



C A R I B B E A N M E T E O R O L O G I C A L O R G A N I Z A T I O N

REPORT OF THE ANNUAL MEETING OF DIRECTORS OF METEOROLOGICAL SERVICES

PORT OF SPAIN, TRINIDAD AND TOBAGO

15 NOVEMBER 2023

INTRODUCTION

1.1 The 2023 meeting of the Directors of Meteorological Services (DMS2023) was hosted by the Government of the Republic of Trinidad and Tobago at the Hyatt Regency Hotel, Port of Spain, Trinidad and Tobago, on Wednesday, 15 November 2023. DMS2023 was chaired by Dr. Arlene Laing, Coordinating Director of the Caribbean Meteorological Organization (CMO) Headquarters.

1.2 The Meeting fixed its hours of work and determined the order in which it would conduct its business.

1.3 The agenda adopted by the Meeting is attached as **ANNEX I** and the list of participants and observers attending the Meeting is attached as **ANNEX II** to this Report.

STATUS OF ACTIONS FROM PREVIOUS MEETING

(Agenda Item 2)

2.1 The CMO Headquarters produced a single document containing an **Action Sheet** that allowed the Meeting to follow-up on the actions taken to implement the decisions of its previous meeting and to discuss any further actions if required.

2.2 The meeting was informed that, over the last year, the National Meteorological and Hydrometeorological Services (NMHS) of CMO Member States closed operational gaps in implementing the *World Meteorological Organization (WMO)* priority programmes, including strengthening observations and data exchange processes that support global numerical weather prediction and early warning systems for weather, water, and climate hazards.

2.3 The meeting noted that, regarding implementation of the Common Alert Protocol (CAP), Belize and Turks and Caicos Islands held CAP workshops, through a project led by the CMO Headquarters in partnership with the National Meteorological Services and the WMO, with funding from the *Climate Risk and Early Warning Systems (CREWS)*.

2.4 The meeting recalled that NMHSs were to submit new Climate Normals and annual national climate reports to the WMO. The meeting was informed that ten Members submitted updated Climate Normals for the 1991-2020 period, while eight Members submitted annual national climate reports.

TRAINING

(Agenda Item 3)

3.1 Ms. Kathy-Ann Caesar, Chief Meteorologist, *Caribbean Institute for Meteorology and Hydrology (CIMH)*, delivered a presentation on the activities, results, and challenges experienced in the meteorological training courses offered by the CIMH during the intersessional period. During the presentation, she provided information on the courses offered from 2022 to 2023 and reported on key issues emanating from WMO Congress 19 that were relevant to the delivery of training courses at the CIMH.

3.2 The meeting was informed that of the 16 students who registered for Entry Level Technicians Course No. 93/23, which ended in July 2023, four (4) students graduated with a credit, eleven (11) students received a pass, and one (1) student failed the course. The students' performance was at a reasonable level except for mathematics, which had a relatively high failing rate.

3.3 The Senior Level Meteorological Technicians (SLMT) Course No. 24/22, which started in January 2022 with 15 registered students ended in July 2023 with 9 students graduating. Three of these students graduated with a credit, four (4) received a pass, two (2) received a conditional pass and one (1) student failed the course. During the course, the lecturers encountered challenges with in-country students who were required to continue working in their respective services while attending the course. This placed these students at a clear disadvantage, as students were working when they needed to be in class, while some

students had to travel to and from work during in-class sessions. Students finding themselves in these circumstances had difficulty concentrating due to exhaustion, and some students, when not working, were babysitting while in class.

3.4 The Meeting was informed that, notwithstanding the challenges encountered with the previous bridging course, the current SLMT bridging-course, which has 14 students, was progressing with renewed focus. The course is focusing on reviewing the fundamental subjects in preparation for the SLMT course with a view to improving the performance of students. No late entries will be allowed in the bridging course to ensure the students get the full experience of the course.

3.5 The Senior Level Meteorological Technicians (SLMT) Course No. 02/22-Degree, which started with 2 students, ended in July 2023 with 1 student gaining a pass, while the other student withdrew early from the course. The Operational Aeronautical Forecasters Course from May to July 2023 ended with all 4 students completing course. Three students gained a credit while one (1) student gained a pass.

3.6 The Meeting was also informed that within the B.Sc. Meteorology programme there were failure rates of 40% in level 2 Synoptic Meteorology, Advanced Dynamic Meteorology and Advance Synoptic Meteorology, even though all except one of the failing students were repeaters. At the same time 4 students recently graduated from the programme with 3 of the 4 obtaining first class honors in meteorology. Meanwhile, 4 students in semester 1 who are majoring in meteorology were on warnings with another 2 students in semester 2 on warning while 2 other students are required to withdraw.

3.7 Directors were reminded that the WMO Cg19 (Resolution 14) approved the amendments to the Basic Instruction Packages for Meteorologists and Meteorological Technicians (BIP-M and BIP-MT) Technical Regulations, Volume I: General Meteorological Standards and Recommended Practices (WMO-No. 49). The changes to WMO-No. 49, Volume I, Part V: Qualifications include the addition of a recommendation that WMO Members should, based on the relevant national, regional, and/or global requirements, determine the necessary level of qualification(s) required for each category of operational personnel. It also revises the Standard that requires an aeronautical meteorological forecaster (AMF) to have successfully completed the Basic Instruction Package for Meteorologists (BIP-M) to describe qualification(s) for AMF that are consistent with the BIP-M.

3.8 Additionally, the Directors were notified that WMO adopted the proposed amendment to the Technical Regulations (WMO-No. 49), Volume I, General Meteorological Standards and Recommended Practices, and the Compendium of WMO Competency Frameworks (WMO-No. 1209) (Appendix II) to update and address the qualification and competency requirements of aeronautical meteorological personnel. Further, there is a two-year deferral of the applicability date of the new or updated WMO provisions to January 01, 2026.

3.9 The changes to WMO-No. 1209, Section 2 COMPETENCIES (SECOND-LEVEL), include the removal of the reference [in the regional variations section] that an aeronautical meteorological forecaster (AMF) is required to possess the Basic Instruction Package for Meteorologists (BIP-M). It also adds a reference [in the regional variations section] that the level of qualification(s) necessary to underpin the required competencies of operational aeronautical meteorological forecasters is to be consistent with the relevant educational framework, background skills, and knowledge described in the Basic Instruction Package for Meteorologists (BIP-M). Further, there is an addition of reference [in the regional variations section] that the aeronautical meteorological office or centre should record evidence that the AMP responsible for the provision of its services has completed the necessary formal learning or courses of study to demonstrate they possess the background skills and knowledge, as described in the relevant competency framework.

3.10 The meeting was further informed that, in an effort to respond to changes in some of the WMO Standards and Recommended Practices, the CMIH Meteorology Section completed an initial mapping exercise, which found that the CIMH training curricula were mostly compliant. The CIMH training topics for Meteorologists (Degree Program) and Aeronautical Forecasters (SLMT), were on par with the New BIP-M. The main area of concern was related to introduction to Geography, which needs adjusting. Additionally, within the Tropical Cyclone Forecaster Competencies frameworks, Tropical Cyclone Competencies at BIP-

M Level are introduced in the SLMT course via the Disaster Preparedness training embedded in the Forecast Office Simulation (FOS) exercises, while Tropical Cyclone Briefings have been introduced at the Senior BIP-MT Level in the MLMT course. Moreover, within the Aeronautical Continuing Professional Development course, a unit of the course is now totally devoted to “Tropical Cyclone Forecasting, Hazard Warning, and Communication.

