



Training Workshop on Multi-Hazard Early Warning Systems with focus on Institutional Partnerships and Coordination

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Radisson Europa Hotel and Conference Center

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1. Background

1. Between 1980 and 2007, in North and Central America and the Caribbean (WMO Regional Association IV), nearly 91% of events, 70% of casualties and 91% of economic losses related to natural hazards were caused by meteorological-, hydrological- and climate-related hazards such as tropical cyclones and storm surges, floods, extreme temperature, and droughts (source: EM-DAT)¹. Globally, over the last 50 years, while economic losses linked to extreme hydro-meteorological events have increased by nearly 50 times, loss of life caused by these hazards has decreased significantly. This has been attributed to early warning systems, linking information from monitoring and forecasting of hydro-meteorological hazards to emergency preparedness and response, especially in some of the most vulnerable countries.
2. Effective early warning systems (EWS) have four components, including: (i) hazard detection, monitoring and forecasting; (ii) analyzing risks and incorporation of risk information in emergency planning and warnings; (iii) disseminating timely and “authoritative” warnings; and, (iv) community emergency planning and preparedness and the ability to activate emergency plans to prepare and respond, with coordination across agencies involved in EWS, at national to local levels; These four components need to be coordinated across many agencies at the national to local levels. Failure in one component or lack of coordination across them would lead to the failure of the whole system.
3. Over the past decade, there has been significant international attention to this topic, including three international EWS conferences (hosted by the government of Germany),² two international experts’ symposia on Multi-Hazard EWS (organized by the World Meteorological Organization – WMO in collaboration with UN-International Strategy for Disaster Reduction system partners),³ and the Global EWS Survey Report, requested by the former UN Secretary General, Kofi Annan, following the tragic 2004 tsunami in the Indian Ocean.⁴
4. Despite this attention, there remain many challenges on legislative, financial, institutional, technical and operational aspects at national to local levels to ensure that EWS are implemented as an integral part of disaster risk reduction strategies in all countries. Furthermore, development and sustainability of these systems nationally can be enhanced through regional cooperation among countries to share data, information and exchange know-how.
5. WMO in cooperation with other UN and international partners as well as its Members has developed a systematic process for documenting good practices in EWS. This has involved extensive consultations with EWS experts during two international symposia and various regional and national events. A standard template for documentation of good practices has been developed and used by countries to document their experiences consistently. To-date seven good practices have been documented through a multi-agency process: (i) Bangladesh Cyclone Preparedness Programme, (ii) Tropical Cyclone Early Warning System of Cuba, (iii) French Vigilance System, (iv) Shanghai Multi-Hazard Early Warning and Emergency Preparedness Programme v) Multi-Hazard Early Warning Systems in the USA: Institutional Coordination and Cooperation of the U.S. National Weather Service vi) The Warning Management of the Deutscher Wetterdienst and, vii) Multi-Hazard Early Warning System in

¹ EM-DAT is the database of Université Catholique de Louvain - Brussels – Belgium - The OFDA/CRED International Disaster Database - www.em-dat.net.

² References to the three international EWS Conferences:

- First International Conference on Early Warning (Potsdam, 1998) www.geomuseum.com/ewc98/
- Second International Conference on Early Warning (Bonn, 2003) www.ewc2.org/pg000001.htm
- Third International Conference on Early Warning (Bonn, 2006) (www.ewc3.org)

³ References to the two international Experts’ Symposia on Multi-Hazard EWS:

- First Experts’ Symposium on Multi-Hazard Early Warning Systems (Geneva, 2006) (www.wmo.int/pages/prog/drr/events/ews_symposium_2006)
- Second Experts’ Symposium on Multi-Hazard Early Warning Systems (Toulouse, 2009) (www.wmo.int/pages/prog/drr/events/MHEWS-II/index_en.html)

⁴ Global Early Warning Survey (2006) [www.reliefweb.int/rw/lib.nsf/db900sid/AMMF6VKH6Z/\\$file/UNISDR-Sep2006.pdf?openelement](http://www.reliefweb.int/rw/lib.nsf/db900sid/AMMF6VKH6Z/$file/UNISDR-Sep2006.pdf?openelement).

Japan.

6. A detailed synthesis of these good practices has revealed ten principles common to the implementation of all seven cases, irrespective of the political, social, and institutional factors in each country. However, it should be noted that specific design and implementation of the EWS vary across the countries, according to their specific history, culture, socio-economic conditions, institutional structure and capacities and available resources for sustainability of the system. These ten principals are:
 - i. There is a strong political recognition of EWS reflected in harmonized national to local disaster risk management policies, planning, legislation and government budgeting;
 - ii. Effective EWS are built upon four components: (i) hazard detection, monitoring and forecasting; (ii) analyzing risks and incorporation of risk information in emergency planning and warnings; (iii) disseminating timely and “authoritative” warnings; and, (iv) community emergency planning and preparedness and the ability to activate emergency plans to prepare and respond, with coordination across agencies involved in EWS, at national to local levels;
 - iii. EWS stakeholders are identified and their roles and responsibilities clearly defined and documented within the national to local plans, legislation, directives, MOUs, etc, including those of the technical agencies such as the National Meteorological and Hydrological Services;
 - iv. EWS capacities are supported by adequate resources (e.g., human, financial, equipment, infrastructure, etc.) across national to local levels and the system is designed and implemented, accounting for long-term sustainability factors;
 - v. Hazard, exposure and vulnerability information are used to carry-out risk assessments at different levels, as critical input into emergency planning and development of warning messages;
 - vi. Warning messages are, (i) clear, consistent and include risk information, (ii) designed with consideration for linking threat levels to emergency preparedness and response actions (e.g., using color, flags, etc) that are well-understood by the authorities and the population, (iii), issued from a single (or unified), recognized and “authoritative” source;
 - vii. Warning dissemination mechanisms are able to reach the authorities, other EWS stakeholders and the population at risk in a timely and reliable fashion;
 - viii. Emergency response plans are developed with consideration for hazard/risk levels, characteristics of the exposed communities (e.g., urban, rural, ethnic populations, tourists, and particularly vulnerable groups such as children, the elderly and the hospitalized), coordination mechanisms and roles and mandates of various EWS stakeholders;
 - ix. Training on risk awareness, hazard recognition and related emergency response actions are integrated in various formal and informal educational programmes and linked to regularly conducted drills and tests across the system to test operational procedures; and,
 - x. Effective feedback and improvement mechanisms are in place at all levels of EWS to provide systematic evaluation and ensure system improvement over time.
7. Based on detailed synthesis of these documented good practices, a guideline entitled “Institutional Partnerships and Coordination in Multi-Hazard Early Warning Systems,” has been developed and a training workshop has been designed. The first of such workshop, entitled, “Training Workshop on Multi-Hazard Early Warning Systems (MHEWS) with Focus on Institutional Partnerships and Coordination”, (hereafter referred to as the MHEWS Workshop) was held on 22-25 March 2010 in San Jose, Costa. This MHEWS Workshop was co-sponsored by WMO, the United States National Oceanographic and Atmospheric Administration - National Weather Service (NOAA-NWS), the United Nations International Strategy for Disaster Risk Reduction (UN -ISDR), the World Bank, El Centro de Coordinación para la Prevención de los Desastres Naturales en América Central (CEPREDENAC), and the Caribbean Disaster Emergency Management Agency (CDEMA). This event will be hosted by the WMO in collaboration with the Instituto Meteorológico Nacional and the Comisión Nacional de Prevención de Riesgos y Atención de Emergencias of Costa Rica. A number of other regional

and international institutions will also be participating in the workshop as well as development and funding agencies. The outcomes of this workshop are summarized in this report.

