

Sub-Seasonal Updates An Example from CariCOF

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WMO OMM

World Meteorological Organization
Organisation météorologique mondiale



**WMO International Workshop on Global
Review of Regional Climate Outlook
Forums, Ecuador, 5 – 7 September 2017**

Background to Seasonal Climate Updates

- *Soon after establishment of CariCOF, in response to the 1997-98 El Niño, 0-month lead 3 month tercile rainfall forecast produced every two months by CIMH.*
- *However, there was a desire to provide tercile rainfall products and information every month (as like GPCs)...to update NMHSs and other users across the region*
- *...also, to cover a typical Caribbean season of six months, commenced preparation of 0- and 3- month lead three month tercile rainfall, commencing in 2013*
- *Further, outlook products developed using an automation tool (CAROGEN) integrated with CPT since 2015...*
- *...so this makes man-hours spent less intensive as the suite of forecast products expanded - both tercile and more tailored forecast products*
- *...produced from a fixed set of pre-determined CCA experiments into an ensemble*
- *...which are run every month to produce monthly updates*

- *...a prediction for Hurricane Irma would not be provided five days ahead with nothing on its progress – so why for seasonal forecasts?*



CCA experiments

example from zero month lead time (*in this case: Sep-Oct-Nov precip forecast*)

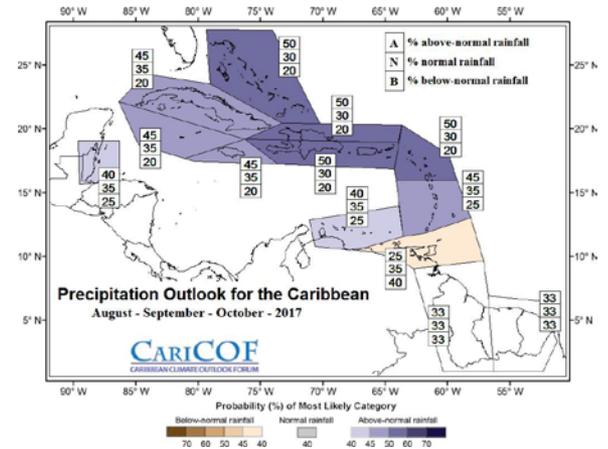
- 1) Predictor is observed SST over the tropical Atlantic and Pacific over July (data source: NOAA ERSSTv3b, obtained from the IRI data library)
- 2) Predictor is observed SST over the tropical North Atlantic over July
- 3) Predictor is predicted SST over the tropical Atlantic and Pacific over SON (data source: NOAA CPC CFSv2, August initialisation)
- 4) Predictor is predicted CFSv2 SST over the tropical North Atlantic
- 5) Predictor is predicted SST over the tropical Atlantic and Pacific over SON (data source: NMME multi-model ensemble mean, August initialisation)
- 6) Predictor is predicted NMME SST over the tropical North Atlantic

For three month lead time forecasts, a similar set of experiments are run.
ERSST same month as 0-month lead, predicted SST covering period of forecast.

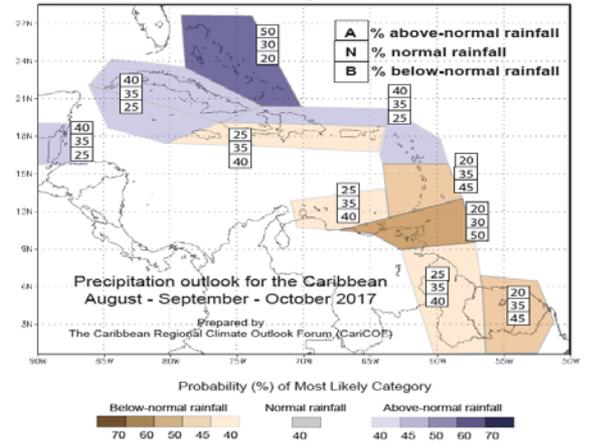
Besides the major control of ENSO (here represented by Pacific tropical SST anomalies) and tropical north Atlantic SSTs on Caribbean rainfall variability, these experiments take the **contrast between Pacific and Caribbean/trop. N Atlantic SSTs** into account, as those factors are regarded as the most important drivers of rainfall throughout the Caribbean.

CariCOF Monthly tercile Products

- *Reminder - Outlook products developed using an automation tool (CAROGEN) integrated with CPT ever since 2015...*
- *For tercile forecasts there are monthly moving 3 month updates (for 0- and 3-month lead)...*
- *...which would also imply that ...*
- *(i) every three-month period would have a forecast, and*
- *(ii) every three months, a 3 three month forecast would be updated (i.e. after releasing a 3-ml forecast, a 0-ml forecast is issued)*

