

# CARIBBEAN METEOROLOGICAL ORGANIZATION

CARIBBEAN METEOROLOGICAL COUNCIL SIXTY-THIRD SESSION GEORGE TOWN, GRAND CAYMAN, CAYMAN ISLANDS 24-25 NOVEMBER 2022

### PROJECT UPDATES AND PROPOSALS

(Submitted by the Coordinating Director)

#### Introduction

1. At the heart of environmental issues and loss and damage in the Caribbean, and our planet, are weather, climate, and water issues. National Meteorological and Hydrometeorological Services (NMHSs) in the Caribbean and across the globe must provide accurate information, analyses and timely forecasts of hazardous weather-related conditions that affect the sustainable development of their nations in the short term. It is also recognized that hydro-meteorological events can aggravate the impacts of other hazards, such as volcanic eruptions and earthquakes. With climate resilience at the forefront of policy within the region, NMHSs must provide the appropriate data and scientific-basis for climate knowledge and climate action. The CMO Headquarters (HQ) is supporting, in particular, the contribution of meteorology, climatology, and related sciences to these activities, through development of projects, programmes, and partnerships guided by a strategic plan.

2. Council will recall that the CMO Headquarters Strategic Plan 2020-2023 identified four 4) regional Strategic Priorities:

- (i) Enhance disaster preparedness and reducing losses of life and property from extreme hydrometeorological events and severe weather
- (ii) Support climate-smart decision-making to build resilience and adaptation to climate risk
- (iii) Support the strengthening and maintenance of observation networks and information services, and
- (iv) Enhance the socioeconomic and national security value of weather, climate, hydrological and related environmental services

3. In alignment with approved strategic priorities, the CMO HQ has continued the implementation of projects presented at CMC61 (November 2021, virtual) and initiated new projects and proposals. The projects undertaken by the CMO Headquarters also respond to the fact that many regional NMHSs still lack appropriate legislative, strategic and institutional frameworks that enable the development and strengthening of Multi-hazard Early Warning Systems (MHEWS), and threaten the long-term sustainable development of Member States. There is still a need for innovative solutions, especially considering the mandate to implement "Early Warnings for All" given by the United Nations Secretary-General, *Antonio Guterres* on World Meteorological Day, 23 March 2022.

4. This is primarily an information document intended to keep the Council up-to-date on the status and/or progress of implementation on any projects that involve CMO Member States and partner organizations and development agencies, such as the *World Meteorological Organization* (WMO), *World Bank*, and Universities.

<u>Doc. 11</u>

# (a) WMO Severe Weather Forecasting Programme (SWFP) (Strategic Priority 1)

5. Council will recall endorsing a proposal by CMO and partners in 2015 to implement a WMO *Severe Weather Forecast Demonstration Project* (SWFDP), within a domain bounded by Trinidad to the south, Puerto Rico to the north, and Haiti in the west, aimed at improving early warnings for non-tropical cyclone severe weather. The SWFP has been fostering greater collaboration among Caribbean National Meteorological Services forecasters and equipping them to provide better services and warnings on severe weather to Disaster Management Agencies and the general public. In June 2019, the 18<sup>th</sup> WMO Congress acknowledged the strides made toward the implementation of the demonstration projects and the SWFDP was designated as the **Severe Weather Forecasting Programme (SWFP)** – Eastern Caribbean (EC). The WMO Secretariat, *Météo-France*, CMO Headquarters, and CIMH have been collaborating to develop the SWFP-EC into an operational programme.

6. The project entered the pre-operational phase in 2019, with all NMHSs within the forecast domain having access to the Extranet of the *Regional Forecast Support Facility* (RFSF-Martinique). Coordinating Director, *Dr Arlene Laing*, and *Mr Jean-Noel Degrace* of Météo-France have been serving as co-chairs of the *Regional Subprogramme Management Team* (RSMT) for the development and implementation of the SWFP. Other CMO representatives on the RMST include *Ms Kathy-Ann Caesar* of the CIMH, as the training lead, and *Mr Dale Destin*, Director (Ag) of Antigua and Barbuda Meteorological Service.