2. About the MHEWS Workshop

2.1. Objectives

8. The objectives of the MHEWS Workshop were to:
- i. Share experiences and lessons learnt from five good practices (Cuba, France, Italy, China/Shanghai and USA) with senior officials from Disaster Risk Management (DRM) Agencies and National Meteorological and Hydrological Services (NMHS) from the participating countries;
 - ii. Discuss the existing regional initiatives in support of disaster risk reduction and particularly EWS;
 - iii. Assess national capacities and gaps related to planning, legislative, institutional and operational aspects of EWS and identify national priorities for strengthening of EWS capacities;
 - iv. Identify and prioritize concrete areas of regional cooperation to support national EWS.

2.2. Participants

9. The participants of the MHEWS workshop included directors or other high level representatives from NMHS and National Disaster Risk Management (DRM) Agencies of 36 countries, eight regional agencies and six international organizations, and representatives from development and bi-lateral donors (Annex I: List of Participants).

2.3. Format of the Sessions

10. The MHEWS Workshop included five sessions (Annex II: Annotated Agenda). A summary of issues addressed in each session is provided below:

Session 1: Opening and Introduction

11. The workshop was opened by Ing. Luz Graciela de Calzadilla, Vice-President of WMO RA IV and Permanent Representative of Panama with WMO, with welcome statements delivered by His Excellency Mr. Jorge Rodríguez, Minister, Ministerio del Ambiente, Energía y Telecomunicaciones, Costa Rica and Ing. Vanesa Rosales, President, National Risk Prevention and Emergency Management Commission, Costa Rica. In this session the background and objectives of the MHEWS Workshop were presented as well as the basic concepts of disaster risk management including, risk assessment, risk reduction through early warning systems and sectoral planning as well as financial risk transfer mechanisms. The components of effective early warning systems and ten basic principals, which have emerged from the synthesis of seven good practices, were presented.

Session 2: Presentations of good practices in multi-hazard early warning systems

12. Leading national experts from DRM Agencies and NMHS of Cuba, France, Italy, Shanghai/China, and the United States of America, presented their multi-hazard EWS and shared their experience and lessons learnt in interactive sessions with the participants. This provided the opportunity for the participants to discuss a number of pertinent topics related to planning and legislation, institutional coordination and operational aspects, emergency preparedness as well as activation of emergency plans based on warning levels.

Session 3: Regional initiatives in disaster risk reduction and early warning systems

13. This session consisted of four separate panels: (i) *Panel 1*: addressed the status of progress in DRR and implementation of national and regional coordination platforms and mechanisms in Central America and the Caribbean (ii) *Panel 2*: presented capacities for risk assessment and modelling, including the Central America Probabilistic Risk Assessment Programme (CAPRA) and the Global Risk Identification Programme (GRIP), (iii) *Panel 3*: discussed technical

capacity development in early warning systems available through a number of agencies including WMO, UNESCO-IOC, WMO RA IV Hurricane Committee, Caribbean Institute for Meteorology and Hydrology (CIMH) and Centro Internacional para la Identificación del Fenómeno de El Niño (CIIFEN) and; (iv) *Panel 4*: addressed early warning system linkages to humanitarian contingency planning and assistance.

Session 4: Review and analysis of national early warning system capacities, gaps and needs in Central America and the Caribbean

14. To facilitate the discussions and analysis of national and regional cooperation needs and requirements, the participants were divided into three working groups (Annex III). Within each working group, national delegations consisted of representatives from DRM agencies and NMHS. Prior to the workshop a “questionnaire on Early Warning Systems” (Annex IV) was disseminated among the participants in advance to the Workshop to carry out a preliminary assessment of national EWS capacities as the basis for discussions during the working groups. Of the 23 countries from the region, 21 had completed the questionnaire and provided it to the Secretariat in advance (Annex V). These responses were analysed, gaps and needs common to all countries, and priorities of action at the (sub)regional levels (Central America and The Caribbean) were identified and presented in the working groups to facilitate rich discussions on, (i) exchange of experiences and systematic discussions on the national EWS capacities, gaps and needs; and (ii) development of recommendations for priorities of action for the development/strengthening of national EWS and, (iii) identification and prioritization of concrete areas for regional cooperation that would support national EWS in Central America, and the Caribbean.

Session 5: Synthesis of the outcomes of Session 4

15. The results and outcomes from the three working groups were presented and discussed during the synthesis session to identify converging issues and recommendations from the working group along the following seven areas, including:
- i. Governance and institutional arrangements
 - ii. Utilization of risk information in emergency planning and development of warning messages
 - iii. Hazard monitoring, forecasting and mandates for warning development and issuance
 - iv. Warning dissemination mechanisms and service delivery of the NMHS
 - v. Emergency preparedness and response to different threat levels
 - vi. Concrete areas for regional cooperation and partnerships
 - vii. Next steps

3. Synthesis of Discussions, Conclusions, and Recommendations from Sessions

3.1. Session 2: Presentations of good practices in multi-hazard early warning systems

16. The experts from DRM agencies and NMHS of five countries of good practice presented their early warning systems and shared their experience and lessons learnt in an interactive session with the participants. All presentations illustrated that the ten principles for effective early warning systems listed in Section 1, were reflected in their systems. During the discussion session, a number of issues relevant to the Central America and the Caribbean were highlighted, including:
- i. Coordination and collaboration mechanisms/programmes, which effectively engage the NMHS and DRM Agencies: In this regard, a number of approaches utilized in different good practices were discussed, such as (i) the United States of America (USA) *StormReady, HurricaneReady and TsunamiReady Programs*, and the “*Warning Coordination Meteorologist*” of the USA NOAA-National Weather Service, (ii) the Cuban annual national drill prior to the hurricane season, (iii) regular coordination and evaluation meetings between Météo-France and civil protection in

context of the French Vigilance System, improvement of emergency plans and development of the warning message in Carte de Vigilance (Vigilance Map). It was highlighted that some of these mechanisms or programmes could be implemented in other countries in the region.

