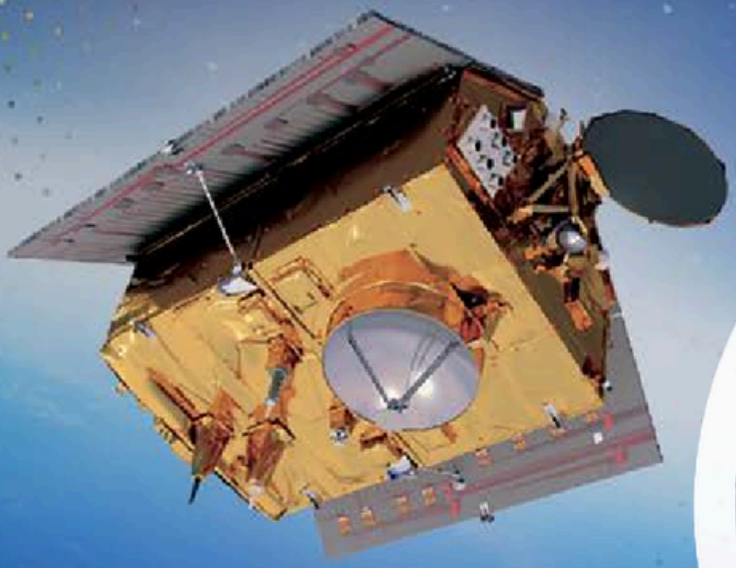
The Intra-ACP Climate Services and Related Applications Programme

Brief for Health Sector Policymakers

Climate Services for Health: Exploring Partnership and Investment Options









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ClimSA
INTRA-ACP CLIMATE SERVICES AND RELATED APPLICATIONS PROGRAMME
An initiative of the Organisation of African, Caribbean and Pacific States funded by the European Union



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Summary

Key Messages & Recommendations

Summary

The World Health Organization (WHO) has deemed climate change to be the greatest health concern of the 21st century, due to its impact on human access to safe shelter, clean air, safe drinking water and nutritious food supply (WHO, 2018).

Small island developing states (SIDS) are among the countries most vulnerable to the impacts of long-term climate change. Many small island states currently suffer high socio-economic burdens from climate-sensitive health outcomes, including morbidity and mortality from extreme events such as heatwaves, as well as, from certain vector-, food- and water-borne diseases (Ebi et al, 2006). Climate is a key driver in the overall burden of disease, particularly in Caribbean SIDS where the ability to manage climate-sensitive diseases constrains regional and national prospects of achieving the Sustainable Development Goals. To mitigate its adverse effects, the Caribbean health sector will need to better quantify and understand the specific effects of climate extremes, variability and change both on overall disease burden and on the effectiveness of public health system responses.

The World Meteorological Organization-designated Regional Climate Centre (RCC) for the Caribbean hosted by the CIMH produces a range of climate information products and tools that can increase the capacity of the health sector to better manage the impacts of climate-related risks.

This Brief

- Summarises the major impacts of weather and climate on human health within the Caribbean;
- Discusses key issues in building resilience particularly through early warning to the impacts of extreme weather and climate events on the health of Caribbean populations; and
- Highlights the suite of products and services produced by the Caribbean Regional Climate Centre (RCC) hosted by the Caribbean Institute for Meteorology and Hydrology (CIMH) that can assist health policy-makers in their decision-making and planning.





Key Messages

- Climate and weather events continue to result in a significant burden of climate-sensitive diseases in the Caribbean. Impacts are expected to increase in a changing climate.

- Health practitioners need to be better equipped to make climate smart decisions through the increased and enhanced use of freely available early warning products from the Caribbean RCC.

- There is an opportunity to partner with the Caribbean RCC and its network of National Meteorological and Hydrological Services to upgrade, expand and mainstream the suite of climate early warning information products and tools for the health sector in decision-making. The Caribbean RCC and its network of National Meteorological and Hydrological Services (NMHSs) invites health policy-makers to join with us to support the advancement of climate services for the Caribbean health sector.

