



# CARIBBEAN METEOROLOGICAL ORGANIZATION

CARIBBEAN METEOROLOGICAL COUNCIL  
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## THE COORDINATING DIRECTOR'S REPORT - 2022 ON CMO HEADQUARTERS UNIT ACTIVITIES (Submitted by the Coordinating Director)

1. This document highlights activities of the CMO Headquarters since the 61<sup>st</sup> Session of the Council, held virtually on 18-19 November 2021, and hosted by the Government of the Co-operative Republic of Guyana. Factors affecting operational aspects at the Headquarters and other matters of interest are also mentioned for information and guidance where appropriate. Details of some activities and developments, where necessary, will be dealt with under separate agenda items. Some activities previously summarized in the CMO Headquarters 2022 Interim Report will be reported in more detail.

### **High Impact Tropical Weather Events**

2. Since the last session of the Caribbean Meteorological Council in November 2021, the major weather impacts in our region for 2022 were hurricanes, tropical storms, strong tropical waves, and other tropical disturbances. Elsewhere in the region, Member States that had been severely impacted in recent hurricane seasons continued in a recovery mode in 2022.

3. In the Caribbean/Atlantic basins, this season was forecasted to be above average, which has been the case for hurricanes (eight for 2022 compared with seven for the 1991-2020 average) but named storms have numbered 14, same as the 30-year (1991-2020) average. For the Caribbean, the season began with **Tropical Storm Bonnie**, which was the first of several disturbances with a preference for moving across the southern Caribbean. It brought heavy rainfall and flooding to the Windward Islands, Trinidad and Tobago, the Netherland Antilles, and coastal South America before making landfall in Nicaragua. The 2022 season, by 15 November, had seen two major hurricanes, Fiona and Ian, both of which affected CMO Member States. In September, Hurricane **Fiona** (Figure 1), brought strong winds, heavy rain and catastrophic flooding, landslides, and rough seas to Puerto Rico and Dominican Republic as the eye moved between the islands before making landfall in the Dominican Republic. Fiona then proceeded to make landfall in eastern Turks and Caicos Islands as a Category-3 Hurricane on 19-20 September. Ian traversed the southern Caribbean, bringing heavy rain and gusty winds to Trinidad and Tobago and the Netherland Antilles and northern coast of South America. Although the eye of **Hurricane Ian** was well south of Jamaica, the island still suffered heavy rainfall, flooding, and landslides. After making its first landfall in Cuba, causing further devastation, **Hurricane Ian** later intensified into a Category-4 hurricane over the Gulf of Mexico, before making landfall once more, this time, devastating the southwest coast of Florida with storm surge exceeding 10-15 ft (3-4.6m). More than 100 deaths were associated with Ian in Florida. Belize was affected by **Hurricane Julia**, which made landfall in Nicaragua, but its rainbands and strong wave action cause significant damage in Belize, mostly due to agricultural losses (US \$10million). In November, **Hurricane Lisa** made landfall just south of Belize City, the most populated area of the country, affected 6500 families, with 500 houses completely destroyed. Fortunately, there were no fatalities or serious injuries but damage was estimated at US\$100 millions.

4. A preliminary summary of the 2022 Atlantic tropical cyclone activity, to 15 November, is shown in **ANNEX I**. Many named systems were tropical storms or minimal hurricanes, which nevertheless brought significant rainfall, flooding, and associated secondary impacts. The CMO Headquarters monitored the warnings issued in the region. Through coordination with the US National Weather Service Weather Prediction Center’s International Desk, the region and CMO Headquarters received excessive rainfall outlooks associated with the systems. The rainfall outlooks are supplementary information that is also shared with the NHC.

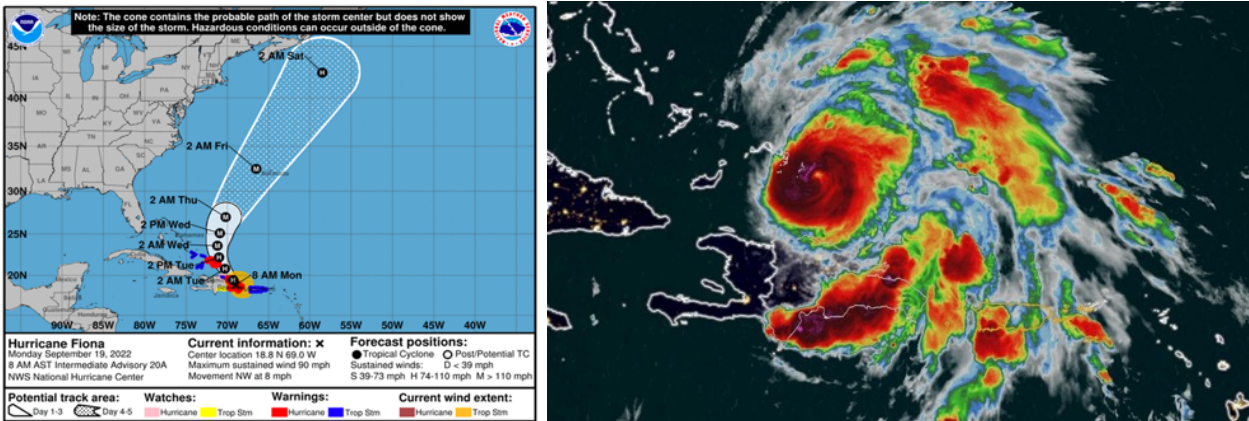


Figure 1. Forecast track of the eye of TC Fiona forecast track and respective GOES-16 Enhanced IR images. Track map, courtesy of NOAA National Hurricane Center. Satellite image, courtesy of NOAA/NESDIS.

5. The year was also marked by episodes of significant Saharan dust. The regular appearance of widespread Sahara dust was often trailing the many tropical cyclones of 2022. At the recent WMO Infrastructure Commission (24-28 October), Members noted the importance of increasing monitoring and prediction capability in the region to support integrated health services and the Global Atmospheric Watch (GAW).

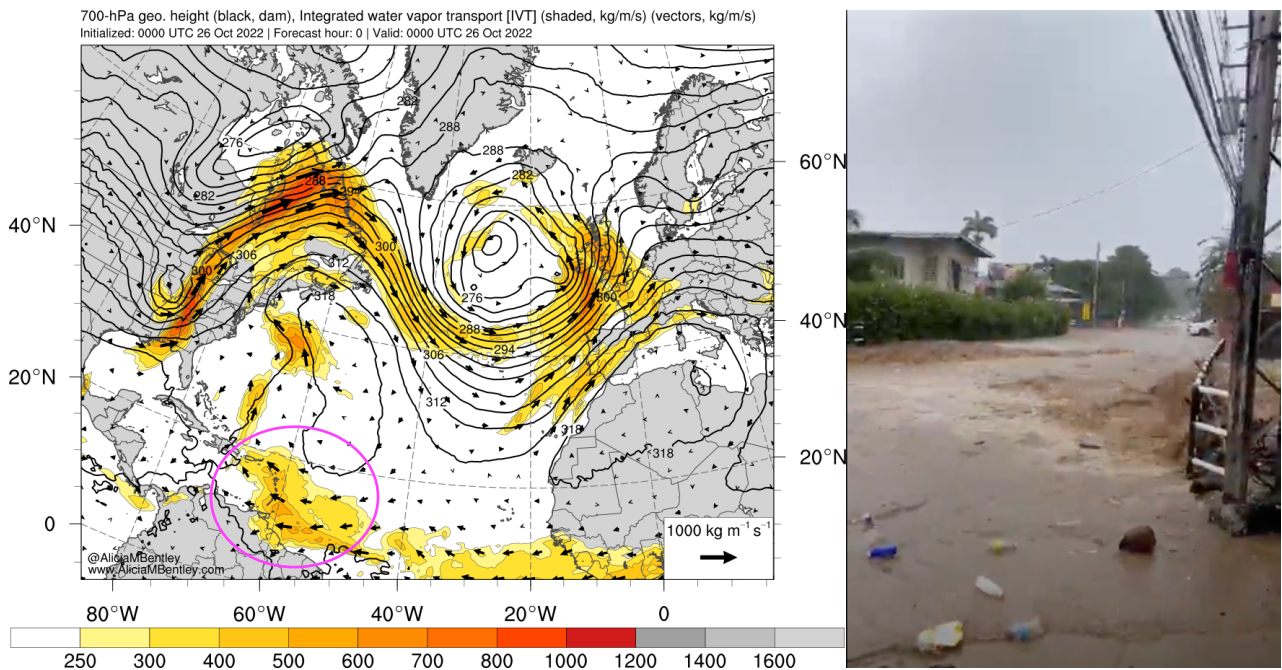


Figure 2. 25 October 2022 - Anomalously high integrated water vapor transport (left), Trinidad and Tobago Flooding (right)

6. To remind us that other types of weather systems, other severe weather, can be damaging and cumulatively costly, during 6 November, Saint Lucia experienced flash flooding and landslides due to the impacts of an upper-level trough, with over 200 households displaced and an estimated US\$2.3 million

of damage. The Windward Islands and Trinidad and Tobago experienced heavy rainfall, flash flooding, and gusty winds on 25-26 October due to the phasing of an upper-level trough with strong divergence, low-level trough, and a weak Kelvin wave. Guyana and Suriname continued to experience record flooding due to an active ITCZ and strong tropical waves. A tornado in Guyana damaged homes and a velocity signature of a tornado was detected by its Doppler velocity image.

### **Multiple Hazards: Volcanic Debris and Heavy Rains**

7. While the explosive eruptions have subsided, St Vincent continues to experience compounded hazards, with heavy rainfall leading to lahars and landslides in the red zone around La Soufriere. Lahars continue to damage infrastructure and water contamination continues to be an issue.

8. The CMO Headquarters and the WMO *Climate Risk and Early Warning Systems (CREWS)* organized a special session at the 44<sup>th</sup> *Hurricane Committee* on social and behavioural sciences.

9. In light of the multiple hazards faced by our Member States in 2021, it is more important than ever to highlight the essential role of the National Meteorological and Hydrometeorological Services in ensuring effective multi-hazard early warning systems for the Caribbean. To that end, the Coordinating Director encouraged and collaborated with the National Meteorological Services of St Vincent and the Grenadines, Barbados, Saint Lucia, Cayman Islands, and Jamaica to highlight their contribution to early warnings and preparedness to the 102<sup>nd</sup> Annual Meeting of the American Meteorological Society (AMS), which was held as a hybrid event on 23-27 January 2022. Council is asked to note that all three presentations were well-received and garnered much discussion in a session of the 10<sup>th</sup> Weather Ready Nations Symposium that highlighted international successes in impact-based forecasting.

