigua & Barbuda*
  From October: "No surface water exploitable in Antigua, **nearly 100% desalination**" (ANUMet)
- *Barbados*
  record driest year resulting in **water outages** in parts of the island.
- *Belize*
  Millions $ losses in agriculture.
- *Cuba*
  Most severe drought since 2004, water deficits in 45% of country, **100,000 people** depending on water delivery by tanks.



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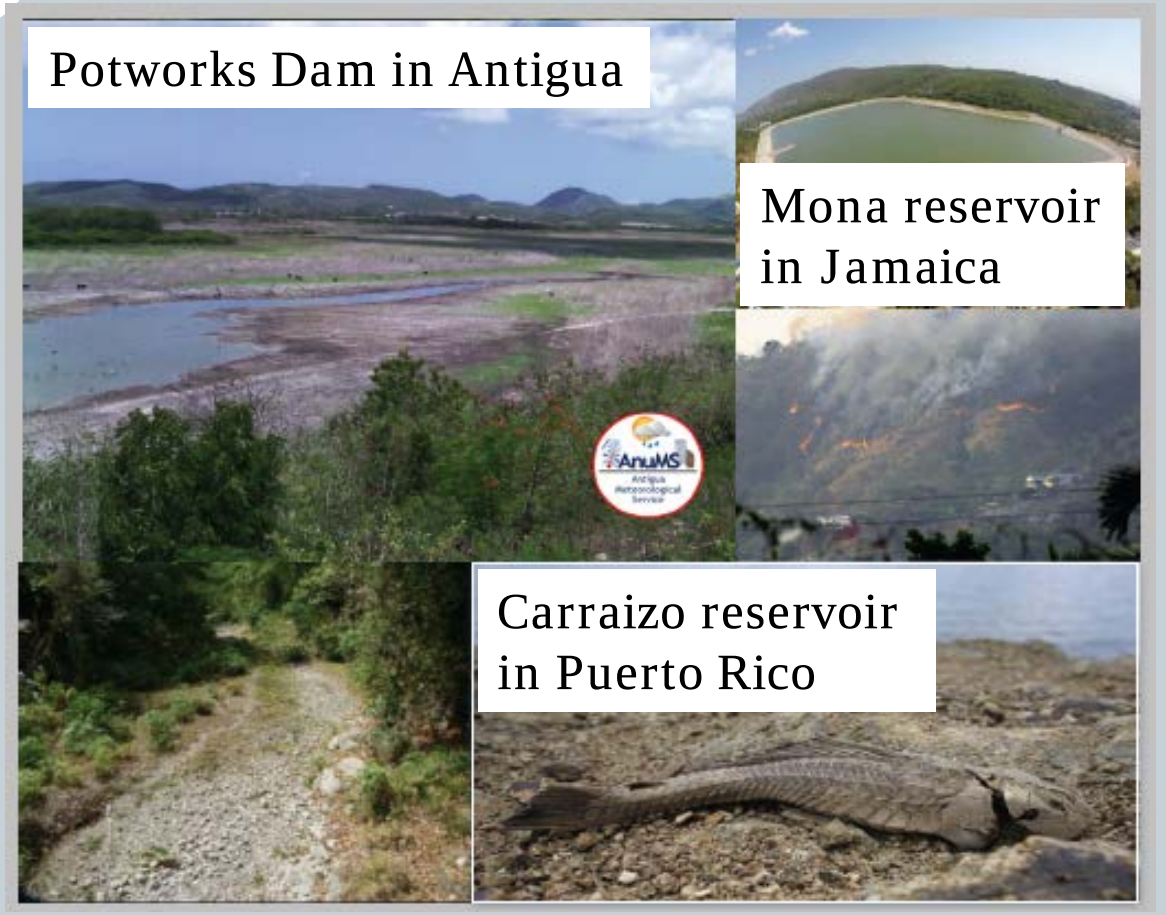
http://www.jamaicaobserver.com/news/Drought-fuels-bush-fires-in-Manchester

In the news – drought!!

2015: record dry in many places

- *Dominica*
  Tropical Storm Erika amidst drought:
  1.3 billion EC$ damage and losses.
- *Dominican Republic*
  11% decrease in agricultural production.
- *Guyana*
  Guyana Water Inc. updated **water rationing** and management practices for Georgetown
- *Haïti*
  200,000 families affected by ongoing drought, with a **30% reduction in harvest** over 2015
- *Puerto Rico*
  streamflows well below average, eastern PR under drought, **rationed water supply** to San Juan up till October. (PR Met Service)



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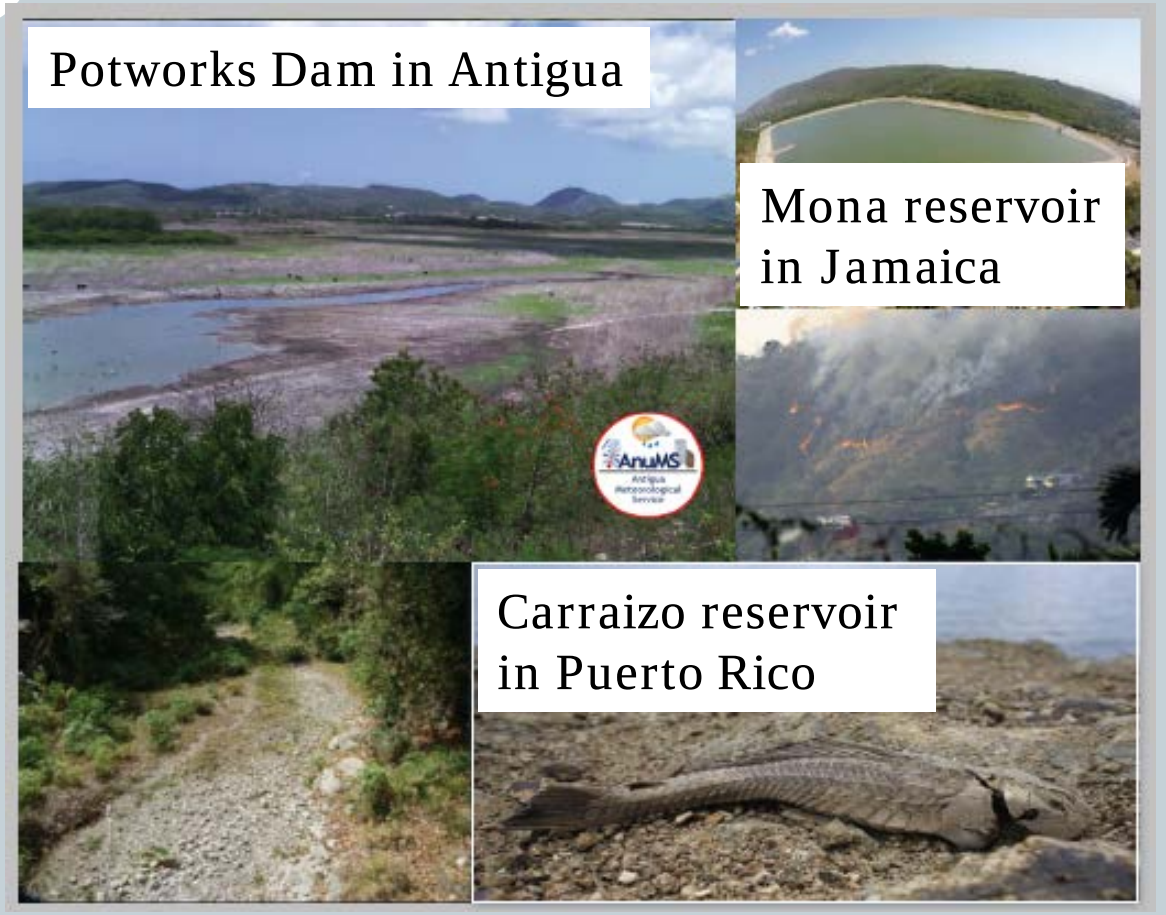
In the news – drought!!