OPERATIONAL MATTERS

(Agenda Item 4)

A. GLOBAL BASIC OBSERVING NETWORK (GBON)

4.1 The Meeting was informed that GBON implementation was endorsed at Congress 19 (Cg19) and that since the in-person WMO regional training workshop in February 2023 in Jamaica and subsequent online training workshops, more CMO Member States have registered GBON stations in OSCAR/Surface and shared observation data globally at an hourly frequency.

4.2 The number of CMO Members with stations on GBON registered in OSCAR/Surface increased from seven (7) to sixteen (16), which represents 100% of CMO Members. Further, the number of CMO Member stations exchanging data at hourly frequency increased from two (2) to eleven (11) stations from eight (8) Members, which represents 50% of the 22 GBON stations registered by CMO Members. Directors were reminded that GBON requires Members to commit and ensure that their surface and upper air observations are exchanged in real time at hourly time frequencies through the WMO Global Telecommunication System and WMO Information System in Binary Universal Format for the Representation (BUFR) of meteorological data.

4.3 The following Members, Anguilla, Belize, the British Virgin Islands, Dominica, Jamaica, Montserrat, and Saint Lucia have registered GBON stations with schedules for hourly exchange of observations internationally; however, in their current operational practice, observations are only exchanged every 3 hours, which is non-compliant with GBON.

4.4 GBON compliance is particularly important because it is directly linked to the Systematic Observations Financing Facility (SOFF), whose purpose is to provide technical and financial support to the implementation and operation of GBON. SOFF will apply compliance with GBON requirements to guide further investments, using international data exchange as a measure of success.

4.5 Members with registered GBON stations that were not compliant with GBON were encouraged to achieve compliance by exchanging data hourly from GBON stations for the full 24 hours per day, given the direct link with SOFF.

B. WMO INTEGRATED GLOBAL OBSERVING SYSTEM (WIGOS) MATTERS

4.6 Directors were provided with an updated report on WIGOS implementation across CMO Member States. Regional-wide efforts to fully implement WIGOS, supported by CMO Headquarters, yielded key outcomes and deliverables that were consistent with the CMO’s strategic goal to advance regional and national WIGOS implementation. Further, CMO Members made considerable improvements, as more NMHSs had functional WIGOS-related National Focal Points (NFP) who received training relative to their responsibilities.

4.7 There is a relatively large increase in CMO Members NMHSs with stations coloured green on the WDQMS Near-real-time NWP monitoring portal. Fifteen stations from CMO Members NMHSs were coloured green on the WDQMS Near-real-time NWP webtool compared to three (3) stations during DMS 2022. This means that 63% of the 24 stations from CMO Member States registered in OSCAR/Surface to exchange data internationally were successfully providing critical input to regional and global numerical weather prediction. This has the potential to increase the accuracy of the guidance products used to create forecasts and warnings.

4.8 Directors were informed that CMO Members NMHSs were on track to achieve most of the components of the WIGOS operational plan by the end of 2023. In this regard, Directors were encouraged to close the gaps by:

- Implementing a National WIGOS Station Identifiers System for registering observing stations in their area of observing responsibility on the OSCAR/Surface database.
- Establishing National WIGOS implementation plans.

C. REGIONAL WIGOS CENTRE

4.9 The meeting was reminded that as part of WIGOS implementation, each WMO Regional Association (RA) was required to operationalize a Regional WIGOS Center (RWC), provide support and assistance to WMO Members, perform data quality evaluation and incident management functions using the WDAQMS Webtool and Incident Management System (IMS).

4.10 Directors were reminded of the Concept of Operations for the RA IV RWC that was approved by the RA IV Management Team. The approved structure of the RWC in operational mode consisted of Leading Nodes and Contributing sub-nodes performing distributed functions for metadata management and quality monitoring, including monitoring, evaluation, and incident management functions to cover all RA IV Members. The approved nodes and sub-nodes of RA IV RWC are as follows:

- **Canada (Ln/Canada):** Leading Node (Ln) for Metadata Management
- **USA (Ln/USA):** Leading Node (Ln) for Quality Monitoring
- **Costa Rica (Cn/Costa Rica):** Contributing Node (Cn) for Spanish-speaking countries for both metadata management and quality monitoring
- **Trinidad & Tobago (T&T) (Cn/T&T):** Contributing Node (Cn) for English-speaking countries for metadata management
- **British Caribbean Territories/Caribbean Meteorological Organization Headquarters (BCT/CMO HQ) (Cn/BCT-CMO):** Contributing Node (Cn) for English-speaking countries for quality monitoring

4.11 The Meeting was informed that all issues for quality monitoring and metadata management will be recorded in the WMO Incident Management System (IMS) through the creation of either issue-tickets or incident-tickets for the issues raised.

4.12 Further, for the successful implementation of the RWC, all Members must have active NFPs for WIGOS, OSCAR/Surface, and WDAQMS to interact with the RWC. Directors were asked to act on the following when required:

- Take note of the actions required by the WDAQMS NFP.
- Act decisively when an incident is escalated by the RWC.
- Nominate or update their NFPs for WIGOS, OSCAR/Surface, and WDAQMS.

D. WMO INFORMATION SYSTEM (WIS) 2.0

4.13 Directors were reminded that during Congress-19, WMO approved the Technical Regulations of the WMO Information System 2.0 (WIS2.0), which has, as a functional requirement, the operating of a WIS 2.0 node by a National Centre such as an NMHS.

WIS2 in a Box Software

4.14 To facilitate this, the WMO developed the open-source software “**WIS2 in a Box**” (<https://docs.wis2box.wis.wmo.int>) to support Small Island Developing States (SIDS) and Least Developed Countries (LDCs) with the implementation of WIS 2.0 nodes.

WIS2 in a Box Implementation in CMO Member States

4.15 Directors were reminded of the discussion during DMS2022 in relation to the WIS2.0 implementation plan, including building CMO Member States capacity to exchange data in BUFR format. Directors were further reminded that the CMO Headquarters, in collaboration with WMO, hosted a WIS 2.0 training workshop that focused on using the WIS2Box software to solve Members data exchange and transmission issues.

4.16 During the workshop, it was decided that participants would continue to work as a team following the workshop to complete the following action items by October 2023:

- Implement a regional WIS2box as a WIS2 node to facilitate multi-country data exchange as a project and use it to exchange hourly data from observation stations (automatic weather stations and manual stations).
- Able to exchange manual observations in BUFR format via the regional WIS2 node using a SYNOP to BUFR conversion template that allows manual data entry of observations, in line with the current mode of operations at most CMO Member State NMHSs.
- Members who have the capacity and resources would implement and manage their own WIS2box as a national WIS2 node.