### **Legislation, Strategic Plans, National Frameworks for Weather, Climate, and Water Services**

10. Recognizing the importance and multi-faceted nature of the functions of our National Meteorological and Hydrometeorological Services, the increasing demands for their services, and the wide range of their customer base, it is essential that their operations be underpinned and guided by comprehensive legislation. Therefore, through implementing Arrangements with the WMO and CMO Headquarters, eight national bills were drafted based on the Model Meteorological Bill and Policy that were endorsed by CMO Members in June 2021. The project was supported by the WMO *Climate Risk and Early Warning Systems (CREWS) Caribbean* project and Environment and Climate Change Canada, for the period 2020-May 2022. The development of the model meteorological legislation was in collaboration with the Organization of Eastern Caribbean States (OECS). The Model Bill and Policy were professionally published in April 2022 and delivered to all CMO Member States (National Meteorological Service and their parent Ministry), CIMH, WMO Secretariat, OECS Commission, and CARICOM Secretariat.

11. To aid in strengthening the capacity for global and regional initiatives to be implementing at the national level, the CMO Headquarters collaborated with the WMO CREWS Caribbean Project to help CMO Member States to develop Strategic Plans, National Frameworks for Weather, Water, and Climate Services, and complementary Action Plans for their National Meteorological Services. Eight strategic plans were developed by the end of December 2021 for Anguilla, Antigua and Barbuda, Dominica, Grenada, Guyana, Jamaica, St Kitts and Nevis, St Vincent and the Grenadines. With funding from CREWS, two plans and frameworks are in development for 2022 for Turks and Caicos Islands and Cayman Islands, respectively. Details will be provided under Agenda Item 11.

### **Strategic Regional Roadmap for Multi-hazard Early Warning Systems (MHEWS)**

12. The CMO Headquarters contributed to the development of a Strategic Roadmap for Multi-Hazard Early Warning Systems in the Caribbean, through the CREWS Caribbean Project, which identified strategic priorities. CMO HQ has been contributing to Priority Activity 1 as lead coordinator on the development of a multi-sensor precipitation grid over the Eastern Caribbean, with the Barbados weather

radar as one of the primary data sources. The project includes CIMH, as the technical lead, and the National Meteorological Services of Barbados, Saint Lucia, and St Vincent and the Grenadines, and Grenada. CMO HQ helped to organize a seven-part series of webinars on Impact-based Forecasting (IBF) and Weather-Ready Nations (WRN) held from May to September 2022. Details of the priority activities will be discussed under Agenda item 11.

## **WMO Matters**

13. Many of the activities of the CMO Headquarters were aimed at regional implementation of global programmes and initiatives, particularly those emanating from the **World Meteorological Organization** (WMO) as they related to the Caribbean, generally, and CMO Member States, in particular. As one of the pillars of its mandate, the CMO must actively participate in WMO activities at the highest possible level in order to ensure that the interests of small developing states are accounted for and to guide and advise the CMO Member States in their own related activities.

14. Therefore, the Coordinating Director, as a member of the **WMO Executive Council** since 2018, led an experienced team of three senior Advisors to the 75<sup>th</sup> Session of the EC in Geneva during 20-24 June 2022. The Coordinating Director, as the Permanent Representative of the British Caribbean Territories with WMO, also ensures the participation of relevant regional experts in the technical work of the WMO for the benefit of the entire CMO Membership.

15. The Coordinating Director continues to serve as the RA IV representative to the **WMO Research Board** (RB), having been selected as the RA IV Research and Modelling Focal Point at the 18<sup>th</sup> Session of RA IV in February 2021. She is the lead author of the Concept Note on *Innovation in Regions* and liaises with regional institutions and WMO Research Programmes and leads on other activities that support the research priorities of North America, Central America and the Caribbean. She also serves on the *WMO Staff Pension Committee*.

16. The Coordinating Director, the Permanent Representative of the British Caribbean Territories with WMO, led a delegation of 6 experts (**ANNEX III**) to the **WMO Services Commission** (SERCOM-2, 17-21 October 2022) and a team of two to the WMO Infrastructure Commission (INFCOM-2, 24-28 October 2022). In preparation for the Sessions of the Commission, the Coordinating Director provided information about the major items and decisions, to the Governments of the WMO Members of CMO Member States and encouraged the participation of their Permanent Representatives and Hydrological Advisers in the Commissions. It should be noted that two CMO Members are not compliant with WMO General Regulation 6, with regard to the formalizing of their Permanent Representative with WMO. Council is asked to **urge** to WMO Members to formalize their Permanent Representatives and Hydrological Advisers with WMO.

17. The outcomes of the WMO will be covered in detail under Agenda Item 5. Nevertheless, it is useful to mention a few major issues that the CMO Headquarters and the CIMH have been involved in that will have immediate impact on CMO Member States. Among these is the implementation of the **Early warnings for All Executive Action Plan, Global Basic Observation Network** (GBON), which will help to improve global weather prediction and climate services; and the **Systematic Observations Financing Facility** (SOFF), which will allow SIDs to be able to implement and sustain their contribution to GBON; and the **Water and Climate Coalition**. The CMO Headquarters has continued to be active in supporting WMO regional activities and guiding national action for the **WMO Integrated Global Observing System (WIGOS)**. Members are reminded of the compulsory implementation of the WIGOS, which became operational in 2020. Disaster Risk Reduction and early warning systems to build resilience to climate change remain as major issues for the Congress.

18. A Virtual **Regional WIGOS Centre** in Regional Association IV (North America, Central America and the Caribbean) (RA IV), which was proposed as a collaboration among the United States National Weather Service, Environment Canada, the CMO Headquarters Unit, and the Trinidad and Tobago Meteorological Service, was endorsed by the RA IV Management Group in January 2020. An updated

version of the RWC conducted under the RA IV Infrastructure Committee and approved by the 31<sup>st</sup> RA IV Management Group meeting. The RWC functions are to monitor and evaluate the availability, timeliness, and quality of observation data, where the CMO HQ and TTMS would cover the English-speaking Caribbean. A workshop on Regional WIGOS Centres will be held in Costa Rica on 12-15 December 2022.

19. The Coordinating Director co-authored the WMO Open Consultative Platform's White Paper, *"Future of National Meteorological or Hydrometeorological Services: Evolving Roles and Responsibilities"*, which has key messages for all stakeholders concerning decisions on institutional, technological and operational changes.

20. Council Members are urged to enact draft national legislation and policy developed through the CMO–WMO Implementing Arrangement; increase data sharing to support services, especially real-time sharing for Multi-Hazard Early Warning Systems; uptake of science and technology advancement; adapting operating models; developing capacities and other key aspects that will influence evolving roles and responsibilities of National Meteorological and Hydrometeorological Services in the Caribbean (NMHSs), especially with the new initiatives such as Early Warnings for All.

21. Council is asked to note that **Mr Glendell De Souza**, STO, received special commendation from WMO RA IV for his development of IWWXM-Car, to encode METARs and TAFs for the Caribbean, from software provided by the United States National Weather Service's Meteorological Development Laboratory.

### **Development of National Meteorological Services in CMO Member States**

22. CMO Headquarters has been working with the new Director of Meteorology of the Turks and Caicos Island (TCI) Airport Authority, **Dr Holly Hamilton**, on the development of their National Meteorological Service, including assistance with a RoadMap for long-term development and a workplan for 2022-2023 and guidance on human and technical capacity building. A Strategic plan project is being developed with funding from CREWS, to be completed by December 2022.

23. The Coordinating Director chaired the *Ministry of Public Utilities "Trinidad and Tobago Meteorological Service Transformation Committee"*, which was tasked with developing a legal framework for the transformation of the TTMS, following a review of its Strategic Development Plan 2015-2024, operations, human resources, public weather services, and observation network. The Committee's report was presented to the Ministry in February.

### **Capacity Development and Outreach**

#### **Promoting National Meteorological Services' Success in Multi-hazard Early Warnings & Impact-based Forecasting in International Conferences**

CMO Headquarters showcased the dedicated services rendered by the National Meteorological Services (NMSs) in response to the multiple and sometimes concurrent hazards faced by the Caribbean during 2021. The Coordinating Director submitted abstracts on behalf of the NMSs in Barbados, Cayman Islands, Jamaica, Saint Lucia, and St Vincent and the Grenadines and collaborated with the NMSs in developing their presentations. All presentations were well-received by international audiences in the *10th Symposium on Building a Weather-Ready Nation: Enhancing Our Nations Readiness, Responsiveness, and Resilience to High Impact Weather Events* in January 2022 and the *1<sup>st</sup> Weather and Society Conference of the WMO World Weather Research Programme*, 28 February–11 March 2022.

25. In order to enhance capacity in project and proposal development, the Coordinating Director participated in a four-part online Leadership & Management Training Programme taught by UK Met Office and focused on development of projects.



## Symposia organization

26. CMO Headquarters, in collaboration with Varysian Ltd, is organizing the Third Caribbean Symposium on Hydro-Meteorology, from 24-26 January 2023, following the success of the first two held in December 2020 and November 2019, respectively. The next symposium will focus on Early Warning Systems and the partnerships needed to ensure that all people are covered (see Agenda Item 11).

## Support to the Regional and Global Water Agenda

27. Since the 61<sup>st</sup> Session of the CMC, the CMO Headquarters has embarked on a number of activities to support the regional and global water agenda. The Coordinating Director contributed to the Global Water Partnerships-Caribbean regional consultations on a *Framework for Integrated Water Resources Management (IWRM)* for the CARICOM States. The Coordinating Director urged CMO Member States to formalize their Hydrological Adviser with WMO and to participate in the development of the Action Plan for Hydrology. Council is asked to **ensure that each WMO Member has a formally designated Hydrological Adviser with WMO.**

28. Further, the Coordinating Director provide input to various forums of the *Global Water Partnership-Caribbean (GWP-C)*, including their Stakeholder Consultations on development of a *Regional Action Framework for Integrated Water Resources Management (IWRM)* for the CARICOM Region. CMO Headquarters engagement with regional organizations is synergistic with the global water agenda, including the ***Water and Climate Coalition*** that was formed by WMO, five other UN agencies, and international organizations such as the GWP.