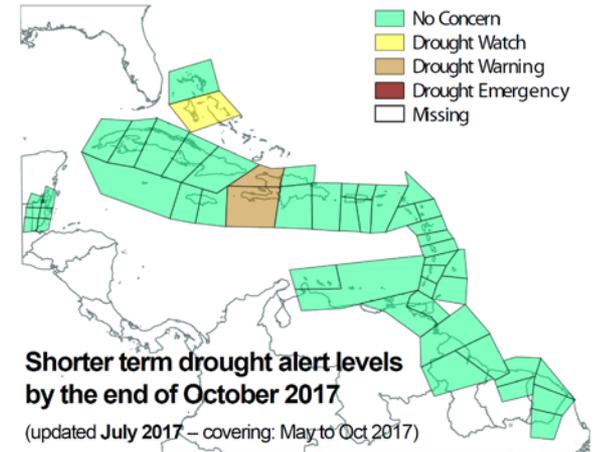


0- month lead (above) and 3-month lead (below) forecasts for August to October 2017

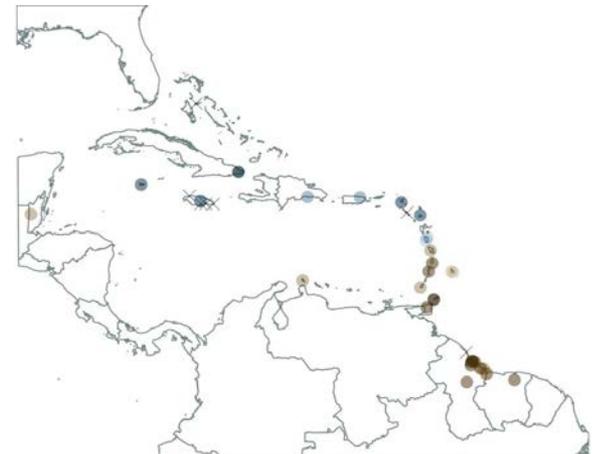


CariCOF Monthly non-Tercile Products 1

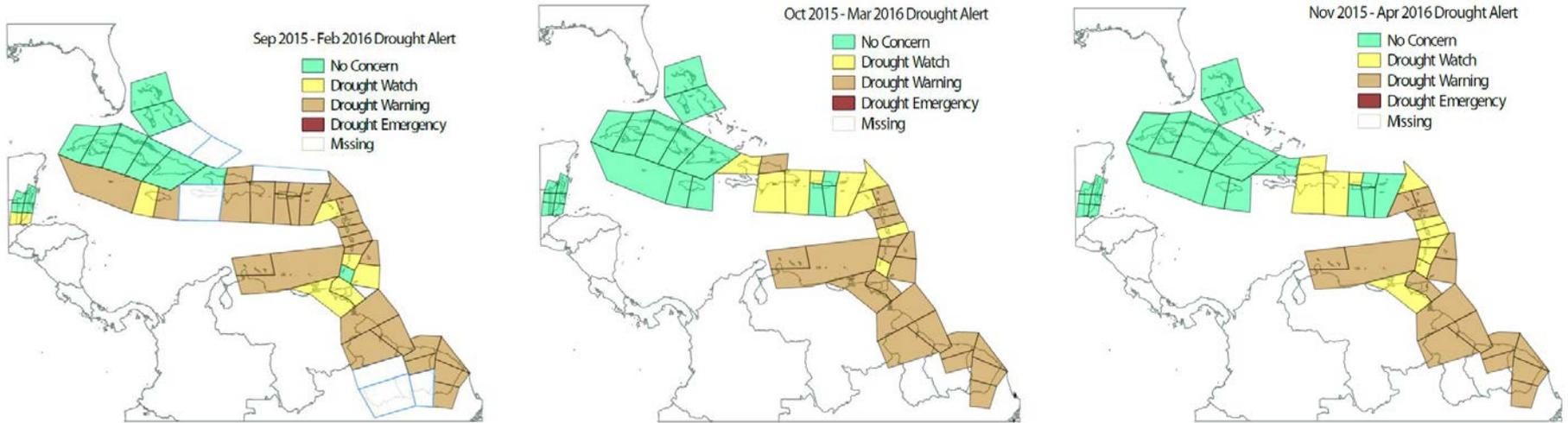
- *The desire also exists to develop monthly non-tercile products and information*
- *Utilises the same automation tool integrated with CPT ever since 2015...*
- *Most non-tercile, tailored products are 0-month lead...outside the traditional, (tested), more widely used terciles. Seeing how well they work and are "incorporated/accepted" by users*
- *These include short term (6 month SPI) drought; frequency of wet days; frequency of 7 day wet and very wet spells (differences due to percentile threshold), and extreme 3 day wet days, wet spells*



Short term (SPI6) Drought Outlook/Alert for end of October 2017 (above) and wet day frequency shift outlook for the period August to October 2017 (below) for August to October 2017