4.17 The Meeting was informed that in order to facilitate the implementation of the regional WIS2Box, CMO HQ signed a letter of agreement with the WMO to host a WIS2Box as a Caribbean WIS2 node via a cloud server provided by the WMO. Under agreement with the CMO Headquarters, the WMO will support the CMO Headquarters and its Members in implementing and operating the Caribbean WIS2 node for four years to provide NMHSs with a simple, effective, and inexpensive method to exchange their weather observations nationally, regionally and internationally. The Caribbean WIS2 node must host at all times, at least five (5) members exchanging data via WIS2. In return, each participating Member on the Caribbean WIS2 node must agree to:

- Participate in the shared CMO WIS2 node implementation and operation.
- Cooperate and commit resources: at least one (1) staff member to act as a WIS2 administrator or focal point to assist with configuring the WIS2Box software, work with other Member States to prepare and submit configuration files, and perform in-country WIS2 duties, including troubleshooting and intervening when there are WIS2 issues to be resolved as they relate to the Member.

4.18 Directors were informed that the Caribbean WIS2 node is up and running and formed part of the WIS2Box demonstration project, with nine (9) CMO NMHSs exchanging data globally on the node. These are: Antigua and Barbuda, the Cayman Islands, Dominica, Grenada, St. Kitts and Nevis, Guyana, Jamaica, Saint Lucia, St. Maarten, St. Vincent and the Grenadines, and the Turks and Caicos Islands. In addition, two members, Belize and Trinidad and Tobago, implemented individual WIS2Box nodes and are also part of the demonstration project. Further, CMO Members surface stations' observations were available on the global brokers that were receiving observations from decoded BUFR messages. The global broker depicting this can be found at <http://wis2live.meteo.fr/>. Additionally, the meeting was reminded that the CMO Members NMHSs that were sharing data using BUFR format on WIS2.0 in real time hourly, represented the closure of a 10-year gap.

1 Directors were also informed that in keeping with the agreement between the WMO and CMO Headquarters, Members participating on the Caribbean WIS 2 node will need to sign an agreement to support their participation in the WIS2 node.

E. PROGRESS IN ICAO METEOROLOGICAL INFORMATION EXCHANGE MODEL (IWXXM)

4.19 Directors were reminded that IWXXM was now a Standard in ICAO Annex 3—Meteorological Service for International Air Navigation, which specifies NMHSs should disseminate METAR, SPECI, TAF, SIGMET, AIRMET, Volcanic Ash Advisory, and Tropical Cyclone Advisory in IWXXM format.

4.20 Directors were informed that ICAO plans to remove the Traditional Alphanumeric Characters (TAC) format as a Standard in ICAO Annex 3, with production of the IWXXM at source being strongly encouraged (rather than translation from Traditional Alphanumeric Characters (TAC) to IWXXM). Further, ICAO has indicated that the dissemination of meteorological information in TAC format will change from a Standard to a Recommended Practice in 2024, then from 2026, will no longer be included in ICAO. By State Letter, with Ref.: AN 10/1-23/1 dated 26 January 2023, ICAO served notice that it plans to further amend Annex 3.

4.21 The proposed amendments address, *inter alia*, increased usage of IWXXM to exchange meteorological information. The proposed amendments are to take effect from November 28, 2024. Members were urged to complete the process of implementing tools for the exchange of aeronautical meteorological messages in IWXXM format.

4.22 The meeting was informed that only Guyana, Trinidad and Tobago and Barbados were exchanging data using IWXXM. Directors were encouraged and urged to implement the exchange of aviation meteorological information via IWXXM as quickly as possible.

4.23 Antigua and Barbuda requested as an action item that efforts be made to hold a regional training workshop on the implementation of IWXXM, similar to the WIS 2.0 workshop.

F. DISCONTINUATION OF WMO-NO. 49, VOLUME II

4.24 Directors were informed of the planned actions for the discontinuation of WMO-No. 49, Volume II Meteorological Service for International Air Navigation, which was approved at Cg-19 via Resolution 12 (Cg-19):

Stage 1: Discontinuation of (1) Part I, International Standards and Recommended Practices: Core Standards and Recommended Practices; and Part II, International Standards and Recommended Practices: Appendices and Attachments of WMO-No. 49, Volume II on 31 December 2023.

Stage 2: Discontinuation of Part III, Aeronautical Climatology and Part IV, Format and Preparation of Flight Documentation upon the applicability of an amendment to ICAO Procedures for Air Navigation Services — Meteorology (PANS-MET) (Doc 10157) (provisionally 2026).

G. IMPLEMENTATION OF A QUALITY MANAGEMENT SYSTEM (QMS) FOR AIR NAVIGATION

4.25 The meeting was asked to recall the 10-year-old WMO and ICAO Standard, which require all NMHSs to establish and implement a properly organized quality system to provide for the quality management of the meteorological information supplied to aviation users. Directors were reminded that a lengthy discussion was held at DMS 2022 on the status of QMS implementation among CMO Member States NMHSs. Further, it was agreed that the CMO Headquarters should engage in a program of actions that will lead to a regional project to advance QMS implementation and certification in the shortest possible time. This program of actions included conducting a baseline assessment of the status of QMS implementation in CMO Member States agencies providing meteorological services for air navigation.

4.26 Directors were provided with the results of the baseline assessment, which shows that the majority of CMO's Member States' agencies providing meteorological services for international air navigation have fully or partially implemented an operational Quality Management System or activities related to implementing a QMS. Only one (1) CMO Member indicated that it made no attempt at implementing QMS.

4.27 The findings for all CMO Members were summarized in the table below, with Members at various stages of the implementations process, while none of the CMO Members NMHSs are certified as being compliant with the ISO 9001 standard.

QMS Baseline Results

QMS Status Implementation Indicator	Number of Members	Notes
Members with QMS established and certified	Nil	No Member has ISO 9001:2015 QMS certification. QMS Certification is a

QMS Status Implementation Indicator	Number of Members	Notes
		recommendation, is desirable, but not mandatory.
Members with QMS established but not certified	7	<p>3 Members implemented – ISO 9001:2015: Antigua & Barbuda, Barbados, St Vincent & the Grenadines</p> <p>1 Member is currently implementing the 9001:2015 standard and is expected to apply for certification before the end of 2023. Guyana</p> <p>4 Members implemented – ISO 9001:2008 :Jamaica, Guyana, St Kitts & Nevis, Trinidad & Tobago</p>
Members with no attempt at implementing QMS for aviation meteorological services	1	1 Member made no attempt at implementing QMS. This member has no human capacity available. Anguilla
Members with no human capacity available for implementing QMS for aviation meteorological services	3	British Virgin Islands Montserrat Saint Lucia
Members with a Certified Quality Manager on active duty (part or full time)	2	Barbados Trinidad & Tobago
Members with Certified QMS Auditors tasked with QMS duties (part or full time)	6	Barbados, Cayman Islands, Grenada Guyana, Jamaica, Trinidad & Tobago
Members with Quality Manual and documentation developed	11	Quality Manuals, Standard Forms, Standard Operating Procedures (SOP) developed Barbados, Belize, British Virgin Islands, Dominica, Grenada, Guyana, Jamaica, Montserrat, Saint Lucia, Turks and Caicos Islands, St Kitts and Nevis
Members with Quality Manual and documentation developed but QMS ISO 9001:2015 not established	8	Belize, British Virgin Islands, Dominica Grenada, Guyana, Jamaica, Montserrat Saint Lucia, Turks and Caicos Islands
Members conducting internal audits within the last two (2) years	4	Barbados, Cayman Islands, Guyana, Montserrat Cayman Island completed a third-party audit, which is required for certification
Members with staff assigned to QMS that have attend non-certificate courses within the last 3 years	8	Antigua and Barbuda, Barbados, Belize, Dominica, Grenada, Guyana, Montserrat, St Kitts and Nevis
Members with no trained personnel or calibration equipment	9	Antigua and Barbuda, Belize, British Virgin Islands ,Grenada, Guyana, Saint Lucia, St Kitts and Nevis, St Vincent & the Grenadines, Turks and Caicos Islands

