Executive Summary

The “Caribbean Regional Workshop on Measuring Effectiveness of Early Warning Systems through Sendai Framework Target (g) and Custom Indicators” workshop was the first in-person session of the workshop, after two pilots planned to test the training materials and indicators (online and hybrid). It was organized by the UNDRR Regional Office for the Americas and the Caribbean (ROAMC), with the support of World Meteorological Organization (WMO) and hosted by the Government of Trinidad and Tobago (T&T). This workshop aimed to strengthen the capacities of Caribbean countries to monitor and evaluate the progress of Multi-Hazard Early Warning Systems (MHEWS) and identify areas where further progress can be made.

The three-day course reached 65 representatives of National Disaster Management Offices, Regional and National Meteorological and Hydrological Services, and National Offices of Statistics of 22 Caribbean countries and overseas territories. As well as other related agencies (UNDP, Caribbean Public Health Agency (CARPHA), Intergovernmental Oceanographic Commission (IOC) UNESCO, The UWI Seismic Research Centre, Caribbean Community Climate Change Centre (CCCCC), among others.

The course was held in person in Port of Spain, T&T, between 10-12 May, two full days (MHEWS) and half day for the Mid-Term Review (MTR) of the Implementation of the Sendai Framework, Caribbean thematic case of the MHEWS. Participants were presented with a broad range of topics

1Anguilla, Antigua and Barbuda, Cayman Islands, Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Kitts & Nevis, Saint Lucia, St. Vincent & the Grenadines, Suriname, Trinidad & Tobago, Turks & Caicos Islands, the Virgin Islands, Cuba and the Dominican Republic.
that address each of the early warning systems and risk assessment capacities in the following areas corresponding to five identified areas for MHEWS effectiveness assessment: (i) Governance; (ii) Disaster Risk Knowledge; (iii) Detection, Monitoring, Analysis, and Forecasting; (iv) Dissemination and Communication; and (v) Preparedness and Response.

Participants appreciated the exchange of experience, tools and approaches shared. Some of the participants said: “many things were learnt at the enlightening, educative and highly productive workshop and I do hope to work with the in-country colleagues to see how the knowledge gained could be taken further”, or “the opportunity to have a dialogue among the MET Services, the Disaster offices, and the Statistical offices is a major accomplishment”.

Background

The Caribbean states are vulnerable to hurricanes and storms (Hurricane Irma and Hurricane Maria, 2017), floods, earthquakes (Guyana, 2021, Haiti and T&T, 2018), volcanic eruption (SVG, 2021). In addition, according to the Economic Commission for Latin America and the Caribbean (ECLAC) projections, as a result of the COVID-19 pandemic health crisis, the economies of the Caribbean will contract by 6.2%. This is expected to result in higher unemployment, greater poverty and inequality, two major and historical drivers of vulnerability in the region. COVID-19 pandemic has shown that multiple risks are connected, which is when compounded, the impacts are exacerbated.

The workshop and related training package contribute to implementing the joint UNDRR-WMO “Measuring Effectiveness of Early Warning Systems through Sendai Framework Monitoring” project with additional implementing support of the World Bank Global Facility for Disaster Reduction and Recovery (GFDRR). One aim of the project is to better support Least Developed Countries (LDCs) and Small Island Developing States (SIDS) in measuring the effectiveness of their (multi-hazard) early warning systems and improving them over time.

One of the seven global targets of the Sendai Framework for Disaster Risk Reduction (SF) 2015-2030, Target (g), aims to “substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030”. It is supported by six of the 38 indicators of the Sendai Framework Monitoring (SFM) system developed by the Open-ended Intergovernmental Expert Working Group on Indicators and Terminology Relating to Disaster Risk Reduction (OIEWG) and endorsed by the UN General Assembly.

Based on the experience of implementing early warnings systems (EWS) initiatives under the CREWS Initiative, there is a need to further explore how countries can better assess and monitor the effectiveness of their national EWS. The Target (g) methodology and associated indicators are reflecting the four components of an EWS as outlined in the OIEWG Report and the Technical Guidance Notes. While those indicators measure the availability of and access to EWS, they do not provide a measure on the quality/effectiveness of those.

Therefore, a set of early warning custom indicators for countries to choose from in the SFM system, were developed under the project in order for countries to measure, on a voluntary basis, the effectiveness of their MHEWS as per their own individual contexts.

Following the development of these custom indicators, a corresponding training package was developed to support the capacity development of Sendai Framework Monitor focal points and their partners to understand and use the new indicators.

This is the first in person session of the workshop, after two pilots (online and hybrid) planned to test the training materials and indicators.

Course Objective

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2 These hurricanes affected the islands of Anguilla, Barbuda, British Virgin Islands, Dominica, Haiti, St. Kitts & Nevis, Trinidad & Tobago and Turks & Caicos, CDEMA 2022.
The workshop aimed to strengthen the capacities of Caribbean countries to monitor and evaluate the progress of MHEWS and identify areas where further progress can be made.

Through the workshop participants gain the skills to better identify the data and information required, understand why the information reported is critical to tracking capacity building efforts and become more confident about selecting a broader sampling of custom indicators to pursue.

**Workshop Content and Methodology**

**Content:** The workshop content was primarily based on the Training Package Development MHEWS Custom Indicators published by the UNDRR, WMO and Shoreline Risk. Course content covers a variety of topics that can be grouped into two interrelated areas:

1. The systems and processes by which Sendai Framework monitoring and evaluation are achieved, specifically regarding Target G (inclusive of 6 Global Indicators that measure regional- and national-level progress and 53 custom indicators that measure progress at the subnational and local levels);

2. For each indicator: the capability or capacity measured; its value to local, subnational, national, or regional capacity; and the methods may be employed to measure progress.

**Methodology:** The training approach is based on principles of adult learning as a short and intensive (2 days) in-service training workshop for high level government officials with a focus on combination of content presentations and group work exercises to master the use proposed tools and approaches as well as using peer to peer learning through sharing from own best practices, experience and lessons learned.

Participants were presented with a broad range of topics and issues that together address each of the early warning systems and risk assessment capacities in the following areas (each corresponding to one of five identified areas of multi-hazard early warning system assessment): (i) Governance; (ii) Disaster Risk Knowledge; (iii) Detection, Monitoring, Analysis, and Forecasting; (iv) Dissemination and Communication; and (v) Preparedness and Response.

**Structure:** The workshop is composed of 9 Modules broken down into two main sessions over two days.

**Materials and Tools:** Each session includes an introduction, learning objectives, participatory methodologies, and activities.

<table>
<thead>
<tr>
<th>Section</th>
<th>Workshop Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sendai Framework Monitor &amp; MHEWS</td>
<td>Module 1: Introduction and Workshop Overview</td>
</tr>
<tr>
<td></td>
<td>Module 2. Sendai Framework Monitor: Global and Custom Indicators</td>
</tr>
<tr>
<td></td>
<td>Module 3. Multi-Hazard Early Warning Systems</td>
</tr>
<tr>
<td></td>
<td><strong>2. Evaluating MHEWS</strong></td>
</tr>
<tr>
<td></td>
<td>Module 4. Evaluating MHEWS: Focus on Governance</td>
</tr>
<tr>
<td></td>
<td>Module 5. Evaluating MHEWS: Focus on Disaster Risk Knowledge</td>
</tr>
<tr>
<td></td>
<td>Module 6. Evaluating MHEWS: Focus on Detection, Monitoring, Analysis and Forecasting</td>
</tr>
<tr>
<td></td>
<td>Module 7. Evaluating MHEWS: Focus on Dissemination and Communication</td>
</tr>
<tr>
<td></td>
<td>Module 8. Evaluating MHEWS: Focus on Preparedness and Response</td>
</tr>
<tr>
<td></td>
<td>Module 9. Discussion, Conclusion and Next Step</td>
</tr>
</tbody>
</table>
Overview of Training Sessions

Opening Remarks

The course was opened with the National Anthem of the Republic of Trinidad and Tobago followed by welcome remarks from by Anwar Baksh, Planning and Development officer from the Office of Disaster Preparedness and Management (ODPM) who welcomed all participants and introduced the speakers for opening remarks.

Major General Retired Rodney Smart, Chief Executive Officer of the ODPM, welcomed all participants to the country and thanked the Minister of National Security for giving the approval to host the workshop in T&T. He also thanked UNDRR for the continuous support that they have been providing to the ODPM in various initiatives related to disaster risk reduction (DRR), including the MCR2030 activities taking place in Tobago during the same week. He recognized the need for a multi-hazard approach to DRR management and wished a productive workshop to participants so they could be better equipped to return to their countries and implement the methodology to strengthen EWS systems.

Ms. Andria Grosvenor, Deputy Executive Director (ag) Caribbean Disaster Emergency Management Agency (CDEMA) acknowledged how the Caribbean hazard landscape has become more complex resulting in cumulative impacts with cascading effects. She emphasized the linkages with the indicators and standards specified in the Caribbean MHEWS checklist to assess the EWS, endorsed by the 2018 Technical Advisory Committee. She reminded CDEMA’s objective of seeking to improve and integrate EWS, building community capacity through tools and processes to support states to identify and prioritize gaps for strengthening MHEWS. Also, she informed about the EWS Consortium -a strategic advisory body for the advancement and strengthened coordination of EWS in the region.

Mr. Rodney Martinez, Representative for North America, Central America, and the Caribbean Member Services and Development Department WMO, thanked UNDRR for inviting the WMO to contribute with the facilitation of the workshop. He emphasized the need to enhance the preparedness and early action of various groups, who are dependent on weather and the impact-based forecasting skills. He lauded the continuous collaborative work between the Meteorological and DRR communities. He informed about the UNDRR and WMO center of excellence on climate change and disasters in Geneva to support the efforts on measuring the effectiveness of EWS, understanding and using custom indicators and providing an evidence-based information.