2015: record dry in many places

- *Grenada*
  Domestic water service interruptions in 2016.
- *St. Kitts & Nevis*
  water rationing resumes in January 2016 after second driest year on record. No water sold to cruise ships since September.
- *St. Lucia*
  two driest years on record in 2014 & 2015 led to **water restrictions** for all households.
- *St. Vincent & the Grenadines*
  significantly **reduced river flows** as of March 2016, intense dryness in Grenadines



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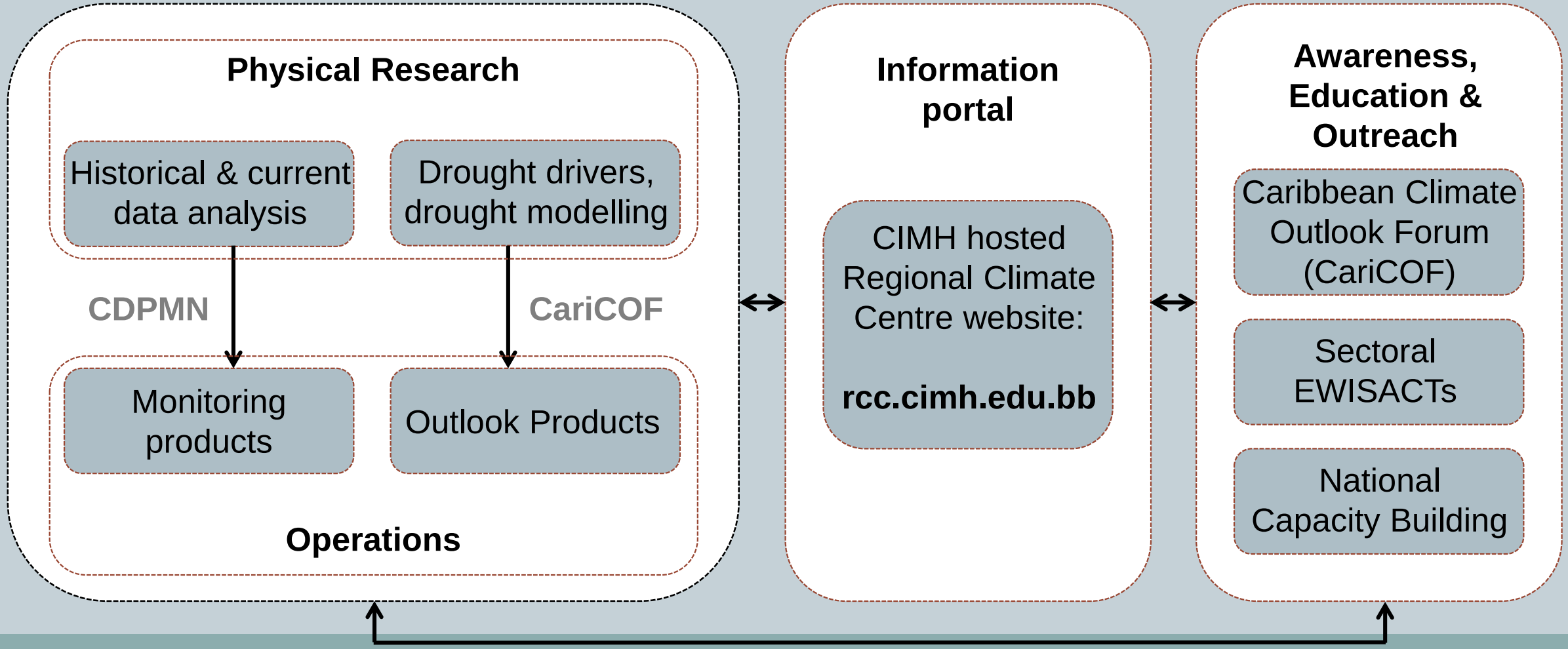
Regional Drought Early Warning Information System (DEWIS): an evolving framework

CIMH coordinated regional DEWIS

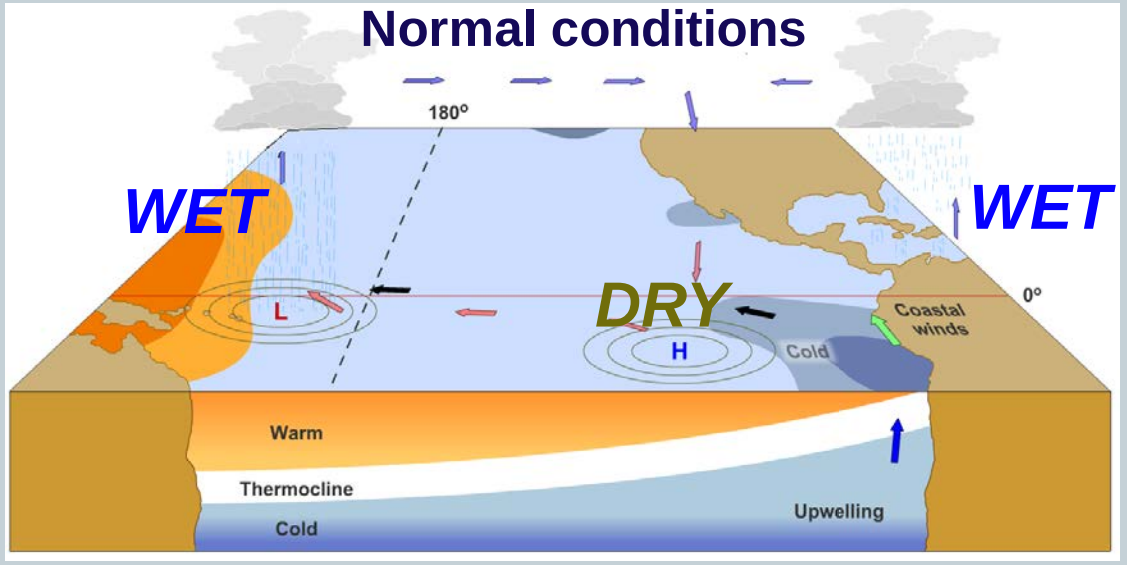


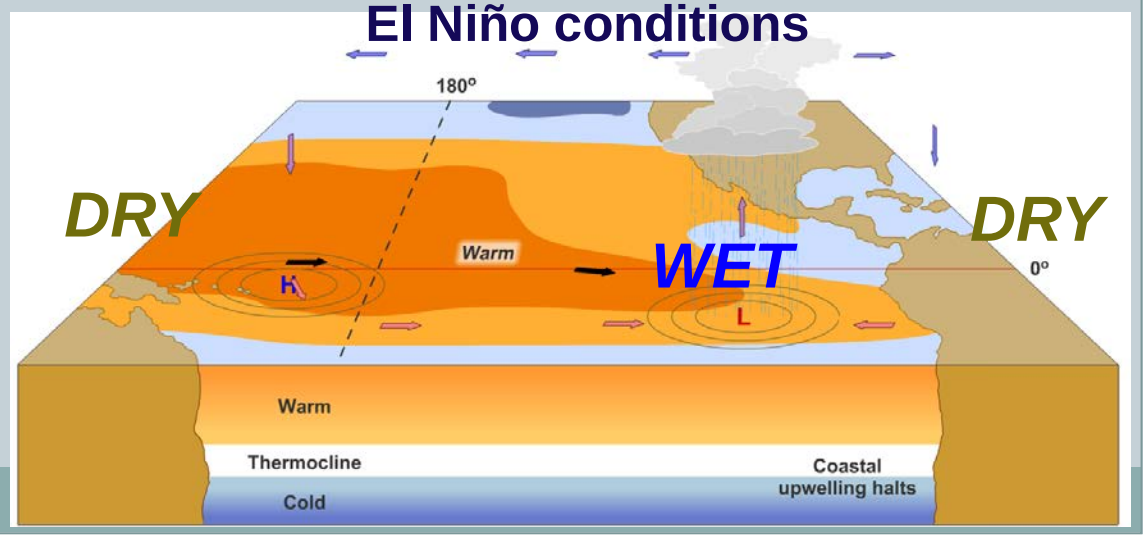
Why the drought? Research

INTERNATIONAL AND REGIONAL RESEARCH

El Niño a major cause for drought in the Caribbean

- **El Niño is…**
  - Warmer than normal sea surface temperatures across the east-central equatorial Pacific (off the coast of South America).
  - Due to ocean currents and winds shift near equator.
  - Occurs every 2-7 years
- El Niño stabilises the atmosphere, tears up storm clouds and **leads to dryness in our region… EXCEPT northern Caribbean**, where El Niño tends to bring more rains in the dry season.
- **El Niño 2015-'16**, the 2nd strongest since at least 1950, will end in the May-June-July season.
- El Niño probably to be replaced by **La Niña towards the end of 2016**, with opposite impacts (including excessive rainfall and more active hurricane activity) to be expected.