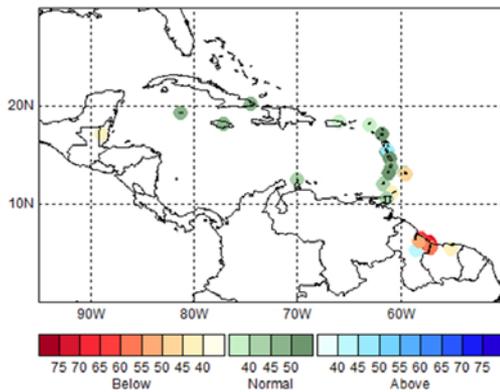


SPI6 outlook and 3 day wet spell frequency shift

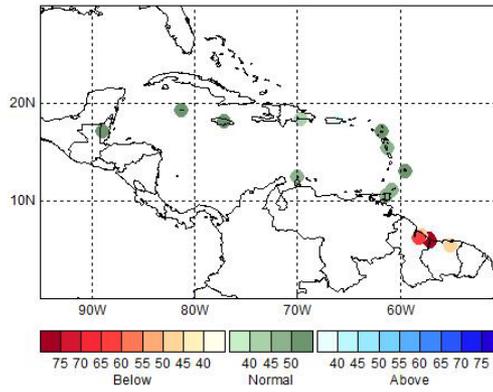


TIME

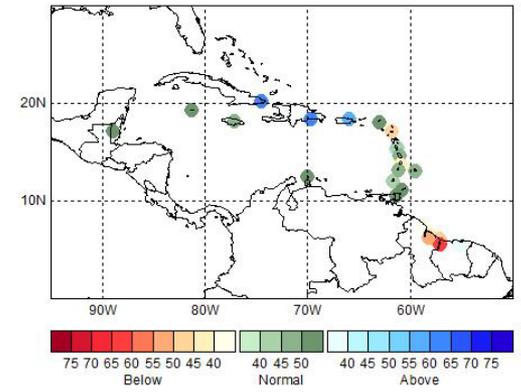
DJF 2015-6 Exceptional 3-day Wet Spells Shifts



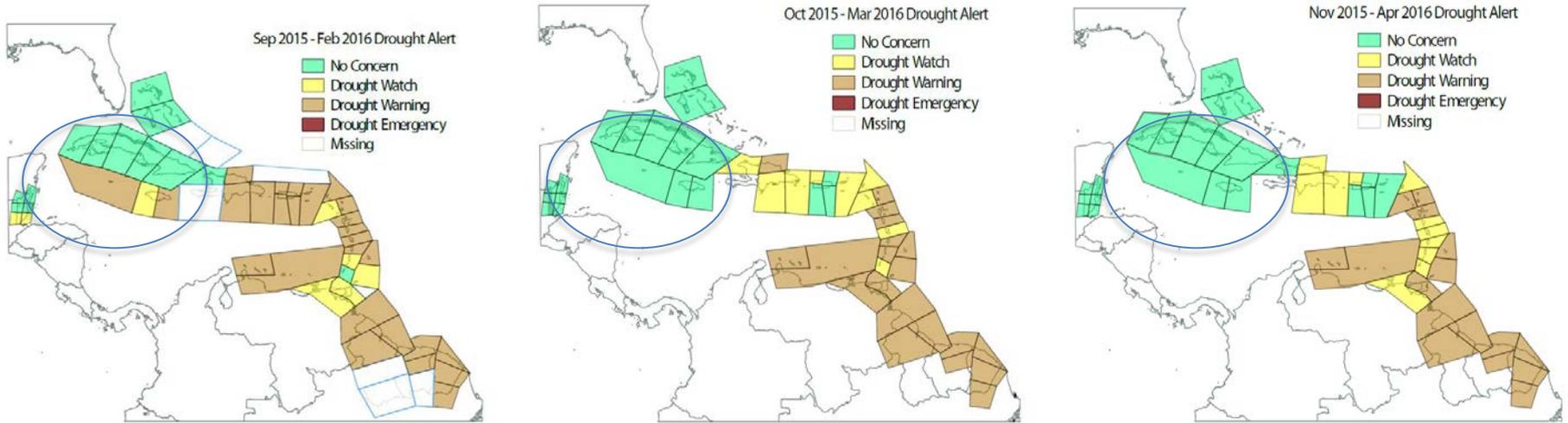
JFM 2016 Extreme 3-day Wet Spells Frequency Shift



FMA 2016 3-day Extreme Wet Spells Frequency Shift



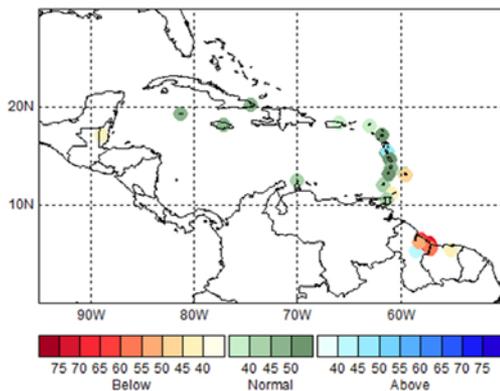
SPI6 outlook and 3 day wet spell frequency shift



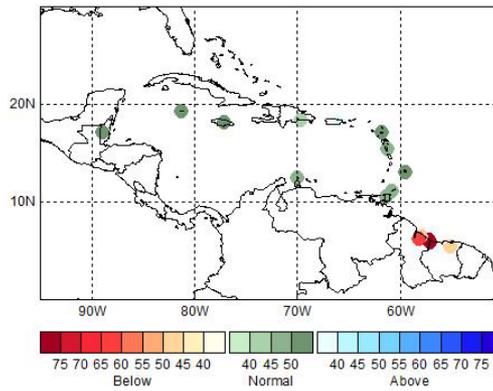
TIME

Important to update drought information for Jamaica and the Cayman Islands?