The Honorable Fitzgerald Hinds MP, Minister of National Security of T&T, Keynote Address started by reminded how EWS during the potential eruption of La Soufriere Volcano in St. Vincent and the Grenadines in 2021 allowed timely evacuations. He emphasized the importance for T&T of being aligned to the global frameworks and pathways; with the ratification of the SF in 2020, appointment of the ODPM to be the focal point and implementing lead agency, and the declaration of the Month of May as National Disaster Prevention and Preparedness Month. He informed about the assessment on MHEWS conducted by the ODPM that allowed to acknowledge the progress and gaps to address, and the two key documents that the country is developing for the implementation of the SF, the Comprehensive Disaster Management Policy and the Country Work Program. He wished a successful workshop that serves as the foundation to create new opportunities to strengthen the resiliency of the respective countries and the region.

Mr. Dennis Zulu, Acting UN Resident Coordinator for Trinidad and Tobago, Suriname, Aruba, Curaçao and St. Maarten reminded the SF seven targets and four priorities for action to prevent and reduce disaster risk. He wished a productive workshop that will benefit the Sendai focal points and enhance capacities to stronger monitoring and use of EWS giving us more time to respond better and quicker.

Mr. Raul Salazar, Chief of Office, UNDRR ROAMC welcomed the participants and Government of T&T’s support with this workshop and for being a leading example within the Americas and the Caribbean in enhancing cooperation in the framework of DRR. He emphasized the importance of improving the MHEWS since the ability to warn multiple hazards increases the efficiency and consistency of warnings through coordinated and compatible mechanisms and capacities; and reminded the importance of knowing how communities perceive risk. He informed that Midterm
reviews consultations were going to be held to assess how well countries are doing on the SF -in the case of the Caribbean region a thematic MTR on EWS. He acknowledged the need for technical cooperation at all levels scaling from the global to community level to ensure DRR strategies are mainstreamed and integrated.

Day 1 - Sessions 1-3

Module 1: Introduction and Workshop Overview: fundamentals of disaster risk reduction

Dr. Jair Torres, Disaster Risk Advisor for UNDRR ROAMC, lead facilitator, presented Module 1 -the agenda, purpose and course goals and the foundational concepts surrounding DRR, including key terminology (hazard types and classification, exposure, vulnerability, DRR, resilience).

Module 2: Sendai Framework Monitor: Global and Custom Indicators

Mr. Carlos Uribe, program officer of UNDRR ROAMC, presented Module 2 - historical account of the efforts of the UN system to support regional and national DRR capacity (SF and its predecessor frameworks and conventions); Objective of SF, the seven targets, the four priorities, SF Monitor process and the development of a national strategy and plan(s) for DRR related to SDGs 1, 11 and 13; Overview of Systemic Risk -the multidimensional nature of risk with a systemic approach; Target G Global indicators and custom indicators.

Module 3: Multi-Hazard Early Warning Systems

Mr. Rodney Martinez, Representative for North America, Central America, and the Caribbean Member Services and Development Department WMO, presented Module 3 about the fundamentals of a MHEWS. He started by sharing his experience as part of the navy in Ecuador when the “Fenomeno El Niño” happened in 1998. The team was responsible to coordinate all the scientific institutions. They detected a warm water mass and informed the government 6 months in advance, however nothing happened in term of preparedness and impacts on lives and the Ecuadorian economy were high. The content of Module 3 is the following:

- Definition, history, function of EWS.
- Four key components of EWS:
  1. Disaster Risk Knowledge: Understanding Risk, inclusive of vulnerability, and resilience (including the influence of climate change, development, and other exacerbating factors)
  2. Detecting, Monitoring, Analysis, and Forecasting of Hazards and Possible Consequences: Detection, analysis, monitoring, forecasting capabilities, and how opportunities for each of
these differ by hazard. The role of data and information.

3. Warning Dissemination and Communications: Communicating warning information

4. Preparedness and Response Capabilities (in the context of how MHEWS inform these capabilities)

- Caribbean Regional Consortium.

Main Discussion Outcomes Mod. 1-3:

Participants were asked about the main challenges for MHEWS:

- Part of the population does not use official sources (MET, Hydro…) as main resources of information on meteorological hazards. E.g., in Guyana, indigenous communities use information based on traditional beliefs - how the moon appears, how a specific bird pass.

- Lack of baseline data (raised by representatives of Cayman Islands, Suriname). “If there is a lack of accurate data, you don’t understand the risk and you can’t plan in advance”.

- Lack of proper communication/misinformation:
  
  - Some of the population use incorrect information. There is a lot of information in good graphics or videos, but the quality needs to be considered since instead of using national official data, they are based on international sources not accurate for the islands. Need to empower local institutions to better communicate national information so they are able to compete with these nice graphs and videos.
  
  - Part of the population don’t understand the messages displayed. Need for public education to understand the information displayed.
  
  - Official information is not reaching the most vulnerable communities. Need to empower community leaders (churches, associations, etc.) to communicate the risks to the communities. The Dominican Republic uses a community net where these leaders are informed by the government, so they inform the communities to activate the response. Media is engaged too.

Session 4 - Linking Systemic Risks and MHEWS, by Dr. Roger S. Pulwarty, Senior Scientist in the NOAA Physical Sciences Laboratory at the NOAA Office of Oceans and Atmospheric Research.

Four key components of EWS: (i) Disaster Risk Knowledge; (ii) Detecting, Monitoring, Analysis, and Forecasting of Hazards and Possible Consequences; (iii) Warning Dissemination and Communications; (iv) Preparedness and Response Capabilities.

- Need to make the link between DRR and CCA most effectively. Still only half of the 193
Members of WMO have MHEWS systems in place.

- Systemic risk (first codified by the GAR report in 2019) concept needed to understand and manage the interdependent and multi-dimensional variables of risk that are created by and magnified among different systems as they interact across geographic scales. For example, during hurricane Harvey, the big impact was not the winds on the water, but the water hitting toxic waste dumps that then released into drinking water.

- Need to think about EWS in a broader context -global network, cascading risks. The history of great powers, the role of tourism, the import of oil and other sources, migration, droughts, food insecurity,... risk drivers and new dynamics critically for the Caribbean.

- Investing $1 saves four to seven lives in the future, but still, we aren’t doing it. Possible reasons behind: Rational trust vs affinitive trust: Changing minds is not easy, since data and facts are not enough (rational trust). We trust people that have our interest in heart (affinitive trust).

**Main Discussion Outcomes session 4**

- Need a better DRR coordination between stakeholders and mechanisms outside the control of the government, that transcend the political term. A mechanism that takes into account other key stakeholders – opposition, and other interest groups.

- Importance of good governance. For example, during the eruption of la Soufriere volcano in St. Vincent and the Grenadines, the Prime Minister hosted a daily program with chief scientist and heads of different sectors to communicate accurate information to society, creating the enabling environment to warn out the population.

- Importance of linking policy and data. Many governments need to invest in good quality data, environmental data, metadata, and train people on understanding the data.

**Module 4. Evaluating MHEWS: Focus on Governance**, by Dr. Jair Torres (UNDRR).

- Overview of the governance structures and systems that are established to enable MHEWS. Global and Custom Indicators enable monitoring and evaluation of implementation for Sendai Framework Target G.

- Seven (7) governance-focused indicators in the context of early warning governance and not in an individual, sequential manner.

- Planning for multi-hazard early warning capacity (including strategic plans, statutory authorities, government budgets, science and technology policies, and other governance structures).

- Assignment of early warning roles and responsibilities, of entities and individuals.

- Governance and institutional arrangements of early warning data and operations, including stakeholder coordination, data and information management, risk assessment, hazard monitoring, event notification, and others.

- Collaboration on early warnings, including mutual aid and other types of agreements, and bi/multilateral cooperation.

- Inclusion in the governance and engagement processes, including (but not limited to) gender.

**Exercise Mod. 4 - EWS governance**: Divided into working groups, participants discussed the aspects of governance that might have helped to ensure ample early warning occurred on this island prior to an event overtaking the village and neighboring villages:

- Context: (i) Small archipelago island country; (ii) District alone has warning authority; (iii) District alone controls sirens; (iv) Very little local coordination.

- Event: (i) Nighttime wildfire; (ii) Fast-moving event; (iii) Communication disrupted; (iv) Power disrupted; (v) No district warning received; (vi) Fire spreading to nearby villages.

Below are the main problems highlighted by participants.
• Lack of recognition of the risk.

• Lack of empowerment at the local level. Local government was never empowered to make these kinds of decisions. Sometimes only one person has the “right” to make the decision, if this person does not take it, everything fails. Need to empower persons below and delegate authority. Lack of legislation at the local level -there should have been a mandate that allows local authorities to be able to implement and activate a plan. Need to identify roles and responsibilities.

• Lack of coordination. Need to have intercommunity coordination.

• Failure of communication: should have been an alternative source of communication, redundant communication systems, call trees. Need to have contingency plans to trigger the notification system.

• Lack of a structured plan. There should have been a plan tested to see how solid it was.

• Lack of identification of the vulnerable groups.

Module 5. Evaluating MHEWS: Focus on Disaster Risk Knowledge, by Carlos Uribe (UNDRR)

• Overview of risk assessment including vulnerability, coping capacities, and hazard exposure. Capacities need to exist accessible, complete, accurate, and usable data to support risk assessment processes at each administrative level of government.

• Eleven (11) disaster risk knowledge-focused indicators in the context of establishing disaster risk knowledge and informing early warning processes and stakeholder communities, rather than in an individual, sequential manner for each custom indicator.

• Gathering data to effectively measure hazard risk.

• Event modeling, including cascading and simultaneous hazard events, disaster damage and loss data, impact analysis, and climate risk projections.

• Consequence analysis.

• Vulnerability and its role in consequence analysis.

• Mapping hazard risk.

• Using risk assessment to support early warning.

Main Discussion Outcomes Mod.5

• Some participants shared confusion about the way of calculation of certain indicators (in particular Custom Indicator 2.5: Population Vulnerability Assessment – 1 Yes, 0 No). Facilitators shared that the indicators could be adapted and contextualized depending on the availability of information or the nature of the EWS.

• Andria Grosvenor (CDEMA), part of the experts committee creating the indicators, explained that on the qualitative indicators, (yes/no) countries can be in between, in terms of having some elements or not (Yes fully or yes partial). The “yes partial” would allow to identify those elements that the country does have and does not have and show the progress over time.