## CMO Radar Network and the CMO Operational Radar Group (CORG)

29. CMO HQ hosted the first meeting of the CORG on 7 June 2022 on a virtual platform. The meeting was chaired by the STO, who is the Secretary of the CORG. The CORG comprises radar technicians and IT personnel from radar host countries and CIMH. The Coordinating Director provided an overview of the CMO Radar Network. The Barbados Meteorological Service was invited to give a presentation on its radar upgrade to dual-polarization and ***Dr R Jeffery Keeler***, retired Senior Research Engineer, National Center for Atmospheric Research (NCAR), presented on radar maintenance and operations. The CORG agreed to select/elect two co-chairs after reviewing resumes of the participants.

30. Through the CREWS Initiative, Dr Keeler, a well-known radar expert, was hired by the World Bank to conduct a technical study of the Caribbean Radar Network, in collaboration with CMO HQ. The CMO HQ provided input to the Terms of Reference for the consultancy and organized his visits with the radar host countries, their radar technicians, and IT staff. Meetings were also arranged with CIMH and relevant senior government officials. The study will guide proposals to upgrade the radars, with the support of the Caribbean Development Bank (CDB).

## SERVIR-Amazonia Caribbean

31. CMO Headquarters is partnering with the *International Centre for Tropical Agriculture (CIAT)*, as part of the *SERVIR-Amazonia* expansion to the Caribbean, to deliver capacity building in the generation and use of climate data and other relevant geospatial data in Trinidad and Tobago. *SERVIR-Amazonia*, part of a joint initiative of the *National Aeronautics and Space Administration (NASA)* and the *United States Agency for International Development (USAID)*, “collaborates with regional partners to understand their needs, and then translate these needs into the co-development of tools, products, and services that will allow countries to improve decision making around natural resource management.” As a partner, CMO Headquarters will host a series of workshops “to improve inter-institutional collaboration and interaction among stakeholders, strengthening of their geospatial capacities, and other disciplines necessary to support the sustainable co-development of services and/or technical applications.”

## Marine Meteorology, Ocean Science, and Services

32. The CMO Headquarters facilitated the participation of forecasters from the Cayman Islands, Grenada, and Turks and Caicos Islands in the WMO Course on Marine Services for English-speaking Caribbean Island Nations – Phase 1. The delivery of this course was the culmination of discussions that started between WMO and CMO Headquarters in 2019 and involved developing better understanding of marine customer needs through interviews.

33. The Coordinating Director was an invited panelist in the UN Decade for a Safe Ocean Laboratory hosted by UNESCO-IOC on 5 April 2022. She also spoke at the UN Ocean Conference in June 2022 to discuss the importance of expanding marine observations and sharing of data in real-time and archives for multi-sector use.

## Disaster Risk Reduction, Climate Adaptation, and COP27

34. Council is asked to note that CMO is an admitted Intergovernmental Organization (IGO) of the United Nations Framework Convention on Climate Change (UNFCCC) and broke new ground as a collaborator for a Side Event at the 27<sup>th</sup> Conference of Parties (COP27) in Egypt. CMO collaborated with the *Climate Risk Early Warning Systems (CREWS)* Secretariat and the WMO for an event on “*Mitigating Climate Risk and Enhancing Resilience: Towards Early Warnings for All*” on 11 November 2022.

35. CMO was represented at COP27 by the Coordinating Director. She participated in various events that support the UN Secretary-General, **António Guterres**, call for action to ensure that *every person on Earth is protected by early warning systems within five years*. The WMO, designated to lead this effort, presented [an Action Plan](#) to achieve this goal. The Action Plan highlights the need for better understanding of risk across all time scales and the compounding risk factor of hydro-meteorological events. Key to the implementation of “Early warnings for all” are **National Meteorological and Hydrological Services** and **Disaster Risk Management** agencies, as authoritative providers; collaborating across multiple sectors with other national and regional stakeholders.

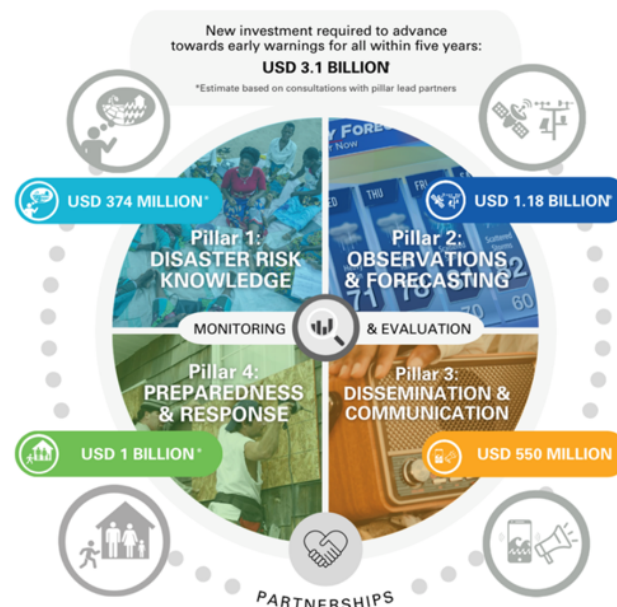


Figure 3. Budget overview for the four pillars of Early Warnings for All Initiative

36. The Coordinating Director was a presenter in four other Side Events at COP27, on:
- Environmental Monitoring for Loss and Damage: Early Warning Systems and Impact Attribution Capacity in the Caribbean SIDS
  - Public-Private approaches in response to the Early Warnings for All initiative

- Scaling-up early warning and early action through comprehensive disaster and climate risk management
- Early Warning Systems and the impact of the Canada CREWS Project

37. Council will recall that a major responsibility for the CMO Headquarters with regard to DRR is the Severe Weather Forecast Programme (SWFP) Eastern Caribbean, which focuses on severe weather (heavy rain, strong winds, rough seas/swells) that can occur at any time of year. The Regional Subprogramme Management Team is co-chaired by *Météo-France-Martinique* and CMO Headquarters and supported by CIMH. The SWFP Eastern Caribbean is in pre-operational test phase, with global and regional model forecasts being used to monitor potential severe weather by the *Regional Forecast Support Facility* (RFSF)–Martinique.

38. CMO HQ organized and chaired the Management Team meeting by video-conference on 14 December 2021, at which the CMO CCRIF intern presented a draft Severe Weather Operational Plan. In April 2022, the Coordinating Director and *Météo-France* Co-Chair reported to the 44<sup>th</sup> Hurricane Committee on recent activities. In June 2022, the Coordinating Director and her advisers met with the Director of *Météo-France*, **Ms Virginie Schwarz**, in Geneva, on the side of the WMO Executive Council, to review collaborative activities, in accordance with our formal *Working Arrangements*.

39. Partnerships for Weather, Water, and Climate Services to Increase Resilience: On 13 May 2022, CMO HQ hosted **Mr Rodney Martinez Guingla**, WMO Representative for RA IV for a meeting in Port of Spain with stakeholder organizations headquartered in Trinidad and Tobago, focused on partnerships for weather, climate, and water services; early warnings; and resilience building to extreme weather and climate. Participants from the media, hydrology, public health, disaster risk reduction, coastal and marine, and academic sectors, presented activities related to weather, water, climate, and early warning systems and proposed areas of collaboration and cooperation.

40. The Coordinating Director was an invited speaker to the WMO Technical Conference on Early Warnings for All, 22 October. She prepared the slides and Mr De Souza, STO, gave the presentation in Geneva.

41. The Coordinating Director was invited to give a keynote speech for World Broadcasting Union/UNDRR workshop on “Media Saving Lives”; chaired Panel on “Strengthening Multi-Hazard Early Warning Systems in Latin America and the Caribbean” at the launch of the State of the Climate in Latin America and the Caribbean 2021; served as a panelist for meetings of WMO, World Bank, UNDRR.

42. In addition to the activities reported above, the CMO Headquarters Unit continues to advance disaster risk reduction in cooperation and coordination with Caribbean Disaster and Emergency Management Agency (CDEMA), CIMH, and other regional institutions. Through the Regional Early Warning System (REWS) Consortium led by CDEMA, CMO HQ aided in the development of a Multi-Hazard Early Warning System Checklist and also participated in the REWS Project Steering Committee Meeting in September 2022 in Barbados. Additionally, the Coordinating Director served on the Steering Committee of a project by WMO and CDEMA to strengthen early warning operational arrangements between National Disaster Organizations and National Meteorological and Hydrological Services. Other related activities are described under Agenda Items 5 and 11.

### **CARICOM-CARIFORUM Related Activities**

43. CMO Headquarters participated in the 103rd Special Meeting of the *Council for Trade and Economic Development (COTED) - Environment and Sustainable Development*, on 9 and 23 June, The meeting focused on: (i) Advancing Environmental and Natural Resource Governance In CARICOM (ii) Climate Change and Disaster Risk Reduction (iii) Ocean Matters and (iv) CARICOM Engagement in other International Environmental Governance Process – topic areas in which the Organs of the CMO (CIMH, CMO HQ) and the National Meteorological and Hydrometeorological Services of CMO Members have contributed and will continue to contribute.



44. Council is asked to note that the Coordinating Director participated in various CARICOM related activities in 2022, including with the CARICOM Digital Skills meeting in August and shared with the CARICOM Secretariat, the related activities and decisions of the WMO and its Members that were of regional interest. Those included the *Early Warning for All Executive Action Plan; Water and Climate Coalition*; the *Global Basic Observation Network*, which is vital for weather forecasting and climate services; and the *Systematic Observation Finance Facility (SOFF)*, intended to support least developed countries with sustaining their basic observation network and international data exchange via the WMO Unified Data Policy.

45. Council is asked to note that CMO Headquarters has been contributing to the development of the CARIFORUM Post-Cotonou Regional Programming, by providing reviews of the draft programming and participating in the CARIFORUM regional consultation meetings.

46. The CMO Headquarters Finance and Administrative Officer, **Mrs Natalie Araujo-O'Brien**, continues to serve on the CARICOM RBM Leadership Group and the Finance Committee of the Caribbean Community Administrative Tribunal (CCAT). The Finance and Administrative Officer (FA), and the STO participated in an RBM/MEAL Workshop designed to successfully advance sustainable RBM practices, in order to expedite the full adoption of RBM by all Regional Institutions.

#### **Headquarters Matters: Retirement and New Hires in 2022**

47. Council is invited to join the CMO Headquarters in congratulating the Science and Technology Officer (STO), **Mr Glendell De Souza**, on his retirement in October 2022, after serving for 17 years with great dedication as a pioneer in the position. Council will recall its approval of the planned transition for the position, which included a period of overlap with his successor and the approval of the one-time costs entailed.