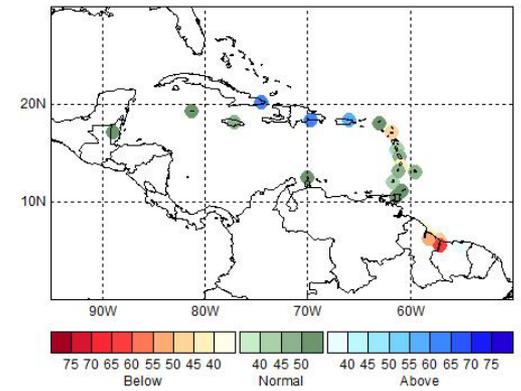
DJF 2015-6 Exceptional 3-day Wet Spells Shifts



JFM 2016 Extreme 3-day Wet Spells Frequency Shift

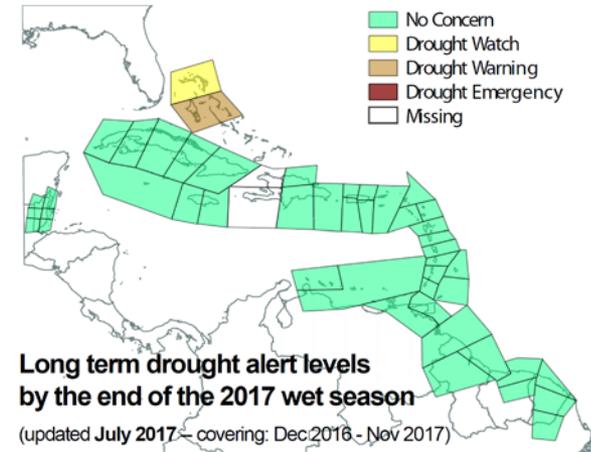


FMA 2016 3-day Extreme Wet Spells Frequency Shift

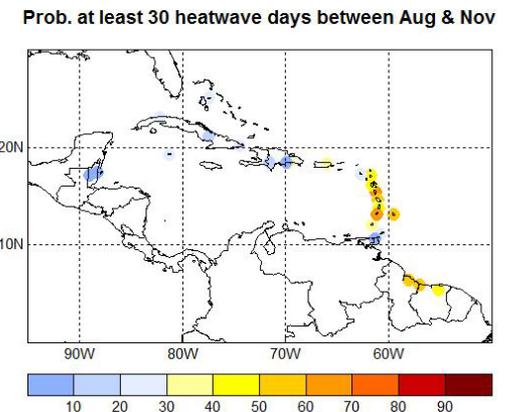


CariCOF Monthly non-Tercile Products 2

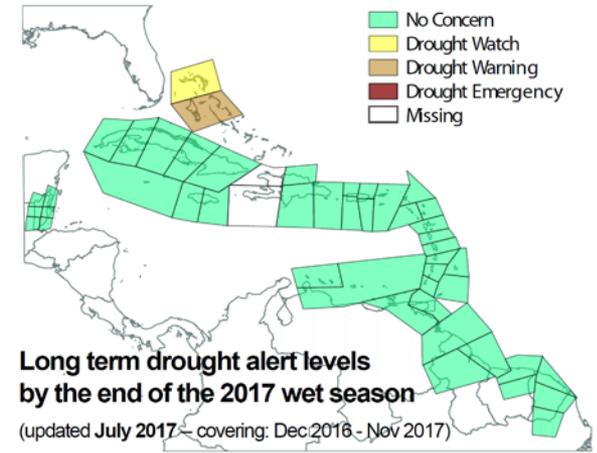
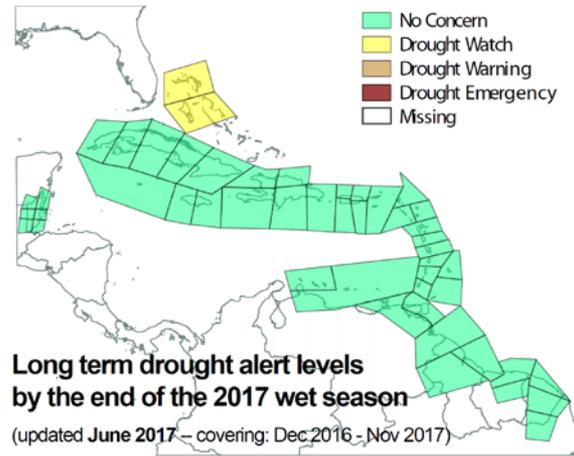
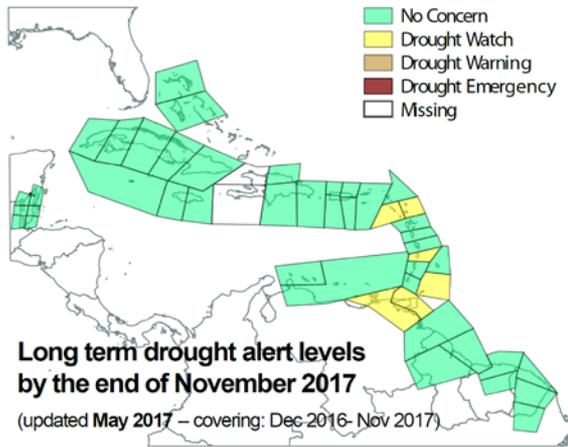
- *However...*
- *There are a couple 'non-moving' updates*
- *Long term (SPI 12 month – Hydrological year) Drought*
 - ❖ *For two twelve month periods depending on where in the calendar year you are*
 - ❖ *During the wet/hurricane season SPI12 (December to November) forecast from June to November*
 - ❖ *During the dry season SPI12 (June to May) forecast from December to May*
- *Heat waves*
 - ❖ *Heat outlooks for the hotter part of the year (i.e. starting in May and up to October/November) (new product for 2017 commenced June 2017)*
 - ❖ *So for 2017 from probability of heat wave days from June to November, then July to November etc.*