DAY 2:

Module 6: Evaluating MHEWS: Focus on Detection, Monitoring, Analysis and Forecasting, by Rodney Martinez (WMO)

• Overview of the operational aspects of early warning, inclusive of detecting hazard events before or when they are happening, monitoring the situation as it develops, analyzing risk data associated with the developing situation, and forecasting hazardous conditions and/or damaging effects.

• Seven (7) DMAF-focused indicators in the context of four functions – detection, monitoring, analysis, and forecasting - rather than in an individual, sequential manner for each custom indicator.
• The technical, technological, institutional, informational, and other requirements of effective hazard monitoring, detection, analysis and forecasting at the national, subnational, and local levels
• Translating the output of hazard monitoring and detection efforts into operational awareness and forecasting.
• The existence and resilience of early warning system infrastructure.

Main Discussion Outcomes Mod.6
• An EWS become nonfunctional when it does not generate a response.
• A participant from ICG-Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean explained that in the region, tsunami warning systems are not capable to detect tsunamis not caused by earthquakes. Also, in the region, the sea level network is not what it should -need of more expensive stations. In Costa Rica, sea level gauges are managed but the sea corrupts and damages everything fast.
• Roles of tsunami warning: (i) National tsunami warning centers are technical entities capable of analyze all the data related with an event and define the threat level for the country; (ii) Tsunami warning focal point are entities capable to receive a tsunami warning 24/7. There could be two entities or one entity doing both. In Costa Rica they are different, since the National tsunami warning center does not operate 24/7. The Tsunami warning focal point is the disaster management office.
• A participant from the Department of Disaster Management of Anguilla shared that this institution and the police are linked, so the police is able to send national warnings the same way as the Disaster Management office. Thus, the Tsunami warning focal point is the police station (24/7). Also, they have sirens set up in the country. In addition, every year the country participates in the CARIBE WAVE 22 Tsunami Exercise, as part of a public awareness campaign.
• Improve the capacity of the UWI seismic research center to bring it up to operate 24/7 implies high costs because it needs a team of resident geophysicist who could operate 24 seven and support staff. The problem is most of the Caribbean regions depends on the Pacific Tsunami Center to provide warning guidance.
• The region relies a lot on internet instead of using the Global Communication System (GCS) to provide warning guidance – the MET offices have the capacity but some of them not using it but relying on internet.
• In the DR, they have different redundant ways of communication (radio, secondary forecast center, etc.). The country has developed an EWS using a platform owned by the private sector; the government with the three large telecommunications companies have a plan to recover communication in times of emergencies. In case of collapse, they can reconnect in five minutes. The private sector share the warning SMS messages in certain sectors and regions, particularly in the touristy areas and translates these messages into English, German and French. Also, the DR conducted a drill at a national level with 3.5 million people participating in 2021.

Module 7. Evaluating MHEWS: Focus on Dissemination and Communication, by Jair Torres (UNDRR)
• Overview of alert and warning dissemination and communication. Early warning and forecasting data are of little value if disaster risk managers lack the means and capabilities to transmit that data to potentially-impacted populations.
• Risk communication topics critical to early warning capabilities.
• Fourteen (14) early warning Dissemination and Communication-focused indicators in the context of risk communication.
• The organizational and decision-making processes that enable effective communication of
early warning messages.

- The different risk communication stakeholders, including public information officers; political or social leaders; the news media; social media; and others.
- Connecting with early warning audiences, including proper channels and methods, feedback mechanisms, coverage and reach, and other dissemination factors.
- Improving the reliability and effectiveness of warning systems and messages, including accessibility and inclusion in early warning messaging.
- Establishing and maintaining early warning communication standards and protocols.

**Main discussion outcomes Mod.7**

- Andria Grosvenor (CDEMA) shared the importance of awareness campaigns. CDEMA's awareness campaign (*disaster fighters*) funded through the European Union and the World Bank used influencers -cricket players, musicians- to build the awareness during the hurricane season with a catchy jingle, and information messages at the time of the warning. Effectiveness in terms of population reached across the region was significant.
- Some participants pointed out the relevance of having representatives from the statistical offices in the workshop since data is key for EWS.

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**Module 8. Evaluating MHEWS: Focus on Preparedness and Response**, by Carlos Uribe (UNDRR)

- Overview of the preparedness and response factors that enable early warning messages to be translated into disaster risk reduction and more effective consequence management. Disaster risk management stakeholders and the public must both possess the skills, knowledge, and resources to act appropriately when warning messages are received, in terms of evaluating Target G coping capacities.
- Fourteen (14) Preparedness and Response-focused indicators in the context of risk communication rather.
- The incorporation of early warning procedures, responsibilities, inputs, and outputs are integrated in disaster response and recovery plans.
- National and subnational preparedness measures to most effectively act on warning information received.
- Community-based early warning systems and disaster risk management.
• Preparedness education, including the measuring of public knowledge and risk perception, the integration of response action into the educational curriculum, and the conduct of drills and exercises.

• Capturing and using information generated during disaster response and recovery to update and otherwise improve early warning systems.

Main Discussion Outcomes Mod. 8

Examples of preparedness activities:

• A participant from the National Emergency Management Agency of SKN shared that encourage the target audience group to become the leader is key. When you give the message groups are passive, whereas if you empower a specific group, it triggers a behavioral change. The country has defined each month defined by a hazard (tsunami, hurricane, etc.). School based to business-based campaigns, so these groups become messengers among families and colleagues. Key messages can go through music to appeal a bigger audience.

• A participant from the Department of Disaster Management of Anguilla shared different preparedness activities: coloring disaster books in kindergarten and preschool, children taking part in the Caribbean wave exercise, local singers creating a song for awareness, Campaign BBB “Be aware, Be informed, Be prepared”, jingles, PSA, among others.

Outcomes of working groups

Exercise 1, related to the Custom Proposed Indicators: Divided into working groups per country, participants discussed if the proposed indicators help to measure the progress on implementing Target G and their effectiveness.

Exercise 2, related to MET, NDMO and Statistics Office working better in MHEWS in the country: Divided into working groups per country, participants discussed how they can better work together (MET, NDMO and Statistics Office) to help ensure that MHEWS are linked to how different sectors assess, manage and reduce their risk, as well as the partnerships needed to ensure this.

Below are the main problems highlighted by participants:

Regarding exercise 1, most of the participants agreed that customs indicators were appropriate and will help to achieve the outcomes outlined under target G. However, some points were raised:

• Measurement scale, 0 or 1 seems a bit confusing in some cases.

• Clear indicator(s) to measure the adequacy of resource allocation/commitments for MHEWS.

• Unclear measures to reach the population.

Some participants shared as one of the main challenges for effective MHEWS, the lack of communication among the key stakeholders reunited in the room (Disaster Management offices, MET and National Stats offices, among others) -working in silos. Also, the lack of coordination among institutions; lack of linkages with SDGs or development plans.
One of the groups, composed by MHEWS Regional Group (ACS, CARIBE-EWS, CARDI, CARPHA, CDEMA, CIMH, CMO, IFRC, SRC, UWI), replied the following regarding Custom Proposed Indicators (exercise 1):

The indicators are generally considered wide-ranging and comprehensive. Although there are areas for enhancement:

- Some of the indicators may be subjective.
- Some Yes/No indicators may be too absolute - “trick questions” e.g., Indicator #4.4, #2.5. The response will most often be No. Proposed restructuring for example on measures to reach the population.
- Suggest addition of a third option for the Yes/No indicators to include Yes/Partial/No. This can capture areas of progress and highlight areas which can be improved.
- There are currently 42 indicators identified. Previously there were approximately six (6) indicators for Target (g) before.
- Challenges with consistent monitoring and reporting on the indicators were identified before. What added value will the number of indicators bring?
  - **Note** the process for monitoring and evaluating may be onerous for small states as this is not the only evaluation framework required.
  - **Also note** dedicated resources may be required.
  - **Consider** what support may be available to countries.
  - **Note** using consultants may not necessarily build the capacity of states.
  - **Also note** more refinement in measurement and clarity is required for some indicators.
- Indicators should be prioritized. Use of good proxy indicators that will provide a good measure of progress in the five (5) areas is encouraged.
- The development/identification of the proxy indicators should be undertaken through the expert group. Expand the expert group and link to regional mechanisms for the Caribbean such as the Regional Early Warning System Consortium (REWSC).
- The measurement should provide a picture of the status of the countries as it related to MHEWS once they have monitored the progress.
Regarding the way MET, disaster management offices and Statistics Office can better work together (exercise 2):

- MHEWS should not be seen in isolation. Should be considered as a part of national development and hence a sustainable development viewpoint.
  - MHEWS monitoring should be mainstreamed.
  - How do we better engage all key sectors in this context and ensure their coordination?
  - Role of Ministry of Planning/Ministry of Finance and Economic Development should be explored.
  - MHEWS -> National Development Plans -> CDM Strategy - >SFDRR

- MHEWS monitoring should be connected to national development plans and programs – e.g., Roof to Reef (Barbados), Ridge to Reef (Jamaica) etc.
  - The sector approach can often create silos, risk should be assessed on the system.
  - Encourage the promotion of systems thinking.

- Good practices regionally that can be replicated nationally can be considered:
  - EWISACTs consortium for design, development and delivery of climate products and services - MOUs between regional sectoral agencies to guide the development of early warning products and services
  - REWSC – brings together partners for all hazards

- Champions that foster intersectoral coordination are encouraged.

- Institutions responsible for other hazards should work together with MET, NDMO and Statistics: Seismic hazards (SRC/UNESCO IOC); Health related hazards (CARPHA); Water (CIMH, GWP-C, UNESCO IHP); Environmental hazards (UWI, REMPEITC)

- Encourage private-public partnerships.

- Tourism sector should be included for the Caribbean.

- The workshop has discussed the indicators in the context of the MHEWS Pillars. However, is effectiveness based on the current hazard experience adequately defined? Note the intersectionality of hazards experienced (systemic risks) in the region and dynamic experiences.

- Multi-hazard, concurrently occurring with cascading impacts.