7. Since CMC61, the RSMT met virtually on 14 December 2021, to examine progress made at the *Regional Forecast Support Facility* (Météo-France Martinique), including the Extranet updates, new data/products from Canada, and more accurate radar products from the new Guadeloupe radar. Presentations were made by the WMO Standing Committee on Disaster Risk Reduction on MHEWS Interoperable Environment, to coordinate among the SWFP, the Coastal Inundation and Forecasting Initiative (CIFI), and Flash Flood Guidance System (FFGS), and the establishment of an advisory group on Severe Weather Forecasting.

8. It was agreed that products could be made available to NMHSs in Caribbean states outside of the EC domain. The training plan for 2022 and 2023 was presented by CIMH and the RSMT agreed to develop a severe weather case study catalogue to enhance forecaster skill. A CIMH intern developed a library of case studies as a first step in that process. CMO Headquarters proposed a project to develop the catalogue but the project was postponed due to the lack of an intern to develop the database and interface for the catalogue.

9. In April 2022, Co-Chairs, Dr Laing and Mr Jean-Noel Degrace reported to the 44<sup>th</sup> Hurricane Committee on recent activities of the SWFP-EC, including (i) new products and resources for forecasting severe weather; (ii) the draft Severe Weather Operational Plan; (iii) activities planned for 2022 and 2023; (iv) the coordination with the International Weather Ready Nations, which included a series of webinars on impact-based forecasting presented through the World Bank CREWS Caribbean component. 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, including the SWFP-EC, in accordance with our formal *Working Arrangements*.

10. Plans for the Severe Weather Forecasting Programme Eastern Caribbean for 2022 to 2023, include:

• NOAA/WMO RA IV Satellite Training workshop, to be held virtually on 5-8 December 2022

- A new high-resolution ensemble AROME weather model, with 1.3km grid, will be made available in the SWFP-Extranet. This is a first and major advance for Caribbean weather forecasting, where forecasters will have access to an ensemble model that captures small island-scale circulations and weather systems.
- EUREC4A-UK/CMO-SWFP workshop, being planned in-person, 20-23 February 2023
- Technical Workshop on use of the SWFP-EC Extranet, Communication and Public Weather Service
- Development of a severe weather case study catalogue
- Forecaster exchange and attachment at RFSF Martinique

The next meeting of the RSMT is scheduled for 13 December 2022 as a video conference.

11. The CMO Performance Monitoring Survey undertaken earlier this year found that, although there was a steady increase in the number of CMO Members participating in the SWFP (2020: 5; 2022: 8), the training of forecasters had been stalled, with only one (1) being trained so far in 2022. Members within the domain are encouraged to participate in the SWFP and those trained are encouraged to train fellow forecasters to use the SWFP-EC platform. Directors are encouraged to nominate forecasters to participate in upcoming training workshops.

# (b) CREWS Caribbean: Strengthening Hydro-Meteorological and Early Warning Services in the Caribbean (Strategic Priorities 1, 2 & 4)

12. Council will recall discussions from CMC58 to CMC61 about the Climate Risk and Early Warning System (CREWS) Caribbean Project, co-funded by the CREWS Initiative, and Environment and Climate Change Canada (ECCC), and being implemented by the WMO, the World Bank Global Facility for Disaster Reduction and Recovery (WB/GFDRR), the UN Office for Disaster Risk Reduction (UNDRR), and regional partners: Caribbean Disaster Emergency Management Agency (CDEMA), CIMH, and CMO Headquarters. The purpose of the CREWS-Caribbean project is to strengthen and streamline regional and national systems and capacity related to weather forecasting, hydrological services, multi-hazard, impact-based warnings and service delivery for enhanced decision-making in CARICOM countries.

- 13. The CREWS-Caribbean Project has three components:
  - Component (1): Development of a regional strategy and roadmap for EWS; led by WB/GFDRR and implemented together with WMO, UNDRR and regional partners, in coordination with national disaster management and national meteorological services.
  - Component (2): Institutional strengthening and streamlining of early warning and hydro-met services; led by WMO
  - Component (3): Support for piloting high priority activities at the national level with regional involvement as well as at the regional level, informed by the regional strategy; led by WB/GFDRR

The CMO HQ contributed to the development of the "*Strategic Roadmap for Advancing Multi-Hazard Early Warning Systems in the Caribbean 2020-2030*" under Component 1, and the implementation of activities related to Components 2 & 3.