Long term (SPI12) Drought Outlook/Alert for end of November 2017 (above) and probability of at least 30 heatwave days between August and November 2017 (below)

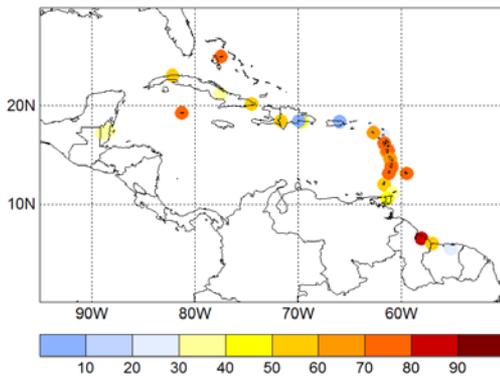


SPI12 outlook and Probability of at least 30 Heat wave days

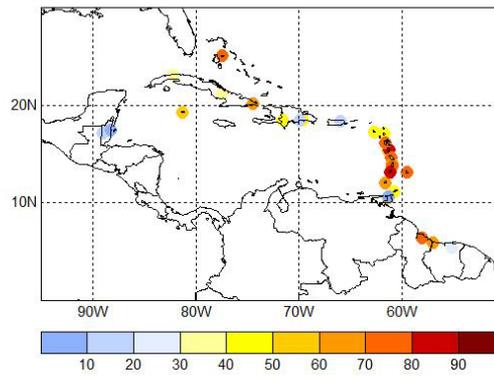


TIME

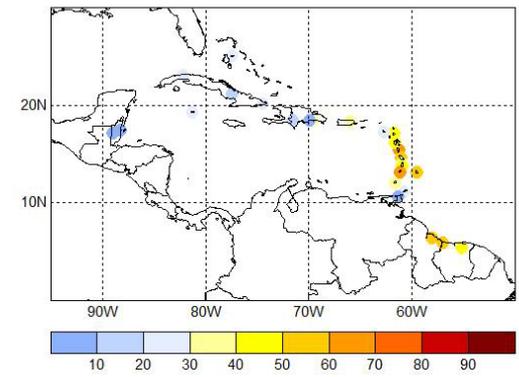
Prob. at least 30 heatwave days between Jun & Nov



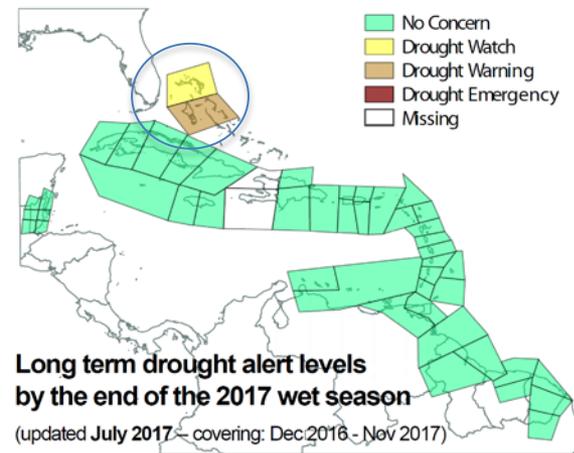
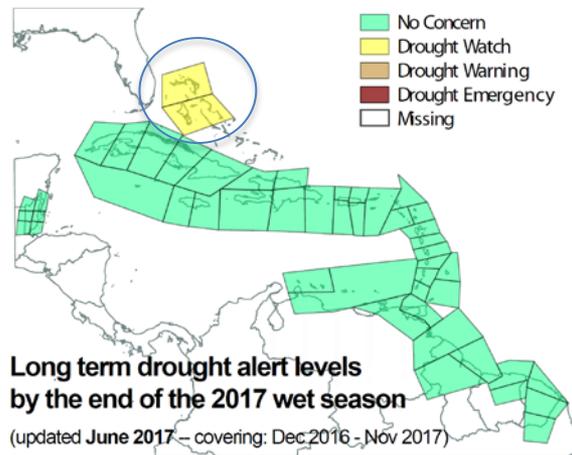
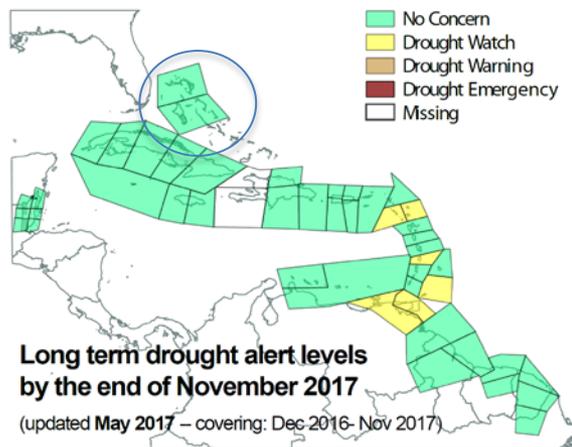
Prob. at least 30 heatwave days between Jul & Nov



