

CARIBBEAN INSTITUTE FOR METEOROLOGY AND HYDROLOGY  
CARIBBEAN REGIONAL CLIMATE CENTRE

Climate Services for Caribbean Society  
Policy Brief Series  
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Brief for Policy-makers within the Water Sector #1: July 2020

Climate Services and Water: Exploring the Policy Options

This Policy Brief:

- Summarises the major impacts of climate on water security;
- Discusses key issues towards building adaptation and resilience to the impacts of extreme weather and climate events on water security within the Caribbean; and
- Highlights the suite of products, packages and services produced by the Caribbean Regional Climate Centre (RCC) that can assist water policy makers in their decision making and planning.

Key Issue(s)	Recommendation(s)
<p>There is a paucity of hydrometeorological data needed for making estimations for safe yield for ground water resources, as well as environmental flows for surface water resources, particularly in smaller islands across the region.</p>	<p>Further financial and human resources made available for adequate, well maintained observation networks of higher spatial density that include Automatic Weather Stations, particularly in smaller islands across the region.</p>
<p>Droughts impact are not limited to the water sector. Water scarcity and drought impairs industries across all sectors and necessitates the need for developing/enhancing early warning systems and making changes throughout their whole value chain to reduce climate risks (particularly with calculations of probabilistic risk), create resilience and remain competitive in the future.</p>	<p>Foster collaboration, at both the national and regional levels, that brings together actors from across a range of sectors and work pro-actively towards establishing building resilience to water scarcity and drought.</p> <p>Support interdisciplinary R&amp;D programmes at the regional and national levels aimed at providing a new and/or enhanced range of targeted climate early warning products for the water sector.</p>
<p>Severe weather and climate events, including floods and drought continue to cause significant damages to infrastructure directly impact the sector and has cascading impacts on other productive and social sectors. A new phase of innovation is needed to design and develop the next generation of upgraded climate early warning information for the water sector.</p>	<p>Sector access to and application of freely available operational climate information products developed by the Caribbean RCC, as well as hazardous weather watches and warnings issued by local met offices, in the support of decision making within the water sector facilitates sectoral and societal resilience. Future investments in the enhancement and expansion of climate early warning information to serve the water sector facilitates sectoral and societal resilience. Future investments in the enhancement and expansion of climate early warning information to serve the water sector is critical.</p>

## Water Resource Management across the Caribbean Region

Water resources within Caribbean countries, for both potable and irrigation water, is quite diverse. Many countries; such as Trinidad and Tobago, Grenada, St. Vincent and the Grenadines, St. Lucia and Dominica, predominantly use surface water for their main supply. Although direct measurements of the vulnerability of surface water resources across the region is not available, the volume of surface water storage per capita in the Insular Caribbean (St. Lucia (16 m<sup>3</sup> per capita), St. Vincent (45 m<sup>3</sup> per capita), Trinidad (8 m<sup>3</sup> per capita)) alludes to this vulnerability, particularly when compared to mainland Caribbean countries (Dominican Republic (1,161 m<sup>3</sup> per capita). Ground water resources are currently used in Barbados (90% of water supply), Jamaica (84% of water supply), Antigua and the Bahamas. Prolonged periods of low rainfall and prolonged abstraction levels that exceed the sustainable aquifer recharge threatens aquifer yields. Desalination is rapidly gaining popularity within the region as a method of augmenting the volume of available fresh water. Although, the cost of energy to power desalination is a more pertinent issue in the Caribbean, since fuel for generating electricity must be imported at elevated cost, countries that rely on desalination have generally judged it to provide enough quality, quantity and reliability to merit high energy costs [14]. Currently, desalination accounts for a majority of the water supply of Antigua and Barbuda and the Bahamas [2].