Gap Analysis

4.28 Directors were informed that, using the WMO QMS implementation checklist, a gap analysis was conducted to identify areas within the main clauses of the ISO 9001:2015 requirements that were not being fully applied (or not applied at all) by CMO Members.

4.29 Directors were presented with the results in the table below, where each gap was evaluated by Members according to its level of criticality (low = green, middle = yellow, high = red), with red being the most critical gap to fill.

Largest gaps found in QMS implementation at CMO Member States NMHSs

Gaps in NMHSs QMS Implementation	Criticality
Inadequate demonstration of senior management commitment to QMS	High
Insufficient internal audits	High
Insufficient customer satisfaction monitoring & measurement	High
Ineffective communication of quality policy	Medium
Inadequate staff training options provided for QMS	Medium
Missing SOPs, standard forms, work instructions	Low
Missing Quality manual	Low
Insufficient documented control on key processes	Low
No Gap analysis	Low

4.30 The meeting was reminded that many of the processes used by the NMHSs were based on, and make reference to standard and recommended procedures according to the WMO technical documentation. This suggests that the NMHSs already follow technical standards that are complementary to ISO 9001 requirements. Directors were further informed that the results showed that most CMO Members have the enabling components to easily commence implementation of a formal QMS to provide the assurance of meeting the WMO and ICAO relevant standards.

4.31 However, senior management must oversee the QMS implementation by taking accountability for its implementation, monitoring progress via frequent internal audits and regular management reviews, and closing the human, financial and instrument calibration resource gaps while also addressing the associated risks.

4.32 Directors were informed that the CMO Headquarters was seeking to use the results of the assessment to access collaboration to conduct a training session on QMS implementation in 2024 that will enhance Members ability to implement a quality system.

H. INTEGRATED HEALTH SCIENCE AND SERVICES

4.33 Directors were asked to note that the WMO agreed to accelerate the implementation of lifesaving preparedness and early warnings of extreme heat and biological and other risks to human health to protect people from climate and health-related hazards, in coordination with the Early Warning for All Initiative.

4.34 In this regard, WMO plans to further strengthen its efforts in health research and service delivery through the Implementation Plan for Advancing Integrated Climate, Environment, and Health Science and Services (2023–2033). Further, the WMO plans to assist Members in strengthening the capacities of their NMHSs and other providers and users of health-tailored meteorological information services to protect public health.

4.35 Directors were informed that the WMO requested Members NMHSs to enhance their mandates to support the health sector and to nominate and support the work of health sector focal points for health-related research and services through collaboration to address increasing climate risks to health. In line with this, Members were expected to:

- Scale-up products and services required to effectively support the health sector.

- Take actions to enhance the monitoring, forecasting, warning, and management of environmental health risks, such as extreme heat, ultraviolet (UV) radiation, and hazardous air quality.
- Contribute to the implementation of integrated health science and services by sharing current capacities, expertise and experience.
- Strengthen research and operational mechanisms, including the open sharing of meteorological and health data.
- Facilitate coordination and cooperation with other relevant actors within the health community on matters of climate, weather, water, and environmental health risks.

OUTCOMES AND HIGHLIGHTS FROM WMO CONGRESS MEETING (Agenda Item 5)

A. WMO ELECTION OF OFFICERS FOR NEXT FOUR YEAR

5.1 It was highlighted during the meeting that the WMO Congress 19 elected Dr. Arlene LAING (British Caribbean Territories and Coordinating Director CMO Headquarters) and Dr. Garvin CUMMINGS (Chief Hydrometeorological Officer Guyana Meteorological Service) as members of the Executive Council. Both Executive Council Members, together with Mr. Evan Thompson (Director of Jamaica Meteorological Service, WMO RA IV President) as an ex-officio member provide the CMO with three members at the highest level of the WMO governance structure, the first time in 150 years of the IMO/WMO.

B. MEMBERS TO LEVERAGE THE EARLY WARNING FOR ALL INITIATIVE

5.2 The Meeting was informed that WMO, by [Resolution 4 \(Cg-19\)](#), called on Members NMHSs to leverage the **Early Warnings for All** (EW4All) UN global initiative, develop their own initiatives, and utilize all forms of bilateral and multilateral cooperation, including twinning arrangements as well as Public-Private Engagement, to assist with MHEWS capacity gaps and contribute to the fulfillment of the EW4All vision. New activities associated with EW4All at the national level will require increased capacity development in line with the expected increase in demand for services and associated training. It will also provide greater visibility and political support for NMHSs, as it will require NMHSs to be part of a collection of partners at national levels with interagency collaboration. Twinning arrangements are advocated as an avenue to support and build the capacities of the NMHSs and to close major gaps associated with EW4All, including the development of quality management systems, access to a calibration laboratory, maintenance and repair of weather radars and other equipment, IT support, software development, and access.

Directors were encouraged to:

- Leverage financing from existing initiatives in which WMO is one of the lead agencies.
- Identify, catalogue, and integrate priority and emerging hazards
- Invest in observing networks and utilization of satellite data
- Accelerate data and information sharing to support EWS
- Develop early warning services taking an Impact Based approach
- Invest in human capacities and competencies
- Scale-up work with partners on the implementation of the Common Alerting Protocol (CAP)
- Update WMO register of alerting authorities to allow redistribution entities such as alert hubs, Big Tech such as Google & Microsoft to scale up official warnings
- Seek twinning arrangements with developed NMHSs.

C. ICAO PROPOSED AMENDMENTS TO IMPROVE THE DEFINITION OF METEOROLOGICAL AUTHORITY IN ANNEX 3

5.3 Directors were alerted to ICAO [Proposals for Amendment of Annex 3](#) that suggested amendments in Attachments B and C of the document to clarify the existing definition for "meteorological authority" and, in consequence, introduce a new definition for "meteorological service provider", to better distinguish the roles and responsibilities of both entities. The proposed definitions are as follows:

- **Meteorological authority.** The authority entity providing or arranging for the provision of meteorological service for international air navigation on behalf of a Contracting State, and providing oversight and regulation of the meteorological service.
- **Meteorological service provider.** The relevant entity providing meteorological service for international air navigation on behalf of a Contracting State.