48. In May 2022, the CMO Headquarters (HQ) welcomed a new Project Development Officer (PDO), **Mr Haley Anderson**. Mr Anderson came to CMO after working with the Trinidad and Tobago Meteorological Service and the Office of Disaster Preparedness and Management.

49. The CMO Headquarters established a Selection Committee for the post of Science and Technology Officer (STO) whose membership comprised the Coordinating Director and two Directors of National Meteorological Services that did not have any staff members as applicants for the post. The Selection Committee was:

- **Mr Evan Thompson**, Director of the Meteorological Service of Jamaica;
- **Dr Garvin Cummings**, Director of the Hydrometeorological Service of Guyana;
- **Dr Arlene Laing**, Coordinating Director, CMO Headquarters, Chair

50. After an extensive evaluation process, the Committee unanimously agreed that the post of the next Science and Technology Officer at the CMO Headquarters should be offered to **Mr Kenneth Kerr**, formerly of the Trinidad and Tobago Meteorological Service. Mr Kerr started on 14 June 2022 as the Science and Technology Officer Designate (STOD), for a period of understudy with the incumbent STO. With the recent retirement of Mr De Souza, Mr Kerr's title is now Science and Technology Officer.

#### **Status update on Strategic Objectives**

51. Council will recall granting approval of the *Strategic Plan 2020-2023* and the *Operational Plan 2020-2023* of the CMO Headquarters by the 59<sup>th</sup> Council and 60<sup>th</sup> Council, respectively. An update on the Status of the Strategic Plan outcomes and Key Performance Indicators are presented in **Annex II**, while a detailed update on Strategic Plan Performance Monitoring Indicators is presented in **Annex III**. Council is asked to note that these activities are helping to achieve the intermediate outcomes under each Strategic Goal; the upgrading of National Meteorological Services; enhancement of early warning

systems and disaster risk reduction; support for the implementation of the WMO Integrated Global Observation System (WIGOS); contributions to establishing regional priorities for operationally-directed research, marine meteorology and ocean services; contributions to the development of the WMO Unified Data Policy, and the framework for the Global Basic Observation Network, among other activities.

### Other Matters

52. Council is asked to note that, by 15 October 2022, the level of financial contributions received from Member States had increased to 77%, a marked improvement following the decrease to 30% in 2021. Contributions seem to be aligned with the adverse socio-economic impact of the COVID-19 pandemic, and subsequent expansion of economic activity during 2022. Details will be discussed under Agenda item 6(c).

53. The CMO Headquarters is supporting the CIMH in its implementation of the Intra-ACP Climate Services and Related Applications (ClimSA) Programme, on behalf of the CMO. ClimSA is an initiative of the Organisation of the African, Caribbean and Pacific States (OACPS) funded under the 11<sup>th</sup> European Development Fund (EDF) to strengthen the climate services value chain. See the Principal's report for further details.

54. **ANNEX IV** to this Document indicates meetings and other events attended (or scheduled attendance) by officers of the CMO Headquarters in 2022. This schedule of activities undertaken by the CMO Headquarters to-date was relatively heavy this year, comprising of a mix of CMO, WMO, and UNDRR regional implementation activities. Several regional meetings were related to disaster risk reduction and Multi-Hazard Early Warning Systems in the Caribbean. The Headquarters Unit formally congratulated newly-appointed Ministers, who oversee the National Meteorological and Hydrometeorological Services; introducing each to the CMO and its role in supporting Member States

55. The CMO Headquarters continues to promote the participation in as many scientific, technical and training events as possible by the National Meteorological and Hydrometeorological Services and the CIMH, particularly those sponsored by the WMO and its partners that have a special relevance to the region. The list below shows the events that the Coordinating Director was able to facilitate from December 2021 to November 2022:

- Virtual Conferences, Meetings, Courses, and Workshops
- (i) 102<sup>nd</sup> American Meteorological Society (**AMS**) Annual Meeting, 10 Weather Ready Nations Symposium, 24-27 January 2022 [*B Jeffers, St Vincent and Grenadines, D Nurse, Barbados*]
  - (ii) **WMO RA IV Workshop on Hurricane Forecasting and Warnings**, 28 February- 4 March 2022 [*L Pologne, H Hamilton, BCT*]
  - (iii) **WMO World Weather Research Programme (WWRP) 1st Weather and Society Conference**, February 28 – March 11 2022 [*S Clarke, BCT; B Jeffers, SVG; D Nurse, Barbados*]
  - (i) **WMO Course on Marine Weather Forecasting Services for English-Speaking Caribbean Nations**, 14 March - 17 June 2022 [*Multiple participants*]
  - (ii) **WMO 44th Session of the RA IV Hurricane Committee (HC-44)**, 25-28 April 2022 [*Multiple participants*]
  - (iii) **CREWS World Bank Multi-hazard Impact-Based Forecasting & Early Warning Seven (7)-part Webinar Series for the Caribbean Region**, 16 May; 1, 15, and 30 June; 13 and 27 July; 10 August 2022 [*Multiple participants*]

- (iv) **CREWS World Bank Multi-Sensor Precipitation Grid Demonstration Virtual Workshop, 5 July 2022** [Multiple participants]
- (v) **CREWS Multi-Sensor Precipitation Grid User Training Webinars, 27 October, 3 and 10 November 2022** [Multiple participants]

In-person

- (vi) **UNDRR Caribbean Regional Workshop on Measuring Effectiveness of Early Warning Systems through Sendai Framework Target (g) and Custom Indicators, 10-12 May 2022,** [Multiple participants]
- (vii) **CMO/WMO Partnerships for Weather, Water, and Climate Services, Early Warning and Anticipatory Action to Increase Resilience, 23 May 2022** [Multiple participants]

**Action Proposed to Council:**

56. The Council is invited to:

- (i) **Note** the activities and issues concerning the CMO Headquarters in 2022, in particular, the implementation of legal mandates and strategic plans in Member States, the engagement with disaster risk reduction and early warning systems; a new venture for CMO – the hosting of Side Event at UNFCCC/COP27; geospatial analysis capacity building; as well as those issues concerning the wider Caribbean Community;
- (ii) **Discuss** the impact of the 2022 hurricane season, other high impact weather, on the region and, in particular, the impact on CMO Member States;
- (iii) **Note** the progress on the CMO Headquarters Strategic Plan 2020-2023.

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CMO Headquarters  
November 2022

## High Impact Hazardous Events of 2022

### Preliminary Atlantic Tropical Cyclone Tracks

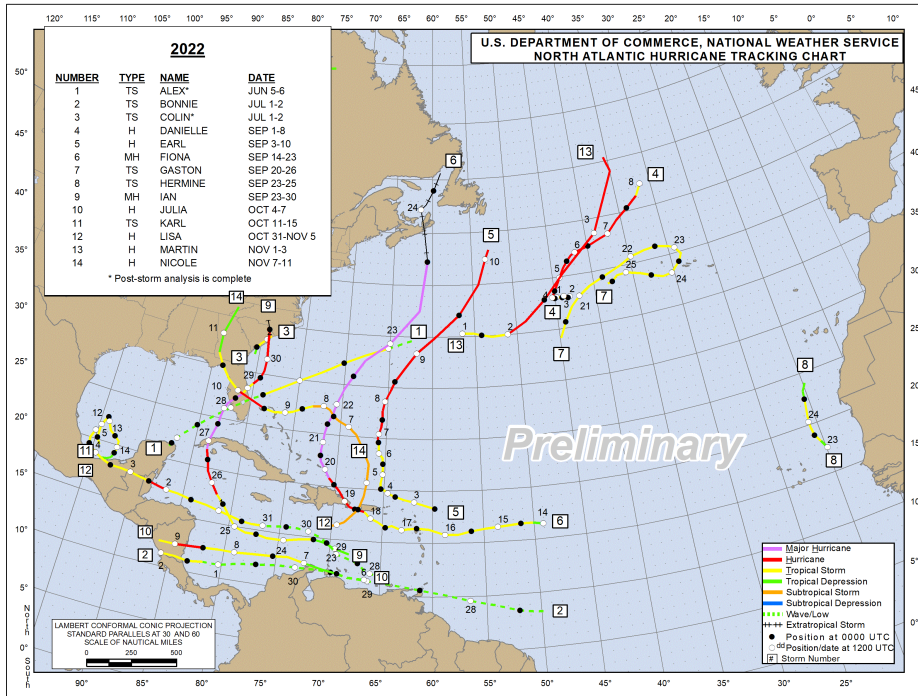


Figure A1. Atlantic Tropical Cyclone Tracks for 2022, up to 11 November 2022



Image of 6 November flash flooding in St. Lucia. Source: thecaribbeannewnow.com

Figure A2. Flash flooding in Saint Lucia due to an upper-level trough

### 1. Support to Regional Strategic Goals for 2020-2023 and beyond

Programme	Partners (if any)/Contact Organizations	Status	Remarks
CMO's participation in a <b>WMO Regional Management Group</b> to align RA IV working structures with the WMO Strategic Plan (2020-2023) goals to support National Meteorological and Hydrological Services in North America, Central America and the Caribbean	Canada, Costa Rica, Jamaica, USA, and WMO		
CMO's participation in the (i) development of a Regional Operating Plan; (ii) organization of the 18 <sup>th</sup> RA IV Session and (ii) high-level dialogue between RA III and RA IV.			
<b>CARICOM/CARIFORUM Strategic Programming</b> CMO Headquarters continues to contribute to regional programming and strategic planning by CARICOM	CARICOM Institutions, Secretariat		