14. The CMO Headquarters and the WMO signed an Implementing Arrangement in April 2020 for the delivery of aspects of the CREWS-Caribbean *Project Component 2* through the project, "*Building Resilience to High-Impact Hydro-meteorological Events through Strengthening MHEWS in Small Island Developing States (SIDS) in the Caribbean*". This project is helping create an enabling environment for National Meteorological and Hydrological Services (NMHS) of CMO Member States and their governments to strengthen legislative, policy, and strategic frameworks.

15. The WMO Component of the CREWS Caribbean project and *Environment and Climate Change Canada* (ECCC) provided \$263,000 USD, via a WMO-CMO Implementing Arrangement, for the CMO Headquarters to implement the following activities by May 2022. With funding from CREWS, a second WMO-CMO Implementing Arrangement, signed in June 2022 and amended in August 2022, provided US \$68,870 for expansion to more Member States.

#### • Meteorological Legislation and Policy

Under the original Implementing Agreement, a Model Hydro-Meteorological Bill and Meteorological Policy for NMHSs were developed by a legal consultant and endorsed by CMO Member States on 2 June 2021. The Model Bill and Policy Documents were professionally published (see Annex I) and distributed to all Member States, CIMH, CARICOM Secretariat, Organization of Eastern Caribbean States (OECS), WMO Secretariat, and the CREWS Secretariat.

Subsequent to the endorsement of the Model Bill, eight (8) National Bills were adapted from the Model Bill by Anguilla, Antigua & Barbuda, Belize, Grenada, Jamaica, St Kitts & Nevis, Saint Lucia, and St Vincent & the Grenadines. Through the new Implementing Agreement, the adaptation of one (1) additional Bill, for Barbados, was initiated in September 2022. Policy directions were received from the *Honourable Wilfred Abrahams*, Minister of Home Affairs and Information on the future organizational and legal framework for the Barbados Meteorological Service (BMS). After initial consultations with the BMS a first draft of the National Meteorological Bill was been prepared. Consultations with the BMS and key stakeholders have been held, and a revised draft is being prepared for validation.

A 'Strategic Plan 2020-2023 Performance Monitoring Survey' undertaken by the CMO HQ between July to September 2022 found that although National Meteorological Bills and Policies were adapted by several Member States, **only four (4)** reported having a legal basis for their operation, with two (2) more in draft form. There remains an urgent need for most CMO Member States to develop and implement their governance framework.

#### National Strategic Plans and Framework for Weather, Water, and Climate Services

At CMC61, Council was informed of the delivery of eight (8) National Strategic Plans (NSPs) and Frameworks for Weather, Water and Climate Services, with complementary Action Plans (NSPs, FWWCSs & APs), after months of consultation and guidance by the WMO, CMO HQ, and CIMH Regional Climate Centre. The beneficiaries were Anguilla, Antigua & Barbuda, Dominica, Grenada, Guyana, Jamaica, St Kitts & Nevis, and St Vincent & the Grenadines. Through the new Implementing Agreement, two (2) additional NSPs, FWWCSs, & APs are currently in development for the Turks and Caicos Islands and the Cayman Islands. For the Turks and Caicos Islands the consultancy is past the inception phase and baseline assessment, and is in the process of reviewing a draft Strategic Plan. The Cayman Islands Strategic Plan development was recently initiated, with a kick-off meeting held on 14 October 2022. Since the Cayman Islands already possessed a Strategic Plan, the objective was shifted towards reviewing and updating their existing plan in accordance with the WMO Integrated Strategic Planning Handbook (WMO No. 1180) and Template, for regional and international consistency. The inception phase was completed, and the project has shifted towards the development of the baseline assessment and a draft of the Strategic Plan. Several consultations were held with national stakeholders.

The CMO HQ Performance Monitoring Survey determined that a total of twelve (12) CMO Member States had developed strategic plans, which should increase to thirteen (13) with the completion of the Turks and Caicos Islands intervention. There remains a need for the

remaining territories to develop their strategic frameworks and keep them under review (Saint Lucia, Montserrat, British Virgin Islands). National Meteorological and Hydrometeorological Services currently in possession of valid strategic plans are also encouraged to conduct midterm or end-of-term reviews to ensure they remain appropriate and to ensure that their plans are being utilized in their national development plans. The latter is critical for accessing certain international development funding.