5.4 Directors were informed to keep abreast of these proposed recommendations that make a distinction between the Meteorological Authority and the Meteorological Service Provider and, if approved, will have implications for Member States NMHSs, which are currently the Meteorological Authority for international air navigation and can engage in cost recovery.

D. WMO POSITION ON RELEVANT WORLD RADIOCOMMUNICATION CONFERENCE 2023 (WRC-23) AGENDA ITEMS

5.5 The Meeting was alerted to WMO's position paper on a number of the World Radio-Communication Conference 2023 (WRC-23) agenda items on frequency bands to be discussed at WRC-23 from November 20 to December 15, 2023 that are of prime interest or concern for meteorology and related fields. Chief among the areas of concern was Agenda item 1.2, "To consider identification of the frequency bands 3300–3400 MHz, 3600–3800 MHz, 6425 – 7025 MHz, 7025 – 7125 MHz and 10.0–10.5 GHz for International Mobile Telecommunications (IMT). Of primary concern to the WMO is an IMT identification in the 6425 – 7025 MHz or 7025 – 7125 MHz frequency bands.

5.6 WMO's concern is that these bands are used to measure a wide range of ocean and land surface properties and are of critical importance in weather prediction. Specifically, sea surface temperature (SST) measurements performed in these frequency bands are of prime importance for weather forecasting and climate monitoring. Sea surface temperature measurements are vital for the Caribbean, as tropical storms form when sea-surface temperatures exceed 26°C and the intensity of tropical storms, and hurricanes, and other severe thunderstorms is modulated by warm ocean perturbations.

5.7 Directors were informed that the WMO has urged all Members to promote WMO's position on WRC-23 agenda items to ensure availability and protection of suitable radio-frequency bands needed for meteorological operations and to make their national radio communication administrations fully aware of the importance and requirements for radio frequencies for meteorological activities. Directors were also encouraged to register all radio communication stations and radio frequencies used for meteorological operations with their national radio communication administrations. Further, to participate actively in national, regional, and international activities on relevant radio communication regulatory issues and to involve their telecommunication experts in the work of relevant regional & global telecommunication organizations.

E. REGIONAL IMPLEMENTATION PLANS FOR THE WMO HYDROLOGICAL STATUS AND OUTLOOK SYSTEM (HydroSOS)

5.8 Directors were asked to recall the recommendation to start operationalizing the global WMO Hydrological Status and Outlook System (HydroSOS) through regional implementation plans ([Resolution 5, Cg-Ext\(2021\)](#)). Directors were then informed that WMO was accelerating the regional plans for the implementation of HydroSOS, which were approved by Resolution 9 at the 19th Congress. As an initial step, RA IV conducted a HydroSOS Caribbean Workshop from October 31 to November 02, 2023 in Barbados. It is expected that the final plan will focus on implementing HydroSOS at regional, national, local, and basin scales, including developing the capacity of NMHS in the Caribbean to produce hydrological status reports and outlooks.

5.9 Under the regional implementation of the HydroSOS, NMHSs will use in-situ observations, remote sensing and modelled data to create hydrological forecasts and integrate them across spatial scales for dissemination through the HydroSOS Portal. Directors were urged to get involved in the implementation of HydroSOS to strengthen monitoring and forecasting capacities for floods and droughts, and capacity to produce hydrological status reports and outlooks in their countries.

F. WMO STRATEGY FOR SERVICE DELIVERY AND ITS IMPLEMENTATION PLAN

5.10 Directors were updated on the [WMO Strategy for Service Delivery](#) which provides a detailed description of a roadmap for the Member States and their NMHSs to improve their standard and specialized services. In this regard, WMO will provide a variety of support functions to NMHSs of relevance to the provision of services, including assisting Members with technology transfer, training for capacity development, collaboration on research, and the provision of services. It will also contribute to policy formulation related to weather, climate, water, and related environmental issues at national levels.

G. WMO-COORDINATED GLOBAL GREENHOUSE GAS MONITORING INFRASTRUCTURE

5.11 The meeting was informed that, given the increasing focus on the role of Greenhouse Gases (GHG) as a driver of climate change and the need to strengthen GHG information for decisions on climate mitigation efforts, Cg-19 approved a new Global Greenhouse Gas Watch (GGGW) as a monitoring initiative to support urgent action to reduce heat-trapping gases that are fuelling temperature increases. It is expected that the new [Global Greenhouse Gas Watch](#) will fill critical information gaps and provide an integrated, operational framework that brings under one roof all space-based and surface-based observing systems, as well as modeling and data assimilation capabilities. Members were urged to contribute to the ongoing development of the implementation plan.

H. GLOBAL AND REGIONAL IMPACTS OF CHANGES IN THE CRYOSPHERE

5.12 [Resolution 6 \(Cg-19\)](#)-Priorities to address global and regional impacts of changes in the cryosphere - specifically refers to Small Island Developing States, which include the Caribbean. It highlights that the WMO strategic goal of an Earth system approach requires additional actions on the integration and use of cryosphere observations and data to close the gaps to a fully coupled cryosphere in the Earth system. The changes in the cryosphere are felt well beyond the countries where they occur, being transmitted to vast human populations and the ocean via impacts on atmospheric circulation and hydrological systems, with cascading impacts on weather and climate.

5.13 The Caribbean is exposed to the downstream impacts of melting glaciers through sea level rise, coastal flooding and inundation, and increased hazardous seas. Understanding the downstream impacts of cryosphere dynamics requires long-term marine meteorological observations.

I IMPACTS OF WEATHER IN 2023 (LOSSES, DAMAGES, BEST PRACTICES, CHALLENGES)

(Agenda Item 6)

6.1 During the weather impacts session, it was indicated that the presence of *El Niño* conditions during 2023 helped to bring about high impact record-breaking extreme temperatures, excessively hot days and heat events across Member States. However, despite *El Niño* presence, record-warm ocean waters assisted with the region experiencing an active hurricane season.

6.2 This notwithstanding, only a few Members of the CMO experienced direct socio-economic loss and damage impacts from tropical cyclones as the majority of tropical storms and hurricanes curved northward earlier, thus mostly sparing the islands. One tropical storm, Philippe, was particularly erratic and behaved in a topsy-turvy fashion that challenged regional forecasters. Apart from this, some Members experienced other impactful events from significant non-tropical cyclone weather events, which caused socio-economic losses and damages. During the season, some Members experienced diverse challenges in effectively warning of impending weather, while most highlighted a number of best practices used that facilitated improved warning messages, communication and reach.

6.3 **Anguilla** was minimally impacted by Hurricane Tammy on 23 October 2023, which produced close to 5 inches of rainfall that led to flooding and landslides in a number of areas, mainly in South Hill and Island Harbour. There were no reports of damage or injury to people or property.

6.4 **Antigua and Barbuda** experienced significant flooding and some wind damage from erratic Tropical Storm Philippe, which impacted the country between the night of 2 October and early morning of 3 October, 2023, with sustained winds of 61 mph and a peak gust of 75 mph while unleashing heavy rains, which amounted to close to 8 inches along with impactful lightning strikes. This led to significant flooding, which impacted both residents and buildings. During the passage of the storm a bolt of lightning reportedly struck the Antigua Yacht Club building, immediately triggering a fire that destroyed the building, which housed several businesses.