Key Recommendations

Invest in the development and mainstreaming of climate early warning information for health at national and regional levels. Two specific investment areas include:

1. *Improving the provision of climate information for health*
   - Invest in foundational research and development (R&D) for a new generation of impacts-based climate early warning information products tailored for health.

2. *Supporting health practitioners' application of climate information*
   - Support the development and/or strengthening of national coordination mechanisms that facilitate closer working relationships between health practitioners and the National Meteorological and Hydrological Services;
   - Support the development and/or enhancement of Health National Adaptation Plans that advance climate services for health; and
   - Support training and other capacity building workshops that increase health practitioner abilities to interpret and apply climate information for climate informed decision-making at the national level.





Climate Impacts on Health in the Caribbean

Climate Impacts on Health in the Caribbean

THE EFFECTS OF HEAT ON HEALTH

- The Caribbean Heat Season is the period of the year during which excessively hot days and nights, and heat waves are regularly experienced.
- Typically, the Caribbean Heat Season runs from April/May to October, but heat waves can occur as early as March and as late as November. The greatest risk for heat health effects will occur during these months.

Impacts on Health within the Caribbean

There is a paucity of conclusive data or studies on the effects of heat on human health within the region; however, the issue is an ongoing and increasing concern for vulnerable populations such as the very young and elderly, those with chronic conditions, and outdoor oriented workers, especially with 2010, 2016, 2020, 2023 and 2024 record-breaking heat seasons occurring in ever more rapid succession.

The burden of chronic non-communicable diseases (NCDs) in the Caribbean Community (CARICOM) is the highest in the Latin American and Caribbean region (Healthy Caribbean Coalition n.d.). Persons with NCDs face special challenges with thermoregulation when compared to a healthy adult, especially those persons taking certain types of medication.

Morbidity from excessive heat among this sub-population is likely, especially during heat waves.

Increased heat stress associated with heatwaves, can increase mood-affective and stress-related disorders, as well as, other mental and behavioural disorders. Persons taking medication for mental health disorders are particularly at increased risk of heat-health effects.

Heat can exacerbate dry conditions potentially triggering wildfires which may contribute to higher concentrations of airborne particulate matter impacting air quality and associated respiratory illnesses and ocular allergies. Wildfires exacerbated by extreme heat can also impact the provision of health care if health facilities are affected, damaged or destroyed.



Caribbean RCC products that can inform the potential risk of heat impacts include:

CLIMATE EVENTS	MONITORING	FORECAST	BULLETINS
Rising Number of Hot days Heat Waves	Mean Tenperature Anomalies	The CariCOF Temperature Outlook The CariCOF Heat Outlook	The Caribbean Health-Climatic Bulletin

VECTOR-BORNE DISEASES

The suitability of the environmental which depends to a large extent on temperature and precipitation and their variations are key factors influencing the proliferation and/or distribution of vector-borne diseases such as Leptospirosis, dengue fever, yellow fever, Chikungunya and Zika, which are all prevalent in the Caribbean region.

Impacts on Health within the Caribbean

Leptospirosis – episodes of flooding due to extreme rainfall during severe weather events may increase the risk of Leptospirosis due to displaced rodents that could contaminate flood waters, household items and food containers. In 2005, a confirmed leptospirosis outbreak in Guyana occurred after a month of unusually high rainfall and severe flooding along the country's densely populated Atlantic coast (Dechet, 2012).