## 2. Expected Outcomes for NMHSs in CMO Member States

<b>Strategic Priority 1:</b> Enhance disaster preparedness and reducing losses of life and property from extreme hydrometeorological events and severe weather			
<b>Ultimate Outcome 1:</b> Support for delivery of authoritative, accessible, user-oriented, and fit-for-purpose information and services to reduce the disaster risk of hydrometeorological extremes			
<b>Intermediate Outcome 1:</b> Enhanced capability of Members to develop, deliver, and utilize accurate and reliable weather, climate, water and related environmental impact-based forecasting services to mitigate against extreme hydrometeorological events.			
<b>Key Focus Areas in 2020-2023</b>			
<ul style="list-style-type: none"> <li>• Support implementation of impact-based forecast and warning products and services</li> <li>• Strengthen national capacity in multi-hazard early warnings through enabling legislation that clarifies the roles and responsibility of NMHSs</li> <li>• Support Members' delivery of authoritative national weather, water, and climate information products and services, through enabling legislation authorizing those functions.</li> <li>• Support the development of national strategic plans, national frameworks for weather, water, and climate services, and action plans</li> <li>• Support the upgrading of meteorological services in the Turks and Caicos Islands</li> <li>• Support the enhancement of weather services via uptake of modern technology in service delivery and quality management principles.</li> <li>• Provide guidance on the adoption of international standards, quality control mechanisms and recommended practices.</li> <li>• Provide guidance to NMHSs for the implementation of redundant communications systems that should be used in WMO RA IV (North and Central America and the Caribbean)</li> <li>• Assist in the mobilization of resources involving development agencies and national governments for disaster risk reduction</li> </ul>			
<b>Activities</b>			
Programme	Partners (if any)/Contact Organizations	Status	Remarks
<b>Drafting of Legislation for National Meteorological Services</b> CMO Headquarters is driving projects to adapt the Model Meteorological Bill and Policy by CMO Member States without legal mandates for their operation.	WMO, Relevant Government Ministries, NMHSs, including their stakeholders, Organization of Eastern Caribbean States (OECS). Sponsors – CREWS	The Model Meteorological Bill and Policy endorsed in June 2021 has been adapted by five (5) Member States: Antigua and Barbuda, Dominica, Jamaica, St Lucia, St Vincent and the Grenadines and St Kitts and Nevis. One (1) additional Bill and Policy adaptation is currently underway in Barbados.	The CMO signed a new Implementing Agreement with the WMO in June 2022, and extended its scope in August 2022 by Amendment No. 1.  Strategic Plan Performance

<p><b>Strategic Plans with National Framework for Weather, Water, and Climate Services and Complementary Action Plan</b></p> <p>CMO Headquarters is extending the development of National Strategic Plans in CMO Member States that requested assistance.</p>	<p>WMO, Relevant Government Ministries, NMHSs, including their stakeholders, CIMH. Sponsors – CREWS</p>	<p>Eight (8) Strategic Plans were developed under the original Implementing Agreement with the WMO. Two (2) additional Strategic Plans are currently being developed for the Turks and Caicos Islands, and the Cayman Islands</p>	<p>Monitoring (2021/2022): # of Members with Legal Basis = 3/4 # of NMHSs with Strategic Plans = 8/12</p>
<p><b>Severe Weather Forecast Programme Eastern Caribbean</b></p> <p>CMO HQ and Météo-France Martinique, co-chair the Regional Sub-programme Management Team (RSMT), guiding implementation of the SWFP-EC by which NMHSs access new numerical weather products, radar products, and lightning monitoring, and more; Improving service delivery of seamless and accurate warnings of hazardous weather that may not be the results of a tropical cyclone and could occur at any time of year, in collaboration with relevant national organizations; Training of forecasters in severe weather forecast concepts and cascading-scale of global to regional to local scale and in collaborative forecasting using online platform</p>	<p>Météo-France, NOAA, Environment and Climate Change Canada, WMO, CIMH</p>	<p>CMO co-organized satellite workshop on 5-8 December 2022</p>	<p>SWFP Training Activities planned for 2021 were postponed to 2022.</p> <p>Strategic Plan Performance Monitoring (2021/2022): # of forecasters trained in SWFP concept = 7/1 # of Members participating in the SWFP = 7/8</p>
<p><b>EUREC<sup>4</sup>A-UK-CMO Caribbean Weather Forecasting Initiative</b></p> <p>CMO Headquarters collaborated with the University of Leeds to propose a Caribbean Weather Forecasting Initiative, including two workshops and a Forecast Testbed as part of EUREC4A field campaign. The first workshop and testbed were organized in collaboration with CIMH. The first workshop was held prior to the field campaign to train forecasters on providing briefings to support research operations. Supported goals of the SWFP.</p>	<p>University of Leeds, WMO, CREWS, UK Met Office, NOAA, CIMH, Meteo-France</p>	<p>CMO co-planned a workshop to be held on 20-24 February 2022, as Part 2 of satellite workshop on 5-8 December 2022</p>	

<p><b>Regional Hurricane Warning System</b></p> <p>Coordination of CMO Member States' involvement in the Atlantic-Caribbean Hurricane Warning System, including backup arrangements among States. Coordination of annual training activities with the US National Hurricane Center</p>	<p>NOAA/NHC, CDEMA, and WMO</p>		
<p><b>Development of a new Meteorological Service in the Turks and Caicos Islands</b></p> <p>CMO Headquarters assistance for a complete multi-stage development of a new National Meteorological Service from a small ad-hoc meteorological operation in support of Civil Aviation. New internal structure will include observational systems and network, telecommunications, data collection, dissemination and storage; instrument maintenance; multi-level training programmes</p>	<p>TCI Airport Authority; TCI Department of Disaster Management and Emergencies; Bahamas Department of Meteorology, CIMH</p>	<p>Strategic Plan drafted for TCIAA Meteorological Unit. TCI Director of Meteorology training in marine meteorology service delivery in 2022. New entry-level meteorology technician hired.</p>	<p>Major multi-year activity for the TCI and CMO</p>
<p><b>Development of St Kitts and Nevis Meteorological Service</b></p> <p>CMO Headquarters has been supporting the development of the St Kitts and Nevis Meteorological Service, (i) with a new Strategic Plan; (ii) drafting of a national meteorological bill, with the support of WMO; (iii) reviews of proposals for implementing their Strategic Plan via a Green Climate Fund Readiness project.; (iv) Supporting St Kitts and Nevis in transitioning of St Kitts Terminal Aerodrome Forecasts (TAFs) from the US National Weather Service to forecasters in St Kitts and Nevis.</p>	<p>CCCCC, GCF, Government of St Kitts and Nevis, CIMH</p>		
<p><b>Ongoing upgrades of Communication Systems and Infrastructure</b></p> <p>Guidance/Assistance to Member States on the correct communications systems to be procured and the necessary data protocols, formats and information pathways to share the information generated regionally and internationally.</p>	<p>NMHSs, NOAA, WMO, World Bank</p>		

<p><b>Measuring the Effectiveness of Early Warnings Systems through Sendai Framework Monitoring</b></p>	<p>WMO, UNDRR, NMHSs, NDOs, NSOs Sponsor – CREWS</p>	<p>The CMO was involved in the planning and execution of the in-person workshop and coordinated the participation of CMO Member State NMHSs. The CMO also participated in discussions related to the development of custom indicators.</p>	<p>Supports the implementation of the UN Mandate to provide “Early Warnings for All” given by the UN Secretary-General on World Meteorological Day 2022</p>
<p>The CMO coordinated the participation of Member State NMHSs in a workshop held in May 2022 in Trinidad and Tobago. The goal of this workshop was to bring together NMHSs, National Disaster Offices (NDOs), and National Statistical Offices (NSOs) to develop practical skills for monitoring and evaluation of MHEWS implementation through the use of custom indicators.</p>			

<b>Risks</b>	<b>Mitigation Measures</b>
<p>Limited economic resources to support the activities, especially following the global pandemic and ongoing conflicts, and the resultant shrinking of economies worldwide.</p>	<p>Support the setting of priorities for a basic level of services that are the most critical to support and conduct interim analysis of Member State capacity to implement the programmes and activities.</p>
<p>The continuing risk of hurricanes and other hazards can have major impacts on the socioeconomic development of Member States and would limit the available funding that supports the programmes</p>	<p>Encourage NMHSs to seek partnerships among sectors for whom weather, water, and climate data are vital. It is hoped that the legislation being developed will provide a mechanism for those engagements.</p>

<b>Strategic Priority 2:</b> Support climate-smart decision making to build resilience and adaptation to climate risk.			
<b>Ultimate Outcome 2:</b> Climate services and information integrated into policy and decision-making framework for building socioeconomic resilience and reducing climate risk			
<b>Intermediate Outcome 2:</b> Enhanced capability of Members to develop, access and utilize accurate, reliable climate, water and related environmental services to best support the policy-making and actions that mitigate against climate risks and build socioeconomic resilience.			
<b>Key Focus Areas in 2020-2023</b>			
<ul style="list-style-type: none"> <li>Support Members in delivery of authoritative national climate information products and services in the priority areas of the CIMH-led Early Warning Information Systems Across Climate Time Scales (EWISACTS) to adapt and respond to climate variability and change through draft legislation that authorizes their provision of climate services.</li> <li>Support the development of national strategic plans, national frameworks for weather, water, and climate services, and action plans</li> <li>Encourage participation of NMHSs in a climate service information system enabling all Members to access, and add value to, the best available regional climate information products and methodologies.</li> </ul>			
<b>Activities</b>			
<b>Programme</b>	<b>Partners (if any)/Contact Organizations</b>	<b>Status</b>	<b>Remarks</b>
<b>Drafting of Legislation for National Meteorological Services</b>			See updates under <i>Strategic Priority 1</i>
<b>Strategic Plans with National Framework for Weather, Water, and Climate Services and Complementary Action Plan</b>			
<b>SERVIR-Amazonia</b> The CMO Headquarters has partnered with the International Center for Tropical Agriculture (CIAT) to implement a USAID-funded development initiative to advance learning and the sharing of best practices and innovative approaches toward the forecasting and monitoring of extreme hydrological events and monitoring of mangrove ecosystems. Activities aim intent to build capacity in the use of geospatial information to improve environmental decision-making	International Center for Tropical Agriculture and Bioversity International Sponsor - USAID	A User Needs Workshop was held at the CMO Headquarters on 24 August 2022. The CMO assisted in facilitating the workshop and co-developing the training programme. The first training session was held on 18 November 2022. Eleven (11) more virtual and in-person training sessions are scheduled to take place until April 2023.	The CMO Headquarters signed a Sub Award contract with CIAT in October 2022
<b>Risks</b>		<b>Mitigation Measures</b>	
Limited human resources and workforce competency to deliver climate services, particularly for the smaller Meteorological Services		Support the setting of priorities for a basic level of services that are the most critical to support and conduct interim analysis of Member State capacity to implement the programmes and activities;	



	Encourage NMHS to work with CIMH to develop the scientific and technical skills of their staff
The continuing risk of hurricanes and other hazards can have major impacts on the socioeconomic development of Member States and would limit the available funding that supports the programmes	Encourage NMHSs to seek partnerships among sectors for whom weather, water, and climate data are vital. It is hoped that the legislation being developed will provide a mechanism for those engagements.