6.5 Later in the month, the country was significantly threatened by Hurricane Tammy, which made landfall on the island of Barbuda as a category 1 hurricane on the night of 22 October 2023, with sustained winds of 92 mph, a peak gust of 114 mph, and close to 5 inches of rainfall. There were instances of flooding and damage to trees and utility lines that knocked out electrical power on the island of Barbuda.

6.6 Antigua and Barbuda Meteorological Service (ABMS) indicated that as a best practice, it implemented a media center at its office that now enables it to produce its own video messages on weather warnings or to arrange interviews and communicate with the public and mainstream media. During times of severe and noteworthy weather, the center will allow the meteorologists to provide a more detailed insight into the weather conditions affecting the country. ABMS also highlighted difficulties in being able to tailor watches and warnings for five territories under its responsibilities, as a key challenge.

6.7 **Barbados** was affected by a number of weather events during 2023, including Tropical Storm Bret on June 22nd, tropical waves on June 28th and August 20th, feeder band activity associated with Tropical Storm Philippe on October 2nd, and Hurricane Tammy on October 21st along with heatwave episodes during the month of September 2023. Of these, Tropical Storm Bret produced close to 4 inches of rainfall in some locations, with peak wind gust of 49 knots, which led to damage to some coastal properties, a few houses suffering roof damage, felled trees and localized flooding. Rainfall and strong wind downdrafts from thunderstorms within the feeder band of Tropical Storm Philippe led to flash flood, damage to the roofs of more than 4 properties, and downed trees and power outage.

6.8 The Barbados Meteorological Service highlighted its increased social media presence, public outreach events, enhancement of its 3D-PAWS observing network to increase observations, and a new fleet of unmanned surface vessels for marine data collection, as best practices.

6.9 **British Virgin Islands (BVI)** was impacted by Tropical Storm Philippe, which passed near BVI on October 4th with maximum wind speeds near 60 mph and heavy rainfall totals between 4 and 12.0 inches, with the highest amounts occurring in the Settlement area in Anegada. The areal average rainfall during Philippe was 8 inches in 36 hours. Impacts included impassable roads due to rock, mud and debris blockage and flooding. Some areas also experienced falling rocks.

6.10 In terms of best practices, BVI highlighted its method of dissemination of weather information and improvement in liaising with the leaders of the Government on potential severe weather events. It also highlighted the interaction between both public and private entities in preparedness and educating the population on being prepared before, during and after a storm.

6.11 In terms of challenges, the BVI pointed out delays with issuance of the various watches and warnings (flood, tropical storm or hurricane) from the forecasting office, which affect the early warning systems. Another challenge was the non-standardized communication between the territory and the Antigua and Barbuda Meteorological Service and the slow retrieval of weather station data for analysis after events. Another challenge encountered was that flood threshold provided did not match with the drainage in the territory. A key challenge was the public response to the information provided in that the public wants to be told when to do what they need to do.

6.12 **Dominica** was threatened or impacted by three (3) tropical cyclones, namely Tropical Storm Bret and Hurricanes Phillippe and Tammy. Even though Bret did not cause any impacts, it was highlighted as a significant storm for the country's National Meteorological Service. It was the first tropical storm during which the National Meteorological Service of Dominica had sole discretion and responsibility for placing the country under tropical storm watch or warning since the decision was taken at the Forty-fifth Hurricane Committee

to ease Barbados of this responsibility. Tropical Storm Philippe produced over 6 inches of rainfall on the island, which caused flooding and landslides in some locations that resulted in minimal infrastructural damage across the island.

6.13 As best practices, the Dominican Meteorological Service reported that it collaborated with the Office of Disaster Management to conduct an ongoing educational campaign to help citizens better understand the information disseminated and to gather feedback. It also used real time data from its Hydro-met network, which provides the ability to alert specific communities of potential flooding/landslide activity. In terms of challenges faced, it highlighted difficulty in establishing a Standard Operating Procedure document for its tropical cyclone early warning system.

6.14 **Guyana** reported drier than usual dry season conditions that led to 1511 bush fires for the year, with 849 occurring between July and October. This impacted river flow as there was a significant reduction in water flow at the Kaieteur water falls, which was attributed to *El Niño*. At the same time, warmer than normal temperatures in September and October led to the recording breaking excessive heat as temperatures reached 38.0°C at Timehri, 38.5 °C at Lethem, and 37.5 °C at New Amsterdam in September. In October temperatures soared higher and set new temperatures records with 38.3 °C observed at Timehri and 39.2 °C at Lethem. On the other end of the scale, there were also heavy rainfall events that led to periodic flooding in the earlier months of the year.

6.15 Guyana reported that, as best practices, it has held more awareness sessions, outreaches, forums, and discussions with the public and stakeholders. It has also collaborated with key stakeholders to organize El Nino and Drought preparedness exercises throughout the country. In terms of challenges, it was reported that issuing severe thunderstorm warnings for hail to areas that are likely to be affected remains difficult to do, even with access to satellite and radar data.

6.16 **Jamaica** was impacted by two significant weather events in 2023. The first, which occurred between 24 and 26 September, produced heavy and persistent rainfall over the eastern parishes that led to flooding, landslides, and blocked roadways. The second event occurred from 25-26 October, with heavy rainfall occurring in Eastern and Southeastern Parishes that also led to flooding, landslides, and blocked roadways. The country also witnessed an increased occurrence of lightning strikes from July to October, with four people being struck by lightning in September. The country also experienced drought conditions during an extended period from January to July.

6.17 As best practices that were used and which received good reviews over the year, Jamaica Meteorological Services (JMS) reported that it is using video briefings with graphics and plain text to communicate its early warning messages. It is also now producing consistent hurricane-ready messages, and has partnered with the disaster agency to hold lightning forums that bring public awareness to the hazard. It also held training and workshops with the agency to enhance national cooperation in line with the Weather-Ready Nations standards. As a challenge, the JMS reported that communicating warning information, especially updates, in the quickest possible time remains a challenge, as there is a need for a media room to produce content for dissemination.

6.18 **Montserrat** was threatened by Tropical Storm Philippe and Hurricane Tammy; however, only Tropical Storm Philippe produced significant rainfall and lightning, which caused minor damages due to flooding, lahars, landslides, and felled trees. In terms of best practices, Montserrat indicated that the forecast and updates received from Antigua and Barbuda Meteorological Service were timely and accurate and that the DMCA provided media updates after being in constant discussions with ABMS. Using WhatsApp to receive updates from the ABMS was also a good practice.

6.19 **Saint Lucia** was impacted by Tropical Storm Bret from the evening of 22 June into the early morning of 23 June 2023, with heavy rains and strong winds mostly to the south of the island. Maximum sustained wind speeds of 62 mph and highest wind gust of 104 mph were recorded at the Hewanorra Airport, with 72.9 mm (close to 3 inches) of rainfall also recorded. Tropical Storm Bret caused significant agriculture losses and damages to the country's banana and plantain crops, totaling approximately USD 10.5 million in losses. It also knocked out the island's electrical power, which left approximately 60% of the electricity network without power and caused damage to roofs and homes.