See attachment 2 for all group outcomes (14 groups).

**Closing ceremony**

The workshop was closed by Jair Torres (UNDRR) who wrapped-up the course, thanked participants and introduced the speakers for closing remarks.

**Major General Retired Rodney Smart** (ODPM) thanked organizers for being dreamers of big dreams and encouraged participants to be prepare to implement everything learnt during the course.
Dr. Andria Grosvenor (CDEMA), acknowledged the importance of bringing together statistical offices, national disaster management organizations and MET offices. She emphasized the importance of implementing what was learnt during the course (custom indicators, MHEWS check list, etc.) and encouraged participants to work together. She pledged to continue the work done by the EWS consortium to the region. She thanked organizers (UNDRR, WMO) and T&T for being a great host.

Roger Pulgarty (NOAA), motivated participants to implement and stay connected through the funding mechanisms and partnerships, and to rely on the support of regional institutions “you have a lot to do and you have a lot to make the rest of us do”. He emphasized the importance of making the case to the UN that there is no climate change adaptation that occurs without effective disaster risk reduction.

Arlen Laing (CMO) lauded the cooperative spirit of participants, the connection forged in meetings like the workshop, from going to school together or training together or through living through disasters together. She encouraged participants to be ambassadors for everything experienced during the workshop.

Mr. Rodney Martínez (WMO) acknowledged the importance of bringing together the three institutions (statistical offices, disaster management organizations and MET offices) as a step to work together, breaking the silos and as an opportunity to reinvent the ways to do things and ensure what it is required in the region.

Carlos Uribe (UNDRR) thanked the Minister, General Smart, Anwar Baksh, and the ODPM, for making the dream possible, a dream that started two years ago writing a proposal to CREWS. Also, he acknowledged the importance of having the three institutions, the key stakeholders, as a step forward to work together. In 2018 during a workshop in Singapore, UNDRR brought together NEMOs, ministries of planning and finance and was a successful step that brought synergies and more collaboration.

Jair Torres (UNDRR) thanked participants, the three institutions and in particular, the regional offices (UIOC, UWI, CARPHA; CARDI, CDEMA, IRFC, etc.) for breaking the silos and working in a multi-faceted approach.

The workshop closed with music, where all participants were invited to dance the “Disaster fighters” song, similar to the closing of the VII Regional Platform for Disaster Risk Reduction in the Americas and the Caribbean (1-4 November 21), where Local Government and Rural Development Minister, Hon. Desmond McKenzie played a Bob Marley song for the closing.
Conclusions

The workshop increased the capacity and knowledge on MHEWS and the set of custom indicators to measure Effectiveness of EWS through Sendai Framework Target (g) among representatives of disaster management agencies, Regional and National Meteorological and Hydrological Services, and National Offices of Statistics of 22 Caribbean countries and overseas territories, as well as other regional agencies.

This workshop is part of the training package that contributes to implementing the joint UNDRR-WMO “Measuring Effectiveness of Early Warning Systems through Sendai Framework Monitoring” project with additional implementing support of the World Bank Global Facility for Disaster Reduction and Recovery (GFDRR). It aimed to strengthen the capacities of Caribbean countries to monitor and evaluate the progress of MHEWS and identify areas where further progress can be made. All participants are called to continue this learning process in order to expand knowledge, and to contribute to the implementation of work done on a daily basis.

Participants appreciated the exchange of experience, tools and approaches shared. Some of them summarized as key takeaways: “the opportunity to have a dialogue among the Met Services, the Disaster offices, and the Statistical offices is a major accomplishment” or “many things were learnt at the enlightening, educative and highly productive workshop and I do hope to work with the in-country colleagues to see how the knowledge gained could be taken further”.

The detailed agenda and participant list are available in annex.
<table>
<thead>
<tr>
<th>Time</th>
<th>Day 1 MHEWS &amp; IBF</th>
<th>Time</th>
<th>Day 2 MHEWS</th>
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<th>Day 3 MTR</th>
<th>Consultation for the MTR SF Caribbean thematic case of the MHEWS</th>
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<tr>
<td>08:00 – 08:30</td>
<td>Registration to the workshop</td>
<td>09:00 – 09:15</td>
<td>Day 1 Recap</td>
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<td>- ODPM, CDEMA, WMO, UNRC, UNDRR (ROAMC), Ministry of National Security</td>
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<td>09:30 – 10:00</td>
<td>Module 1. Introduction and Workshop Overview:</td>
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<td>10:00 – 10:45</td>
<td>Module 2. Sendai Framework Monitor: Global and Custom Indicators</td>
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<td>10:45 – 11:00</td>
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<td>12:00 – 12:30</td>
<td>Keynote: Linking Systemic Risk and MHEWS (NOAA)</td>
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<td>Presentation MTR SF process</td>
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<td>Module 4. Evaluating MHEWS:</td>
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<td>Module 5. Evaluating MHEWS:</td>
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<td>Presentation about the response to La Soufriere volcano eruption (SVG) - The Seismic Research Centre</td>
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<td>Module 5. Exercise</td>
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³ Only participants from Guyana and Trinidad and Tobago.
**Attachment 2: Final exercise outcome**

**Group 1 – DR and Curacao:**

Ex.1. **Custom Proposed Indicators:** We have not changed the indicators already provided. However, new indicators could be included:

- Public investment. Percentage of public investment allocated to the formulation and implementation of early warning systems on multiple threats.
- More assertive communication
- Monitoring
- Review of country regulations to understand and homogenized concepts in the region

Ex.2: How can MET, NDMO and Statistics Office better work together.

DR should include the National Stats office (ONE) in the early warning protocol of countries so that they have specific roles and functions. They must have a permanent link in the COE tables, such as a permanent coordination platform and tools to work together. Some of the functions could be: (i) Pull the data, (ii) Present annual statistics, statistical series; (iii) Support work on emergency or contingency plans; (iv) Support in the preparation of the institutional reports.

- ONE (Stats office) would collect the data and produce the statistics, ONAMET (MET) would provide the hydrometeorological information and the COE (Disaster Management office) would evaluate the events and issue the alerts.
- What partnerships may be needed to ensure this? A Memorandum of Understanding and Working agreements between institutions.

**Group 2 – Sint Maarten:**

Ex.2: How can MET, NDMO and Statistics Office better work together:

- St. Maarten is part of the Kingdom of the Netherlands and became a constituent country within the Kingdom as of 10-10-10. Warning previously via the Netherlands;
- EW is now a national responsibility and currently in development through the EU funding in collaboration with the UNDP;
- Action point of this initiative is a study to determine most suitable EWS taking several components into consideration such as cultural diversity (various languages), landscape (hills/mountains);
- Previously siren system, also being worked on is cell broadcast;
- Development of a governance structure with roles and responsibilities, protocols and SoP’s, communication plans;
- Hurricanes Irma and Maria, COVID lesson learned is the need for end-to-end system (linking of the various methods currently used= media, social media, government website, radio, television, speaker car).
- The main stakeholders do work together on the national level and assistance is provided at the Kingdom level as it necessitates.
- Sometimes the responsibilities are not clearly demarcated and as such there is the need for proper governance and legislation/SOPs
- Capacity is always a challenge in small territories thus there is the need to collaborate with different agencies to determine how resources can be shared e.g. How do we look at having a professional communicator coordinate the message from different entities?
- In the areas of Tsunami warning there is the need to finalize the responsibilities, the public can be clear which entity is responsible for disseminated the warnings

**Group 3 – Grenada:**
Ex.1: Custom Proposed Indicators:

- Does your country group consider that the proposed indicators will help to measure the progress on implementing Target G and their effectiveness? Yes, it would, but the Disaster Office is a coordinating body

- What’s Missing? (i) Legislation; (ii) Lead Agencies MOU/ Roles & Responsibilities; (iii) Specified dates for reporting (Monthly, quarterly, etc.); (iv) Equipment; (v) Human Resources; (vi) Training; (vii) Simplification of the reporting form

- What should not be there? Exercises is important but are expensive particularly for SID, no budgetary allocation. Particularly when you have to exercise for each hazard.

Ex.2: How you can better work together (MET, NDMO and Statistics Office)

- MOUs/SOPs
- What partnerships maybe needed to ensure this? Agriculture, Health, Ministry of Infrastructure, NAWASA, Grenlec, Ministry of Climate Resilience & the Environment

Group 4 – SVG:

Ex.1: Custom Proposed Indicators:

**Governance:** All customs indicators are appropriate and will help to achieve the outcomes outlined under target G: National Documents; National Disaster Management Act 2006; National Emergency Management Plan; Country Work Program (CWP 2022-2026); SVG EWS roadmap; National Economic and Social Development plan; CDM Policy.

Suggested custom indicators:

- More quantitative indicators that assess the effectiveness of the governance arrangements and allow for improvements of the system through the analysis of existing gaps.
- Data Exchange Agreement - Has limited information related to DRR and no mention of data sharing agreement at the policy level (1.3)
  - Verbal agreement exists between national agencies e.g., agreements and understanding for collaboration and data sharing among SVG met services, CWSA and NEMO.
  - Indicators should also measure the level of involvement of other vulnerable groups, differently-abled and the elderly. (1.5)

**Disaster Risk Knowledge**

- Indicator required to explicitly assess vulnerabilities at the micro-levels (Communities). (2.5)
- Indicator 2.2 - quantitative indicator required to identify gaps.
- We need to measure the process of translation into preparedness scenarios

**Detection, Monitoring, Analysis and Forecasting**

- All indicators are effective and sufficient to achieve the elements outlined in Target G
- Indicator is good for internal assessment and analysis of the system’s effectiveness, but the information is not necessary for public consumption. (3.4)

**Dissemination and Communication**

- All of the indicators are relevant
- Custom indicators should also consider assessing
- A need to measure the extent of participation in the disaster dissemination and communication framework. (4.1)
- Need to consider assessing the extent to which populations receive warning information (4.4)
- Test the effectiveness of the use of CAP for some hazards
Preparedness and Response: All custom indicators are appropriate and effective

Ex. 2: How you can better work together (MET, NDMO and Statistics Office):

- Clearly define collaboration & communication strategies in legal and policy framework
- Establish Inter-agency operational plans and MOUs
- Inter-agency training on the various components of the EWS – including all key stakeholders e.g., set-up of sector-specific EOCs and NEOCs training and exercises.
- Establish a multi-hazard emergency management Information/ Management system that is accessible to all sectors.
- Increase situational awareness through a common and share platforms

Group 5 – Suriname:

Ex. 1: Custom Proposed Indicators. What’s missing:

Suriname lacks Financial and human resources;

- a. Not enough people have technical skills regarding disaster knowledge. More training is needed at all levels and at the local level (villages) in different languages.
- b. There are not enough instruments to have better real time data available. Example. At that moment precipitation and temperature data is only measured at 3-5 stations in coastal area, and data for the rural is estimated from stations from French-Guyana. Also, maintenance is needed as parts of the exiting equipped are not proper and some need to be replaced.
- Also, Suriname is very vulnerable to sea level rise (80% of population live in coastal area), and up until now we do not collect data on Sea level rise or if it is collected is not real time data.
- More awareness is needed at schools etc. and in the media on how to identify measures and how to be prepared if there is a disaster.
- All the 5 indicators must be there, but there should also be data regarding the basic population data, by sex, age and location, to know the local characteristic e.g.: tradition, and people living in the interior. Take into account the vulnerability of the population.