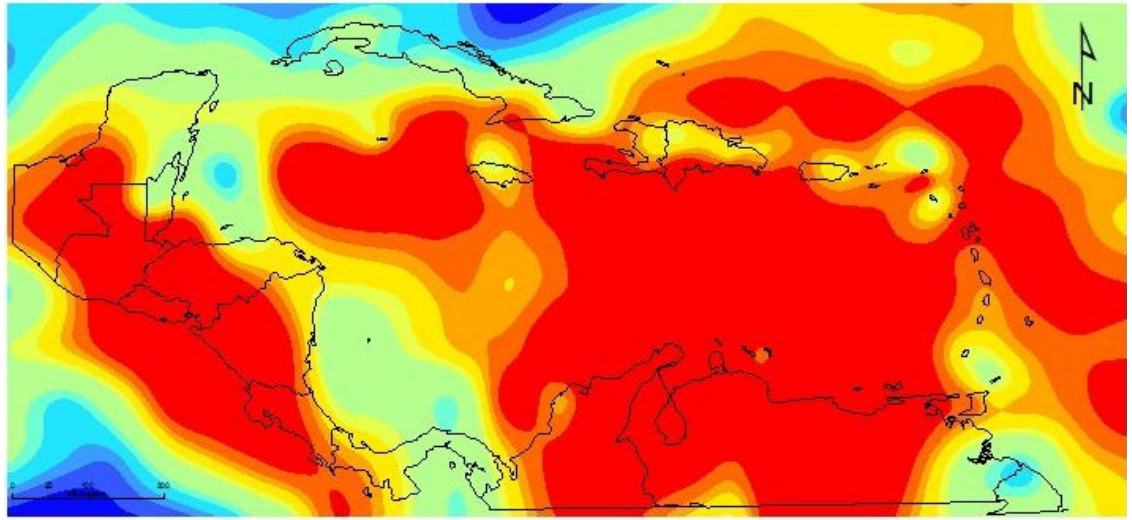


How do we know?
Monitoring capacity since 2009

MONITORING

Regional drought monitoring products

E.g. the map below shows 12-month drought severity between April 2015 and March 2016



Source: SPI Monitor **(since 2009),** Caribbean Drought Bulletin

OBSERVATIONS:

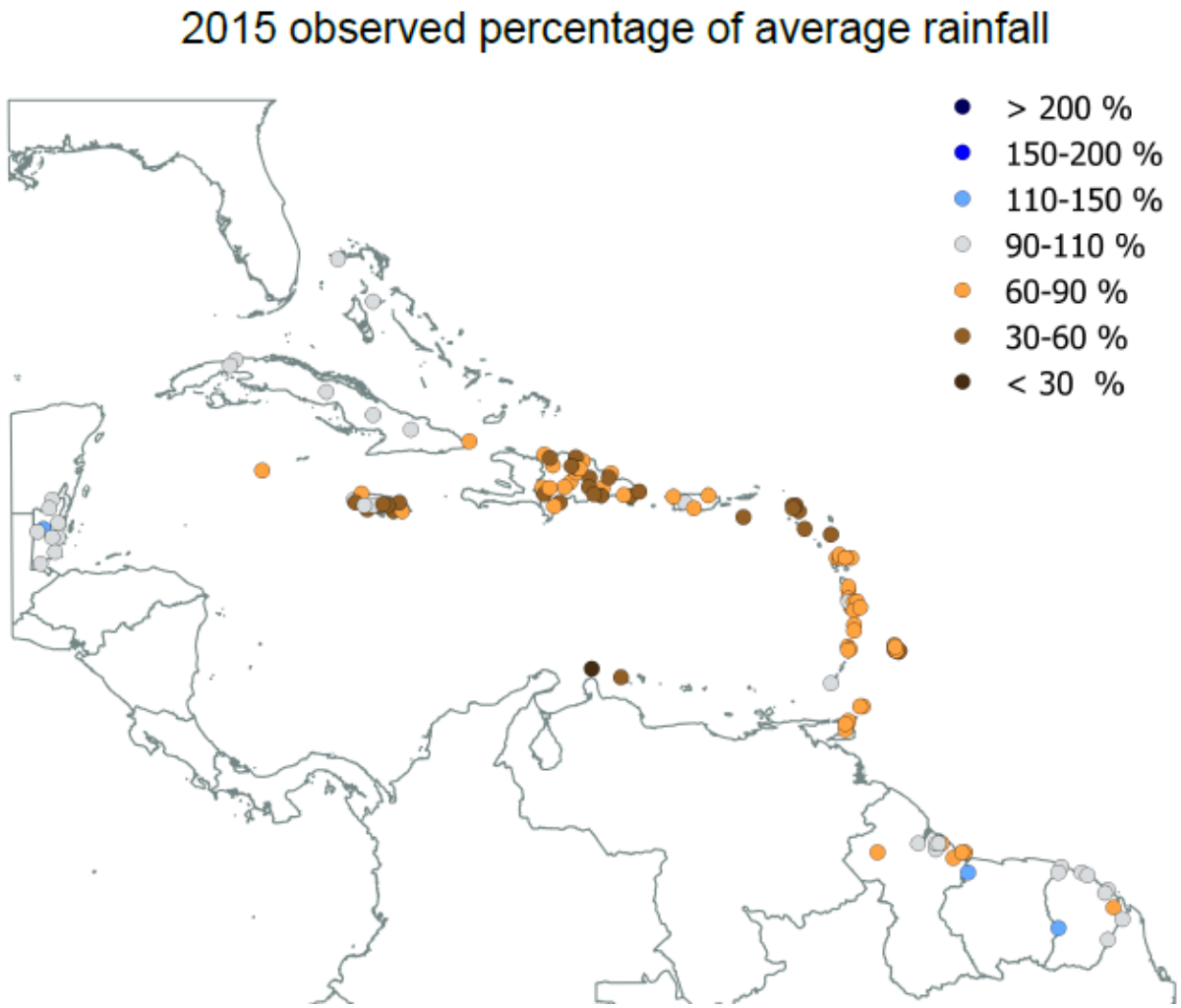
- Short- to mid-term drought in Anguilla, Antigua, BVI, Grenada, Guyana, SVG, …
- Long-term drought drought throughout region.

IMPLICATIONS:

- Areas in short- to medium-term drought:
  (i) more bush fires,
  (ii) lower agricultural yields,
  (iii) possible price increase in local goods.
- Areas in long-term drought:
  (i) unreliable water supply due to water shortages &
  (ii) water consumption restrictions.

MONITORING

Regional drought monitoring products



Source: Forecast Quality Verifications (since 2015)

OBSERVATIONS:

- Short- to mid-term drought in Anguilla, Antigua, BVI, Grenada, Guyana, SVG, …
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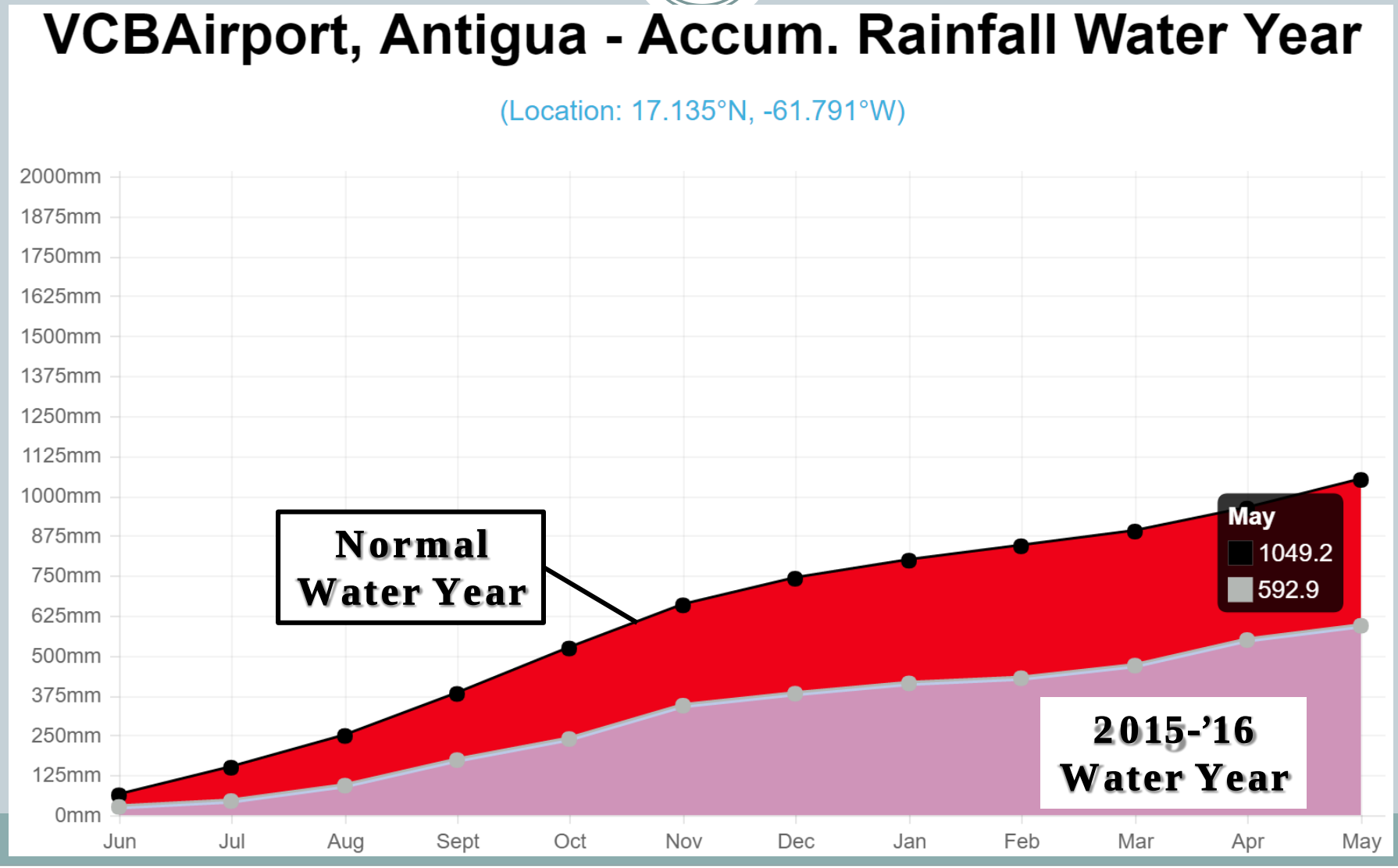
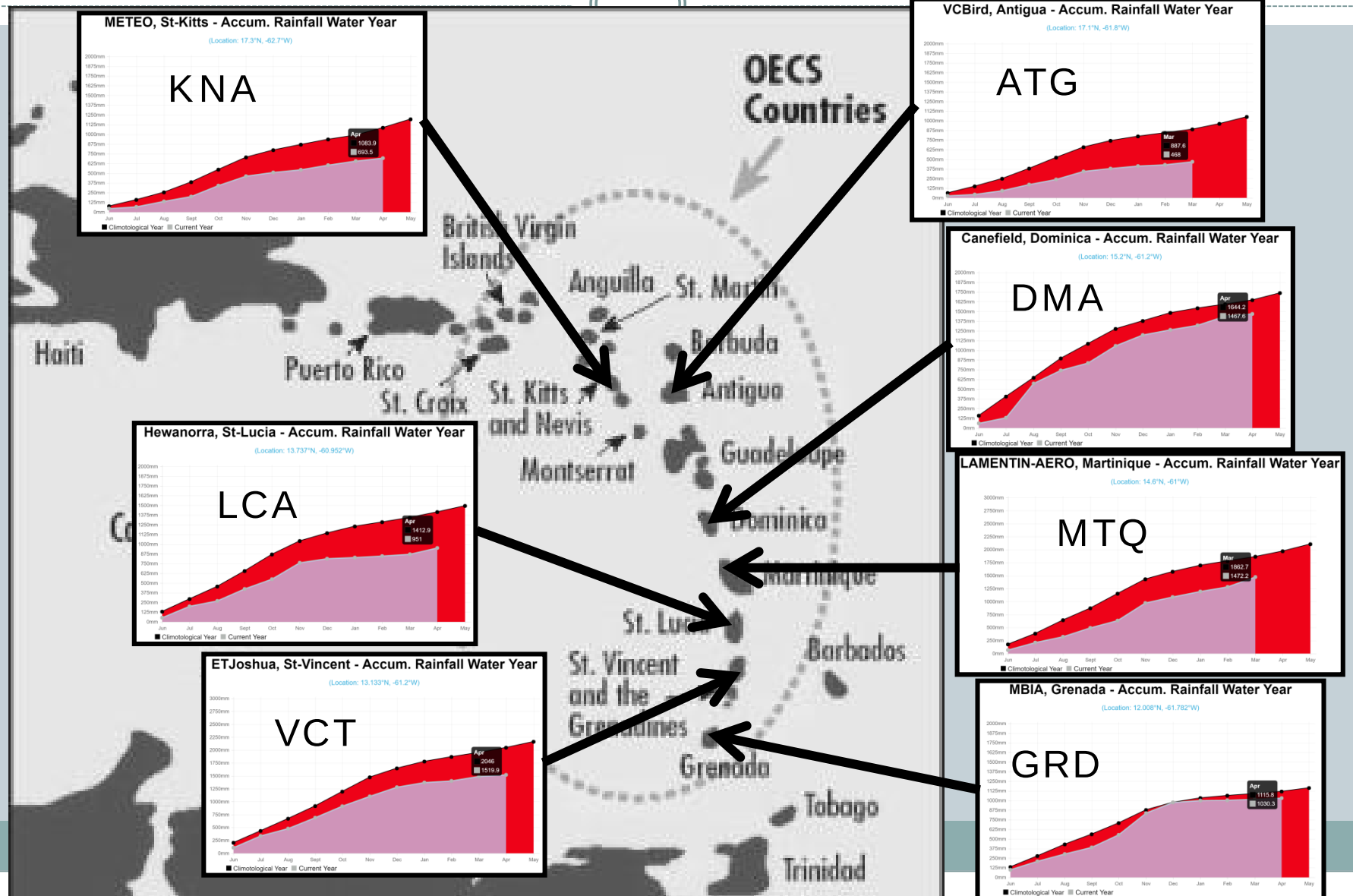
MONITORING

Site-specific rainfall deficits / surplusses (150+ sites)



MONITORING

Rainfall deficits in OECS through March/April 2016



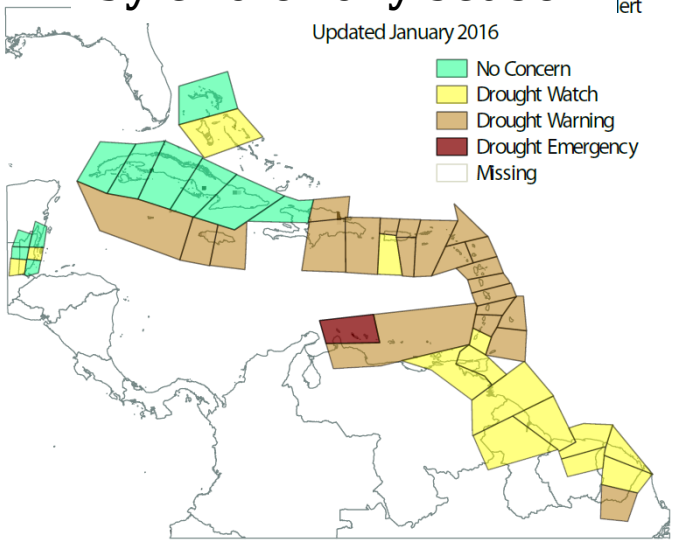
Did we know?
Forecasting capacity since 2010

FORECASTING

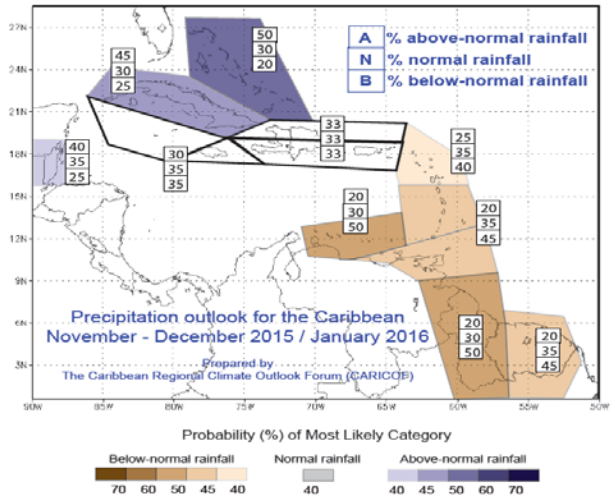
Drought outlooks for the Caribbean

Drought was forecast

LONG-term drought by end of dry season



Dry season rainfall was not to bring relief



Source: [CariCOF climate outlooks]

ALERT LEVEL	MEANING	ACTION LEVEL
NO CONCERN	No drought concern	✓ **monitor resources** ✓ update and ratify management plans ✓ public awareness campaigns ✓ upgrade infrastructure
DROUGHT WATCH	Drought possible	✓ **keep updated** ✓ protect resources and conserve water ✓ implement management plans ✓ response training ✓ monitor and repair infrastructure
DROUGHT WARNING	Drought evolving	✓ **protect resources** ✓ conserve and recycle water ✓ implement management plans ✓ release public service announcements ✓ last minute infrastructural repairs and upgrades ✓ report impacts
DROUGHT EMERGENCY	Drought of immediate concern	✓ **release public service announcements** ✓ implement management and response plans ✓ enforce water restrictions and recycling ✓ enforce resource protection ✓ repair infrastructure ✓ report impacts

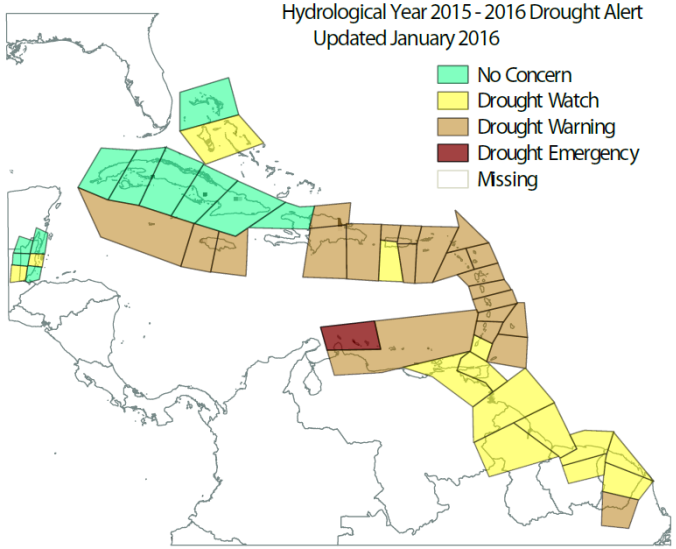
Expected Implications:

- Limited recharge of large water reservoirs.
- Water shortages in 2016 tourism season a particular threat.