Aedes aegypti-borne diseases – The Caribbean region has historically experienced an unprecedented crisis of co-occurring epidemics of Dengue, Chikungunya, and Zika. Between 2013 and 2019, 186,050 cases of dengue, 911,842 cases of chikungunya, and 143,127 cases of

Zika were reported in the Caribbean (Lowe et al., 2020). Outbreaks translate into increased morbidity and mortality and high costs to healthcare systems. For example, the Caribbean remains the area within the Americas with the highest cost per capita (International dollars $8.70) (Shepard et al. 2011) and about 9,000 years of lost time due to ill health and premature deaths as a result of dengue. One estimate puts the cost of dengue to the Caribbean at about US$321 million annually (Carrington, 2013). While active, local transmission of Chikungunya and Zika has not been noted for the majority of Caribbean islands, the rise in Chikungunya cases (2024-2025), particularly in South America, places the wider Caribbean on a higher alert level for a future outbreak. The emergence and subsequent establishment of novel viruses such as SARS-CoV-2 in the Caribbean exacerbated matters by complicating disease management. Dengue control and response in the midst of the COVID-19 pandemic was particularly challenging for Caribbean countries (PAHO, 2020).

Precipitation-related products which indicate water excess or shortage which are linked to the proliferation and/distribution of vector populations and, to a lesser extent, infection rates include:

CLIMATE EVENTS	MONITORING	FORECAST	BULLETINS
Drought	SPI Monitor	The CariCOF Climate Outlook Newsletter	The Caribbean Health-Climatic Bulletin
Wet Spell	SPEI Monitor	The CariCOF Drought Outlook	
Flood		The CariCOF Dry Spells Outlook	
		The CariCOF Wet Days and Wet Spells Outlook	
		CariCOF Flash Flood Potential Outlook	

TROPICAL CYCLONES, WELL BEING AND MENTAL HEALTH

The Atlantic Hurricane/Wet season runs approximately from June to November annually. This period is characterized by severe weather systems which are often accompanied by a range of hazards, including floods, landslides, high winds, and occasionally storm surges, among others. Extreme weather events that can lead to disasters are likely to cause an increased burden on already stressed healthcare services.

Impacts on Health within the Caribbean

- Severe weather events like tropical cyclones can result in physical injury and loss of life. The 2017, 2019 and 2024 Atlantic Hurricane seasons impacted multiple Caribbean SIDS causing over 200 deaths in addition to numerous injuries (WMO, 2018; https://www.emdat.be).

- Severe weather systems including tropical cyclones impact health infrastructure such as hospitals, health centres and pharmacies, affecting population access to care including medical equipment and supplies, medication and treatment. In 2012, Hurricane Sandy damaged 3 health facilities in Jamaica (CDEMA, 2012); while Hurricane Maria caused severe damage to 15% of the buildings at the Princess Margaret Hospital, the only referral hospital in Dominica's health care system, as well as, several health centres and clinics (Government of Dominica, 2017). A number of health facilities in The Bahamas were damaged or destroyed during Hurricane Dorian in 2019 (https://www.hfmmagazine.com/articles/3789-us-health-systems-help-assess-dorian-damaged-bahamian-hospitals) with similar impacts in the Grenadines from Hurricane Beryl (https://www.directrelief.org/2024/07/damaged-clinics-no-running-water-compromised-vaccines-hurricane-beryls-impacts-on-health-care-are-widely-felt/)

- Psychological effects and mental disorders in the wake of disasters is a common occurrence. In the wake of Hurricane Maria's passage in Dominica, anxiety and hopelessness about the future, disillusionment and resentment, feelings of loss, bereavement and guilt, as well as the need for greater emotional support were commonly reported (Gleason et al., 2018). Similarly, Bahamians experienced significant psychological fallout including post-traumatic stress disorder in the wake of the passage of Hurricane Dorian in 2019 (Rolle, 2019) and and Jamaicans after Melissa in 2025 (https://www.theguardian.com/global-development/2025/dec/16/trauma-storm-hurricane-melissa-emotional-devastation-mental-health-ptsd-jamaica).