The water sector is continually affected by rainfall extremities, at both ends, i.e. droughts (an extended period of rainfall deficit, often accompanied by increased evaporation rates, that reveals itself in a deficit of water availability) and excessive rainfall events (a short period of time, usually less than a week, with daily total precipitation exceeding a certain threshold defined for a given location). These extremities contribute to the gradual deterioration of the networks, with physical losses of production and high levels of Non-Revenue Water (NRW) as well as unreliable supply, with significant shortfall in potable water supply during the dry periods [12]. The following is a short summary of the impacts of both extremities on the water sector.

### Water Scarcity (Dry Spells and Droughts)

Water scarcity can potentially impair economic growth and sustainable development creating strain on existing infrastructure with increasing costs for citizens businesses and the governments. The Caribbean accounts for seven of the world's top 36 water-stressed countries, i.e. countries with less than 1000 m<sup>3</sup> freshwater resources per capita, with Barbados being in the top ten. The other six countries are Antigua and Barbuda, Dominica, Jamaica, St. Lucia, St. Vincent and the Grenadines and Trinidad and Tobago [5]. Furthermore, end of century climate change projections for the Caribbean for rising inland and ocean surface temperature (1.0 to 3.5°C), annual rainfall (-50% to 13.7%) and mean sea level rise (up to 1.4m) are likely to increase the demand for water by households, farmers, tourism, manufacturers and the recreation industry among others [1,15].

The region has experienced a number of (meteorological) droughts since 1990: in 1994-1995, 1997-1998, 2002-2003, 2004-2005, 2009-2010, 2014-2016 and the 2019-2020 drought. The duration and intensity of meteorological droughts, which essentially suggests some deficit in the normal rainfall amounts, affects varying sectors across the region to different degrees and at different times. The impacts of the recent 2019-2020 drought across the region is summarized in the table below.

### Examples of Socioeconomic Impacts due to drought (2009 to 2010 and 2019 to 2020)

<b>Agriculture</b>	<ul style="list-style-type: none"> <li>• Loss of crops and livestock – (Antigua and Barbuda, 2010) onion crop was expected to be about 500,000 kg, 25 percent of it was lost, whilst about 30 percent of the tomato crop which was estimated to total 250,000kg was lost [9].</li> <li>• Increased food prices – (Trinidad and Tobago, 2010) An increase in the price of fruit in March by 60.8 per cent [9].</li> <li>• Bush fires – (Dominica, 2010) 160 fires (mainly bush fires) in the first quarter of the year, an increase from the 103 fires recorded for the entire 2009 [9].</li> </ul>
<b>Water</b>	<ul style="list-style-type: none"> <li>• Drying of reservoirs – (Guyana, 2010) water levels falling significantly below the designated safe level for irrigation in the East Demerara Water Conservancy (EDWC) [2].</li> <li>• Shortage of supply – (St. Vincent, 2020) On 6 April, the Central Water and Sewage Authority announced service interruptions at nights, adding that shutdowns may also have to occur during specified daytime hours (iWitness News 7 April 2020). By 29 May, the country was operating at 35% of its capacity over 5 of its major water systems, and therefore continued with water rationing (Searchlight newspaper 29 May 2020).</li> <li>•</li> </ul>
<b>Health</b>	<ul style="list-style-type: none"> <li>• Outbreak of Water-borne Disease - (Jamaica, 2010) ingestion of unsafe water lead to increased incidences of diarrhoea [2].</li> </ul>
<b>Energy</b>	Decrease in the contribution of hydro power to total electricity production - (St. Vincent and the Grenadines, 2020) the Cumberland Hydro-electric power plant generated significantly lower than average electricity expected for this dry period, the Richmond Hydro-electric power plant was only able to run one of two units, whereas the South rivers Hydroelectric power plant experienced flow reductions but was not severely affected (personal communications, CWSA, May 2020).
<b>Tourism</b>	(Belize, 2019) tourism impacted by pollution of New River around Orange Walk where pollution is high due to low water levels, with fish dying and a pungent smell remaining, affecting tourists (Amandala Newspaper 9 April 2020).