Ex. 2. How you can better work together (MET, NDMO and Statistics Office):

- Strengthen the Collaboration between all the stakeholders.
- There is no National Statistical System. Need establishing it with focal points from government agency, where the NSO (Nation Stats office) could lead.
- Need to establish a Disaster Risk team with all the stakeholders who could help in a disaster, government, Police, Fire department, Telecommunication and media but also representative on a lower level -local authorities (village heads etc.).
- Install a free app application, where people could report if there a disaster.
- Train people in the metadata of the indicators and how to better collect data. Involve the NSO.

Group 6 – Turks and Caicos:

Ex.1: Custom Proposed Indicators:

Target G: Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030

- Does your country group consider that the proposed indicators will help to measure the progress on implementing Target G? Yes. The proposed indicators will provide some guidance on the areas that need attention in developing the MHEWS in our country.
- Anything missing? How do we consider/account for the illegal immigrant community in the event of an emergency?
Measure up based on the 5 components – ranked by best measured to worse:

1. **Dissemination and Communication**: relatively well. SMS, social media, DDME Alert App -warning messages, Emergency Media Group

2. **Preparedness and Response**: relatively well. Preparedness activities (8 Campaigns on different hazards -month/designated hazard); Training (Shelter Management, Disaster Assessment, Emergency Operations, Crisis Management); adequate building codes.

3. **Governance**: need to update some of the legislation. National Disaster Plan, National Disaster Management Structure and Operational Committees, need better engagement and collaboration with relevant departments and stakeholders.

4. **Disaster Risk Knowledge**: areas of attention: having a centralized platform for risk data, hazard event documentation.

5. **Detection, Monitoring, Analysis and Forecasting**: no weather observation network

Ex. 2: How you can better work together (MET, NDMO and Statistics Office)

- Need serious improvement in this area. Lack of communication and collaboration between the relevant agencies.
- Establish point persons/liaisons in each relevant department/agency assigned to be a part of a working group that ensures the development and efficiency of the MHEWS

**Group 7 – SKN:**

Ex. 1: Custom Proposed Indicators:

**Governance. What’s Effective?**

- There is strong collaboration between most response agencies (guided by National Disaster Plan, 2013).
- Tsunami SOP approved by cabinet 2021
- Disaster Management Act

**What’s Missing?**

- There is a need for mother intergovernmental coordination, with defined roles, guiding by legislation and enforcement.
- Built redundancy
- Need for a more all-inclusive approach of both public & private sectors coordinating.
- Emergency powers for Disaster Management needed.
- Centralized Data Repository with a database management system, that is accessible to all stakeholders.

**Disaster Risk Knowledge:**

- Lack of proper system to manage risk knowledge (lack of communication between disaster offices and entities to be affected).
- There is segmentation of risks, based on sectors.
- Use of ‘layman’ terms to educate general public on their risks

**Detection, Monitoring, Analysis & Forecasting:** Strong Multi-Hazard Monitoring systems & System exists to detect threats.

**What’s Missing?**

- Need for stronger forecasting.
- Better utilization of in-house capacity to forecast.
- Better analysis needed.
- Formalized post analysis & proper reporting post impact needed (SOP’s for post impact reporting).

Dissemination & Communication. What’s Missing?
- Communication Governance (message formation and packaging at all levels)
- Enhancement of all target audience, participatory approach.
- Need for CAP.

Preparedness & Response. What’s Missing?
- Need for budgetary allocations for preparedness activities & response.
- Need for Disaster preparedness, response & recovery budgetary allocation for different sectors.

Ex. 2: How you can better work together (MET, NDMO and Statistics Office)
- Better sharing of data across organizations and agencies via central data repositories.
- Better coordination amongst statistics and MET & NDMO’s & Statistics.
- What partnerships maybe needed to ensure this? All department responsible for collecting & analyzing data

Group 8 – Guyana:
Ex. 1: Custom Proposed Indicators:
Since Guyana just completed a MHEWS gap analysis, we feel as though the indicators will help greatly in measuring progress in MHEWS access for our people in Guyana and across the Region.

A few points to consider:
- Consider revisiting the measurement scale, 0 or 1 seems a bit confusing in some cases.
- Clear indicator(s) to measure the adequacy of resource allocation/commitments for MHEWS.
- For the benefit of our colleagues outside of disaster offices, it was suggested that we make clearer the alignment between the SDGs and the indicators, particularly at forums like these.

Ex. 2. How you can better work together (MET, NDMO and Statistics Office):
- Supportive legislation is required that mandates MHEWS actions, specify responsible parties.
- Operationalize, review and/or revamp the institutional arrangements for coordinating, monitoring and evaluating MHEWS. The EWS Sub-committee of the National Disaster Risk Management Coordinating Platform.
- Establish MoUs to strengthen public-private partnerships and partnerships with civil society, particularly, media, telecoms service providers, for all phases MHEWS.
- Scale up sustainable approaches for MHEWS dissemination and communication training and sensitization with media houses.
- Strengthen bilateral agreements and programs for data sharing, and impact-based forecasting. For example, this can tackle transboundary flooding between Guyana and Brazil. Oil spill should also be considered.
- Scale up and standardize scientifically sound and accepted risk assessment methodologies and modeling.
- Improve partnership the national disability commission for increased access to appropriate early warning for People Living With Disabilities (PLWDs).
- Ramp-up partnerships with Ministry of Finance, Local Government, Housing, etc. for strengthened national development strategies in alignment with Sendai priorities MHEWS.
- Assess the human resource needs across sectors for enhanced MHEWS implementation.
- Clear budgetary arrangements for MHEWS as part of DRR are required so as to better track resource allocations across sectors. E.g., a budget line for DRR.

Group 9 – T&T:
Ex.1: Custom Proposed Indicators:
Governance. Sufficient. What is missing?
- Mainstream and Integrate DRR within and across all sectors. (ongoing)
- Development of national and local frameworks (updating NRF)
- Adopting and implementing national and local DRR strategies and plans (Ongoing)
Disaster Risk Knowledge. What is missing?
- Technical resources available for conducting risk analysis.
- Financial resources for conducting risk analysis – mainly done through donor funding
- Hazards Maps for tsunamis
- Vulnerability assessment needs to be conducted at the community level.
- Men and women vulnerability not analyzed separately.
- Results of risk assessments not integrated into local risk management plans.
Detection, Monitoring, Analysis and Forecasting. What is missing?
- Systems exist for most priority hazards.
- No tsunami forecasting system – reliance on the PTWC
- Institutional arrangements and mechanisms not implemented across all sectors and levels.
- Monitoring and metadata not accessible for verification
Dissemination and Communication
- Hydro-Met alert and dissemination system in place - public and relevant stakeholders
- Tsunami Protocol is in draft stage
- Exercises to improve Inter-Agency collaboration for response to hazard alerts
Preparedness and Response
- Response plans are developed however they require updating
- Resource and capability gaps identified before hurricane season
- Drills and exercises conducted with first responders and the community utilizing EWS
- Work is required on multi-hazard risk assessments to support evacuation strategies
- Public awareness strategies and programs require more active participation from the general public

Ex. 2. How you can better work together (MET, NDMO and Statistics Office). Suggestions:
- MOU with CSO
- Documented MOU with TTMS
- Ministry of Health can provide relevant statistical data
- Coordinating committee to develop efficient collaboration – identification of clear roles and responsibilities.

Group 10 – MHEWS Regional Group (ACS, CARIBE-EWS, CARDI, CARPHA, CDEMA, CIMH, CMO, IFRC, SRC, UWI):
Ex.1: Custom Proposed Indicators:
GENERAL: The indicators are generally considered wide-ranging and comprehensive.

AREAS FOR ENHANCEMENT

- Some of the indicators may be subjective
- Some Yes/No indicators may be too absolute - “trick questions” e.g., Indicator #4.4. #2.5. The response will most often be No
  - Proposed restructuring for example on measures to reach the population
- Suggest addition of a third option for the Yes/No indicators to include Yes/Partial/No. This can capture areas of progress and highlight areas which can be improved.
- There are currently 42 indicators identified. Previously there were approximately six (6) indicators for Target (g) before.
- Challenges with consistent monitoring and reporting on the indicators were identified before. What added value will the number of indicators bring?
  - Note the process for monitoring and evaluating may be onerous for small states as this is not the only evaluation framework required.
  - Also note dedicated resources may be required.
  - Consider what support may be available to countries.
  - Note using consultants may not necessarily build the capacity of states.
  - Also note more refinement in measurement and clarity is required for some indicators.
- Indicators should be prioritized. Use of good proxy indicators that will provide a good measure of progress in the five (5) areas is encouraged.
- The development/identification of the proxy indicators should be undertaken through the expert group. Expand the expert group and link to regional mechanisms for the Caribbean such as the Regional Early Warning System Consortium (REWSC).
- The measurement should provide a picture of the status of the countries as it related to MHEWS once they have monitored the progress.