- Following tropical cyclones, there is an increased chance that the conventional means of water supply may be compromised. For example, runoff, sediment, debris and flooding resulting from extreme rainfall or storm surge can contaminate sources of drinking water or damage water distribution systems. In 2004, 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 (Cashman, 2014); while Hurricane Sandy destroyed 460 water systems in 2012 (CDEMA, 2012). This may result in persons seeking alternative water





resources where the water is untreated and the water quality is unknown, potentially increasing gastrointestinal illness.

- Food insecurity due to the potential for crop damage and loss or inability to have productive cropping and the knock-on effects on human nutrition is a concern in areas affected by severe weather systems.

*Information on tropical cyclones and other severe weather systems is readily accessible through tropical storm watches, warnings, advisories and outlooks produced by each country's NMHS. The Caribbean RCC also provides a tailored Atlantic Hurricane season outlook ahead of the annual season which presents forecasts for the first half, the second half and the peak of the Hurricane Season, in addition to hurricane season activity forecasts from the most reputable forecasting agencies.

CLIMATE EVENTS	OUTLOOK	BULLETINS
Tropical Cyclones	The CIMH Atlantic Hurricane Season Outlook	The quarterly Caribbean Health-Climatic Bulletin offers information on the annual Atlantic Hurricane season as appropriate

SAHARAN DUST AND RESPIRATORY DISEASES

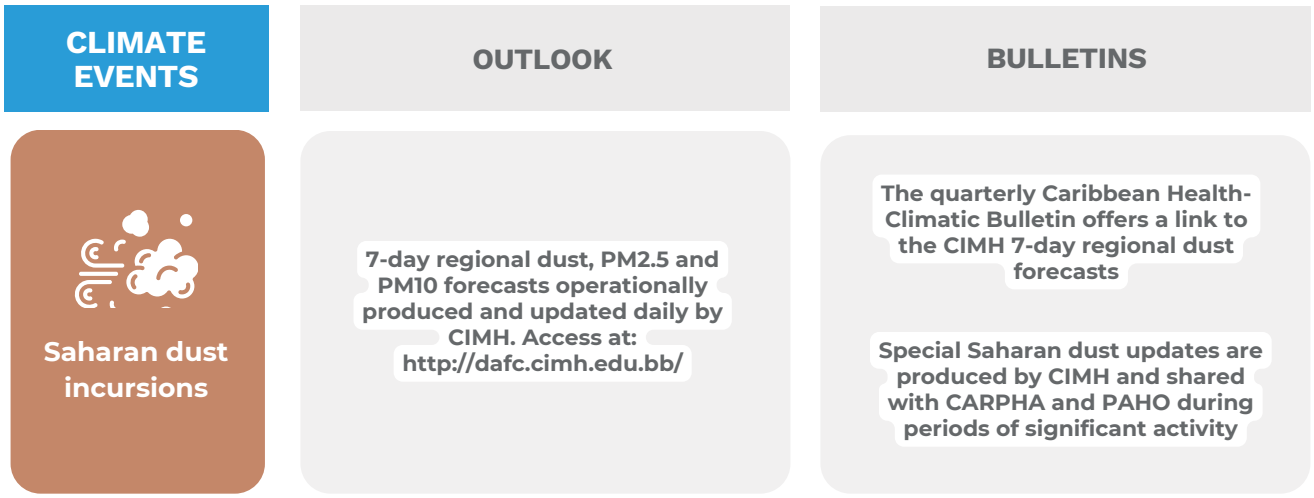
Saharan dust travels thousands of miles from the Sahara region to the Caribbean annually on prevailing upper level winds. Dust clouds often reach concentrations exceeding United States Environmental Protection Agency (EPA) and World Health Organisation (WHO) standards for particulate matter of 10 microns or less (PM10) and finer particles of 2.5 microns or less (PM2.5), posing serious health risks (Tong et al, 2023).