The Caribbean RCC produces a series of Precipitation-related that may help the water sector mitigate and respond to water availability/scarcity. These include:

<u>Climate Events</u>	<u>Monitors</u>	<u>Outlooks</u>	<u>Bulletins</u>
<ul style="list-style-type: none"> <li>• Drought</li> <li>• Dry Spell</li> </ul>	<ul style="list-style-type: none"> <li>• SPI Monitor</li> <li>• SPEI Monitor</li> </ul>	<ul style="list-style-type: none"> <li>• The CariCOF Caribbean Climate Outlook</li> <li>• The CariCOF Drought Outlook</li> <li>• The CariCOF Dry Spells Outlook</li> </ul>	<ul style="list-style-type: none"> <li>• The Caribbean Drought Bulletin</li> </ul>

Extreme Rainfall Events (Floods and Landslides)

Extreme rainfall events; such as Tropical cyclones, more commonly occur during the May to November Caribbean rainy season but on occasion, can occur outside the rainy season. In some instances, these events can often lead to flashfloods and landslides that can damage infrastructure and reduce the capacity of the water sector. Examples of infrastructure damages include:

- Contamination of water aquifer supply through saline intrusion - Runoff and flooding, resulting from hurricane rainfall and storm surge, can contaminate sources of drinking water. For example, in 2004, a storm surge associated with Hurricane Francis increased the chloride levels from 400 to 13,000 mg/L in some of the well fields on North Andros in the Bahamas [2].
- Damage or exceed the capacity of water infrastructure - For example, existing hurricane activity already affects water infrastructure in Jamaica through landslides that compromise dam reservoir integrity and damage pipelines, damage to intake works and boreholes through sediment and debris, damage to pump stations either directly due to floods or indirectly through loss of power [2].
- Limits to water supply - For example, landslides, resulting from the activities of Hurricane Tomas 2010 in St. Lucia, lead to some 80% of the population having to cope with very limited water supply and suggests the need for risk and uncertainty analysis [2].

The Caribbean RCC produces a series of rainfall-related information products that may help the water sector mitigate and respond to the impacts from extreme rain events. These include:

Climate Events	Monitors	Outlooks	Bulletins
<ul style="list-style-type: none"><li>• Flood</li><li>• Wet Spell</li></ul>	<ul style="list-style-type: none"><li>• SPI Monitor</li><li>• SPEI Monitor</li></ul>	<ul style="list-style-type: none"><li>• The CariCOF Caribbean Climate Outlook</li><li>• The CariCOF Wet Spells Outlook</li><li>• Rainfall Frequency and Extreme Forecasts – Wet Days and Wet Spells Outlook</li></ul>	<ul style="list-style-type: none"><li>• The Caribbean Drought Bulletin</li></ul>

\* Information on tropical cyclone and severe weather systems is readily accessible through Tropical Storm watches, warnings, advisories and outlooks produced by each country's national weather service.

The range of precipitation-related climate monitoring and forecast products, mentioned above, are updated monthly by a team of regional and national level climate experts. Operationally, the monthly timestep is already useful for helping the water sector to make better decisions, particularly regarding drought-risk. These monitoring and forecasting products form an essential part of the basis for the Caribbean Drought Bulletin.

## Improving the Provision of Climate Information for Water Resource Management

Making estimations for safe yield and environmental flows for surface water resources, is problematic due to the paucity of weather and climate information [2]. A similar paucity was also flagged by farmers and extension officers during the 2010-2013 Caribbean Agrometeorological Initiative (CAMI) project [16]. Although initiatives such as the Improving Climate Data Information Management Project (ICDIMP) [3,4], supported by the Pilot Programme for Climate Resilience, work towards increasing the density of meteorological instruments and greater allocation of resources to cover the many drainage basins within the region, much work is still needed, particularly in smaller islands across the region. The Caribbean Institute for Meteorology and Hydrology (CIMH) has supported a number of initiatives such as that have increased the density of weather stations at fine time scales in digital formats.