- ii. Importance of plans, legislation and various directives in ensuring clarity of roles and responsibilities of various EWS stakeholders at different levels: The importance of consistency in policies, legislation and planning at different levels of government and the need for clarity in authority and mandates were highlighted. The discussions highlighted that, in Central America, countries were focusing on development or amendment of these laws and in this regard harmonization of the laws across the region was important; whereas in the Caribbean, while some laws exist, they could benefit from review as some may be outdated. In this regard understanding of the EWS and DRM related policies, plans and legislation in countries of good practices may be useful. Furthermore, it was discussed that the region could benefit from access to samples of the laws from countries with good practices.
- iii. Harmonization of the Regional Watch and Warning Systems: Different threat/warning levels and related coding (e.g., color) systems and the need for harmonization of these systems were discussed, particularly for the Caribbean region. The importance of linking watch and warning codes and clarity of associated emergency actions on the ground was highlighted. The Vigilance System of the French West Indies (FWI) and French Guiana was presented and discussed as a good practice and one that could be considered for the region within the context of regional watch and warning harmonization.
- iv. Role of the media in dissemination of warnings and public education: The importance of the role of media in the region as a key partner in dissemination of warnings to the public, and public awareness raising was stressed. In this regard, the need for development/strengthening of the partnership between media and the NMHS as well as more joint training and educational programmes were highlighted. Special training for the media in hydro-meteorological hazards and warnings as well as through the media for the public were stressed to be effective ways to develop and enhance these partnerships. In this regard, the experiences of Météo-France in the FWI, and the Meteorological Institute of Cuba were specifically highlighted.
- v. Social aspects of mass evacuations: The social aspects and challenges in motivating the population to evacuate, in case of impending danger, were discussed. The discussions focused on the importance of building trust in the warning system and evacuation conditions. Security of the peoples' belongings (left behind, or taken to the shelters) and their safety in the shelters were mentioned as factors to be addressed in convincing people to evacuate. It was noted that there is need for social-cultural studies in understanding human behavior and response to warnings and evacuation orders.
- vi. Regional collaboration: EWS are resource intensive. However, it was highlighted that through regional cooperation and leveraging of resources, infrastructure, sharing of data, tools, products and, know-how mutual benefits could be achieved to reduce costs, and address inter-operability and sustainability issues more effectively.

3.2. Session 3: Regional Initiatives in Disaster Risk Reduction and Early Warning Systems

17. Session 3 aimed to take a stock of relevant regional activities in disaster risk reduction and EWS in Central America and the Caribbean regions and highlighted synergies that could be realized through cooperation and coordination across these activities. However, during the discussions, it was highlighted that a systematic mapping and analysis of all EWS related activities in the two sub-regions should be carried out as there were other relevant regional activities that were not presented in the meeting.

*Panel 1: National Disaster Risk reduction platforms and regional coordination mechanisms
in Central America and the Caribbean*

18. DRR coordination mechanisms for the implementation of the Hyogo Framework for Action 2005-2015 (HFA)⁵ in Central America and the Caribbean were presented as the foundation for coordination of EWS development in the sub-regions.
- i. In Central America, there is a “Plan Regional de Reduccion de Desastres” derived from HFA. CEPREDENAC is focusing on harmonizing the DRR approaches in the region and promoting best practices at the policy and institutional levels.
 - ii. In the Caribbean, under the coordinated Framework of the Caribbean Community (CARICOM), which consists of 15 members, 5 associate members and 7 observers from the Caribbean region, there exists a number of organizations and centers that serve the various needs of the region. Specifically, the Caribbean Disaster Emergency Management Agency (CDEMA) presented the regional framework named the Comprehensive Disaster Management (CDM) as a platform for advancing the implementation of HFA, which as its second priority area of action includes risk assessment and EWS with multi-hazard approach and the linkages to key economic sectors. Additionally, there are a number of existing initiatives that call for strengthening or sustaining the interactions among meteorological/hydrological and disaster management communities. It was highlighted that the strengthening of institutional partnerships in the context of CDM is the preferred method for EWS development in the Caribbean region. However, other islands in the region, which are not CARICOM members, have other coordination mechanisms in DRM, which need to be considered.
19. It was highlighted that development of effective DRR and EWS would require a multi-dimensional, multi-sectoral and multi-agency approach at national to local levels. Many good practices at the community level exist that could be scaled up and linked to the national processes.
20. Flood and drought were also highlighted as key issues in both Central America and the Caribbean and that implementation of flood, drought risk management and warning systems would require regional cooperation in a number of areas.

Panel 2: Risk Assessment and the Central America Probabilistic Risk Assessment Programme (CAPRA) and Global Risk Identification Programme (GRIP)

21. Risk assessment is the foundation for development of disaster risk reduction strategies, policies and planning (e.g., early warning systems, land use planning, infrastructure development and retrofitting, building codes, etc). There is a need for capacity development in risk assessment in the region. In this regard, a number of existing regional and global programmes are addressing these issues, using different methodologies and approaches:
- i. Global Risk Identification Programme (GRIP) provides guidance on standardization of vulnerability and exposure data and simple methodologies for risk assessment.
 - ii. WMO is providing guidelines and related training workshops on standardization of hazard data, metadata and mapping tools for meteorological, hydrological and climate related hazards through its technical programmes (e.g., floods, droughts, tropical cyclone and storm surges, etc).
 - iii. The Central America Probabilistic Risk Assessment Programme (CAPRA) has facilitated sophisticated probabilistic risk modeling approaches including hazard modules, exposure and vulnerability modules to model probabilities of potential damage and losses. This type of modeling has been applied to risk financing strategies, insurance, land use planning and on-time damage and loss estimates.

⁵ HFA was adopted by 168 countries during the World Conference on Disaster Reduction in January 2005 in Kobe, Japan.

There is need for a dedicated technical and institutional capacity development programme to scale up CAPRA in different countries in Central America.

22. It was highlighted that there is a need for a comprehensive risk assessment programme for the Caribbean region, building on existing activities of the World Bank and CIMH supporting risk management and the insurance (i.e., the Caribbean Catastrophe Risk Insurance Facility - CCRIF). Specifically, there is need for exchange of good practices in risk modeling and analysis. In addition, under the banner of risk assessment, issues related to hazard monitoring, development and maintenance of climatological databases and metadata, data rescue and weather and climate forecasting and analysis tools need to be considered: The meeting noted that another major challenge in the region is the need for developments of impact databases.