Implications for Health

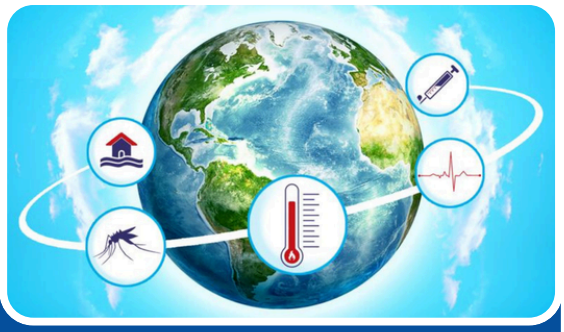
- Exposure to outdoor fine particulate matter is the fifth most common risk factor for death worldwide, accounting for 4.2 million deaths and 103.1 million disability adjusted life-years in 2015 (Sakhamuri and Cummings, 2019).

- Air pollution contributes to the development of pulmonary and cardiovascular diseases and has been linked to adverse effects on fetal development during pregnancy and lung growth restrictions in children (Sakhamuri and Cummings, 2019). Some studies on pediatric asthma accidents and emergency admissions in the Caribbean show an increase in respiratory health effects in association with Saharan dust days (Monteil et. al, 2005; Monteil, 2008).

- Saharan dust may also exacerbate allergic rhinitis in susceptible persons. Sahara dust products may help the health sector in their response to respiratory illnesses, as well as ocular allergies.



The suite of operational climate monitoring and forecast products cover all countries in the geographic Caribbean and are updated monthly by a large team of regional and national level climate experts. Other products such as the quarterly Caribbean Health-Climatic Bulletin are co-produced in close association with key health partners such as the Caribbean Public Health Agency (CARPHA) and the Pan American Health Organization (PAHO).



The Caribbean Health-Climatic Bulletin

The Caribbean Health-Climatic Bulletin (HCB) is a climate-smart tool developed and disseminated by CARPHA, PAHO and CIMH. The Caribbean HCB:

- Offers insights on the typical climate conditions of each upcoming season;
- Provides an outlook of how wet, how dry, how hot etc. the upcoming 3-to-6-month period will be; and
- Advises on the health implications arising from this seasonal climate information.

In this way, the Caribbean HCB guides health professionals who manage health systems to identify and prepare for potential upcoming favourable or inclement climate conditions in the Caribbean. It does this by suggesting several implications of forecasted seasonal climate in five key areas of health practice including respiratory, vector-borne and gastrointestinal illnesses, well-being and mental health, and non-communicable diseases. Use of this information can help to inform strategic and operational decisions in the Caribbean health sector.

All products are freely available on the Caribbean RCC website at http://rcc.cimh.edu.bb.

More broadly, the CIMH also provides services to support near real-time monitoring of the hydrological environment, impact-based forecasting, and early warning. A key tool in this regard is the Caribbean Dewetra Platform – an online spatio-temporal data fusion decision-making platform hosted and maintained by CIMH. The platform can be used to support impact-based forecasting and early warning for the health sector. For example, dust and air quality forecasts are published daily on the platform and presented as overlays over geo-located critical assets.

Further, Common Alerting Protocol (CAP) workflows are supported for the dissemination of warnings[1]. Access to the Caribbean Dewetra Platform is freely available to Member States of the Caribbean Meteorological Organisation (CMO)

[1] For more information on CAP, consult your national disaster management office or meteorological services.

Improving the Provision of Climate Information for Health

The Caribbean RCC continues to work with regional partners CARPHA and PAHO to improve the range and quality of health-climate information through foundational R&D activities. Dengue fever and other febrile mosquito-borne diseases place considerable health and economic burdens on Caribbean populations. Under the 2013-2017 United States Agency for International Development (USAID) funded Programme for Building Regional Climate Capacity in the Caribbean (the BRCCC Programme), the Caribbean RCC partnered with a leading international research team to develop *climate-driven spatiotemporal models to predict Aedes aegypti-borne disease outbreaks.* Early results showed good correlations with drought, excess rainfall and minimum temperature (Lowe et al, 2018). More recent work supported by PAHO and implemented the by EU CARIFORUM Climate Change and Health Project ("Strengthening Climate Resilient Health Systems in the Caribbean") has developed and tested a modelling framework to predict the probability of a dengue outbreak in Barbados with a 3-month lead time (Fletcher et al, 2025).