Ex. 2. How you can better work together (MET, NDMO and Statistics Office).

- MHEWS should not be seen in isolation. Should be considered as a part of national development and hence a sustainable development viewpoint.
  - MHEWS monitoring should be mainstreamed
  - How do we better engage all key sectors in this context and ensure their coordination?
  - Role of Ministry of Planning/Ministry of Finance and Economic Development should be explored.
  - MHEWS -> National Development Plans --> CDM Strategy - >SFDRR
- MHEWS monitoring should be connected to national development plans and programs – e.g., Roof to Reef (Barbados), Ridge to Reef (Jamaica) etc.
  - The sector approach can often create silos, risk should be assessed on the system.
  - Encourage the promotion of systems thinking.
- Good practices regionally that can be replicated nationally can be considered:
  - EWISACTs consortium for design, development and delivery of climate products and services - MOUs between regional sectoral agencies to guide the development of early warning products and services
  - REWSC – brings together partners for all hazards
- Champions that foster intersectoral coordination are encouraged.
Institutions responsible for other hazards should work together with MET, NDMO and Statistics

- Seismic hazards (SRC/UNESCO IOC)
- Health related hazards (CARPHA)
- Water (CIMH, GWP-C, UNESCO IHP)
- Environmental hazards (UWI, REMPEITC)

Encourage private-public partnerships

Tourism sector should be included for the Caribbean

The workshop has discussed the indicators in the context of the MHEWS Pillars. However, is effectiveness based on the current hazard experience adequately defined?

- Note the intersectionality of hazards experienced (systemic risks) in the region and dynamic experiences
- Multi-hazard, concurrently occurring with cascading impacts

Group 11 – Saint Lucia:

Ex.1: Custom Proposed Indicators:

**Governance:**

At the National Level

- An Early Warning System Governance Structure in Draft coming out of the Roadmap for St. Lucia in 2018 and the Early Warning Systems Policy
- Involves the Agencies responsible for Flood and drought. Will be expanded to include other agencies
- The policy takes into consideration gender, vulnerable populations and economic inequalities.

At the local level

- Community based groups responsible for early warning systems guided by plans and procedures provided by national body.
- These groups are equipped with the necessary equipment and infrastructure
- St. Lucia Met Office is the only legal authority which is able to advice the Prime Minister on the declaration of a national drought

Gaps

- Review and updating of risk data last update was doing in 2014.

**Disaster Risk knowledge**

- Existing Hazard vulnerability study exists for some communities.

Gaps

- There are a number of gaps which need to be filled to help up get up to speed.
- Little communication and collaboration between agencies

**Detection, Monitoring, Analysis and Forecasting**

- The Met service is open round the clock for consistent monitoring. They are the focal point for detecting Tsunamis, hurricanes,
- We have specifications for each hazard along with hardware and software. Maintenance is an issue because of high operational costs and resources.

Gaps

- Data collection is weak due to lacking scientific resources and equipment
Dissemination and Communication
- Common Alerting Protocol (CAP)
- Awareness and drills at school halted because of Covid but will continue
- Social media
- Alliance with the local media and local celebrities
- PSAs are aired on various disasters
- Focus Group/town hall meetings
- Radio Broadcast interrupt
- Gaps: Some studies are not published which results in duplicated efforts

Preparedness and Response
- Multi-hazard Sirens (in four communities) funding is being sourced for additional vulnerable communities
- Town Criers
- Response plans for every possible hazard

Gaps
- Little awareness where the public is concerned

Ex.2
- Statistics can work with NEMO to help develop Risk profiles at the community level. Helping to identify location of vulnerable populations.
- District statistics officer can be incorporated into the DDMC

Group 12 – Anguilla:
Ex.1: Custom Proposed Indicators:
- Yes, the proposed indicators will help to monitor the progress we are making, but only after the checklist has been undertaken
- What’s missing – We need assistance to implement the checklist to inform of our current position and use it to move forward.
- I think all the components are needed.
- Our current National Disaster Management Committee structure speaks to linkages for a MHEWS. In real time this does not happen on a consistent basis.
- We still work in Silo’s until an event happens and we work together and then break apart again until the next time.
- Partnerships across
  - The existing DM mechanism
  - Ministries and Departments
  - Utilities
  - Public

In a more cohesive and sustainable way

Retrospective Review 2015 to date
- Q1 – Most relevant
  - Monitoring and Warning – collaborating with neighboring islands SXM/SKN/ANU
  - Dissemination & Education – targeted campaigns 3Bs/CLASP/4Ps
Response Capability – need investment in training

Why?
It will give us credibility among the public and possibly aid in getting reliable information to persons in a timely manner.

Social media – Facebook, Instagram, TikTok
Partner with the Youth Parliament/Youth Ambassadors to couch the message to young people.

Instagram followers/influencers
Bring the message to a personal level

Q2
The Anguilla Warning System (AWS) was set up in 2007 and is a CAP based system.

CAP is designed for "all-hazards" (addressing weather events, earthquakes, tsunami, volcanoes, public health, power outages, etc.) and for "all-media" (addressing communications media such as sirens, cell phones, faxes, radio, television, and various other digital communication networks including the Internet) through common standards on category of hazard, alert level, etc.

CAP is the glue that holds all the pieces of the Anguilla Warning System together. The use of a CAP backbone allows for the integration of multiple and diverse technologies into the Anguilla Warning System as illustrated here

- Q5 – Becoming Tsunami Ready and changing our shelter policy to accommodate Shelters in the TEZ
- Q6 – Not really the advice from DDM is falling on deaf ears as the budget is needed for other immediate things, not for What-If's
- Q7 – We will plod along unless the British Government perceives a threat and holds our government’s hand to the fire.
- Q8 – Opportunities would be investment in the technology to do the transition
- Q9 – Challenges – political will to invest
- Q10 – yes, the political will barring any hazard events in the interim
- Q11 – utilizing the existing mechanisms, bringing MET under GoA
- Q12 – Performing the checklist with assistance. Although we would say in-house, often the voice from outside holds more weight.

Allocating a budget to the National Disaster Management Committee (NDMC) to allow for exercising and awareness building

Group 13 – Cayman Islands:

Ex.1: Custom Proposed Indicators:

Taking into account the 5 components:

1. Governance
   - Strategy has been agreed by all stakeholders
   - The Cayman Island has enacted the Disaster Preparedness and Hazard Management Act which includes a dedicated disaster response fund. During an activation Government can requisition all Government assets and building and redeploy non critical Government workers as needed. Also, evacuation zones can be announced
The highest levels of Government are embedded into the National Response Mechanism in the National Hazard Management Executive (Governor, Premier, Attorney General, Minister of Finance etc.)

Agreements between agencies are strong and good (Mechanism is well established)

Standardized processes SOPs in the National Hazard Management Plan

The data we have is updated however a large amount of Risk Data is lacking for example: tsunami wave run up, storm surge, storm driven waves, detailed flood mapping, ground speed acceleration data

Cross border exchanges with neighboring countries – the tsunami notification from the PTWC could be improved by a robot call system – email is not dependably checked in a timely way

We don’t currently use CAP

Taking into account the 5 components:

2. Disaster Risk Knowledge

- Key hazards and threats are identified however our knowledge of exposure is again limited by lack of risk data analysis
- More work could be done to make climate change risks more specifics to Cayman
- Roles and responsibilities are good
- Risk Info consolidated – yes on the National Disaster Management Office Website
- The message of risk info is properly incorporated into our EWS systems

3. Detection, Monitoring, Analysis and Forecasting

- Detection and monitoring are good in many respects however there are some areas that need improvement
- Lacking the capacity to accurate detect and estimate storm surge, storm wave height and wave length, tsunami wave run up, air quality
- Some risk analysis is too basic to inform the planning and development process and, in some cases, inadequately to appropriately inform residents of threats so they can make informed public safety decisions. For example: limited scientific expertise and technical knowledge to accurate forecast storm surge in advance of an impact, same with wave heights, same with flood mapping. This lack of capacity prevents us from creating risk and vulnerability maps, and may impede the ability to issue evacuation orders.
- Event forecasting – only some we can forecast – good at wind and rain forecasting - lacking in surge and waves. Also, rainfall info is not specifically impacted based because it is not directly linked to geographical information systems which would provide more detailed info about locational flooding.

4. Dissemination and Communication

- Our communications capacity is very strong. All media persons and EOC personnel are in grouped email and WhatsApp groups
- We have significant penetration on social media and with our website. All first response agencies can speak to one another and to the NEOC through the Ultra High Frequency (UHF) Motorola Radio System
- We have training programs and public awareness for schools, Government agencies and the business community. Tips on the radio station at the frequency of 100 per day
- We have a national emergency notification system which include the ability to interrupt all radio stations simultaneously. We have an Emergency Notification / Alert App
During an activation a cross section of Government Communicators join to form the Joint Communications Services which is the single clear voice of Government.

Women are well considered in our communications and disaster response mechanism. We want to add a Cell Broadcast System to reach all handsets in range of cell towers including tourists, and that will allow us to be more geo specific and geo locate.

5. Preparedness and Response

- The Cayman Islands has a strong preparedness program that includes a very comprehensive public awareness program for priority hazards, training for first response agencies and shelter manager and a robust exercise regime.
- The structure of the national response is well established and exercised for a range of hazards.
- The National Hazard Plan which includes hazard specific sub plans (for example Hurricane / Tsunami etc.) is updated annually to incorporate lessons learned from exercises and actual activations.
- All Government agencies are required to file a continuity of operations plan each year detailing how they will continue or quickly resume their critical functions.
- The EOC includes 18 emergency response teams (For example ESO leads the Damage and Economic EST), the Policy Policy Group and National Hazard Management Executive which includes the highest levels of Government.

Ex. 2

How you can better work together?

- We work together well. For example, ESO is embedded in our NEOC and was vital in the Pandemic response.
- In terms of embedding the different sectors they are also embedded in our NEOC for example agriculture, tourism and private sector generally are all built into our comprehensive disaster response mechanism.