Panel 3: Technical Capacity Development in Early Warning Systems

23. As highlighted in the EWS good practices, a critical component of an effective EWS is hazard monitoring, detection and forecasting and that regional cooperation in a number of areas such as harmonization and interoperability of observing networks for comprehensive and systematic data collection, data sharing and forecasting is necessary to enable all countries in the region to have access to the latest technologies, tools and forecasting products. In this regard, the following was highlighted:

- i. The Meeting was informed of the regional tropical cyclone programme for RA IV, coordinated through the WMO RA IV Hurricane Committee (established in 1978 and with 26 members in the region), the activities of WMO Regional Specialized Meteorological Center for Tropical Cyclone (RSMC) – Miami Hurricane Center (operated by the USA NOAA-National Weather Service) providing forecasts and bulletins to all NMHS in the region, and related regional activities including technical cooperation, forecasting, planning and exchange of data and information in meteorology and hydrology in this context among all members of WMO RA I (Annex VI). The Meeting discussed the important role of RSMC-Miami and that the RA IV Hurricane Committee could serve as a platform for addressing technical aspects of regional cooperation in EWS for countries in RA IV.
- ii. WMO, through its ten Scientific and Technical Programmes, its eight Technical Commissions, operational network of the NMHS of its Members and in partnership with a number of leading technical agencies and centers of excellence, provides a wide range of technical capacity development and training activities related to monitoring, detection, telecommunications, forecasting, hazard mapping, warnings and other products and services for meteorological, hydrological and climate-related hazards and conditions. A set of guidelines on standardization of hazard databases, metadata and mapping tools, forecasting and training have been developed, including Integrated Flood Management (IFM) helpdesk, Flash Flood Guidance System, Integrated Marine and Ocean Hazards Forecasting and Coastal Inundation Forecasting Demonstration Project (CIFDP), Drought Monitoring and Risk Management, heat wave and health warning guidance, Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS), Air Quality Modeling and Forecasting (GURME), Severe Weather Forecasting Demonstration Project (SWFDP), and the Global Framework for Climate Services (GFCS), which will facilitate a coordinated network of global, regional and national climate centers for provision of climate information to support climate risk management and adaptation. In addition, WMO is developing a service delivery framework to assist the NMHS in providing effective service delivery to support various stakeholders. As well, guidance materials, training programmes and “learning by doing” programmes have also been developed for NMHS public weather services to support cooperation with the Media and the health sector. Finally, WMO assists the NMHS to ensure adoption of a quality Management Framework to ensure effective delivery of high quality products and services. More detailed information for some of the WMO technical capacity development activities is available in Annex VII.
- iii. Progress with the development of the Tsunami warning systems in the Caribbean and adjacent seas, through the Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG-

CARIBE) was presented and the meeting stressed the importance of coordinating with other projects and activities in the region, particularly with the hydro-meteorological EWS systems and related regional coordination inked to Hurricane Committee.

- iv. Under the umbrella of CARICOM there are a number of organizations and centers that serve the various needs of the region. CDEMA, the Caribbean Meteorological Organization (CMO) and the Caribbean Institute for Meteorology and Hydrology (CIMH) were highlighted. CMO coordinates the joint scientific and technical activities related to weather, water, and climate. CMO operates the following facilities: CMO Upper-air Network, CMO Weather Radar Network, Regional Meteorological Telecommunications Network, and the Regional Hurricane Warning System. CIMH, the research arm of CMO, carries out meteorological and hydrological training and instrument calibration and maintenance as well as conducting research and development in a number of areas including: (i) satellite & marine meteorology, (ii) physical meteorology, (iii) hydrometeorology, water resources management and site investigations, (iv) computational meteorology and climatology, and (v) applications of meteorology. However it was noted that a number of other thematic regional agencies also operate under CARICOM, such as Caribbean Agriculture Research and Development Institute (CARDI), Caribbean Community Climate Change Centre (CCCCC), Caribbean Telecommunications Union (CTU), and the Caribbean Environment Health Institute (CEHI).

CMO and CIMH have been involved in a number of regional climate change and adaptation projects, including:

- Caribbean Planning for Adaptation to Climate Change (CPACC) project (1997-2001): This project included: designing and establishment of a sea level/climate monitoring network, establishment of databases and information systems, inventory of coastal resources and use and formulation of initial adaptation policies.
 - ACCC (2001-2004) Project: Designed to sustain activities initiated under CPACC and to address issues of adaptation and capacity building not undertaken by CPACC.
 - MACC Project (2004 – 2009): Designed with the main objective to mainstream climate change adaptation strategies into the sustainable development agendas of the Small Islands and low-lying States of CARICOM.
 - SPACC Project (2007-2011): Designed with the goal to support efforts by Dominica, Saint Lucia, and St. Vincent and the Grenadines to implement specific (integrated) pilot adaptation measures addressing the impacts of the climate change on the natural resource base of the region, focused on biodiversity and land degradation along coastal and near-coastal areas.
- v. CIIFEN is developing a regional climate center for the Andean region, including seasonal forecasts, training on climate modeling and downscaling. No representative from CCCCC could participate in the meeting. However, the activities of CCCCC need to be further explored.

24. The meeting stressed that there are a number of other regional agencies that are engaged in other relevant activities not presented in the Workshop and that these need to be mapped and that synergies among these initiatives should be explored towards development of coordinated sub-regional cooperation programmes in EWS. Furthermore, the need for strengthening regional cooperation in flood and drought risk management for both sub-regions and capacity development of the regional agencies working in these areas was further stressed.

Panel 4: Early Warning Systems and the linkages to humanitarian contingency planning and assistance

25. Regional humanitarian emergency response mechanisms that have been established for the Caribbean region could benefit from further strengthening of the coordination mechanisms across various institutions and benefit from improved hydro-meteorological forecasts and

warning information.

26. Humanitarian Agencies such as WFP, in collaboration with a number of stakeholders and partners have developed early warning systems (e.g., SATCA) targeted specifically at their humanitarian planning and operations and should not be confused with the national EWS.
27. Humanitarian organizations and civil society organizations working at the community level could support national warning dissemination at the community level (“the last mile”).
28. Building and expanding on the strong technical regional cooperation in tropical cyclones, there is a need for i) development/strengthening of national EWS, ii) harmonization of the regional watch and warning systems with those at the national levels, and improved service delivery at the national level in supporting national to local emergency contingency planning and response operations.
29. The discussions during this panel also concluded that the EWS programme development of the two sub-regions (Central America and the Caribbean) should, as a first step, perform an analysis of current and planned activities in the region, in order to leverage existing resources, capacities and activities.

3.3. Session 4: Working Group Recommendations on Priorities of Action for National and Regional Cooperation in EWS

30. Analysis of the responses to the questions in the EWS Questionnaire, with respect to priorities of action for strengthening of national early warning systems and regional cooperation programme to support EWS, are summarized in Annex VIII.
31. Building on the results of responses to the EWS Questionnaires, the Working Groups prepared concrete recommendations on both national and regional cooperation issues in support of EWS for Central America (Working Group A) and the Caribbean (Working Group B and C). Sub-regional analyses and recommendations of the Working Groups for specific priorities of action for each sub-region are outlined in Annex IX.

4. Overall Conclusions and Recommendations

32. Recommendations prepared by the Working Groups were further synthesized during a plenary session and a number of commonalities were identified in Central America and the Caribbean. The following overall recommendations for the MHEWS Workshop emerged. For specific sub-regional recommendations of the MHEWS Workshop, please refer to Annex IX.

Governance and Institutional Arrangements

33. It was highlighted that, in most countries of the region, there is a need for enhancement and/or development and enforcement, of clear EWS policies, planning, legal frameworks, and dedicated budget supporting EWS at national to local levels. In some countries, this is hampered by the lack of political will and/or complete absence or lack of institutional capacity of the NMHS or DRM agencies. The need to institutionalize the relationship between DRM agencies and NMHS from national to local levels through the documentation of plans, protocols and standard operating procedures was highlighted. Finally, need for further clarification of institutional arrangements and protocols for regional coordination and cooperation among countries and existing regional institutions was identified as a high priority area in both Central America and the Caribbean.