FORECASTING

Can we trust the outlooks?

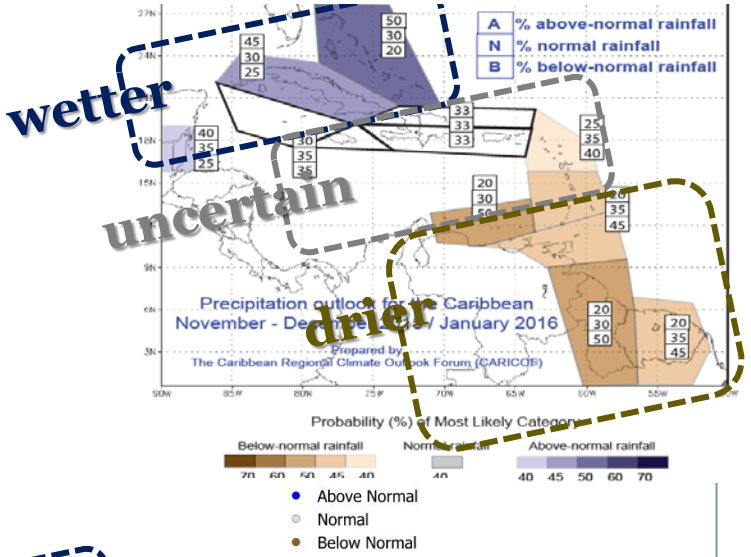
LONG-term droughts



Forecasts verify well… when a drought is forecast

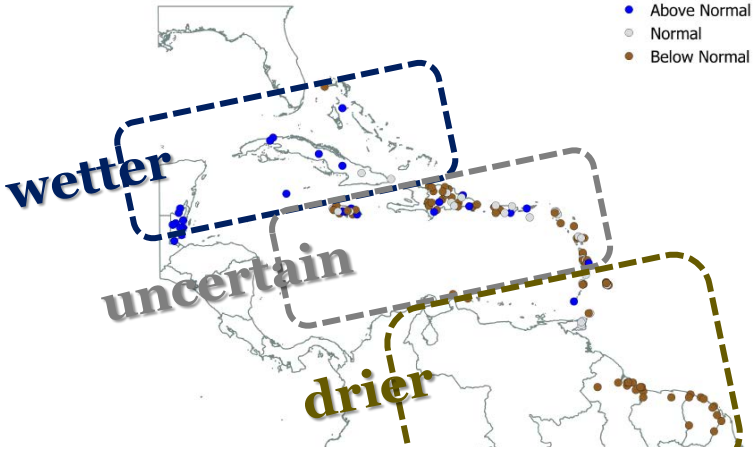
Source: Forecast Quality Verifications (since 2015)

Precipitation outlooks tercile categories



12-month SPI based forecasts with a 6-month lead time:

- **It identifies 88% of droughts with a six month lead-time** (based on the *ROC*)
- **It pays off to follow the suggested drought alert levels to avert damage** (based on a 40% *effective interest rate*)

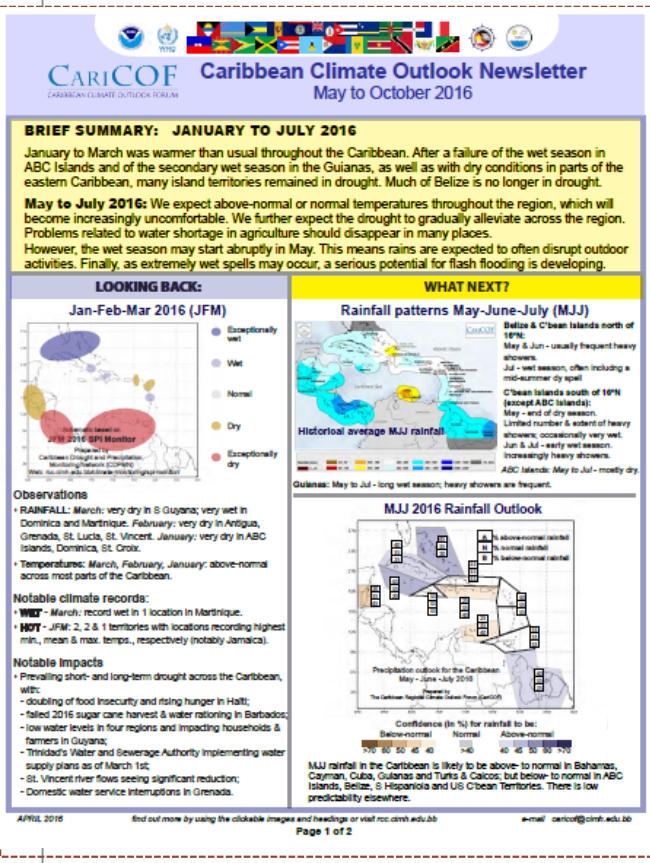


Observed tercile categories of rainfall

Awareness, Education & Outreach

COMMUNICATION PRODUCTS

Our bulletins aim to offer more digestible overviews:


CariCOF
Caribbean Climate Outlook Newsletter
May to October 2016

BRIEF SUMMARY: JANUARY TO JULY 2016

January to March was warmer than usual throughout the Caribbean. After a failure of the wet season in ABC Islands and of the secondary wet season in the Guianas, as well as with dry conditions in parts of the eastern Caribbean, many island territories remained in drought. Much of Belize is no longer in drought.

May to July 2016: We expect above-normal or normal temperatures throughout the region, which will become increasingly uncomfortable. We further expect the drought to gradually alleviate across the region. Problems related to water shortage in agriculture should disappear in many places.
However, the wet season may start abruptly in May. This means rains are expected to often disrupt outdoor activities. Finally, as extremely wet spells may occur, a serious potential for flash flooding is developing.

LOOKING BACK:

Jan-Feb-Mar 2016 (JFM)

Observations
- **RAINFALL:** *March:* very dry in S Guyana; very wet in Dominica and Martinique. *February:* very dry in Antigua, Grenada, St. Lucia, St. Vincent. *January:* very dry in ABC Islands, Dominica, St. Croix.
- **Temperatures:** *March, February, January:* above-normal across most parts of the Caribbean.

Notable climate records:
- **WET** - *March:* record wet in 1 location in Martinique.
- **HOT** - *JFM:* 2, 2 & 1 territories with locations recording highest min., mean & max. temps., respectively (notably Jamaica).

Notable impacts
- Prevailing short- and long-term drought across the Caribbean, with:
  - doubling of food insecurity and rising hunger in Haiti;
  - failed 2016 sugar cane harvest & water rationing in Barbados;
  - low water levels in four regions and impacting households & farmers in Guyana;
  - Trinidad's Water and Sewerage Authority implementing water supply plans as of March 1st;
  - St. Vincent river flows seeing significant reduction;
  - Domestic water service interruptions in Grenada.

WHAT NEXT?

Rainfall patterns May-June-July (MJJ)

Historical average MJJ rainfall

Belize & C'bean Islands north of 16°N: May & Jun - usually frequent heavy showers. Jul - wet season, often including a mid-summer dry spell
C'bean islands south of 16°N (except ABC Islands): May - end of dry season. Limited number & extent of heavy showers; occasionally very wet. Jun & Jul - early wet season. Increasingly heavy showers.
ABC Islands: May to Jul - mostly dry.
Guianas: May to Jul - long wet season; heavy showers are frequent.