Under the BRCCC programme, the Caribbean RCC also completed phase 1 in the development of a regional Heat-Health Early Warning System. These studies have shown the strength of the interannual variability of the El Nino Southern Oscillation (ENSO) and North Atlantic Ocean temperatures as predictors for heatwave frequency at seasonal time scales. Those findings legitimated the use of seasonal forecasts of heatwave day frequency and their integration alongside existing heat-related seasonal forecasts products, into operational Seasonal Heat Outlooks.

Phase 2, in part under ClimSA Caribbean, sought to integrate new science sectoral implications of excessive heat exposure into the operational Seasonal Heat Outlooks. Phase 2 further focused on investigating the subseasonal predictability of heat extremes, resulting in the development of heat extreme forecasts for week 2 and weeks 3-4. Furthermore, phase 2 involved the tailoring of climate prediction tools to enable automation of heat forecasts.

Phase 3 in CIMH's development of heat-health early warning systems development will involve:

- Developing historical national or within-country time series of morbidity and mortality related to heat-health effects*;
- Identifying critical heat-health effect thresholds*
- Building a seasonal heat-health effect forecast model; and
- Co-developing an alerting protocol for heatwaves.

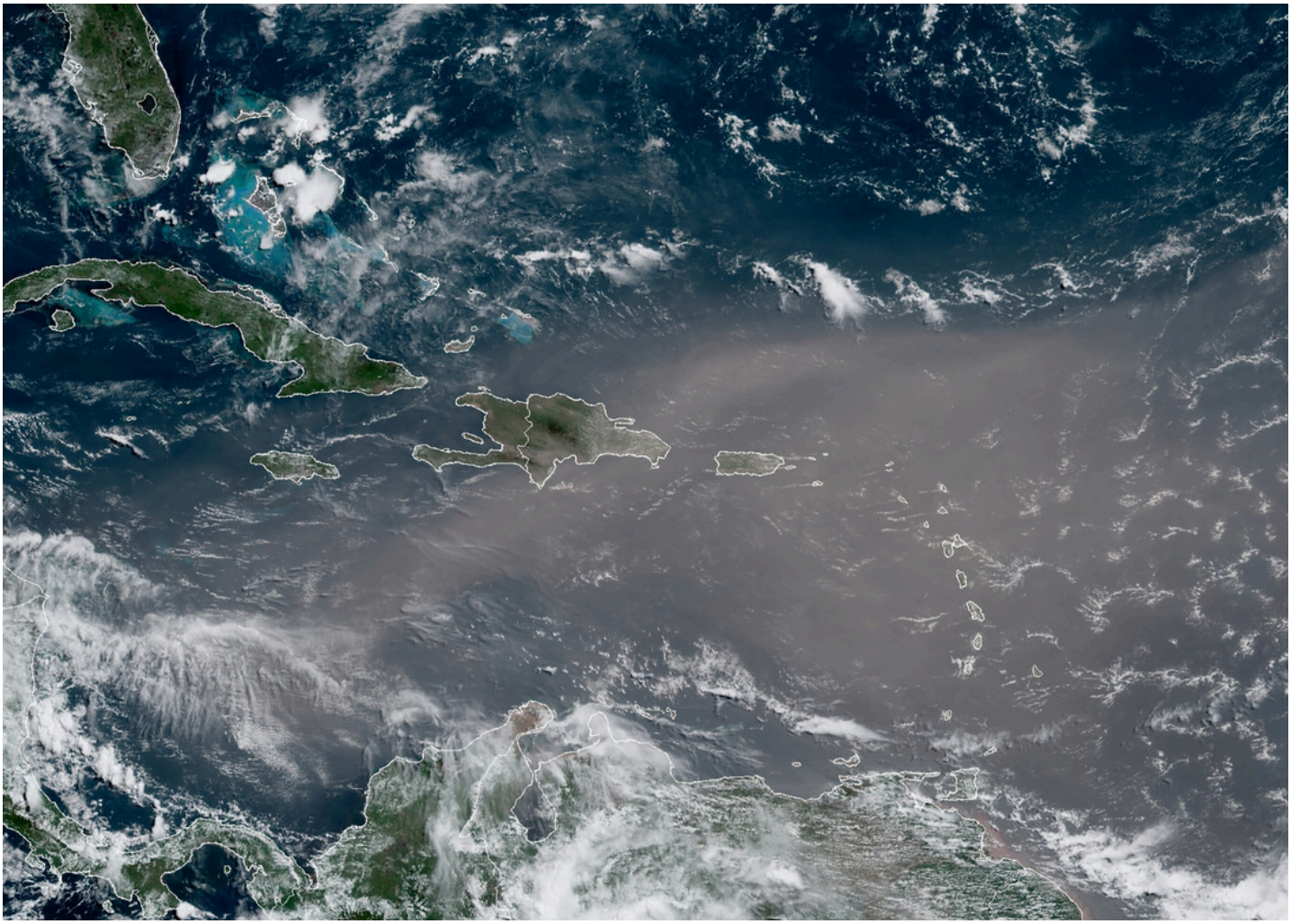
* A pilot project in Grenada supported through the Pan-American Health Organization completed in 2023 provided a proof of concept of how to build excess morbidity and mortality datasets and identifying thresholds for including in heat-health early warning systems.