<b>Strategic Priority 3:</b> Support the strengthening and maintenance of observation networks and information services			
<b>Ultimate Outcome 3:</b> Enhanced observations and integrated information services for impact-based forecasting and decision-support for both routine activities and high-impact events.			
<b>Intermediate Outcome 3:</b> An integrated observational network optimized to ensure effective national coverage and accessibility for risk monitoring and numerical weather prediction. High quality fit-for-purpose measurements feeding a continuous data exchange underpinned by best practices in data management and data processing mechanisms.			
<b>Key Focus Areas in 2020-2023</b>			
<ul style="list-style-type: none"> <li>● To encourage and support international exchange of data, along with strengthened monitoring of compliance within WMO RA IV</li> <li>● Provide advice on the development of data management systems and practices through WMO Information System (WIS) to help ensure that all observational data and key products are properly archived.</li> <li>● Help facilitate international exchange of data, along with strengthened monitoring of compliance.</li> <li>● Assist in the development of data management systems and practices through WMO Information System (WIS) to help ensure that all observational data and key products are properly archived</li> <li>● Creating and operationalizing of the CMO Operational Radar Working Group</li> <li>● Supporting the use of information technology for impact-based forecast and warnings.</li> <li>● Supporting the use of guidance material to facilitate integration of externally-sourced observations into the impact-based forecast process.</li> <li>● Provide leadership in promoting the principles on which global meteorology is built, emphasizing authoritative voice, common standards, data and product sharing among NMHSs of Member States.</li> </ul>			
<b>Activities</b>			
<b>Programme</b>	<b>Partners (if any)/Contact Organizations</b>	<b>Status</b>	<b>Remarks</b>
<b>WMO Integrated Global Observation System (WIGOS) – Initial Operational Phase</b>			
<b>(i) WIGOS Station Identifiers</b> This service will involve the provision of advice and guidance to help Members integrate the new WIGOS Station Identifiers (WSI) into their monitoring systems. CMO Headquarters will help support NMHSs who are responsible for the establishment of WSI schemas, observational data product integration, and end user awareness and transition	CIMH, WMO, NMHSs of CMO Member States and other national entities with surface observing stations		Requirements And guidelines provided by the WMO Infrastructure Commission.
<b>(ii) WIGOS National Implementation Plans</b>	WMO, NMHSs of CMO Member States		Strategic Plan Performance

<p>CMO Headquarters is providing guidance and templates for Member States to use in developing their National Implementation Plans.</p>	<p>and other national entities with surface observing stations</p>		<p>Monitoring (2021/2022): # of Members implementing WIGOS = 6/6</p>
<p><b>(iii) WMO Integrated Global Observation System (WIGOS) – Regional WIGOS Centre</b></p> <p>Regional WIGOS Centres ensure the quality of surface observation (accuracy, availability, and timeliness). A Regional WIGOS Centre has been approved by WMO RA IV Management Group as a virtual centre to be hosted by NOAA, Environment and Climate Change Canada, the CMO Headquarters, and Trinidad and Tobago Meteorological Service. The CMO Headquarters and TTMS will be responsible for the WIGOS Data Quality Monitoring for the English-speaking Caribbean</p>	<p>WMO, NOAA, Environment Canada, TTMS</p>		<p>Technical Tools developed by WMO and Centres in other regions. Extra Resources needed for Caribbean part of RWC</p>
<p><b>(iv) Global Basic Observation Network (GBON)</b></p> <p>CMO Headquarters will help support NMHSs to be compliant with the requirements to contribute essential observations and data exchange for the public good of all nations - improved weather forecasts and climate services. The Coordinating Director served on the WMO Study Group for GBON and coordinated interactions between the WMO and regional government officials on the financing facility that is to support the implementation of GBON</p>	<p>CIMH, CCCCC, NOAA, WMO, NMHSs of CMO Member States and other national entities with surface observing stations</p>		<p>Systematic Observations Financing Facility (SOFF) aims to support countries to meet GBON requirements</p>
<p><b>Ongoing Installation of Remote Sensing Equipment and the Sharing of Data</b></p> <p>CMO Headquarters providing guidance/assistance to Member States on the procurement of remote sensing</p>	<p>WMO, NOAA, National Governments, NMHSs and Stakeholders</p>		<p>Project driven with funds from national and international sources.</p>

<p>systems (terrestrial and space-based), data protocols and formats. Also providing guidance to Member States on the integration of national observing platforms into the global observing systems.</p>			
<p><b>SERVIR-Amazonia</b></p>			<p>See update under <i>Strategic Priority 2</i></p>

<b>Risks</b>	<b>Mitigation Measures</b>
<p>Limited human resources and workforce competency to deliver climate services, particularly for the smaller Meteorological Services</p>	<p>Delegating more of the CMO Science and Technology Officer's time to assist Member States with WIGOS implementation.</p>
<p>Under WIGOS, NMHSs are to be integrators of weather, climate, water, and environmental data, who identify surface observations at the national level and make outreach to other data holders. Data policy at the national level may not support this activity and NMHSs will need the support of their governing bodies.</p>	<p>CMO to advise Caribbean Meteorological Council and other Government entities on the importance of the services of NMHS and WIGOS.</p>

<b>Strategic Priority 4:</b> Enhance the socioeconomic and national security value of weather, climate, hydrological, and related environmental services			
<b>Ultimate Outcome 4:</b> Enhanced service delivery capacity of Members to ensure availability of essential information and services needed by governments, economic sectors, and citizens			
<b>Intermediate Outcome 4:</b> Improved access to regional and global monitoring and prediction systems and utilization of weather, climate and water information and services that brings tangible benefits to Members			
<b>Key Focus Areas in 2020-2023</b>			
<ul style="list-style-type: none"> <li>• Facilitate development of draft legislation to aid Member States with respect to technical, institutional, and human resources, enabling them to provide needed weather, climate, water and related environmental services</li> <li>• Facilitate the development of national strategic plans and operational plans for NMHSs to boost their service capabilities and, hence, their socio-economic value</li> <li>• Liaise between Member States and WMO to support the assessment of the economic benefits of NMHSs.</li> <li>• Support Members to understand and acquire the qualification and competencies required for effective service delivery, focused on WMO standards and recommendations.</li> <li>• Coordinating with WMO on new integrated weather service delivery, such as their marine service delivery training initiative, to which the CMO Headquarters has been contributing.</li> <li>• Facilitate the establishment of principles and guidance for successful partnerships with public sector, private sector, or academia to improve and expand services and develop markets for services. Expand on dialogue started during the Caribbean Symposium 2019: Operational Hydro-meteorology Leadership Summit.</li> <li>• Support improvement in the communication skills of NMHSs and uptake of modern technology in service delivery.</li> <li>• Help NMHSs to become more visible by amplifying their news</li> </ul>			
<b>Activities</b>			
<b>Programme</b>	<b>Partners (if any)/Contact Organizations</b>	<b>Status</b>	<b>Remarks</b>
<b>Drafting of Legislation for National Meteorological Services</b>			See updates under <i>Strategic Priority 1</i>
<b>Strategic Plans with National Framework for Weather, Water, and Climate Services and Complementary Action Plan</b>			
<b>Support Members in enhancing communication skills of NMHSs</b> The CMO Headquarters developed a proposal to enhance the communication of warnings and other information from NMHSs and to aid media	CBU, NOAA, UN Office for Disaster Risk Reduction (UNDRR)		



<p>and disaster managers to better understand hydrometeorological hazards. Discussions were initiated with the Caribbean Broadcast Union (CBU) and the American Chamber of Commerce to develop a workshop in 2020, that expanded regionally, a national plan by Grenada's Manager of Meteorology. The proposal was tabled due to the pandemic. In the interim, the CBU developed an online self-paced course in media communication that was opened to meteorologists in a number of CMO Member States.</p>			
<p><b>Partnerships to advance Caribbean Hydro-Meteorology</b></p> <p>The CMO Headquarters has been working with private sector in hydro-meteorology to promote dialogue in Caribbean Symposia on Operational Hydrometeorology and to identify successful partnerships that demonstrate the value of weather, climate, and water services to society.</p>	<p>Varysian Ltd, WMO, NMHSs of CMO Member States, CIMH, Stakeholders in the Public, Private, and Academic Sectors, and Civil Society</p>		
<p><b>Recruitment of experts to advance Caribbean Hydro-Meteorology</b></p> <p>The CMO Headquarters has been working with CIMH and Member States to identify persons to serve on national and international bodies to help raise the profile of Caribbean Hydro-meteorology. For example, the CMO is now represented in the Presidency of WMO RA IV, on the WMO Executive Council, the Chair of Expert Teams in WMO Aviation Services, Member of WMO-WHO Integrated Health Services, Chair and Vice-Chair of the RA IV Services Committee, Chair and Vice-Chair of the RA IV Infrastructure Committee. Former CIMH staff member recently joined WMO Secretariat as a Scientific Officer, the first</p>	<p>CMO Member States, CIMH, WMO</p>	<p>Ongoing</p>	

Caribbean person in that type of position for several years.			

<b>Risks</b>	<b>Mitigation Measures</b>
Limited pool of persons from whom to choose, so some persons are asked to serve in multiple capacities, which is detrimental to their ability to be effective.	Recruit new mid-career persons and take advantage of training in management and leadership for early-career persons to develop management expertise. Also mentoring of early career scientists and encouragement to develop scientific skills as well as international relations, policy, foreign language, etc.

## **STRATEGIC PLAN 2020-2023 PERFORMANCE MONITORING FINDINGS**

57. Council will recall the CMO HQ presenting a regional *Strategic Plan 2020-2023* at CMC59, Anguilla, 14-15 November 2019, which was subsequently revised in November of the same year, and approved by Member States in April 2020. The overarching theme of “*Strengthening Capacity, Adding Value, and Building Resilience in the Meteorological and Hydrometeorological Services in the Caribbean*” was underpinned by the need for regional action towards the attainment of the UN 2030 Agenda for Sustainable Development, Paris Agreement on Climate Change, and Sendai Framework for Disaster Risk Reduction. It also acknowledged the role of the organs of the CMO and National Meteorological and Hydrometeorological Services (NMHSs) in supporting their implementation, under the overall guidance of the WMO strategic priorities and long-term goals, specifically:

- *Long Term Goal 1*: Better serve societal needs: delivering authoritative, accessible, user-oriented and fit-for-purpose information and services, and
- *Long Term Goal 4*: Close the capacity gap on weather, climate, hydrological and related environmental services: Enhancing service delivery capacity of developing countries to ensure availability of essential information and services needed by governments, economic sectors and citizens.