16. Under Component (3) of the CREWS Caribbean Project, four priority activities have been proposed for implementation by the World Bank:

- Priority Activity 1: Development of a Multi-sensor Precipitation Grid
- Priority Activity 2: Support the Transition to Impact-Based Forecasting
- Priority Activity 3: Development of a Regional Emergency Alert System
- Priority Activity 4: Integrated Approach to Flooding

The priority activities are to be implemented by various regional organizations including CIMH, CDEMA, CMO Headquarters, Météo-France, Caribbean Telecommunication Union (CTU), among others. As noted in CMC61, the CMO HQ is leading the coordination of *Priority Activity 1*, the development of a Multi-sensor Precipitation Grid over the Eastern Caribbean, with CIMH as the technical lead. The CMO HQ helped to organize a seven-part webinar series on Impact-Based Forecasting and Warning under *Priority Activity 2*. CMO HQ also provided input to a feasibility study for a regional early alert warning system (*Priority Activity 3*), while *Priority Activity 4* will benefit from the success of the Multi-Sensor Precipitation Grid (*Priority Activity 1*). These activities are supported by a grant of US\$50,000 from the World Bank.

• Multi-Sensor Precipitation Grid over the Eastern Caribbean

Development of the Multi-Sensor Precipitation Grid is being implemented by the World Bank, through a contract with the *Centro Internazionale in Monitoraggio Ambientale* (CIMA) Foundation, to integrate radar and satellite-derived rainfall estimates with rain gauge data. The precipitaton grid also includes quantitative precipitation forecasts from regional numerical weather prediction models. The precipitation grid will be shared among participating countries and regional institutions to drive forecasting systems such as Flash Flood Guidance Systems (FFGSs), and be useful to disaster management, water resource managers, agriculture, energy, and other sectors with a need for accessible, accurate rainfall information. The CIMA Foundation has since completed the development of the web-based platform (sample product is shown in Annex II), and in July 2022 a demonstration workshop was held for the benefit of potential users. The system has been operational since September 2022. In late October-Early November three (3) User Training webinar were hosted by the CIMA Research Foundation and coordinated by the CMO HQ and CIMH, to the benefit of regional users from various sectors. The webinars remain available for self-paced training.

The goal of Priority Activity 1, is to utilize the Caribbean Weather Radar Network to prepare a regional precipitation grid that will integrate radar and satellite derived rainfall estimates and local rain gauge data. Since the entire region is benefited, the hope is that countries would participate so that the grid may be incrementally extended as beneficial experiences are shown.

#### (c) EUREC<sup>4</sup>A-UK/CMO Caribbean Weather Forecasting Initiative (Strategic Priority 1)

17. Council will be aware that the University of Leeds and CMO Headquarters, implemented a *Caribbean Weather Forecasting Initiative* in support of *EUREC<sup>4</sup>A-ATOMIC*, an international field study led by institutions from France, Germany along with the CIMH. The Forecasting Initiative was partially funded through an agreement between WMO and CMO Headquarters, as it supported the Severe

Weather Forecasting Programme (SWFP) Eastern Caribbean by helping forecasters to understand the strengths and limitations of high-resolution weather prediction models and developing collaboration practice among regional forecasters.

18. Council will note the benefits of the Initiative to the National Meteorological Services of CMO Member States, whose forecasters gained enhanced capability in numerical weather prediction and dry season weather and localized storms prediction, through training workshops and a Forecast "Testbed" during the field study. Two workshops will be held in support of the *Caribbean Weather Forecasting Initiative*: one in December 2022, led by NOAA and CIMH, which will include the satellite aspects of the same case studies to be examined in terms of the numerical model predictions in a second workshop in February 2023, led by University of Leeds and CMO Headquarters, with support from CIMH.

### (d) **SERVIR-Amazonia** (Strategic Priorities 1 – 4)

19. SERVIR-Amazonia is part of SERVIR Global, a joint development initiative of the National Aeronautics and Space Administration (NASA) and the United States Agency for International Development (USAID). SERVIR-Amazonia is led by the Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT). With additional funding from USAID for a 2-year period covering 2022-2023 the programme was extended to include the Caribbean region. The main aim is *"to advance learning and the sharing of best practices and innovative approaches toward the forecasting and monitoring of extreme hydrological events, and the monitoring and evaluation of land use and land cover changes in mangrove ecosystems"*. This is achieved through collaboration *"with regional partners to understand their needs and then translate these into the co-development of tools, products, and services to allow countries to improve decision-making around natural resource management"*. The programme also promotes inter-institutional collaboration among national stakeholders to co-develop and co-deliver environmental services.