Recommendations:

- i. Regional/sub-regional institutions should advocate and support the revision of EWS policies, and legal frameworks (e.g. development of a legislation template based on experiences from countries of good practice in EWS could be helpful to the region)
- ii. Awareness campaigns should be conducted for national decision-makers on hazards, their possible impacts and ways these impacts could be reduced through prevention, preparedness measures and EWS.

Utilization of Risk Information in Emergency Planning and Warnings

34. The working groups recognized the need to incorporate risk information, including potential impacts (e.g., potential loss of life, property and infrastructure destruction, crop losses) as well as behavioral advice, in warnings in a way that is understandable to all (engaging social science). Furthermore, the discussions concluded that risk mapping and analysis at national to local levels is the foundation for development of national to local emergency preparedness and response plans. In this respect, the discussion highlighted the critical need in both Central America and the Caribbean regions to monitor, archive and share hazard, vulnerability and exposure data as well as develop institutional capacities for risk modeling and analysis. The strengthening of cooperation among, and capacity development of NMHS, other technical agencies and line ministries, was identified as key for the development of risk assessment capacities.

Recommendations:

- i. A regional programme for the development and dissemination of risk assessment, modeling and mapping capacities should be developed for the Caribbean and the Americas regions, including:
 - Regional / bi-lateral projects for institutional capacity development in risk modeling and assessment.
 - Need for the development of a regional methodology for risk assessment and mapping, including the data needs (on hazard, vulnerability and exposure), standards for data collection and archiving, including metadata, and technical tools for hazard analysis (for each hazard) and risk modeling and mapping tools together with capacity development of institutions or centers with top expertise. Specifically, there is need for exchange of good practices in risk modelling and analysis. (A detailed checklist would be needed)
 - The development of regional databases of hazard events, particularly in context of trans-boundary events (floods, droughts, tropical cyclones, etc) and regional GIS capacities, maintenance of climatological databases and metadata, and climate forecasting tools, needs to be considered
 - Need for a methodology to better utilize risk information in emergency planning and warnings
 - In the Caribbean specifically, linking the risk management programme to existing activities of CIMH supporting risk management and the insurance, including the Caribbean Catastrophe Risk Insurance Facility (CCRIF).

Hazard Monitoring, Forecasting and Mandates for Warning Development

35. The strengthening and maintaining of observation and monitoring networks, their interoperability and sustainability as well as improvement of regional coordination and capacities for data collection, monitoring and storage were discussed as two high priorities in both Central America and the Caribbean. It was expressed that many countries in the region have inadequate technical capacities / infrastructure to utilize the latest technologies (e.g., satellite, real-time data and products, Internet, modeling, etc.). In fact, a number of islands in the Caribbean do not have a NMHS and, in this context, development and strengthening of the regional forecasting centers, which support those countries, was highlighted. It was also emphasized that the development of warning and advisory products should be based on user needs and that there needs to be coordination and information sharing among various technical agencies in providing forecasts and warnings. The importance of harmonization of watch and warning systems, particularly in the Caribbean, was highlighted as a high priority.

Recommendations:

- i. Strengthening/developing monitoring and forecasting capacities for a number of hazards (With CMO, CIMH, other relevant CARICOM agencies and other Islands that are not members of CARICOM) in the following areas:

- a) Integrated marine and coastal hazard monitoring and forecasting (hurricane, storm surges, coastal inundation, winter storms and related swells and high waves)
- b) Drought monitoring and risk management (slow on-set, targeting different sectors)
- c) Severe Weather Forecasting Demo Project and Flash Flood Guidance
- ii. Capacity enhancement should include strengthening of technical capacities of the NMHS and operational forecasting centers staff through trainings, upgrade and sustainability of equipment (hardware) and availability of tools (e.g. software like forecasting and hazard analysis tools from weather to climate timeframes)
- iii. Leverage regional centers of expertise to enhance data sharing, availability of high quality data, forecasting tools and products that can support the development of warnings.
- iv. Implementation and delivery of relevant hazard mapping and forecast products and services should be based on specific user requirements and thus mechanisms to interface with DRM agencies and other stakeholders need to be established to develop product requirements and specifications targeted at the decision applications.
- v. Implementation of an end-to-end quality management system centered on users, to ensure development of relevant products and service delivery and improving them over time.

Warning Dissemination Mechanisms and NMHS Service Delivery

36. EWS dissemination mechanisms, public awareness and receptiveness as well as related feedback mechanisms were identified among significant weaknesses of EWS in most the countries in the region. A combination of channels (modern and traditional systems such as SMS to Fog Horn and volunteers) for dissemination of public information and warnings was recommended. It was noted that media plays a critical role in many countries in the region for dissemination of warnings and public education. Opportunities for strengthening relationships across agencies responsible to issue warnings and the media was highlighted. The development of public-private partnerships (e.g. with media and telecommunication sector) was also noted. Furthermore, the meeting discussed the need for enhanced public education and awareness as well as the need for communication of warnings through customized (adapted) dissemination mechanisms to specific needs (e.g. tourists, disabled, indigenous, women, child care, rural vs. urban).

Recommendations:

- i. Indicators and quality management monitoring mechanisms should be developed to evaluate EWS efficiency and effectiveness - in particular noting the importance of dissemination of warning messages and continuous improvement over time to ensure warnings are received by the authorities and the public and utilized in emergency preparedness and response activation.
- a. Service Delivery in EWS was highlighted as one of the major gaps (regional and national aspects)
 - a) Development of effective warnings and dissemination mechanisms to various stakeholders (e.g., need for effective websites was strongly highlighted, role of media, and other mechanisms for dissemination of warnings to government authorities and DRM agencies, health service, humanitarian agencies, public, etc)
- ii. Joint training programmes targeted at media, emergency managers and NMHS should be conducted to ensure enhanced cooperation and communication across them.
- iii. Public education and awareness campaign to train the population and the media on meaning and appropriate reactions to warning messages should be developed in both Central America and the Caribbean.

- iv. Warning dissemination systems should be adapted to hazard type, lead time, cultural, social, and vulnerability of the population and consideration for reliability and sustainability over time.

Emergency Preparedness and Response Activities

37. The need for capacity development including training and drills in emergency preparedness and response was highlighted. It was expressed that drills should not only be demonstrative but also be used for systematic evaluation purposes to improve the system as well. The importance of strengthened collaboration between NMHS and DRM agencies for delivery of more effective public awareness and educational programmes was discussed. Additionally, during and post-event, in the response phase, the need for NMHS support to provide critical meteorological and hydrological information and forecasts to support the emergency operation centers (EOC) and relief and response operations on the ground was also highlighted. In this regard, the meeting noted in light of a potential event, that NMHS need to consider a spectrum of products and services from the detection of the hazard to post disaster response and relief phase.

Recommendations:

- i. Regular public awareness campaigns to train the population / the media on meaning of and appropriate reactions to warning messages should be a significant part of any EWS
- ii. Review color coding for warnings building on systems in the region (TT, Martinique-Caribbean) for dissemination of warning information and possibility of establishing a harmonized regional watch and warning system for on-going and real-time coordination.