Prob. at least 30 heatwave days between Aug & Nov



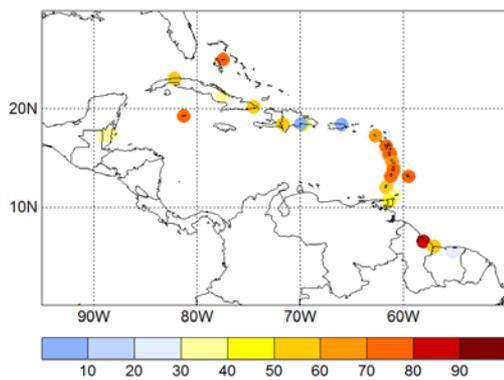
SPI12 outlook and Probability of at least 30 Heat wave days



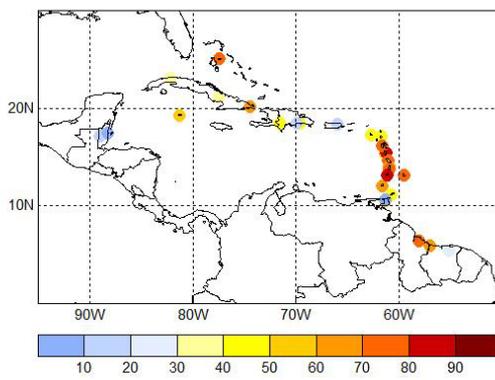
TIME

Forecast of evolution of drought in northern portions of The Bahamas is clear

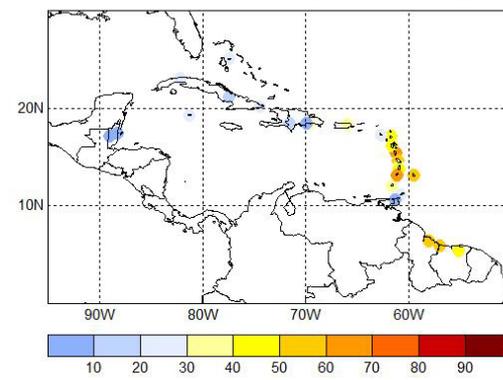
Prob. at least 30 heatwave days between Jun & Nov



Prob. at least 30 heatwave days between Jul & Nov



Prob. at least 30 heatwave days between Aug & Nov



CariCOF Monthly Updates

- *Outside of the two annual forums/assemblies...*
- *Updates are discussed remotely, mainly via email after regional initial output maps are released to NMHSs only for consensus (though mainly objective)...*
- *...However...*
- *CIMH now has a video-conferencing facility thanks to the American People through USAID via the BRCCC Programme (in collaboration with WMO as executing agency)...*
- *...So in near future, between the forums/assemblies, discussions on the forecasts (including consensus) through video-conferencing*



Video-conferencing facility at CIMH, funded by the BRCCC Programme



Dissemination Newsletters/Bulletins

Caribbean climate outlook July to December 2015

CariCOF - The Caribbean Climate Outlook Forum

WHAT HAPPENED? March - April - May (MAM) 2015

Notable climate events - March to May 2015

Observed rainfall records: Dry - MAM: 1 station in St. Barth's, 1 in St. Maarten & 3 in Dom. Rep. (drier: 19.20% of avg.); 1 in Antigua, 1 in Dom. Rep., 1 in Martinique, 1 in St. Kitts, 1 in St. Lucia & 1 in Trinidad.

Summary

March: very wet in Aruba, Barbados, N Guyana and E. Jamaica; very dry in Antigua & St. Martin. April: very dry in St. Barts, Dominica & E. Jamaica. May: very wet in V.I. & E. Guianas; very dry in Dominica, St. Vincent & St. Lucia. Temperatures rose in April (to record high in Cuba) and May, and were above- to normal across the Caribbean.

Headline Impacts

Continued low rainfall over the past year in Antigua led to Pittsford. Clean water levels at around 20% in Apr., more bushfires than usual and 65% of farmers running out of business.

Dry conditions in Dominica impacted vegetation, with more bushfires than usually, and crop s.p. 30% on average left.

St. Lucia declared a water emergency (until July) amidst continuing drought. Dry conditions in Trinidad since Jan. reduced water production to 53%.

Generally dry conditions in April in some regions in Guyana led to shortages of domestic water supply.

WHAT NEXT? July - August - September (JAS) 2015

Consensus Outlook

Early wet season drier than usual in E Caribbean, only Bahamas possibly wetter until September. Heat becoming uncomfortable.