In response to the lack of routine air quality monitoring programmes in regional territories, the Dust and Air Quality Forecasting Centre (http://dafc.cimh.edu.bb) housed at CIMH has taken the initiative toward developing an early warning system aimed at mitigating against the adverse health effects of Saharan dust within the region.

Currently, CIMH provides 7-day dust and air quality forecasts for the Caribbean using the advanced WRF-Chem modelling system. These tools in addition to in situ air quality monitoring will support future research on Saharan dust, air quality and impacts on respiratory, cardiovascular and ocular diseases.

These research streams form the foundation for the design and development of climate-informed health surveillance systems at national levels. These novel impacts-based early warning systems will be piloted in at least 3 CARIFORUM countries in the coming years.

Going forward, more countries are expected to benefit from increased efforts by the climate and health communities to co-develop climate services for the health sector with a focus on climate-driven spatiotemporal models to predict mosquito-borne disease outbreaks, heat-health impacts, as well as respiratory and ocular effects due to Saharan dust incursions into the Caribbean.





Supporting Health Practitioners' Application of Climate Information

Supporting Health Practitioners' Application of Climate Information

In an era of changing climate and increased weather and climate risks, having reliable advice on the timing and intensity of climate events is becoming increasingly important.

To date, there has been a general shortfall in intersectoral platforms or meeting spaces for the health and climate communities. However, multi-disciplinary national coordination mechanisms and user interface platforms are important avenues for supporting practitioner application of climate information. Newer coordination and interface platforms such as National Committees for Climate Services provide a space for regular interaction and intersectoral planning between the National Meteorological and Hydrological Services and climate-sensitive sectors, including the health sector. Where national committees for climate-related activities or disaster management already exist, the re-formulation and/or strengthening of these Committees to incorporate climate services governance into their mandate is increasingly important in mounting a coherent response to climate extremes, variability and change.

Health National Adaptation Plans (HNAPs) provide a roadmap for health sector action on climate. More work is needed to expand the development and/or enhancement of national HNAPs that include the advancement of climate services for health to all Caribbean countries.

Going forward, CIMH will work with regional partners CARPHA and PAHO to offer countries technical training through short courses and training workshops and increased support for the integration of climate-smart approaches for health.