6.20 **St Kitts and Nevis** reported that the country experienced hail on 6 April 2023, during a severe weather event caused by a trough system that produced 66.0 mm (close to 2.6 inches) of rainfall that led to flash flooding in some communities. Later in the year, the country was impacted by Hurricane Tammy in association with a persistent trough system from 21-23 October, during which the islands recorded 145.6 mm (close to 6 inches) of rainfall at the Robert L. Bradshaw International Airport. Tammy caused in excess of USD 4 million in damage to roads and utilities in the country. In terms of best practices, the National Meteorological Service indicated that it incorporated evolving communication strategies to capture different audiences using mass emails, WhatsApp, infographics, live radio, and television broadcasts. It also highlighted the regular updates it provided to stakeholders through the NEOC as a best practice.

6.21 **St Vincent and the Grenadines** was impacted by Tropical Storm Bret late on Thursday, 22 June into Friday, 23 June 2023, which brought heavy rainfall and strong winds to the islands. The maximum rainfall recorded on the island was 79.1 mm. Tropical Storm Bret caused minor flash flooding, lahars, landslides, and downed trees, while some areas on the northeast coast were impacted by storm surge resulting in evacuation of several homes. In terms of best practices employed during the season, the meteorological service communicated regularly with the public and stakeholders with a strong focus on the key messages. It also communicated the uncertainties on the track and intensity of the systems, as well as the expected hazards.

6.22 **Trinidad and Tobago** reported that it received no direct threat from tropical cyclones, however, heavy showers associated with instability from Tropical Storm Philippe caused localized flooding. The country, however, was impacted by excessive heat during September, with 35.9°C recorded on the 21st, which ranks as the 3rd highest temperature on record. The excessive heat caused agricultural livestock and plant losses and increased sales of air condition units. The Meteorological Service issued hot spell alerts and warnings with increased exposure through their public awareness campaign, social media, news, and blogs.

6.23 The **Turks and Caicos Islands** were affected by two tropical cyclones, Tropical Storm Franklin on 23–24 August 2023 and Hurricane Lee between 10–16 September 2023. However, the islands only received minimal impacts from Tropical Storm Franklin. Tropical Storm Lee generated large swells across the exposed Atlantic coastlines, mostly impacting the easternmost islands, leading to the issuance of high surf advisories. The national weather service highlighted joint advisories issued by DDME and TCI Weather Service, utilizing social media platforms for dissemination of information, video presentations, and radio messages as best practices during the events. Key challenges identified were, communicating the uncertainty in the intensity and structure of the storm and relaying that message to the public, including the most appropriate way to stress the difference in impacts likely between the westernmost and easternmost islands. Other key challenges included insufficient synergy between the disaster management and the meteorological service in communicating with the public; as well as dealing with misinformation and sensationalism by “Armchair” and “Social Media” Meteorologists and reporters, which made it difficult to establish an authoritative voice.

SCIENTIFIC PRESENTATIONS & NEW SERVICES DEVELOPED

(Agenda Item 7)

A. Presentation on Caribbean WIS2Box implementation (Regional) (delivered by Dwayne Scott National Meteorological Service of Belize)

7.1 Directors were informed of the steps taken and progress made in implementing the Caribbean WIS2 Node as a regional facility. It was noted that the Caribbean WIS2 Node includes a cloud server provided through an agreement between the WMO and CMO, a Linux machine, the WIS2box opensource software application to handle publishing and subscribing, and a public IP address of <http://18.198.42.212/>.

7.2 The meeting commended the Caribbean administrative group that implemented the Caribbean WIS2.0 node, namely: Dwayne Scott (Belize), Kimberly Seaton (Trinidad and Tobago), Shamal Clarke (Cayman Islands) as the main group, with support from Anwa Springer (St. Kitts and Nevis), Adrian Shaw (Jamaica), Satesh Nanlall (Guyana), and Melorne Mack (Antigua and Barbuda), CMO HQ and WMO. WIS2

node administrators' roles included setting up the systems for the region; assisting with adding Member countries and with training; monitoring the performance of the system; checking for errors; liaising with the WMO to fix issues; and supporting participating countries to successfully implement the WIS2Box.

7.3 Directors were also informed that the OpenCDMS /SURFACE CDMS created by the National Meteorological Service of Belize could be adopted and implemented as a possible solution for a central repository for their data, allowing automated data ingestion into the WIS2box directly.

B. Presentation on National WIS2Box implementation (Trinidad and Tobago case) (delivered by Kimberly Seaton, Trinidad and Tobago Meteorological Service)

7.4 Directors were also shown a method of implementing the WIS2.0box as a standalone case from a national perspective for Trinidad and Tobago. The demonstration included methods of accessing national station data in graphical or table forms, including using Discovery Metadata to discover data descriptions when searching the WIS2 Global Discovery Catalogue, as well as the steps in the user's platform to exchange SYNOP messages in BUFR format.

C. Presentation on the WMO WRF-based Plug-N-Run NWP Tool to Advance Operational Short - Range Forecasting in the Caribbean: A Cost-effective Solution to Run WRF in Real-Time (delivered by Dr. Kyung Jeon Park, WMO Seconded Expert, WMO Members Department)

7.5 Directors were provided with a demonstration of the WMO WRF-based Plug-N-Run NWP Tool (PN-Tool) as a method to advance operational short-range forecasting as a cost-effective solution to run WRF in real-time. Directors were reminded that while CPU speed and RAM now enable NWP on a desktop or laptop, an outstanding challenge was the lack of sufficient NWP experts at Members NMHSs. NWP experts would normally be required to set up the NWP run environment, perform the software installation, NWP design and implementation, set up data collection and preprocessing, model configuration and execution, results analysis and visualization, and maintenance and update of the NWP modeling system.

7.6 Directors were informed that a solution to the expertise gap was the WMO PN-Tool, which is available on a thumb drive that contains all the necessary components already installed. Further, the entire NWP process was automated, including data collection, preprocessing, model configuration and execution, results analysis, and visualization. The tool would allow NMHS to fairly easily perform real-time WRF execution, historical case study runs, data assimilation, and dynamic downscaling for climate services.

7.7 Directors were also informed that the aim is to conduct a 5-day workshop for Members in 2024 that will enable the PN-Tool to be used to build capacity for operational numerical forecasting systems and support each NMHS in implementing NWP real-time systems for their countries.

D. Presentation on Severe Weather Cataloguing to aid Early Warnings and Track Losses and Damages (delivered by Solange Mohammed, recent intern at the CMO)

7.8 Directors were provided with a demonstration of the recently created Severe Weather Case Database cataloguing interface and forecast evaluation form, which was developed by a CCRIF intern hosted by CMO Headquarters, to assist with early warning, and track losses and damages. The form allows a NMHS to document severe weather events and evaluate its forecast and the modelling tools used to generate the forecast. Directors were shown that the form followed the WMO recommendations for cataloguing severe weather events, including using a numbering system for identification of severe weather events using the names of affected towns and coordinates (longitude and latitude) to pinpoint the affected geographical area, type of hazards, and impacts of the hazard.