MJJ 2016 Rainfall Outlook

Confidence (in %) for rainfall to be:
Below-normal | Normal | Above-normal
>70 60 50 45 40 | >40 | 40 45 50 60 >70

MJJ rainfall in the Caribbean is likely to be above- to normal in Bahamas, Cayman, Cuba, Guianas and Turks & Caicos; but below- to normal in ABC Islands, Belize, S Hispaniola and US C'bean Territories. There is low predictability elsewhere.

APRIL 2016 — find out more by using the clickable images and headings or visit rcc.cimh.edu.bb — e-mail: caricof@cimh.edu.bb
Page 1 of 2

More on the climate outlook — **May to October 2016**

Min. and max. temperatures up to July

Minimum Temperature Outlook MJJ 2016 | Maximum Temperature Outlook MJJ 2016

Confidence (in %) for temperature to be:
Below-normal | Normal | Above-normal
>70 60 50 45 40 | >40 | 40 45 50 60 >70

MJJ min. & max. temp. in the Caribbean are likely to be above- to normal.

Wet days and wet spells up to July

What usually happens from May to July?
- Number of wet days: roughly 30 to 60.
- Number of wet spells: roughly 2 to 6, of which 1 to 4 are very wet.
- Number of extremely wet spells: up to 1 or 2.

Forecast and Implications:
- Many wet days: greater occurrence of outdoor activity disruptions; decreasing surface dryness.
- Several wet spells: effective recharge of water reservoirs expected.
- Up to 2 extremely wet spells: serious flash flood potential developing.

Drought conditions up to July

Currently (as of April 30): Most islands are in long-term drought (except Bahamas and Cuba). These places suffer water shortages. Short-term drought is noted in ABC Islands, S Belize, Grenada, Guianas and Trinidad & Tobago.
Alert levels: **Drought watch:** ABC Islands, N Bahamas, portions of central Cuba, Grenada, St. Kitts, St. Vincent and Tobago.
Long-term Concern: **Drought emergency:** ABC Islands, Antigua. Existing water shortages may worsen up until the end of the dry season.
Drought relief expected from May onwards as the wet season may start up to one month earlier than usual.

BRIEF CLIMATE OUTLOOK - August to October 2016

Temperatures across the Caribbean are expected to continue to reach uncomfortable, above-normal levels by August. There are indications (*medium confidence*) that this part of the wet season will be wetter than normal across Belize and the islands (except Trinidad and Tobago). Rains will alleviate long-term drought in many places. However, excessive rainfall could increase the risk of flash flooding and long-term flooding.

For detailed temperature and precipitation outlooks for ASO 2016, please visit rcc.cimh.edu.bb/long-range-forecasts/caricof-climate-outlooks/

What influences the next season?

El Niño Southern Oscillation (ENSO)

Recent observations: A now moderate El Niño is rapidly weakening after reaching peak strength in November 2015; sea-surface temperatures (SSTs) 1.1°C above avg. in equatorial eastern Pacific (NINO3.4).
Model forecast and guidance: Models indicate further return to ENSO neutral conditions for MJJ (55-75% confidence), and a possible transition to La Niña conditions by ASO (50-65% confidence).
Expected impacts on rainfall and temperatures: Shift towards above-normal rainfall is noted for the C'bean due to reduced winds in the upper atmosphere, which allows for stronger, local showers to develop. Higher temperatures are probable for the region, which may also add to increased moisture uptake and lead to increase precipitation.

Climate conditions in the Tropical North Atlantic and Caribbean

Recent observations: SSTs 0-1°C above-average north of C'bean, near average elsewhere; trade wind speed stronger than avg.
Expected conditions: Positive SST anomalies are expected towards the eastern Atlantic by MJJ, but cooler than average waters may develop along the equator and off the western African coast; strength of trade winds is hardly predictable at seasonal time scales; upper level winds are expected to weaken.
Expected impacts: Warm Atlantic temperatures increase evaporation and local deep atmospheric convection, potentially increasing precipitation. However, cooler waters off W Africa and around the equatorial Atlantic may reduce the formation of rain-producing weather systems that are carried into the eastern Caribbean by the tradewinds during MJJ.

Climate outlooks - background

The Caribbean Climate Outlooks are prepared by the Caribbean Regional Climate Outlook Forum (CariCOF). The Caribbean Institute for Meteorology and Hydrology, in its role as WMO Regional Climate Centre in demonstration phase, coordinates the CariCOF process. Contributors to the Outlooks are the Meteorological Services from the region. For more information on how the outlooks are produced, please visit rcc.cimh.edu.bb
The Precipitation and Temperature Outlooks are issued in the form of a map, which shows regions where the forecast rainfall or temperatures have the same probabilities to be:
Above-normal (A) - within the wettest/hottest third of the historical record
Near-normal (N) - within the middle third of the historical record
Below-normal (B) - within the driest/coldest third of the historical record

DISCLAIMER

The information contained herein is provided with the understanding that The Caribbean Climate Outlook Forum makes no warranties, either expressed or implied, concerning the accuracy, completeness, reliability, or suitability of the Outlook. The information may be used freely by the public with appropriate acknowledgement of its source, but shall not be modified in content and then presented as original material.

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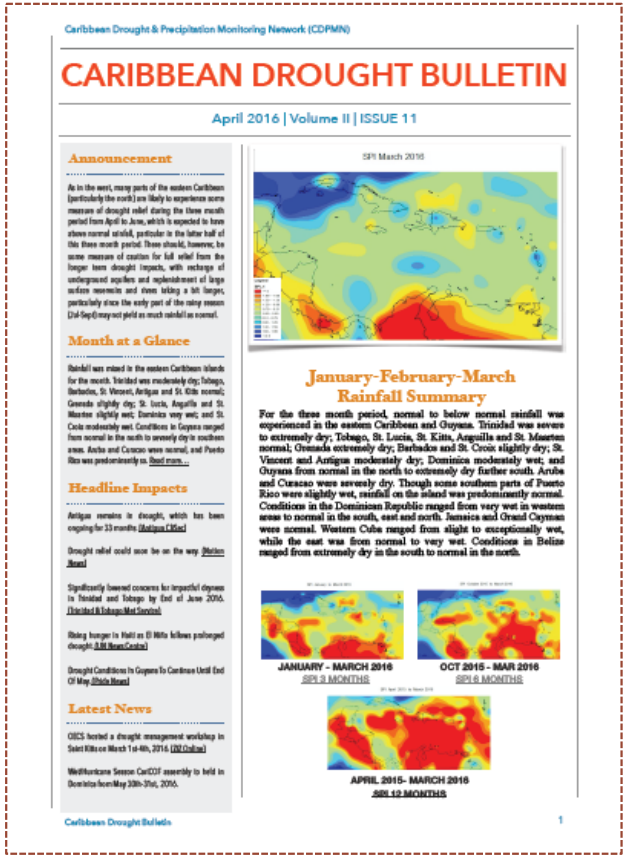

Caribbean Drought & Precipitation Monitoring Network (CDPMN)

CARIBBEAN DROUGHT BULLETIN

April 2016 | Volume II | ISSUE 11

Announcement

Month at a Glance

Headline Impacts

Latest News

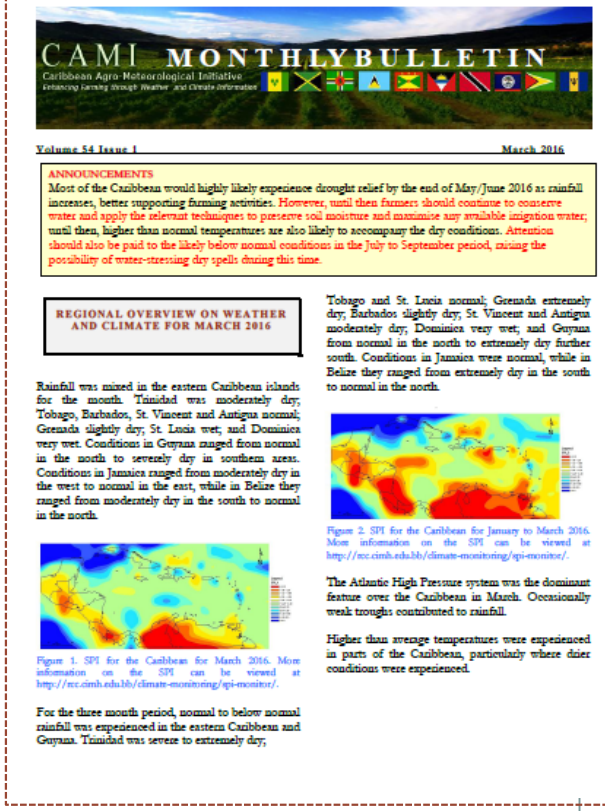
SPI March 2016

January-February-March Rainfall Summary

For the three month period, normal to below normal rainfall was experienced in the eastern Caribbean and Guyana. Trinidad was severe to extremely dry; Tobago, St. Lucia, St. Kitts, Anguilla and St. Maarten normal; Grenada extremely dry; Barbados and St. Croix slightly dry; St. Vincent and Antigua moderately dry; Dominica moderately wet; and Guyana from normal in the north to extremely dry further south. Aruba and Curacao were severely dry. Though some southern parts of Puerto Rico were slightly wet, rainfall on the island was predominantly normal. Conditions in the Dominican Republic ranged from very wet in western areas to normal in the south, east and north. Jamaica and Grand Cayman were normal. Western Cuba ranged from slight to exceptionally wet, while the east was from normal to very wet. Conditions in Belize ranged from extremely dry in the south to normal in the north.