20. The SERVIR-Amazonia Team engaged the CMO during a country visit in April 2022. Following a series of virtual meetings, in July 2022 the CMO and CIAT agreed to partner to deliver the project in Trinidad and Tobago.

21. On 24 August 2022, the CMO hosted a User Needs Workshop in collaboration with CIAT to assess the user organizations' needs, priorities, and capacity-building services for the use of geospatial information to improve environmental decision-making. Twenty-one (21) participants (7 women; 14 men) from thirteen (13) government, academic and NGO institutions participated in-person at CMO Headquarters, and in hybrid format at the Crown Point Meteorological Office in Tobago.

22. CIAT and CMO co-developed a training agenda for twelve (12) capacity-building sessions for a maximum of twenty-five (25) participants for the period November 2022 – April 2023, which will be conducted using a mix of virtual and in-person modes. In-person sessions will be hosted at the CMO Headquarters. The CMO initiated a Sub Award contract, for US \$22,480, with the CIAT on 24 October 2022, with CMO providing:

- Advice on cultural, political, economic and technical matters that could affect or influence the development of the program in the country and region
- Scientific and technical support in the development of program activities
- Logistical and administrative support for workshops, training, travel, lodging, etc.
- Communications coverage and support in developing the program activities (press releases, photos, etc.)
- Coordination with SERVIR-Amazonia representatives on the organization and implementation or program activities
- Support in the preparation of reports on program activities

The training workshops are scheduled for January - April 2023, to be held in-person at the CMO Headquarters.

# **Hydromet Caribbean 2023: Third Symposium on Operational Hydro-meteorology** (*Strategic Priorities 1-4*)

23. Council will recall that Directors of NMHSs expressed a desire for a second symposium following the successful first symposium that the CMO Headquarters Unit co-organized with Varysian Ltd, in November 2019 in Barbados. That first symposium focused on Directors of NMHSs, sharing ideas and seeking solutions to operational hydro-meteorology challenges in the Caribbean. The 2019 symposium focused on data issues and good practices in public-private-academic partnerships. The 2020 symposium, held virtually on 15-17 December 2020, focused on integration of operational hydrology and meteorology in the Caribbean context and how to develop a roadmap for hydrological activities, as well as development and enhancement of partnerships among public sector, private sector, academia, and inter-governmental bodies to strengthen Hydro-Meteorological infrastructure, data sharing, products, and services to meet growing societal demand.

24. Council noted the value of the actions by the CMO Headquarters and its ensuring that the outcomes of both symposia served as inputs to key international meteorological and hydrological policies and strategies being developed regionally and globally by WMO and partner agencies.

25. A third symposium is being planned for 24-26 January 2023 in Jamaica, with emphasis on the establishing partnerships to support "Early warnings for all in five years", looking at challenges, and possible solutions.

# (e) Lightning Detection System and Lightning Safety Awareness (Strategic Priorities 1,3)

26. Council will recall that, the CMO Headquarters indicated its interest in establishing a <u>ground-based</u> Lightning Detection System in the region in partnership with the Meteorological Service of France [Météo-France]. At the 59<sup>th</sup> Session (Anguilla, 2019), Council approved the initiation of a project to develop a CMO Lightning Detection Network and CMO Headquarters has been seeking funding for a lightning detection system in which the equipment purchased and installed under such a project would be owned and operated by the CMO for the benefit of all CMO Member States and the region, in general.

27. CMO has continued to advocate for the inclusion of lightning in disaster risk reduction and is pleased to report to Council that the UNDRR has identified lightning detection as a priority for the next phase of CREWS projects in the region. The importance of lightning safety awareness has come to the forefront, particularly in Jamaica, where a number of lightning deaths occurred in 2020 and several causalities were reported since 2017. Motivated by those incidents, a peer-reviewed study of "Jamaica lightning occurrence, damage and casualties" was co-authored by *Mr Ron Holle*, *Dr Arlene Laing*, *Mr John Cramer*, and *Mr Evan Thompson* of Jamaica, using Vaisala GLD360 lightning data. The study was presented by lead author, Mr Ron Holle, at the 36<sup>th</sup> International Conference on Lightning Protection, 2-7 October 2022 in Cape Town, South Africa, and recommended as a prototype for similar studies of other Caribbean countries and territories. Dr Laing will present on the same topic at the Annual Meeting of the American Meteorological Society in January 2023. This study bolsters the case for a lightning detection network adapted to the variation in sub-regional risks.