Regional Cooperation Programmes in EWS to support National EWS Development

38. The Working Groups noted that while many regional activities relevant to DRR and EWS were reflected by the regional agencies participating in the workshop, there was need for a systematic review of specificities in Central America and the Caribbean with respect to needs, institutional capacities and coordination mechanisms. In addition, a systematic review of activities and initiatives through other regional agencies not represented at the workshop would be needed to determine scope of the regional cooperation programmes which would address the existing gaps and needs and realizes the opportunities for enhanced cooperation and capacity development.

Recommendations:

- i. To create a working group on information exchanges and protocols for the lesser or greater Antilles
- ii. To develop a list of expertise of the countries of the region to facilitate experience sharing.
- iii. To develop or strengthen regional contingency plans for EWS (e.g. NMHS back-up systems)
- iv. To develop regional programmes built upon the existing regional mechanisms, regional centers and their relevant activities to strengthen coordination and cooperation in the following areas:
 - Risk modeling, assessment and mapping capacities
 - Gaps in the observing networks, interoperability across different systems and networks and facilitation of data sharing, regional data bases and data exchange
 - Development/harmonization of watch and warning systems
 - Technical and capacity development on the latest tools and technologies in hazard monitoring and mapping, hazard forecasting, communication and strengthening of regional forecasting capacities within a multi-hazard approach

- Drought and flood monitoring and risk management as inter-regional issues that requires strong cooperation and information sharing
- v. To utilize and strengthen existing Centres of Excellence and regional centers to support various aspects of regional programme implementation.
- vi. To facilitate bi- and multi-lateral projects between neighboring countries (e.g., on shared river basins)
- vii. To coordinate between tsunami and hurricane programmes where there are overlapping areas.

5. Next Steps

39. Following the MHEWS Workshop, a half day “Coordination Meeting for Development of Early Warning Systems in Central America and the Caribbean” was held on 26 March 2010 at the same venue engaging the international and regional agencies and centers as well as development and funding agencies supporting DRR and EWS in the region . The goals of this Coordination Meeting were to, (i) to discuss the outcomes of the MHEWS Workshop and review various initiatives and projects in support of DRR and EWS in the region undertaken or supported by the participating agencies, and (ii) explore opportunities and process for enhanced cooperation and coordination across the regional, international , development and funding agencies for the development of sub-regional programmes and projects to support early warning system development in Central America and the Caribbean. The participants concurred with the recommendations from the MHEWS Workshop and (i) emphasized that a more coordinated (sub) regional approach would be required among regional and international development and funding agencies to support EWS projects in the region, (ii) recommended follow up consultations with the various stakeholders for the development of coordinated and cooperative (sub)regional programmes, building on the existing capacities, institutions and activities in each sub-region. In this regard, the Coordination Meeting recommended that a systematic mapping of the activities and projects supported by development and funding agencies in support of EWS needs to be carried out.
40. Regarding the Next steps, the MHEWS Workshop and Coordination Meeting recommended, the need for a clear road map for the development of a regional cooperation programme in support of EWS and strengthening of the operational relationships of the NMHS and DRM agencies for each sub-region, including:
- i. Systematically map regional activities and interregional pre-existing programs relevant to EWS being carried out by regional centers/agencies and international partners and funding agencies identifying their capacities and gaps.
 - ii. Identify all regional agencies and centers of excellence involved in the implementation of relevant regional activities.
 - iii. Compile, review and analyze various assessments carried at national and regional levels and identify areas of information gap where targeted assessments could be carried out at national and regional levels.
 - iv. Develop a regional cooperation programme in support of EWS and strengthening of the operational relationships of the NMHS and DRM agencies for each sub-region with phased projects (1-2 year timeline) with concrete activities, identification of the implementing partners and their roles, budget, etc. that would address the recommendations of the workshop. This should be achieved through a coordinated, consultative process engaging the regional agencies, national agencies and partners building on regional coordination mechanisms and linking to all the relevant existing activities and technical capacity development programmes to avoid redundancies and address gaps. The Regional Cooperation Programme in EWS could be augmented with national development projects for strengthening of early warning system components and capacities in the countries.
 - v. Engage the donors and financial agencies in the process from an early stage to ensure a coordinated approach for financing of the regional programmes in EWS and strengthening of the operational relationships of the NMHS and DRM agencies for each sub-region.

For more information or any questions please contact:

<p>Dr Maryam Golnaraghi Chief, Disaster Risk Reduction Programme World Meteorological Organization 7bis, avenue de la Paix Case postale 2300 CH-1211 Geneva 2, Switzerland</p>	<p>Tel: + 41-(0) 22-730-8006 Fax: + 41-(0) 22-730-8128 Email: mgolnaraghi@wmo.int</p>
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Annexes

Annex II: Agenda

Training Workshop on Multi-Hazard Early Warning Systems with focus on Institutional Partnership and Coordination

March 22-25, 2010

Radisson Europa Hotel and Conference Center

San José, Costa Rica

http://www.wmo.int/pages/prog/drr/events/MHEWSCostaRica/index_en.html

AGENDA

Early Registration <i>Room Zurqui III, Radisson Europa Hotel - Sunday 21 March from 3:00 - 6:30 pm</i>	
Day 1 – March 22	
0730 – 0900	Registration
Session 1: Opening and introduction Room: Zurqui III <i>Chair: Ing. Luz Graciela de Calzadilla, Vice-President of WMO Regional Association IV (North and Central America and the Caribbean) and Permanent Representative of Panama with WMO</i>	
0900 – 1030	<ul style="list-style-type: none">• <u>Welcome address and opening session</u><ul style="list-style-type: none">- Opening statement by Ing. Luz Graciela de Calzadilla,- His Excellency Mr. Jorge Rodríguez, Minister, Ministerio del Ambiente, Energía y Telecomunicaciones, Costa Rica- Ing. Vanesa Rosales, President, National Risk Prevention and Emergency Management Commission, Costa Rica- Dr. Maryam Golnaraghi - WMO Statement• <u>Background and objectives of the training workshop on Multi-Hazard Early Warning Systems</u> – Maryam Golnaraghi (WMO)
1030 – 1045	Group photo
1045 – 1115	Coffee break
Session 2: Presentations of good practices in multi-hazard early warning systems Room: Zurqui III In this session, experts from National Disaster Risk Management Agencies and National Meteorological and Hydrological Services from five countries, which have been identified as good practices, will deliver presentations and lead discussion sessions on their respective national early warning systems with focus on institutional partnerships and cooperation. <i>Facilitator: Maryam Golnaraghi</i>	
1115 – 1245	<ul style="list-style-type: none">• <u>“Early Warning System For Tropical Cyclones in the Republic of Cuba”</u><ul style="list-style-type: none">- Mr Miguel Angel Puig Gonzalez - National Civil Defense- Dr Tomas Gutierrez Perez and Dr José Rubiera Torres - Instituto de Meteorologia
1245 – 1400	Lunch
1400 – 1530	<ul style="list-style-type: none">• <u>“The French Vigilance System”</u><ul style="list-style-type: none">- Mr Jean-Noel Degrace - Météo-France / Martinique