+ impacts

some short-term drought relief, limited water-related pests, epidemics and damage

- impacts

long-term drought remaining in parts of E Caribbean, heat stress

Our typical JAS rainfall patterns

JAS 2015 Precipitation Outlook

Barbados & Caribbean Islands north of 19°N: Jul to Aug - wet season. Often incl. a mid-summer dry spell. Sep. - wet season. Usually frequent heavy showers.

Caribbean Islands south of 19°N (except ABC Islands): Jul to Sep - wet season. Increasingly frequent heavy showers.

ABC Islands: mostly dry with occasional wet spells.

Guianas: Jul to Aug - long wet season. Heavy showers are frequent. Sep. - dry season. Heavy showers at times.

JAS rainfall in the Caribbean is likely to be below- to normal across the Caribbean, with fewer wet days and wet spells than usual (especially in the Leeward and Windward). However, in the Bahamas we expect above- to normal.

<<< see outlook discussion on page 2 >>>

CARIBBEAN DROUGHT BULLETIN

July 2015 | Volume II | ISSUE 2

Announcement

Below normal rainfall conditions continued in June over most of the eastern Caribbean and across to Jamaica, extending the drought conditions and impacts, particularly over the northern Windward and Leeward Islands. Though rainfall quantities will increase, below normal rainfall will most likely continue during the wet season, causing much concern for water availability later in the year and into the early months of 2016. This situation should be closely monitored.

Month at a Glance

Apur from Trinidad that was moderate to very wet, the islands of the eastern Caribbean were normal to below normal (and particularly below normal). Tobago, Grenada and Anguilla were slightly dry; Barbados, St. Vincent, St. Lucia, Antigua, St. Maarten and St. Croix were moderately dry. Read more...

Headline Impacts

Government imposed water restrictions take effect in Jamaica as low levels of water attachments are reported in St. Thomas (U.S. Virgin Islands).

Drought continues at severe levels in Antigua. April-June is now the fourth driest period on record and also the driest since 2001. It continues to be the worst drought since 2002/2003 (Antigua Times).

The Dominica Meteorological Service has issued an advisory, asking the public, and relevant sectors to practice conservation measures and to develop Drought Plans for the island. (Antigua Times)

St. Lucia implements additional water restrictions as drought worsens. The water restrictions imposed, prohibit the use of potable water for non-potable uses and also a strict schedule of water rationing. (Antigua Times)

April-May-June Rainfall Summary

For the three month period, normal to below normal (and particularly below normal) conditions were experienced in the eastern Caribbean islands. Trinidad was normal, Tobago, St. Kitts and Anguilla moderately dry; Grenada, St. Vincent and St. Lucia slightly dry; Barbados severely dry; Dominica exceptionally dry; and Antigua, St. Maarten and St. Croix extremely dry. Conditions in Guyana ranged from exceptionally wet in the west to moderately wet in the east. Aruba was severely dry and Puerto Rico moderate to severely dry. As one moves outward from the normal east central areas of the Dominican Republic, conditions became relatively drier to become exceptionally dry in the southwest. Western and eastern portions of Jamaica were dry, up to being extremely so, but Grand Cayman was normal to slightly dry.

CARIBBEAN CORAL REEF WATCH

Notable Observations

- El Niño moderate in strength and intensifying.
- Southwestern Caribbean region already unusually warm with early bleaching watches and warnings.
- Bleaching Warning issued for Florida.

Current Global Conditions

- Reports on extensive bleaching have come from the British Indian Ocean Territory, the Maldives, and western Indonesia in the Indian Ocean and from Kiribati in the Central Pacific.
- These observations are consistent with near-record high sea surface temperatures and with a moderate El Niño.

Alert Level Guide	
Alert Level	Interpretation
No stress	No thermal stress
Watch	Low-level thermal stress
Warning	Thermal stress is accumulating
Alert level 1	Bleaching expected
Alert level 2	Widespread bleaching and some mortality expected

Monthly CariCOF newsletter

Monthly Bulletin of the Caribbean Drought and Precipitation Monitoring Network

Monthly Caribbean Coral Reef Watch (May to December)

Dissemination of Sectoral Bulletins



Volume 54 Issue 1

ANNOUNCEMENT
Most of the CI increases, better winter and spring rainfall, but high rainfall in the north should also be possible in the north.

REGIONAL AND CL

Rainfall was mild for the month. Tobago, Barbados, Grenada, slightly very wet. Conditions in the north to conditions in the west to more ranged from mild to the north.

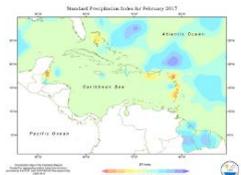


For the three months rainfall was expected. Guyana, Trinidad



A joint bulletin of the Caribbean Agricultural Research and Development Institute (CARDI) and the Caribbean Institute for Meteorology and Hydrology (CIMH). As of April 2017 the previous monthly CAMI bulletins transitioned into the Caribbean Agro-Climatic Bulletin of the CarisAM.

KEY MESSAGES
Concerns remain for the western Caribbean for both short and long term drought and in the southern portion of the eastern Caribbean for long term drought. Some models suggest the possibility for the return of El Niño, and drier than normal conditions late in 2017, and into the 2018 dry season. This will be closely monitored.