JANUARY - MARCH 2016 SPI 3 MONTHS
OCT 2015 - MAR 2016 SPI 6 MONTHS
APRIL 2015- MARCH 2016 SPI 12 MONTHS

Caribbean Drought Bulletin — 1


CAMI MONTHLY BULLETIN
Caribbean Agro-Meteorological Initiative
Enhancing farming through Weather and Climate Information

Volume 54 Issue 1 — March 2016

ANNOUNCEMENTS

Most of the Caribbean would highly likely experience drought relief by the end of May/June 2016 as rainfall increases, better supporting farming activities. However, until then farmers should continue to conserve water and apply the relevant techniques to preserve soil moisture and maximise any available irrigation water; until then, higher than normal temperatures are also likely to accompany the dry conditions. Attention should also be paid to the likely below normal conditions in the July to September period, raising the possibility of water-stressing dry spells during this time.

REGIONAL OVERVIEW ON WEATHER AND CLIMATE FOR MARCH 2016

Rainfall was mixed in the eastern Caribbean islands for the month. Trinidad was moderately dry; Tobago, Barbados, St. Vincent and Antigua normal; Grenada slightly dry; St. Lucia wet; and Dominica very wet. Conditions in Guyana ranged from normal in the north to severely dry in southern areas. Conditions in Jamaica ranged from moderately dry in the west to normal in the east, while in Belize they ranged from moderately dry in the south to normal in the north.

Figure 1. SPI for the Caribbean for March 2016. More information on the SPI can be viewed at http://rcc.cimh.edu.bb/climate-monitoring/spi-monitor/.

For the three month period, normal to below normal rainfall was experienced in the eastern Caribbean and Guyana. Trinidad was severe to extremely dry; Tobago and St. Lucia normal; Grenada extremely dry; Barbados slightly dry; St. Vincent and Antigua moderately dry; Dominica very wet; and Guyana from normal in the north to extremely dry further south. Conditions in Jamaica were normal, while in Belize they ranged from extremely dry in the south to normal in the north.

Figure 2. SPI for the Caribbean for January to March 2016. More information on the SPI can be viewed at http://rcc.cimh.edu.bb/climate-monitoring/spi-monitor/.

The Atlantic High Pressure system was the dominant feature over the Caribbean in March. Occasionally weak troughs contributed to rainfall.

Higher than average temperatures were experienced in parts of the Caribbean, particularly where drier conditions were experienced.

CariCOF Caribbean Climate Outlook Newsletter (since 2013)

Click here

Caribbean Drought Bulletin (since 2014)

Click here

Regional Agroclimatic Bulletin (since 2011)

Click here

USER INTERFACE MECHANISMS

Technical training workshops (since 2009)

Meteorologists, climate scientists and sectoral stakeholders receive training in the provision, communication and interpretation of climate early warning information

Caribbean Climate Outlook Forum (since 2010)

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

INNOVATIONS IN OUTREACH

CariCOF Invitational Drought Tournament (2015)

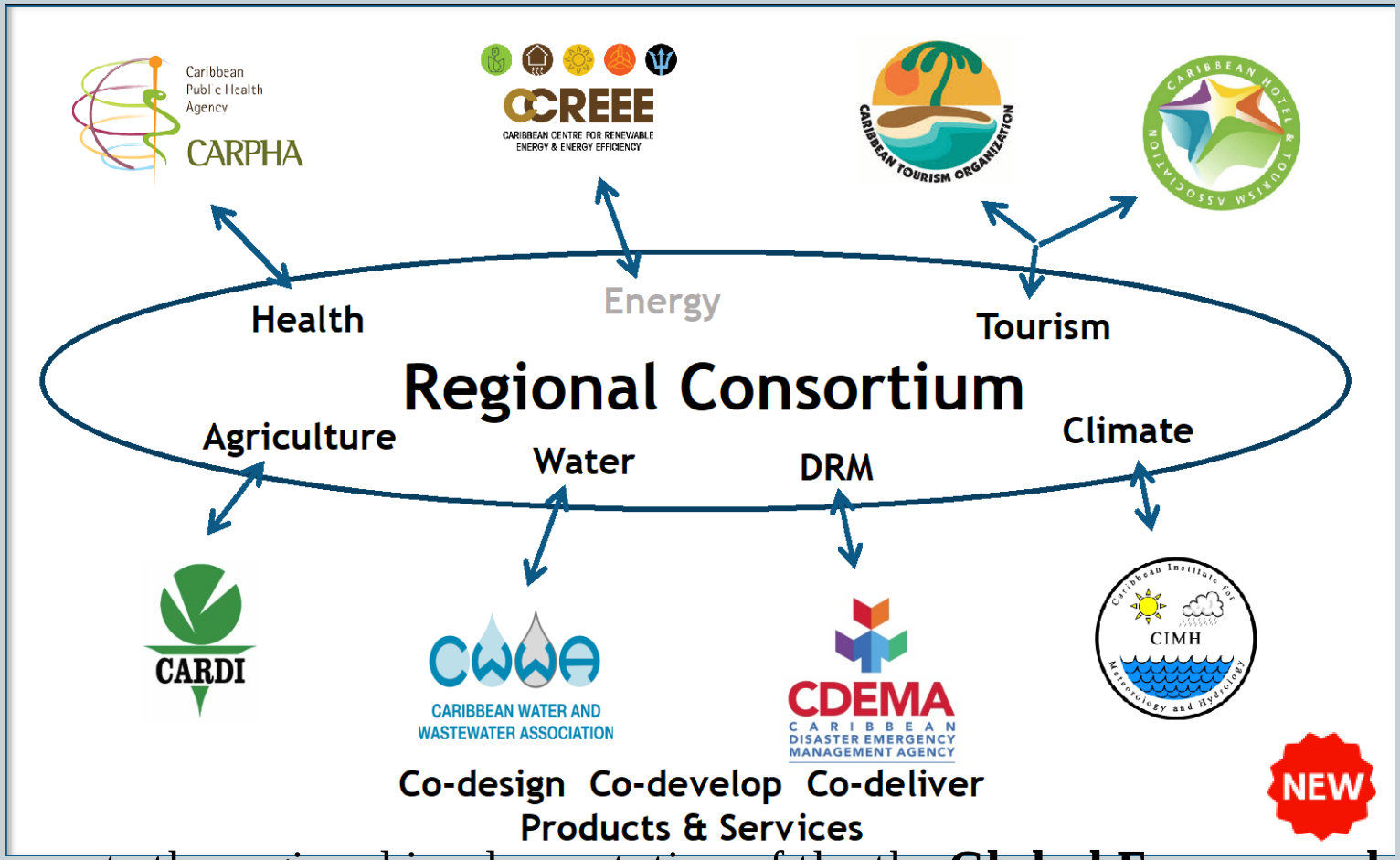
The Invitational Drought Tournament (IDT) is a simulation adaptation framework that supports drought preparedness efforts.

CariCOF Theatre (since 2014)

- Any form of message communication can be explored
- Awareness and product interpretation built through interactive and other practical activity
- Message communicated in drama, song and dance...