What partnerships maybe needed to ensure this?

- Partnerships are generally very good.

Group 14 – Dominica:

Ex. 1: Custom Proposed Indicators:

I think the proposed indicators are adequate and they cover all that I can think of and all play a role in the implementation of an effective MHEWS. Some of which are or can be broken down such as communication which can be broken down into before, during and after an event or without any event at all. All indicators should be there as they are all valid and relevant to MHEWS.

Ex. 2

- How you can better work together (MET, NDMO and Statistics Office) to help ensure that MHEWS are linked to how different sectors assess, manage and reduce their risk?
- I think for us information and feedback from the sectors, legislation, MOUs and accountability would assist.
- What partnerships maybe needed to ensure this?

Budget and public investment, Trainings, workshops, drills, case studies from other countries where these partnerships work well to the benefit of saving lives and property in a timely manner.
## Attachment 3: List of Participants

<table>
<thead>
<tr>
<th>#</th>
<th>Country</th>
<th>Name and surname</th>
<th>Organization</th>
<th>Title</th>
<th>Comments</th>
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<tbody>
<tr>
<td>1</td>
<td>The Virgin Islands</td>
<td>Mr. Keon August</td>
<td>Department Of Disaster Preparedness</td>
<td>Emergency Communications Manager Ag</td>
<td>In-person participant</td>
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<tr>
<td>2</td>
<td>Barbados</td>
<td>Mr. Shawn Boyce</td>
<td>Caribbean Institute for Meteorology and Hydrology (CIMH)</td>
<td>Chief Hydrologist Caribbean Institute for Meteorology and Hydrology</td>
<td>In-person participant</td>
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<td>3</td>
<td>Barbados</td>
<td>Ms. Danielle Lisa Skeete</td>
<td>Department of Emergency Management’s (DEM)</td>
<td>Deputy Director (Ag)</td>
<td>In-person participant</td>
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<td>4</td>
<td>Commonwealth of Dominica</td>
<td>Mr. Marshall Alexander</td>
<td>Dominica Meteorological Service</td>
<td>Senior Meteorological Officer</td>
<td>In-person participant</td>
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<tr>
<td>5</td>
<td>Barbados</td>
<td>Ms. Chante Saunders</td>
<td>The University of the West Indies (UWI) - Disaster Risk Reduction Centre (DRRC)</td>
<td>Student and social Media Manager</td>
<td>In-person participant</td>
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<td>6</td>
<td>Tobago (T&amp;T)</td>
<td>Mrs. Carolyn De Coteau</td>
<td>Trinidad and Tobago Meteorological Service</td>
<td>Meteorologist I (Crown Point Meteorological Office, Tobago)</td>
<td>In-person participant</td>
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<td>7</td>
<td>Tobago (T&amp;T)</td>
<td>Mr. Bobby Andrews</td>
<td>Department of Planning - THA)</td>
<td>Director</td>
<td>In-person participant</td>
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<td>8</td>
<td>Jamaica</td>
<td>Ms. Nikeisha Hibbert</td>
<td>Meteorological Service Division</td>
<td>Meteorologist</td>
<td>In-person participant</td>
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<td>Cayman Islands</td>
<td>Mr. Shamal Clarke</td>
<td>MET</td>
<td>Meteorologist</td>
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<td>10</td>
<td>Saint Lucia</td>
<td>Ms. Maria Medard</td>
<td>NEMO</td>
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<td>Ms. Vigil Saltibus</td>
<td>Saint Lucia Meteorological Services</td>
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<td>St. Kitts &amp; Nevis</td>
<td>Mr. Jacob Ngumbah</td>
<td>National Emergency Management Agency</td>
<td>Head of office Nevis</td>
<td>In-person participant</td>
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<tr>
<td>13</td>
<td>Dominican Republic</td>
<td>Mr. Carlos Paulino</td>
<td>NEMO</td>
<td>Sub. director del COE, Encargado de Planificación y Desarrollo Institucional</td>
<td>In-person participant</td>
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<td>Republic of Guyana</td>
<td>Ms. Allana Walters</td>
<td>Civil Defense Commission</td>
<td>Mitigation &amp; Recovery Unit</td>
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<td>15</td>
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<td>Ms. Susan Hodge</td>
<td>Department of Disaster Management</td>
<td>Programme Officer Community Outreach</td>
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<td>Ms. Twayna Thomas</td>
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<td>Antigua and Barbuda</td>
<td>Mr. Statchel Edwards</td>
<td>Statistics Division Ministry of Finance and Economy</td>
<td>Chief Statistician (Ag) Statistics Division</td>
<td>In-person participant</td>
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<td>Barbados</td>
<td>Mr. Brian Murray</td>
<td>Barbados Meteorological Services</td>
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<td>Cayman Islands</td>
<td>Mr. Simon Boxall</td>
<td>Hazard Management Cayman Islands</td>
<td>Public Awareness and media Relations Officer</td>
<td>In-person participant</td>
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<td>20</td>
<td>Curacao</td>
<td>Mr. Marshandy Luciano</td>
<td>National Meteorological Department of Curacao</td>
<td>Chief of Operation</td>
<td>In-person participant</td>
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<tr>
<td>21</td>
<td>Dominican Republic</td>
<td>Ms. Leidy Ivelisse Ventura</td>
<td>Oficina Nacional de Estadísticas (ONE)</td>
<td>Coordinadora Departamento de Estadísticas Ambientales</td>
<td>In-person participant</td>
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<td>22</td>
<td>Dominican Republic</td>
<td>Mr. Jenuel Almonte</td>
<td>National Office of Meteorology</td>
<td>Meteorologist and WMO Expert Team on Hydrological Infrastructure</td>
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<td>23</td>
<td>Grenada</td>
<td>Ms. Tonya Hyacinth</td>
<td>National Disaster Management Agency (NaDMA)</td>
<td>Deputy Disaster Coordinator (Ag.)</td>
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<td>Ms. Trisha Miller</td>
<td>Meteorological Department Grenada Airports Authority</td>
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<td>Mr. Frank Grogan</td>
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<td>Saint Lucia</td>
<td>Ms. Sherma Small</td>
<td>Central Statistical Office</td>
<td>Statistical Assistant</td>
<td>In-person participant</td>
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<td>St. Kitts &amp; Nevis</td>
<td>Ms. Oureika Lennon Petty</td>
<td>National Emergency Management Agency</td>
<td>Planning Officer</td>
<td>In-person participant</td>
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<td>Mr. Elmo Burke</td>
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<td>St. Vincent &amp; the Grenadines</td>
<td>Ms. Lavorne Williams</td>
<td>Statistical Office Central Planning Division Ministry of Finance, Planning and Economic Development</td>
<td>Chief Statistical Office</td>
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<td>St. Vincent &amp; the Grenadines</td>
<td>Mr. Kenson Stoddard</td>
<td>NEMO</td>
<td>Deputy Director at NEMO</td>
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<td>St. Vincent &amp; the Grenadines</td>
<td>Mr. Billy Jeffers</td>
<td>MET</td>
<td>Manager Meteorological Services</td>
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<td>32</td>
<td>Sint Maarten</td>
<td>Ms. Angelique Gumbs</td>
<td>Department of The Interior and Kingdom Relations</td>
<td>Manager</td>
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<tr>
<td>33</td>
<td>Sint Maarten</td>
<td>Mr. Joseph Nathaniel Isaac</td>
<td>Meteorological department St Maarten</td>
<td>Head</td>
<td>In-person participant</td>
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<td>Suriname</td>
<td>Mrs. Anjali De Abreu-Kisoensing</td>
<td>General Bureau of Statistics</td>
<td>Environment Statistics and SDG focal point at the GBS</td>
<td>In-person participant</td>
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<td>Suriname</td>
<td>Mr. Dewnath Bhaggoe</td>
<td>Meteorological Service Suriname</td>
<td>Deputy director of research and innovation</td>
<td>In-person participant</td>
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<td>Turks &amp; Caicos Islands</td>
<td>Mr. Edward Hall</td>
<td>Department of Statistics</td>
<td>Policy Analyst from the Strategic Planning and Policy Department</td>
<td>In-person participant</td>
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<td>Turks &amp; Caicos Islands</td>
<td>Ms. Holly Hamilton</td>
<td>MET Director of Meteorology</td>
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<td>St. Vincent &amp; the Grenadines</td>
<td>Mr. Gregory Linton</td>
<td>Caribbean Agricultural Research and Development Institute (CARDI) team lead for Disaster and Risk Reduction</td>
<td>In-person participant</td>
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<td>Guyana</td>
<td>Mr. Temitope D. Timothy OYEDOTUN</td>
<td>Faculty of Earth and Environmental Sciences (FEES), University of Guyana (UG) Dean</td>
<td>In-person participant</td>
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<td>40</td>
<td>Costa Rica</td>
<td>Ms. Silvia Chacón-Barrantes</td>
<td>ICG-Intergovernmental Coordination Group Tsunami &amp; Other Coastal Hazards Warning System for the Caribbean &amp; Adjacent Regions /CARIBE-EWS Coordinator SINAMOT Program, Physics Department, Universidad Nacional</td>
<td>In-person participant</td>
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<td>Barbados</td>
<td>Mr. Jeremy Collymore</td>
<td>The University of the West Indies (UW) - Disaster Risk Reduction Centre (DRRC) DRM and Resilience Specialist and Honorary, Research Fellow, Institute of Sustainable Development, UWI</td>
<td>In-person participant</td>
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<td>Ms. Faustina Wiggins</td>
<td>CARICOM Environmental Statistician, Regional Statistics Programme</td>
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<td>Trinidad (T&amp;T)</td>
<td>Mr. Anwar Baksh</td>
<td>Office of Disaster Preparedness and Management Planning and Development Officer</td>
<td>In-person participant</td>
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<td>Jamaica</td>
<td>Mr. Horace Glaze</td>
<td>IFRC FRC’s Disaster Management Coordinator for the Dutch and English-Speaking Caribbean</td>
<td>In-person participant</td>
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<td>Barbados</td>
<td>Mr. Oswald Alleyne</td>
<td>UN Barbados Resident Coordinator Office Development Coordination Officer - Data, Monitoring and Reporting</td>
<td>In-person participant</td>
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<td>Trinidad (T&amp;T)</td>
<td>Mr. Tyrone Gopaul</td>
<td>Central Statistical Office Acting Senior Statistician, Agriculture Division</td>
<td>In-person participant</td>
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<td>Trinidad (T&amp;T)</td>
<td>Mr. Brett Lucas</td>
<td>Office of Disaster Preparedness and Management GIS Specialist</td>
<td>In-person participant</td>
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<td>Mr. Navindra Persad</td>
<td>Office of Disaster Preparedness and Management Regional Coordinator</td>
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<td>Mr. Lloyd Lynch</td>
<td>The University of the West Indies (UWI) - Seismic Research Centre</td>
<td>Research Fellow</td>
<td>In-person participant</td>
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<td>Trinidad (T&amp;T)</td>
<td>Mr. Haley Anderson</td>
<td>Caribbean Meteorological Organization (CMO)</td>
<td>Science and Technology Officer</td>
<td>In-person participant</td>
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<td>Trinidad (T&amp;T)</td>
<td>Dr Arlene Gioretta LAING</td>
<td>CMO</td>
<td>Coordinating Director</td>
<td>In-person participant</td>
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<td>Trinidad (T&amp;T)</td>
<td>Ms. Artie Dubrie</td>
<td>ECLAC</td>
<td>Coordinator, Sustainable Development and Disaster Unit</td>
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<td>Trinidad (T&amp;T)</td>
<td>Mr. Jônatas De Paula</td>
<td>ECLAC</td>
<td>Environmental Affairs Officer, Sustainable Development and Disaster Unit</td>
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<td>Trinidad (T&amp;T)</td>
<td>Ms. Vanita Redoy</td>
<td>IFRC</td>
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<td>Trinidad (T&amp;T)</td>
<td>Ms. Christal Benjamin</td>
<td>Association of Caribbean States (ACS)</td>
<td>Research Assistant</td>
<td>In-person participant</td>
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<td>56</td>
<td>Trinidad (T&amp;T)</td>
<td>Ms. Rosemary Lall</td>
<td>UNDP</td>
<td>Programme Officer Office of Energy, Environment and Disaster Management</td>
<td>In-person participant</td>
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<td>57</td>
<td>Trinidad (T&amp;T)</td>
<td>Mr. Peter Williams</td>
<td>Caribbean Public Health Agency (CARPHA)</td>
<td>Technical Officer, Infectious Diseases and Emergency Response</td>
<td>In-person and online participant</td>
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<tr>
<td>58</td>
<td>Trinidad (T&amp;T)</td>
<td>Ms. Angela Hinds</td>
<td>Caribbean Public Health Agency (CARPHA)</td>
<td>Head of the Health Information Communicable Disease</td>
<td>In-person and online participant</td>
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<td>Mrs. Paula Wellington</td>
<td>Trinidad and Tobago Meteorological Service</td>
<td>Meteorologist III (Ag) - Trinidad Meteorological Office</td>
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<td>Belize</td>
<td>Ms. Michelle Augustine</td>
<td>Belize Meteorological Services</td>
<td>Deputy Chief Meteorologist</td>
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<td>Republic of Guyana</td>
<td>Mr. Errol La Cruz</td>
<td>Bureau of Statistics</td>
<td>Chief Statistician</td>
<td>Online participant</td>
</tr>
<tr>
<td>62</td>
<td>St. Lucia</td>
<td>Ms. Josette Edward-Charlemagne</td>
<td>Climate Change &amp; Disaster Resilience Unit, Org. Eastern Caribbean States (OECS)</td>
<td>Programme Officer Climate Change &amp; Disaster Risk Management</td>
<td>Online participant</td>
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<td>Country</td>
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<td>Organization</td>
<td>Position</td>
<td>Role</td>
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<td>Barbados</td>
<td>Ms. Valerie Taylor</td>
<td>Barbados Statistical Service</td>
<td>Field Office/Liaison Officer</td>
<td>Online participant</td>
</tr>
<tr>
<td>64</td>
<td>Jamaica</td>
<td>Ms. Camille Beckford-Palmer</td>
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<td>Southern Regional Coordinator</td>
<td>Online participant</td>
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<td>65</td>
<td>Barbados</td>
<td>Ms. Nicole Greenidge</td>
<td>CDEMA</td>
<td>Disaster Risk Management Specialist</td>
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</tr>
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<td>66</td>
<td>Trinidad (T&amp;T)</td>
<td>Dr. Erouscilla Joseph</td>
<td>UWI Seismic Research Centre</td>
<td>Director</td>
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<td>67</td>
<td>Trinidad (T&amp;T)</td>
<td>Major General Retired Rodney Smart</td>
<td>Office of Disaster Preparedness and Management</td>
<td>Chief Executive Officer</td>
<td>Opening remarks</td>
</tr>
<tr>
<td>68</td>
<td>Trinidad (T&amp;T)</td>
<td>The Honourable Fitzgerald Hinds MP</td>
<td>Ministry of National Security</td>
<td>Minister</td>
<td>Opening remarks</td>
</tr>
<tr>
<td>69</td>
<td>Trinidad (T&amp;T)</td>
<td>Mr. Dennis Zulu</td>
<td>UN</td>
<td>Acting Resident Coordinator for Trinidad and Tobago, Suriname, Aruba, Curaçao and St. Maarten</td>
<td>Opening remarks</td>
</tr>
<tr>
<td>70</td>
<td>Barbados</td>
<td>Ms. Andria Grosvenor</td>
<td>CDEMA</td>
<td>Deputy Executive Director (ag)</td>
<td>Opening remarks</td>
</tr>
<tr>
<td>71</td>
<td>Panamá</td>
<td>Mr. Raul Salazar</td>
<td>UNDRR ROAMC</td>
<td>Head of office</td>
<td>Opening remarks</td>
</tr>
<tr>
<td>72</td>
<td>Costa Rica</td>
<td>Mr. Rodney Martinez</td>
<td>WMO</td>
<td>WMO Representative for North America, Central America, and the Caribbean</td>
<td>Opening remarks &amp; Facilitator</td>
</tr>
<tr>
<td>73</td>
<td>Panamá</td>
<td>Mr. Carlos Uribe</td>
<td>UNDRR ROAMC</td>
<td>Program Management Officer &amp; Workshop facilitator</td>
<td>Facilitator</td>
</tr>
<tr>
<td>74</td>
<td>France</td>
<td>Mr. Jair Torres</td>
<td>UNDP</td>
<td>Disaster Risk Reduction Advisor &amp; Workshop facilitator</td>
<td>Facilitator</td>
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<tr>
<td>75</td>
<td>USA</td>
<td>Mr. Roger Pulwarty</td>
<td>NOAA</td>
<td>Senior Scientist, Physical Sciences Laboratory at the NOAA Office of Oceans and Atmospheric Research &amp; Workshop facilitator</td>
<td>Facilitator</td>
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</table>
Attachment 4: Relevant materials