1530 – 1600	Coffee break
1600 – 1730	<ul style="list-style-type: none"> • <u>“Multi-Hazard Early Warning System in Italy”</u> - Dr Paola Pagliara - Italian Civil Protection - Dr Sergio Pasquini - Italian Meteorological Service
1800 - 2000	Cocktail Room: Zurqui IV
Day 2 – March 23	
0800 – 0900 Room: Zurqui II	<ul style="list-style-type: none"> • <u>First Coordination meeting of the Drafting Committee (Chair of Drafting Committee: Mr-Lynn Maximuk)</u> Chair of the Drafting Committee, facilitators and rapporteurs of the working groups, members of WMO Task Team on DRR for RA IV and WMO Secretariat.
Session 2: (Continued)	
0900 – 1030	<ul style="list-style-type: none"> • <u>“Shanghai Multi-Hazard Early Warning system”</u> - Mr Haizhen Mu – Deputy Director, Shanghai Meteorological Bureau, China Meteorological Administration - Mr Lei Zhang – Deputy Director, Shanghai Food and Drug Administration
1030 – 1100	Coffee break
1100 – 1230	<ul style="list-style-type: none"> • <u>“Multi-Hazard Early Warning System in the United States of America“</u> - Mr. Nick Crossly – Director of County Emergency Management and Homeland Security and President of the International Association of Emergency Managers - Mr. Lynn P Maximuk, Director, NOAA National Weather Service Central Region - H James Keeney, Regional Warning Coordination Meteorologist, NOAA National Weather Service, Central Region Headquarters
1230 – 1400	Lunch Special Talk by Finland
Session 3: Regional Initiatives in Disaster Risk Reduction and Early Warning Systems Room: Zurqui III Chair: Mr Sadi Laporte, Instituto Costarricense de Electricidad, Costa Rica	
1400 – 1530	<ul style="list-style-type: none"> • <u>Panel 1: Discussion on National Disaster Risk reduction platforms and regional coordination mechanisms in Central America and the Caribbean</u> - Mr Ivan Morales, Executive Secretary, CEPREDENAC - Ms Andria Grosvenor, Technical Manager, Preparedness and Country Support, CDEMA - Mr Pablo Gonzalez, Chief of Risk Management and Climate Change Adaptation Section, OAS - Mr. Julio Garcia, Regional Office for the Americas, UN-ISDR
1530 – 1600	Coffee break
1600 – 1730	<ul style="list-style-type: none"> • <u>Panel 2: Discussion on Risk Assessment and the Central America Probabilistic Risk Assessment Programme (CAPRA) and Global Risk identification programme (GRIP)</u> Moderator: Dr. Oscar Lücke Sánchez, Head of Disaster Risk Prevention and Mitigation, National Risk Prevention and Emergency Management Commission - Dr. Eric Alfaro, Professor, Center for Geophysical Studies, University of Costa Rica - Dr. Carlos Villacis, Global Risk Identification Program Coordinator, UNDP - Ing. Benjamín Huerta, Risk Management expert, ERN, Mexico
Day 3 – March 24	
Session 3: (Continued)	
0900 – 1100	<ul style="list-style-type: none"> • <u>Panel 3: Discussion on Technical Capacity Development in Early Warning Systems</u> - WMO technical capacity development for meteorological, hydrological and climate-related hazards – Ms. Haleh Kootval (WMO) - Inter-governmental Coordination Group for Tsunami Warning System (UNESCO-IOC), Ms Judy Thomas

	<ul style="list-style-type: none"> - Hurricane Committee and its contributions to early warning systems, Dr José Rubiera-Torres - Development in Meteorological Services in the Caribbean, Dr David Farrel - Importance of climate services to support early warning systems, Ms. Ms. Abigail Alvarado, CIIFEN 		
1100 – 1130	Coffee break		
1130 – 1300	<ul style="list-style-type: none"> • <u>Panel 4: Discussion on Early Warning Systems and link to humanitarian contingency planning and assistance</u> - Nelson Castaño, Coordinator of Disaster Risk Management for the Americas, IFRC - Mr. Elbyn Ramirez, Manager of SATCA Project, WFP - Mr Ian King, Disaster Risk Reduction Advisor, UNDP Barbados and the OECS 		
1300 – 1400	Lunch Special Talk by the USA		
<p align="center">Session 4: Review and analysis of national early warning systems capacities, gaps and needs in Central America and the Caribbean</p> <p>In this session, the participants will be divided into three working groups to discuss and analyze their national early warning systems institutional partnerships, cooperation and coordination, gaps, needs and priorities for strengthening of end-to-end early warning systems in their countries. The expected outcomes of these working groups are recommendations for (i) the development of national early warning systems strategies, institutional capacities and coordination mechanisms (ii) concrete regional cooperation activities to support EWS development. A list of the participants in each working group will be posted at the Workshop.</p>			
1400 – 1430 Room: Zurqui III	<ul style="list-style-type: none"> • <u>Goals and expected outcomes of the working groups – Maryam Golnaraghi (WMO)</u> 		
1430 – 1800 1600 – 1630 Coffee break	<p align="center"><u>Working Group A</u> <u>Room: Zurqui II</u></p> <p><i>Interpretation: English / Spanish</i> Facilitator: Dr José Rubiera Torres Rapporteurs: Ing. Luz Graciela de Calzadilla, Armando E. Guzmán, Mr Luis Corrales Secretariat Support staff: Ian Bell and Oscar Arango</p>	<p align="center"><u>Working Group B</u> <u>Room: Zurqui IV</u></p> <p><i>Interpretation: English</i> Facilitator: Dr. Sergio Pasquini, Dr. Paola Pagliara Rapporteurs: Mr. Trevor Basden, Ms. Andria Grosvenor, Mr. Ian King, Mr H James Keeney Secretariat Support staff: James Douris and Francisco Villalpando</p>	<p align="center"><u>Working Group C</u> <u>Room: Zurqui III</u></p> <p><i>Interpretation: English / French / Spanish</i> Facilitator: Mr. Jean-Noel Degrace Rapporteurs: Dr Tomas Gutierrez Perez, Mr Carlos Manuel Paulino Cardenas, Mr. Alexandre Vacher Secretariat Support staff: Charles Baubion</p>
1800 – 1830 Room: Zurqui II	<ul style="list-style-type: none"> • <u>Second meeting of the Drafting Committee to consolidate the outcomes of the working groups and prepare presentations for discussions on Day 4</u> <i>Chair of the Drafting Committee, facilitators and rapporteurs of the working groups, members of WMO Task Team on DRR for RA IV and WMO Secretariat.</i> 		
Day 4 – March 25			
0800 – 0900 Room: Zurqui II	<ul style="list-style-type: none"> • <u>Third meeting of the Drafting Committee -</u> 		
Session 4 (Continued):			
0900 - 1030	<u>Working Group A</u>	<u>Working Group B</u>	<u>Working Group C</u>
1030 – 1100	Coffee break		