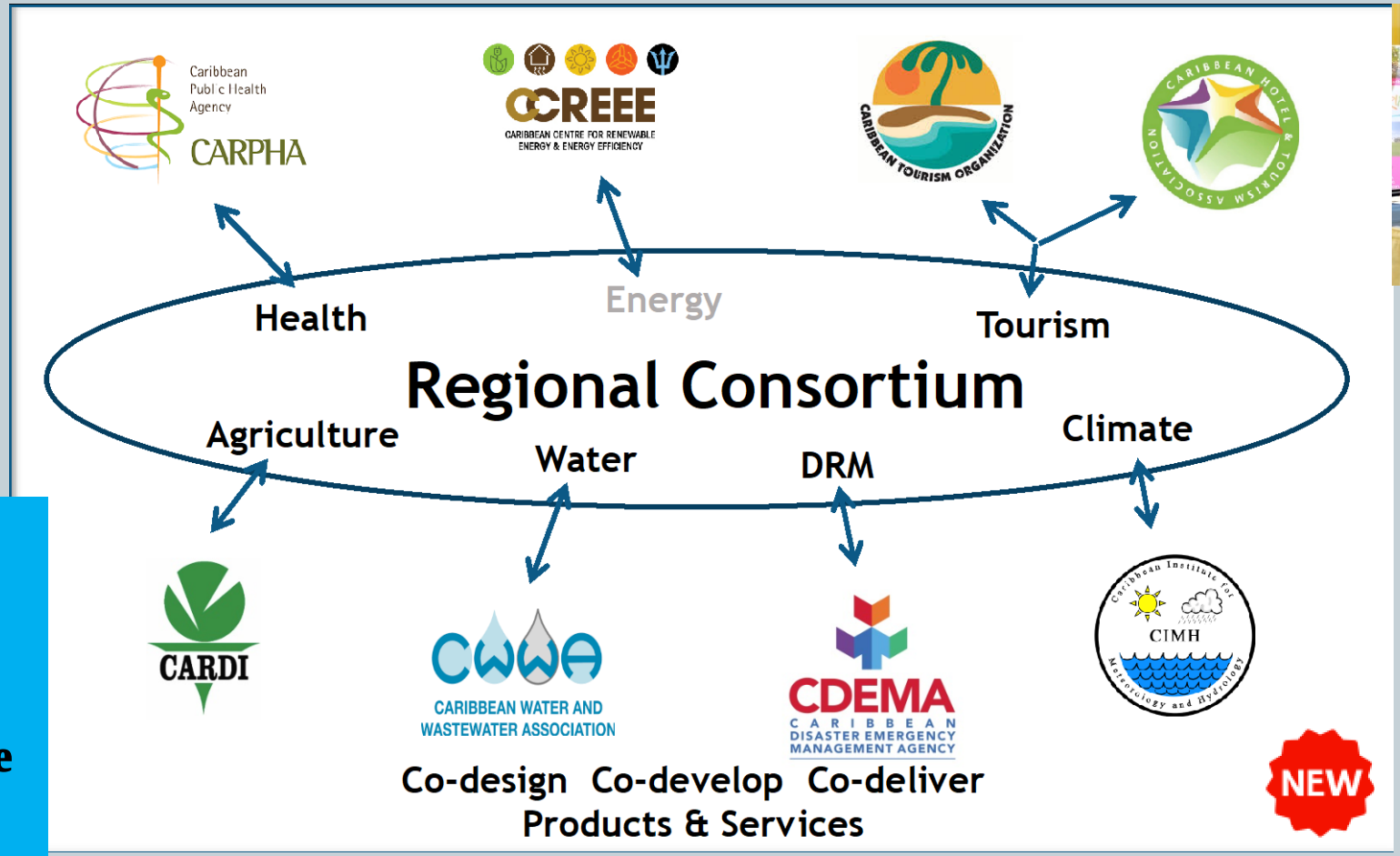
Future – Multi-hazard Tournament

Consortium of Regional Sectoral Early Warning Information Systems Across Climate Timescales (EWISACTs) Partners



Supports the regional implementation of the the **Global Framework for Climate Services (GFCS)**– making operational climate information for decision-making available for the benefit of all

Consortium of Regional Sectoral Early Warning Information Systems Across Climate Timescales (EWISACTs) Partners



CTO, CHTA & CIMH sign LoA to collaborate on climate services agenda (Sept. 2016)

CWWA & CIMH to sign LoA at 25th Anniversary CWWA Conference & Exhibition (Oct. 2016)

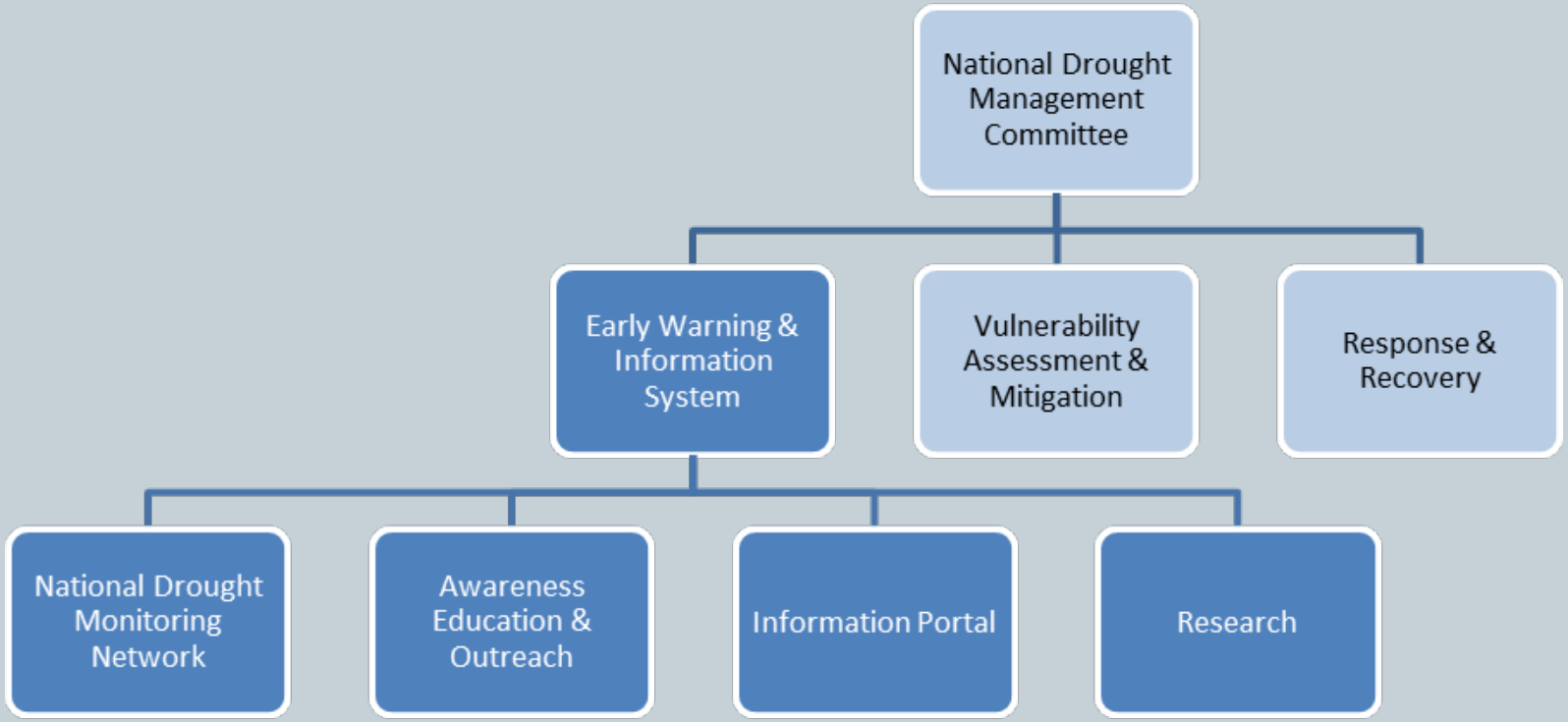
Drought management: capacity building at the national level

In response to the drought of 2009-2010

- CARICOM cooperation on Disaster Risk Reduction (DRR) – funded by the Government of Guyana
- Supported Capacity Building including training on drought monitoring and planning
- Draught documents prepared for Jamaica, Grenada and St. Lucia ...mainly based on the following framework
- In St. Lucia, document on TOR for a Flood and Drought Mitigation Committed ratified by Government of St. Lucia
- Instruments provided to support monitoring of the three main types of drought – meteorological (raingauge), agricultural (soil moisture metres), and hydrological

Framework for National Drought Management

Focus on Drought Early Warning & Information Systems



Under Phase 1 – RRACC Project (OECS)

NEED FOR:

1) national & sector-specific interpretation of monitoring & outlook products

2) national drought frameworks, policies and plans

3) Met Services drought early warning capabilities

WRITING

- during writeshops supported by regional and international organisations

- continued post-writeshop amongst the national agencies

ENHANCED

existing frameworks, policies and plans and TORs to more effectively manage drought risk

COMMENCED

development of drought plans that integrate drought early warning information

Under Phase 2 – BRCCC Programme

CONTINUED TRAINING

to develop a clear understanding of necessary components of:

1) national drought policies

2) national DEWISs

DEVELOP

final drafts of national documents/frameworks

PROVIDE:

1) draft of national Drought Policy for consideration by the Government

2) draft national Plan for a DEWIS for consideration by the Government

Thank you

All data, information, tools and products are available at

rcc.cimh.edu.bb