7.9 The form also allowed for verification of the forecast by selecting labels such as a hit, miss, or false alarm, as well as providing the reasoning for the option chosen. It also allows for qualitative rating of the accuracy of the forecast provided and the usefulness of model guidance, monitoring, and NWP products used in making the forecast or warning. Directors were encouraged to download and fill out the form whenever a severe weather event is observed, and or forecasted, or a warning has been issued.

A. Meteo-France High Impact Weather Events and Newly Implemented Services Impacting the SWFP

7.10 The meeting was provided with a presentation by Météo-France on its newly implemented services impacting the Severe Weather Forecasting Programme (SWFP) Eastern Caribbean (EC), along with high-impact weather events experienced during 2023. Directors were informed that Météo-France had a new Regional Director, Emmanuel Cloppet, a new Head of forecasting activities, and new Deputy Head. Added to this, there was a human resource crunch. However, six forecasters were to be recruited by the end of the year, which should lead to improved operations in the SWFP in 2024.

7.11 Further, Météo-France was committed to improving the use of automatic production for the SWFP-EC and to developing other automatic products that can satisfy the needs of the SWFP. Directors were informed that the regional guidance product and assignment of individual forecasters to the SWFP would be discussed at RSMT in 2024 with WMO, NOAA, and Météo-France, to find an optimal way forward.

7.12 Directors were reminded that the Météo-France deterministic AROME model was upgraded to 1.3 km of horizontal grid in 2022, which is critical for impact-based-forecast on SIDS. The upgraded and enhanced resolution provide a more realistic simulation of fine-scale meteorological phenomena that produce large amounts of rainfall in the region.

7.13 Additionally, Directors were informed that Météo-France has a new AROME Ensemble Prediction System consisting of 16 members with a 2.5km resolution. This model was the first operational convective-permitting ensemble in the region. The ensemble provides common probabilistic outputs such as quantiles and probability of exceeding thresholds of accumulated rainfall, mean wind and gusts, and specific products generated for TC forecast purposes. Added to this, the new radar in Martinique was installed and tested in 2023, while the country is in discussion with the Sint Maarten Meteorological Department to have access to the new radar in Sint Martin.

7.14 In terms of high-impact weather events in 2023, heavy rainfall is associated with Tropical Storm Philippe was a challenge to forecast, with errors on Philippe's track having consequences for the localization of heavy rainfall in NWP models, including AROME. Different runs of the AROME model struggled to match the exact position of Philippe's center, even though the AROME model often suggested realistic rainfall patterns (form and intensity), especially near the storm center.

A. Caribbean Catastrophic Risk Insurance Facility Segregated Portfolio Company (CCRIF-SPC)

7.15 The meeting was provided with a presentation on updates to CCRIF's excess rainfall and tropical cyclone models. CCRIF informed Directors that its excess rainfall model (XSR) was updated to include IMERG as one of the rainfall products used. The update also included a review of the loss calculation approach, adjustments of the vulnerability curves, an additional trigger for localized events, the generation of an ensemble of loss curves, an additional trigger for wet seasons, the inclusion of the latest events in the hazard assessment, the soil crusting effect, and cash crops. It also included a WRF model update from 8-km resolution to 4-km resolution.

7.16 Additionally, the tropical cyclone model (SPHERA TC) updates include a new stochastic catalogue that has been developed and calibrated specifically for the Caribbean and Central America. In the update, tropical cyclone movement was based on auto-regressions, sea level pressure based on auto-regressions, and a spatially variable limiting factor based on sea surface temperature (maximum potential intensity). There is also a longer catalogue of events that is equivalent to 50,000 years.

OTHER MATTERS (Agenda Item 8)

A. Advancing Climate Services at the National Level to Aid Early Warning and Adaptation: How can we get there?

8.1 The meeting was provided with a presentation by the CIMH Regional Climate Centre on what was required to establish climate services at the national level. Directors were told of the importance and role of establishing a national framework for climate services as a platform for institutional coordination, collaboration, and co-production of climate services and the steps to be taken to implement the framework. Directors were shown that a Caribbean framework for climate services already existed, and what was required was to downscale the core components to the national level. This presentation was followed by a discussion on the way forward. In the discussion, Directors expressed the challenges they faced in implementing and producing climate services and were provided with some solutions to overcome the challenges.

B. Exhibitors Session

8.2 For the first time, the DMS meeting included exhibitors' sessions that enabled attendees to visit exhibits before and after sessions and during refreshment and lunch breaks during DMS2023 and the first day of CMC65. The three exhibitors at DMS2023 were ROSE Environmental Ltd – local agent in Trinidad and Tobago for Campbell Scientific Instruments; Survival Systems Limited – local agent for Davies Weather Instruments; and the Trinidad and Tobago Bureau of Standard and its National Institute of Metrology.

8.3 The strategic goal of the exhibits at DMS was to provide awareness and networking in support of the goals of GBON, SOFF, and QMS. Directors of Meteorological Services and industry professionals were able to schedule meetings and engage in meaningful conversations with instrument vendors and QMS service vendors.

8.4 The exhibitors' session provided an opportunity for vendors to showcase products or services to Directors in a focused and personalized setting. This targeted interaction optimized break periods, lunch time, and closed-sessions; connecting Directors with potential vendors to have one-on-one conversations, raised awareness of regional meteorological equipment and service providers, and enhanced opportunities to build relationships.

**ANNUAL MEETING OF DIRECTORS OF METEOROLOGICAL SERVICES
PORT OF SPAIN, TRINIDAD AND TOBAGO**

15 NOVEMBER 2023

AGENDA

1. INTRODUCTION AND ADOPTION OF AGENDA
 2. STATUS OF ACTIONS FROM THE PREVIOUS MEETING
 3. TRAINING
 4. OPERATIONAL MATTERS
 - a) Global Basic Observing Network (GBON)
 - b) WMO Integrated Global Observing System (WIGOS)
 - c) Regional WIGOS Centre
 - d) WMO Information System (WIS) 2.0 & Climate Data Management in the WIS 2.0
 - e) ICAO Meteorological Information Exchange Model (IWXXM)
 - f) Implementation of Quality Management System
 - g) Activities in Drought Management
 - h) Implementation of Integrated Health Science and Services
 5. OUTCOME/HIGHLIGHTS OF THE NINETEENTH MEETING OF WMO CONGRESS
 - a) Members to leverage the Early Warning for All Initiative
 - b) WMO Position on the World Radio Communication Conference 2023 Agenda
 - c) WMO-Coordinated Global Greenhouse Gas Monitoring Infrastructure
 - d) Priorities to Address Global and Regional Impacts of Changes in the Cryosphere
 - e) WMO Strategy for Service Delivery and its implementation plan
 6. THE IMPACTS (LOSS & DAMAGE) OF WEATHER DURING 2023
 7. SCIENTIFIC PRESENTATIONS & NEW SERVICES DEVELOPED SINCE 2021
 8. OTHER MATTERS
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**ANNUAL MEETING OF DIRECTORS OF METEOROLOGICAL SERVICES
PORT OF SPAIN, TRINIDAD AND TOBAGO**

15 NOVEMBER 2023

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