# (f) Technical Study of Radar Network covering CARICOM Countries (Strategic Priorities 1, 3, and 4)

28. Through the CREWS Initiative, Dr R Jeff 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 Headquarters. The CMO Headquarters provided input to the Terms of Reference for the consultancy

and organized Dr Keeler's visits with the radar host countries, their radar technicians, and IT staff, and reviewed preliminary versions of the study report. 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).

#### (g) Upgrading of CMO Radars (Strategic Priorities 1, 3, and 4)

As reported in CMC63, Doc 10, the CMO Headquarters is working with the Caribbean Development Bank on the upgrading of CMO weather radars to improve early warnings and build resilience to extreme weather in a changing climate, through capacity building and sustainable investment.

#### ACTION PROPOSED TO COUNCIL

- 29. The Council is invited to:
  - (i) Note
    - a. the continued efforts of the CMO Headquarters Unit to advance the implementation of the CMO Strategic Plan 2020-2023 through the projects described.
    - b. The progress made in developing regional Early Warning capacity for non-Tropical Cyclone phenomena through the strengthening of the WMO Severe Weather Forecasting Programme to **strongly support** regional participation in its implementation.
    - c. The ongoing drive to advance the adaptation of model meteorological legislation and policy frameworks in CMO Member States through a recently started intervention in Barbados
    - d. The ongoing efforts to develop the strategic and institutional frameworks for weather, water, climate and ocean services for the Turks and Caicos Islands and the Cayman Islands
    - e. The operational status of the Multi-Sensor Precipitation Grid over the Eastern Caribbean and the successful conduct of demonstration and training workshops between September to November 2022 in support of hydro-met sensitive sectors
    - f. The continuation of collaborative weather forecasting initiative workshops under the EUREC<sup>4</sup>A-UK/CMO Caribbean Weather Forecasting Initiative to build regional capacity through knowledge exchange and collaboration with international researchers
    - g. The successful completion of a User Needs Workshop and the commencement of training in the forecasting of extreme hydrological events and the monitoring of mangrove ecosystems under the SERVIR-Amazonia programme
    - h. The ongoing planning for a third operational hydro-meteorology symposium for Directors of National Meteorological Services and other key stakeholders;
    - i. The successful activities in connection with advocacy and research for lightning safety awareness as part of disaster risk reduction, and **support** the exploration of options for an operational ground-based lightning detection system.

# (ii) Recognize:

- a. The mandate given on World Meteorological Day, 23 March 2022, by the United Nations Secretary-General to implement "Early Warnings for All" in five years
- b. The importance of enabling governance, strategic, and institutional frameworks for the development and strengthening of Multi-Hazard Early Warning Systems, and the long-term sustainable development of CMO Member States
- c. That as of September 2022 only four (4) out of sixteen (16) CMO Member States reported being in possession of a legal basis for their operation
- d. That while twelve (12) National Meteorological and Hydrological Services (NMHSs) report being in possession of valid strategic plans, they should be reviewed and updated for appropriateness; and that three (3) NMHSs remain without valid strategic plans and institutional frameworks
- e. The opportunity exists for CMO Member States within the domain of the WMO Severe Weather Forecasting Programme to access the Regional Forecast Support Facility and training in the concept;

#### (iii) Urge Members to:

- a. Adapt the Model Meteorological Bill and Policy to their national circumstances to provide a legislative framework for Multi-Hazard Early Warning Systems and the long-term sustainable development of their country/territory
- b. Develop and/or endorse National Strategic Plans and Frameworks for Weather, Water and Climate Services for National Meteorological and Hydrometeorological Services without an approved strategic and institutional framework
- c. Conduct reviews of existing National Strategic Plans and Frameworks for Weather, Water and Climate Services for National Meteorological and Hydrological Services approaching the mid-term or end of their strategic planning cycle
- d. Utilize the SWFP Regional Forecast Support Facility and participate in training in the WMO Severe Weather Forecasting Programme.

CMO Headquarters November 2022

#### **ANNEX I**

### Excerpts from Model Hydro-Meteorological Services Bill and Policy



# **ANNEX II**

# Sample of Multi-Sensor Precipitation Grid: Accumulated Rainfall (24 h)



Courtesy, CIMA Research Foundation