58. The *Strategic Plan 2020-2023* established the following overarching regional priorities:

- a) Enhancing disaster preparedness and reducing loss of life and property from extreme hydrometeorological events and severe weather.
- b) Supporting climate-smart decision making to build resilience and adaptation to climate risk.
- c) Supporting the strengthening and maintenance of observation networks and information services
- d) Enhancing the socioeconomic and national security value of weather, climate, hydrological, and related environmental services.

Performance monitoring indicators were aligned to the immediate outcomes under each strategic priority for service to NMHSs.

59. In July 2022 CMO NMHSs were invited to provide feedback through an online survey created to take stock of the progress made in implementing the *Strategic Plan 2020-2023* as it relates to services to NMHSs. Survey questions were developed and linked to each monitoring indicator. Responses were quantified and classified as strengths (*12-16 positive responses*), areas for improvement (*6-11 positive responses*), and weaknesses (*<5 positive responses*). Feedback was collected during the period July-September 2022 from all sixteen (16) CMO NMHSs.

### **Summary of Findings on Services to NMHSs**

1. Six (6) main **strengths** were identified in the following areas:
  - (i) The provision of flood and drought monitoring and prediction services by most Member States
  - (ii) The high usage of the World Meteorological Organization (WMO) Regional Climate Centre (RCC) at the Caribbean Institute for Meteorology and Hydrology (CIMH), and Regional Climate Outlook Forums (RCOFs)
  - (iii) The high prevalence of backup communications and power systems in NMHSs
  - (iv) The high number of NMHSs reporting being in possession of strategic plans
  - (v) The reported high accessibility of the CIMH Regional Training Centre (RTC)
  - (vi) The high number of NMHSs whose staff possess adequate levels of core competencies to meet national and international mandates

2. Eleven (11) **areas for improvement** were noted:

- (i) The rate of Common Alerting Protocol (CAP) implementation across Member States
- (ii) The degree of integration into a national Multi-Hazard Early Warning System (MHEWS)
- (iii) The levels of participation and training in the WMO Severe Weather Forecast Programme for the Eastern Caribbean
- (iv) The verification of severe weather services
- (v) The use of websites and social media for the communication of severe weather warnings
- (vi) The rate of Quality Management System (QMS) implementation
- (vii) The integration of weather and socio-economic information in online platforms such as DEWETRA to strengthen impact-based forecasting and warning services
- (viii) The availability of basic systems for delivering climate services
- (ix) The number of Members contributing to the weather and climate impacts databases of the WMO RCC at the CIMH
- (x) The rate of WMO Integrated Observing Systems (WIGOS) implementation
- (xi) The accessibility of direct and indirect international capacity development assistance

3. Ten (10) **weaknesses** are highlighted as areas requiring special attention:

- (i) The analysis and assessment of users' needs and expectations, and their feedback
- (ii) The establishment of Terms of Reference for the CMO Operational Radar Group
- (iii) The lack of governance frameworks establishing NMHSs and frameworks for Public-Private Partnerships
- (iv) Low engagement of the private sector and academia by NMHSs
- (v) Delays in the review of regional Early Warning System (EWS) arrangements
- (vi) Low rates of National Climate Outlook Form (NCOF) organization within Member States
- (vii) The lack of national WMO Information System (WIS) network monitoring and data management systems
- (viii) Low implementation rates of WMO data exchange policies as per WMO Resolutions 40, 25, and 60
- (ix) Limited capacity of NMHSs to provide services beyond basic operations
- (x) The low number of socioeconomic benefits studies done by NMHSs.

### **Full Performance Monitoring Survey Results**

4. The full survey findings are contained in [Table 1](#) on the overleaf.

**Table 1 – CMO Strategic Plan Performance Monitoring Survey Findings**

Ref.	Indicator	2020	2021	2022 <sup>1</sup>	Comments
1.1.1	Number of Members participating in a Common Alerting Protocol (CAP) for warnings and alerts	6	6	6	Yes: GUY, TT, SVG, JAM, ANB, BAR
1.1.2	Number of Members with a MHEWS integrated in a national Disaster Risk Reduction management system	8	9	10	2022 No: SLU, ANG, JAM, MON, BVI, TCI
1.2.1	Number of forecasters trained in the SWFP concept	6	7	1	
1.2.2	Number of Members participating in the SWFP	5	7	8	
1.2.3	At least one verification measure implemented for severe weather forecasts	6	6	6	Number of Members implementing verification measures
1.2.4	Users feedback on the usefulness of severe weather forecasts	2	2	2	Number of Members analyzing user feedback
1.3.1	Number of Members providing national flood and drought monitoring and prediction services	12	12	12	No: ANG, MON, BVI, TCI
1.3.2	Number of Members making use of RCCs and/or RCOFs	15	16	16	
1.3.3	User/stakeholder assessment of the relevance, usefulness and timeliness of outlooks/alerts for extreme climate events	2	2	2	Yes: CAY & TT
1.4.1	Number of Members using (a) web applications and (b) social media in warning delivery	9	9	9	No: ANG, GUY, MON, SKN, GRN, BVI, TCI
1.4.2	Number of Members with QMS for hydrometeorology and EWS.	9	9	9	Number with any QMS. No (7): SLU, ANG, DOM, JAM, BLZ, BVI, TCI
1.4.3	Number of Members using online platforms for integrating weather, water, and climate hazards with socio-economic data	6	6	6	Yes (6): SLU, DOM, GUY, SVG, SKN, GRN No (9): ANG, CAY, TT, JAM, MON, BLZ, BVI, TCI, ANB Partially (1): BAR
1.4.4	Number of Members with agreements between NMHSs and private sector/academia actors on(a) EWS service delivery and (b) maintenance of networks for EWSs	3	4	4	2022 Yes (4): GUY, JAM, MON, BAR No(9): ANG, DOM, CAY, SVG, SKN, GRE, BVI, TCI, ANB Private sector (1): BLZ No answer (2): SLU & TT
1.5.1	Number of Members with backup communication and power systems	11	12	12	2022 Yes (12): DOM, CAY, GUY, TT, SVG, JAM, MON, BLZ, SKN, GRE, BVI, BAR No(2): ANG, TCI Power only (1): ANB Comms only (1): SLU
1.5.2	A revised regional EWS with backup assignments for forecast and warnings	0	0	0	
2.1.1	Number of Members with basic system for delivering climate services	9	10	10	2022

<sup>1</sup> To date. This will be polled in 2023 to obtain final data

Ref.	Indicator	2020	2021	2022 <sup>1</sup>	Comments
					No (5): ANG, DOM, SKN, BVI, TCI No answer (1): MON
2.1.2	Number of Members with QMS for selected services (aviation, marine, hydrometeorology, EWS)	9	9	9	See 1.4.2
2.2.1	Number of Members making use of RCCs and/or RCOFs	15	16	16	
2.2.2	Number of Members organizing NCOFs	3	3	3	2022 Yes: GUY, TT, BLZ
2.2.3	Number of users accessing climate services through web platforms or other methods of service delivery (e.g., mail-in requests)	NA	NA	NA	Mostly NAs received. QTYs received from DOM (>500), SVG (>50), SKN (75), GRE (>100), and SLU (12)
2.2.4	User/stakeholder assessment of the relevance, usefulness and timeliness of climate information	2	2	2	Yes: CAY & TT
2.3.1	2.3.1 Number of Members contributing to the weather and climate impacts databases of the WMO RCC at CIMH	7	8	8	2022 Yes: ANG, DOM, GUY, TT, SVG, SKN, GRE, SLU
3.1.1	Percentage of the regional Earth system covered by observations (especially hydrosphere)	NA	NA	NA	
3.1.2	Number of Members complying with WMO observation standards	NA	NA	NA	
3.1.3	Number of Members implementing national observing system WIGOS	4	6	6	2022 Yes: SLU, DOM, GUY, TT, JAM, SKN No answer (1): CAY
3.2.1	Number of Members with national network monitoring and data management systems established	2	3	3	2022 Yes: DOM, GUY, TT
3.2.2	Number of Members implementing data exchange policies, as per WMO Resolutions 40, 25 and 60.	3	3	3	2022 Yes (3): SLU, GUY, TT No (8): ANG, CAY, SVG, MON, GRE, BVI, TCI, ANB Partially (5): DOM, JAM, BLZ, SKN, BAR
3.3.1	Approved Terms of Reference for the radar operations working group	0	0	0	
3.3.2	Initial meeting/workshop held	0	0	1	Meeting held on 2022-06-07
3.3.3	Online platform initiated for collaboration, troubleshooting, and information exchange	0	0	0	
3.4.1	Number of Members using online platforms, such as DEWETRA, for integrating observations, model forecasts, with hydrological and socio-economic data for decision support and collaboration.	6	6	6	See 1.4.3
3.4.2	Number of Members with agreements between NMHSs and private sector/academia actors on(a) service delivery and (b) maintenance of networks	3	4	4	See 1.4.4
4.1.1	Number of NMHSs with strategic plans	6	8	12	2022 No: SLU, MON, BVI, TCI
4.1.2	Number of NMHSs with legal basis for their operation	3	3	4	2022 Yes (4): ANG, CAY, GUY, MON In draft (2): SVG, SKN

Ref.	Indicator	2020	2021	2022 <sup>1</sup>	Comments
4.1.3	Number of NMHSs with enhanced human and technical capacity to provide a range of services.	1	1	1	2022 Yes: SKN
4.2.1	Number of NMHS staff trained at WMO training centres and/or fellowships	23	16	24	
4.2.2	Number of NMHSs whose staff have adequate (to be defined) level of core competencies to meet national and international mandate	12	12	12	2022 No: SLU, ANG, BLZ, BVI
4.3.1	Number of NMHSs receiving international capacity development assistance	7	8	8	2022 Yes: DOM, GUY, TT, SVG, MON, SKN, GRE, BAR
4.3.2	Number of Members benefiting from catalyzed development projects	10	11	11	2022 No: DOM, CAY, TT, BVI, TCI
4.3.3	Number of Members with legal basis for public-private partnerships	2	2	3	2022 Yes (3): ANG, CAY, MON Not sure (2): BLZ, SKN
4.3.4	Number of Members with socioeconomic benefit analysis conducted in the past X years	2	2	2	2022 Yes: GUY & JAM