Modules 1-3. Introduction, Sendai Framework Monitor: Global and Custom Indicators and MHEWS:

- Instructor Guide
- Workshop Participant Guide
- Sendai Framework for Disaster Risk Reduction
- Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction
- Technical Guidance for Monitoring and Reporting on Progress in Achieving the Global Targets of the Sendai Framework for Disaster Risk Reduction
- GAR2019, Chapter 8
- Sendai Framework Monitoring System - Frequently Asked Questions (FAQs)
- CREWS MHEWS Custom Indicators and Methodologies for Computation
- WMO – Multi-Hazard Early Warning Systems: A Checklist
- WMO Poster – “WMO Global Operational Network in Support of Multi-Hazard Early Warning Systems”
- WMO - Guidelines on Multi-hazard Impact-based Forecast and Warning Services
- IFRC - Community Early Warning Systems: Guiding Principles
- WMO - Guidelines on the Definition and Monitoring of Extreme Weather and Climate Events
- WMO - Step-by-step Guidelines for Establishing a National Framework for Climate Services
- WMO – 2020 State of Climate Services: Risk Information and Early Warning Systems
- WMO – Guidelines on Early Warning Systems and Application of Nowcasting and Warning Operations
- Practical Action and Early Warning Systems
- ODI. 2019. The ‘Triple Dividend’ of Early Warning Systems: Evidence from Tanzania’s Coastal Areas

Module 4. Evaluating MHEWS: Focus on Governance

- Instructor Guide
- Workshop Participant Guide
- CREWS MHEWS Custom Indicators and Methodologies for Computation
- CREWS MHEWS Custom Indicators Computational Matrix
- All India Disaster Mitigation Institute. 2019. Trans-Boundary Early Warning Systems in Asia.

Module 5. Evaluating MHEWS: Focus on Disaster Risk Knowledge
• Instructor Guide
• Workshop Participant Guide
• Malteser International. 2015. Mapping of Stakeholders and Initiatives on Early Warning Systems in Myanmar.
• Shifting the Paradigm: Introducing the Global Risk Assessment Framework (GRAF)
• INFORM Report 2020: Shared Evidence for Managing Crises and Disasters

**Module 6: Evaluating MHEWS: Focus on Detection, Monitoring, Analysis and Forecasting**

• Instructor Guide
• Workshop Participant Guide
• WMO - Guidelines on Multi-hazard Impact-based Forecast and Warning Services

**Module 7. Evaluating MHEWS: Focus on Dissemination and Communication**

• Instructor Guide
• Workshop Participant Guide
• Twomlow, Anna, and Marianna Budimir. 2020. Visualization of Early Warning Information. SHEAR.

**Module 8. Evaluating MHEWS: Focus on Preparedness and Response**

• Instructor Guide
• Workshop Participant Guide
• Villagran de Leon, Juan Carlos, and Janos Bogardi. 2006. Early Warning Systems in the Context of Disaster Risk Management. [https://www.eird.org/cd/indm/documentos/46fad12d0a62e5.3 8742613.pdf](https://www.eird.org/cd/indm/documentos/46fad12d0a62e5.3 8742613.pdf).