FEBRUARY IN REVIEW
The Bermuda-Azores High Pressure System along with weak unstable conditions contributed to this month's rainfall patterns.

- Portions of Dominica and Barbados experienced slightly wet conditions, whereas the rest of the Eastern Caribbean region experienced dry to normal conditions.
- Predominantly above normal rainfall across the Guianas.
- Predominantly normal rainfall across the northern Caribbean with mixed conditions across The Bahamas and in the west in Belize.

DECEMBER 2016 TO FEBRUARY 2017
A glance over the three-month period December to January we observe mixed conditions across the region

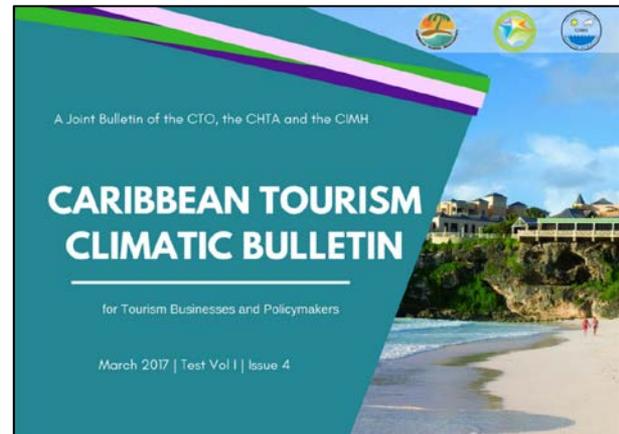
- Exceptionally wet conditions in southwest Dominica where the northeast was moderately dry.
- Generally normal to severely dry conditions were experienced in the northern Caribbean

ABOUT CarisAM
The Caribbean Society for Agricultural Meteorology (CarisAM) is an online platform that hosts forums, provides online weather and climate information for agro-meteorologists, and much more. Agricultural interests can register and access relevant information and be part of future capacity



What are the Key Climate Messages for April to June?
Heat stress will start appearing in May when the hot part of the year starts. In addition, there is the possibility of heat waves in Belize and Trinidad. Along with the heat, we expect the wet season to start in May or June. There will likely be increased rainfall, resulting in decreased surface dryness and increased water availability and some concern of flash flooding appears after April. Finally, at this time of the year, UV radiation will be very intense on sunny days.

- What are the Health Implications?**
- Respiratory Illness**
There may be an increase in symptoms in persons with asthma, as well as persons with allergies to dust as episodes of Saharan dust incursions into the Caribbean tend to annually peak between May and July. The surface dryness before the wet season may lead to greater levels of dust in the atmosphere.
 - There may be an increase in symptoms for persons with allergies to pollen until the dry season comes to an end.**
 - There may be increased risk of Legionella growth in water systems due to warmer temperatures.**
 - There may be increased risk of ENT (ear, nose and throat) infections due to contact with flood waters contaminated with faeces.**
 - Gastrointestinal Illness**
Beyond April, cases of gastroenteritis may increase in frequency. Increased temperatures may accelerate proliferation of pathogens. In the event of flash floods, contamination of food and water supplies might occur.
 - Non-communicable Diseases**
Mortality from heat stress is likely to increase beyond April, especially in persons with pre-existing chronic non-communicable diseases. There is an increasing risk of dehydration, possibly leading to apathy, general weakness, dizziness, fainting, and kidney failure.
 - There is an increased risk of skin damage, due to the very intense UV radiation at this time of year on sunny days.**
 - Vector-Borne Illness**
With the increasing heat and return of the wet season, there may be an increase in cases of vector-borne diseases such as Dengue, Chikungunya, Zika and Yellow Fever. The increased temperatures may shorten the generation time for mosquitoes and the maturation time for pathogens to mature inside the mosquito. In addition, increased rainfall may create more breeding places for mosquitoes. Some mosquito eggs laid last year may still be present in breeding areas and may become activated by settling rain water, thus later contributing to mosquito populations. However, note that in case of flash floods, flood waters may sweep away mosquito eggs, larvae and pupae, potentially reducing the number of cases.
 - Until the end of the dry season, there will be very limited risk of Leptospirosis due to human contact with flood waters contaminated with the urine of infected animals, as well as food or soil exposed to these contaminated flood waters.**
 - Physical Injury or Death**
There is the possibility of persons suffering injury or death. Flash flooding may lead to cases of drowning, persons being swept away by flood waters, physical trauma by debris in the flood water, possible land slides, and electrocutions.
 - There may be increased mental stress, and resulting violence, due to high temperatures.**



Quarterly Tourism-Climatic Bulletin (since May 2017)

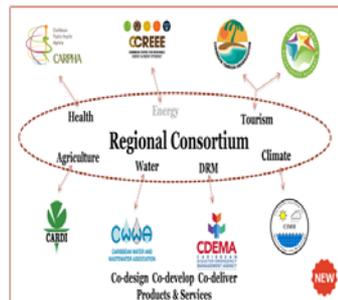
Typical Bulletin development process

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

Co-designed, Co-produced and co-delivered with regional consortium partners



Quarterly Health-Climatic Bulletin (since May 2017)



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

Thank you Merci



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