*Acronyms used:*

1. ANG: Anguilla
2. ANB: Antigua & Barbuda
3. BAR: Barbados
4. BLZ: Belize
5. BVI: British Virgin Islands
6. CAY: Cayman Islands
7. DOM: Dominica
8. GRE: Grenada
9. GUY: Guyana
10. JAM: Jamaica
11. MON: Montserrat
12. SKN: St Kitts & Nevis
13. SLU: St Lucia
14. SVG: St Vincent & the Grenadines
15. TT: Trinidad & Tobago
16. TCI: Turks and Caicos Islands

**2021/2022 CMO HQ Missions**  
(Not related to the CMC meetings)

December 1	<b>WMO</b> Coordination Mechanism (WCM) for humanitarian activities [STO]
December 7-9	Hydro-Meteorology Latin America Symposium 2021, Panelist, [CD & STO]
December 14	<b>WMO</b> SWFP Eastern Caribbean RSMT Meeting, Chaired [CD]
January 24-27	102 <sup>nd</sup> American Meteorological Society ( <b>AMS</b> ) Annual Meeting, Virtual [CD] <i>in conjunction with</i>
January 22	<b>WMO/NWS International Session</b> [CD & STO]
January 24	<b>WMO</b> Open Consultative Platform, Panelist [CD]
January 25	30th RA IV Management Group Meeting [CD & STO]
February 2 & 7 July	<b>WMO</b> Research Board Meetings [CD]
February 10	<b>AMS</b> Annual Meeting Oversight Committee [CD]
February 17	<b>Global Water Partnership – Caribbean</b> (GWP-C) Stakeholder Consultations on Framework for Integrated Water Resources Management (IWRM) for the CARICOM Region [CD]
February 18 & April 22	<b>World Bank/CREWS</b> - Precipitation Grid Prototype [CD & STO]
February 18	<b>WMO/CDEMA</b> Project Steering Committee [CD]
February 23	World Bank GFDRR, Panelist [CD]
February 24 & 25	<b>WMO</b> Staff Pension Committee – UN Staff Pension Board 70th Session [CD]
February 28 – March 11	<b>WMO</b> World Weather Research Programme (WWRP) 1st Weather and Society Conference [CD]
March 1	<b>CARICOM</b> , 33rd Intersessional Meeting of the Conference of Heads of Government of CARICOM [CD]
March 4, April 6, June 9	<b>WMO</b> EC Task Force on the Evaluation of Constituent Body Reform [CD]
March 30-31	World Broadcasting Union/United Nations Disaster Risk Reduction ( <b>UNDRR</b> ) Regional Workshop, Keynote Speaker [CD]
March 31	<b>CREWS</b> Advisory Services for Strengthening Regional Emergency Alert Capacity of the Caribbean (under CREWS Caribbean Project) [CD & STO]
April 5	UN Safe Ocean Laboratory, Panelist [CD]
April 21, May 20	Regional Workshop <b>WIGOS &amp; WIS</b> [STO]



April 25-28	44th Session of the Hurricane Committee (HC-44) [CD & STO]
May 3	Forecast-Based Financing for Hurricanes - Feasibility Study Inception Workshop [CD]
May 10-12	<b>UNDRR</b> /Office of Disaster Preparedness and Management (ODPM) Trinidad and Tobago Workshop 'Measuring Effectiveness of Early Warning Systems through Sendai Framework (In person, Port of Spain) [STO, PDO, CD]
May 13	Partnerships for Weather, Water, and Climate Services, Early Warning and Anticipatory Action to Increase Resilience (Host, in person, Port of Spain) [CD & PDO]
May 16, June 2 & 15, July 13 & 27, August 10 September 7	<b>CREWS</b> Impact-Based Forecasting (IBF) Webinar Series, CMO co-organized [PDO & CD]
May 17	Trinidad and Tobago Meteorological Service '2022 Wet & Hurricane Seasons National Climate Outlook Forum' [PDO]
May 18	<b>WMO</b> RA IV Infrastructure Committee [CD & STO]
May 19	<b>UNICEF &amp; CDEMA</b> 'Leveraging Private Sector Role in Preparedness and Response to Disasters: Views of the Eastern Caribbean Private Sector and Humanitarian Actors' Workshop (CARICHAM, CPSO and USAID) [PDO]
May 23	World Bank 'Gender data for decision making' Webinar [PDO]
May 23 & 24	Third Multi-Hazard Early Warning Conference (MHEWC-III) [CD]
May 25-28	7th Session of the Global Platform for Disaster Risk Reduction (GP2022), Panelist in Side Event [CD]
May 27 & 31	Caribbean Climate Outlook Forum (CariCOF) [CD & PDO]
June 7	<b>CMO</b> Operational Radar Group (CORG) – Hosted first meeting [CD, STO & PDO]
June 8	<b>WMO</b> CLIMSA "Consultative Meeting on Generic and Sector-Specific User Interface Platforms" [CD & PDO]
June 9 & 23	One Hundred and Third Special Meeting of the Council for Trade and Economic Development (COTED) Officials [CD, STO, PDO]
June 13	<b>UNFCCC</b> 2nd Technical Expert Dialogue on New Collective Quantified Goal on Climate Finance [CD]
June 20-24	<b>WMO</b> , 75th Session of the Executive Council (EC-75) (In-person, Geneva) [CD, STO, STOD]
June 22	<b>WMO</b> 31st RA IV Management Group Meeting in Geneva [CD, STO, STOD]

June 24	<b>WMO</b> Scientific Advisory Panel on Economic Benefit Assessment of Climate Services [STOD]
June 29	<b>UN</b> Ocean Conference – Panelist, Data Issues [CD]
July 5	Multi-sensor Precipitation Grid Demonstration Virtual Workshop (CMO - Invitations and outreach to sector organizations) [CD, STOD]
July 6	Webinar-RA IV Expert Team on Services for Aviation (ET-AVI) [STOD]
July 6	Webinar-RA IV Expert Team on Marine Meteorological and Oceanographic Services [STOD]
July 13	CIMH 58th Board of Governors Meeting [CD, STOD]
July 14	Webinar on Good Practices on Climate Services in RA IV, Presenter [STOD]
July 22	<b>WMO</b> , High-level launch, Report on the State of Climate in Latin America and the Caribbean 2021, with High-level Panel on the Role of the National Meteorological and Hydrological Services and the Research Community to strengthen MHEWS in the region, (CD - Chair) [CD, STO, STOD, PDO]
July 25-27, August 3	Regional WIGOS Centres (RWC) Global Workshop [STOD]
July 26-27	WMO/CDEMA CREWS – Testing of SOPs for Multi-Hazard Warning Coordination & Communications in the Caribbean, Virtual Briefing and Table-Top Exercise [PDO]
August 2	Common Alerting Protocol (CAP) Implementation Workshop and Training Course [STOD]
August 6-13	NOAA Satellite Conference & Collective Madison Meeting (CMM) [STOD]
August 15	Visit to the Tobago Meteorological Services Division [CD]
August 15	Opening Ceremony of the General Assembly of the Caribbean Broadcasting Union [CD]
August 16-19	Turks and Caicos Kick-Off Meeting: National Strategic Plan for Meteorological Services [CD, STOD, PDO]
August 18	WMO/CLIMSA, Consultative Meetings on Regional and National Frameworks for Weather, Water and Climate Services [PDO]
August 24	CMO & CIAT, SERVIR-Azania Users Needs Workshop (in-person) [CD, STOD, PDO]
August 29-31	GDPFS Symposium on Requirements for NWP Data and Products [STOD]
August 30	CARICOM, Digital Skills Taskforce Consultations on Digital Skills, CARICOM Regional and Treaty Organizations [CD, PDO]

September 2	WMO CREWS Project Steering Committee for the Project to Develop SOPs between National Disaster Organizations and National Meteorological and Hydrological Services [PDO]
September 6-8	5C's GCF Regional Project Development Workshop [CD, STOD]
September 6	Legislation Inception Meeting with the Barbados Meteorological Services [CD, PDO]
September 9	Global Synthetic Weather Radar Meeting [CD, STOD]
September 19-21	IFRC/Alert Hub & WMO, 2022 Common Alerting Protocol (CAP) Workshop and Training [CD, PDO]
September 20-23	Gender Mainstreaming in End-to-End Early Warning Systems for Flood Forecasting (E2E-EWS-FF) and Integrated Flood Risk Management (IFRM) [CD]
September 27-29	First WMO-GCF Global Forum on Climate Science Information – Data, Tools and Methods [STOD, PDO]
September 29-30	WMO Research Board Meeting, Geneva [CD]
October 7	INFCOM Webinar GBON stations Designation Process: Regional Associations III and IV [STOD]
October 7	WMO RA IV, Good practices in the Provision of Hydrological Services [PDO]
October 10	WMO Information System (WIS) workshops RA III & IV prior to the Commission for Observation, Infrastructure, and Information Systems (INFCOM-2) [STOD]
October 11	Association of Caribbean States Webinar “Investing in Multi-hazard Early Warning Systems to Empower those Most at Risk [CD, PDO]
October 11-13	WIS 2.0 Satcom Forum Session [STOD]
October 13	UNDRR, Early Warning and Early Action for all - Focus on the Caribbean [PDO]
October 14	WMO Secretary General Briefing to Permanent Representatives [STOD, PDO]
October 14	Kick-off Meeting, Cayman Islands National Strategic Plan for Meteorological Services [STOD, PDO]
October 17-21	2nd Session - Commission for Weather, Climate, Water and Related Environmental Services and Applications (SERCOM-2) [CD, STOD, PDO]
October 18	WMO, Launch of the WMO Guidelines on Implementation of a Coastal Inundation Forecasting – Early Warning System (WMO No. 1293) [PDO]
October 24-28	2nd session of the Commission for Observation, Infrastructure and

Information Systems (INFCOM-2) [CD, STOD]

November 3 WMO Assessment of Multi-Hazard Early Warning Systems Capabilities  
[CD, STOD, PDO]

November 7-18 Conference of the Parties of the UNFCCC (COP27) [CD]

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December 2 10th Meeting of CARICOM Secretary-General & Heads of Community  
Institutions

December 5-8 NOAA Virtual Satellite Training Workshop

December 12-15 Regional WIGOS Centre Workshop, Costa Rica

December 13 Severe Weather Forecasting Programme Management Team Meeting,  
Virtual Platform