## Increasing regional capacity to develop climate services for the reduction of water stress

As previously discussed, water scarcity and drought have very serious implications on human livelihoods and economy growth and development. Industries seriously impaired by water scarcity, such as food, agriculture, energy and mining, need to develop early warning systems and make changes throughout their whole value chain to reduce climate risks, create resilience and remain competitive in the future. Building resilience to water scarcity and drought requires us to collaborate across sectors and stakeholders. Given the size and scale of the challenge, we need regional collaboration that brings together actors from across a range of sectors and work pro-actively to address issues of drought [11].

Towards increasing capacity of Caribbean countries to deliver equitable and sustainable Integrated Water Resources Management (IWRM) in efforts of drought mitigation and response, CIMH, in collaboration with regional and national networks, selected national governments and community water users, launched the Caribbean Drought and Precipitation Monitoring Network (CDPMN) in 2009 under the 2007-2012 Caribbean Water Initiative (CARIWIN), which was funded by the Canadian International Development Agency (CIDA), through the University Partnerships in Cooperation and Development (UPCD) program. The CDPMN monitors drought and general precipitation at national and regional scales using monthly rainfall and temperature anomalies, as well as the Standard Precipitation Index (SPI) and Standard Precipitation-Evapotranspiration Index (SPEI) indicators and differences in the SPEI and SPI at different time scales. Additionally, CARIWIN focused on capacity building with three specific countries (Guyana, Grenada, Jamaica) by involving local community organizations, water user associations and regional and national networks through training courses, hydrological data processing and management, use of field instruments and water policy [7,8,9].

The Caribbean RCC continues to build the capacity for mitigation and response to drought within the region by the monthly dissemination of the Caribbean Drought Bulletin, further discussed below. This specifically aids the water sector in monitoring and predicting water levels, production and delivery needs, as well as raise public awareness of and inform government action on pending water crisis.

### The Caribbean Drought Bulletin

The Caribbean Drought Bulletin tracks how dry spells or droughts, and to a lesser extent excessive rainfall, have developed in the past months and up to a year. It maps drought situations at regional and national levels for one-, three-, six- and twelve-month time periods. Additionally it provides headline news on drought impacts affecting the region's climate-sensitive sectors.

The Caribbean Drought Bulletin offers evidence-based support for drought early warning. It can help:

- The agricultural sector assess water availability for cropping, livestock, pest and disease management options on monthly to annual time periods. It helps in planning and selecting appropriate resources and production methods.
- The disaster management sector guide coordination for a drought response.
- The energy sector gauge how hydropower supply maybe affected in meeting seasonal energy demands and predict energy product cost, as well as demands for cooling and desalination.
- The health sector examine drought conditions to prepare communities for risk, including limited access to food and potable water for drinking and sanitation.
- The tourism sector monitor and predict water availability for hotel and public infrastructure, as well as mitigate operational shortages.
- The water sector monitor and predict water levels, production and delivery needs, as well as raise public awareness of and inform government action on pending water crises.

CIMH continues to encourage multi-sectoral agreements, projects and partnerships; such as EWISACTs. The strong interlink between the various sectors within the region leads to climatic impacts on one sector seemingly affecting other sectors. The water sector is a prime example of this as the water availability is crucial to all sectors within the region. The Caribbean RCC continues to make strides in the development and implementation of weather and climate monitoring and prediction tools supporting climate risk management within the water sector and strongly believe that climate risk management within the region can be enhanced by policy making that catalyses the development and use of climate early warning information tailored to the water sector .

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The Caribbean Pilot Programme for Climate Resilience (PPCR) is a climate change adaptation initiative of the global PPCR supported by the Climate Investment Funds. The Caribbean PPCR has two complementary tracks. The first track consists of country based investments in six vulnerable countries and the second is a regional track involving regional organizations working in the Caribbean in key sectors.

Main objectives:

1. To improve regional processes to acquire, store, analyse access and disseminate climate relevant data
2. To pilot and scale up innovative climate resilient initiatives in the region

For more information on the Caribbean PPCR, please visit <https://caribppcr.org.jm>