Health and climate are strongly interlinked, making increased climate risk management by the health sector crucial. Climate risk management in health can be enhanced by policies, plans, coordination mechanisms and interface platforms that support climate informed decision-making by Caribbean health practitioners. The Caribbean RCC continues to work alongside national Ministries of Heath and Meteorological Services across the region, regional health bodies (CARPHA and WHO/PAHO) and research institutes to make strides in increasing the Caribbean's capacity to develop climate services for health. The Caribbean RCC invites health policy-makers to partner with us to support the advancement of climate services for Caribbean health, as well as the integration of these services into national and health sector planning and practice.

This publication was jointly produced by the Caribbean Institute for Meteorology and Hydrology (CIMH), the Pan American Health Organization/World Health Organization (PAHO/WHO), and the Caribbean Public Health Agency (CARPHA), under the Intra-ACP Climate Services and Related Applications (ClimSA) Programme, with support from the European Union.

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The Caribbean Regional Climate Centre (Caribbean RCC)

Regional Climate Centres (RCCs) designated by the World Meteorological Organization (WMO) are centres of excellence dedicated to providing regional climate products and services. Their mission is to enhance the capacity of national meteorological services in each region, enabling them to deliver high quality climate information and prediction products to national users. RCCs produce mandatory regional products, including climate data sets, climate monitoring tools and long-range forecasts, which serve as critical regional inputs for National Meteorological and Hydrological Services (NMHS) climate operations. RCCs also deliver training and capacity building for the NMHSs in their region.

The Caribbean RCC at the CIMH leads the development and distribution of the operational climate products, services and programmes delivered by CIMH including but not limited to long range (seasonal) forecasts, regional climate monitoring, the Caribbean Climate Outlook Forum (CariCOF), the Caribbean Drought and Precipitation Monitoring Network (CDPMN), and sectoral focused climate bulletins co-produced with regional sector agencies. The RCC also provides training on the development and delivery of climate products and services to national level providers of climate information, as well as offer training to national and regional stakeholders on how to effectively interpret climate information and integrate it in their planning and decision-making activities.



About the Intra-ACP ClimSA Programme

The Intra-ACP Climate Services and Related Applications (ClimSA) Programme is a four-year initiative funded by the European Union (EU) through the 11th European Development Fund (EDF) and implemented in the Caribbean by the Caribbean Institute for Meteorology and Hydrology (CIMH). It forms part of a global effort led by the Organisation of African, Caribbean and Pacific States (OACPS) to strengthen the provision and use of climate information services across ACP regions.

In the Caribbean, the programme seeks to enhance the entire climate services value chain through technical and financial assistance, infrastructure development, and capacity building. The programme's goal is to improve access to and application of climate information to support informed decision-making at all levels, enabling more effective adaptation measures and fostering a climate-resilient Caribbean.

Sixteen OACPS Member States benefit from this initiative through regional capacity building, institutional strengthening at CIMH, and the sharing of lessons and results from three pilot sectors:

- Agriculture and Food Security Sector in Guyana
- Water Sector in Jamaica
- Health Sector in Dominica

Main Objectives

- Strengthen interaction between users, researchers, and climate service providers in the Caribbean.
- Ensure effective provision of climate services at regional and national levels.
- Improve access to climate information and enhance regional capacity to generate and apply climate data.
- Mainstream climate-informed decision-making into regional and national policy processes.
- Build resilience in key socio-economic sectors affected by climate variability and change.

This publication was produced under the Intra-ACP Climate Services and Related Applications (ClimSA) Programme, implemented by the Caribbean Institute for Meteorology and Hydrology (CIMH). This programme is supported by the European Union under the 11th European Development Fund (EDF) Intra-ACP ClimSA Programme, and the Organisation of African, Caribbean and Pacific States (OACPS).

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Brief for Health Sector Policymakers

Climate Services and Health: Exploring Partnership and Investment Options

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