Day 4 – March 25 (continued)

Session 5: Review of the outcomes of the working groups

Room: Zurqui III

Chair: Mr. Lynn Maximuk (*Chair of the Drafting Committee*)

1100 – 1300	<ul style="list-style-type: none"> • <u>Presentations and discussion on priorities of action, recommendations</u> <p><i>The outcomes of each working group will be presented by the rapporteurs of each working group:</i></p> <ul style="list-style-type: none"> ○ <u>Working Group A</u> ○ <u>Working Group B</u> ○ <u>Working Group C</u>
1300 – 1430	<p>Lunch Special Talk by Spain</p>
1430 – 1645	<p><u>Session 5 (Continued) : Discussions on priorities of action, recommendations and final conclusions for way forward – Mr Lynn Maximuk</u></p>
1645 – 1700	<ul style="list-style-type: none"> • <u>Official Closing of the workshop by Ing. Luz Graciela de Calzadilla, Vice-President of WMO Regional Association IV (North and Central America and the Caribbean)</u>
1700 – 1800 Room: Zurqui II	<ul style="list-style-type: none"> • <u>Final meeting of the Drafting Committee to incorporate final recommendations in the final MHEWS Workshop document</u>
1730 - 1930	<p style="text-align: center;">Special session: Multi-Hazard Early Warning System for Haiti Room: Zurqui III</p> <ul style="list-style-type: none"> - Implementation of Haiti warning system for the 2010 Rainy and Hurricane Season - Discussion of the longer-term Multi-Hazard EWS development for Haiti <p><i>Moderator: Jean-Noel Degrace - Director, Martinique Regional Office, Météo-France</i></p> <ul style="list-style-type: none"> - Ing. Ronald Semelfort - Directeur Centre National de Météorologie, Haiti - Mr Abel Nazaire - Deputy Coordinator, Direction de la Protection Civile, Haiti - Peter Chen - Chief, Global Data Processing and Forecasting Services - Abdoulaye Harou - Acting Director Aviation and Defence Services - Meteorological Service of Canada (MSC) <p style="text-align: center;"><i>With French/Spanish/English interpretation - All participants are welcomed</i></p>

Annex III: Composition of Working Groups A, B, C

COMPOSITION OF THE WORKING GROUPS

WORKING GROUP A

Room: Zurqui II

Facilitator: *Dr José Rubiera Torres*

Rapporteurs: *Ing. Luz Graciela de Calzadilla, Mr Luis Corrales, Mr Armando E. Guzmán*

Secretariat Support staff: *Mr Ian Bell and Mr Oscar Arango*

Interpretation: *English / Spanish*

Countries	Persons	Countries	Persons
Costa Rica	Dr Juan Carlos Fallas Sojo Ms Rebeca Morera Ms Evelyn Quiros Mr Juan Diego Naranjo Ms Vanessa Rosales Dr. Oscar Luke Ing. José Joaquín Chacón Mr Sadi Laporte M. Mr Oscar Valverde Cerros Ms Samaneh Ebrahimi Dr Eric J. Alfaro Mr Luis Guzman Brenes Mr Jose Bonilla	Honduras	Mr Francisco Argenal Mr Eliseo Silva Rotela Mr Oscar Fernan
		Mexico	Mr Horacio Rubio Gutiérrez Mr José G. Castelan Pescina Ing. Benjamín Huerta Garnica
		Nicaragua	Mr Isaias Montoya Mr. Ervin CHEVEZ Mr Manuel Sobalucano Bravo
		Panama	Ing. Luz G. de Calzadilla Mr Jorge Rodriguez Mr Dany Castillo
El Salvador	Mr José Mauricio Martinez Garcia Mr Edwin Velis Mr Oscar Ordonez	CEPREDENAC	Mr Ivan Morales
		CIIFEN	Ms Abigail Alvarado
Guatemala	Ing. Paris Rivera Mr Andrés Casasola Ms Teresa Marroquin	JICA	Mr Eiji Kawahigashi
		WFP	Mr Elbyn Ramirez

WORKING GROUP B

Room: Zurqui IV

Facilitator: Dr. Sergio Pasquini, Dr. Paola Pagliara

Rapporteurs: Mr. Trevor Basden, Ms. Andria Grosvenor, Mr. Ian King, Mr H James Keeney

Secretariat Support staff: Mr James Douris and Mr Francisco Villalpando

Interpretation: English only

Countries	Persons	Countries	Persons
Bahamas	Mr Trevor Basden Captain Stephen Russell	Guyana	Mr Garvin Cummings Colonel Chabillal Ramsa
Barbados	Ms Sonia Nurse Ms Judy Thomas	Jamaica	Mrs Sylvia McGill Mr Ronald Jackson
Belize	Mr Dennis Gonguez Mr Elodio Aragon Mr Evan Tate	Trinidad & Tobago	Mr Marlon Noel
BCT		ACS	M. Luis Fernando Andra
• Cayman islands	Mr John Tibbetts Mr Omar D. Afflick	CIMH	Dr David A. Farrell
• Anguilla	Mrs Melissa Meade	CMO	Mr John Henry Peters Mr Terence Walters
• British Virgin Islands	Mr Dale Lake	CCCCC	Mr Carlos Fuller
• Montserrat	Mr Bennet Kirwan	CDEMA	Ms Andria Grosvenor
• Turks and Caicos Islands	Jamell Robinson	JICA	Mr Taku Yoshida
Grenada	Mr John Henry Peters Mr Terence Walters	Finland	Mr Martti Heikinheimo
		China	Mr Zhang Lei

WORKING GROUP C

Room: Zurqui III

Facilitator: Mr. Jean-Noel Degrace

Rapporteurs: Dr Tomas Gutierrez Perez, Mr Carlos Manuel Paulino Cardenas, Mr. Alexandre Vacher

Secretariat Support staff: Charles Baubion and Hugo Hidalgo

Interpretation: English / French / Spanish

Countries	Persons	Countries	Persons
Antigua & Barbuda	Mr Dale Destin Mr Philmore Mullin	France	Mr Jean-Noel Degrace
Colombia	Mrs Maria Teresa Martinez	Haiti	Ing. Ronald Semelfort Mr Abel Nazaire
Cuba	Dr Tomás Gutiérrez Pèrez Mr Miguel Angel Puig Gonzalez	Netherlands Antilles & Aruba	Mr Alfredo Capello Mr Clive Richardson Mr Julius Melaan
Dominica	Ms Sheryl Etienne-Leblanc Mr Nathanael Isaacs	Saint Lucia	Mr Venantius Descartes Mr Dawn French
Dominican Republic	Mr Andres Miguel Campusano. Mr Carlos Manuel Paulino Cardenas	Saint Vincent and the Grenadines	Houlda Peters
Canada	Mr Abdoulaye Harou Mr Frederic Miville-Deschênes		

Annex IV: Early Warning System Questionnaire

Please list the contact information for individuals who contributed to this questionnaire:

Title	First name	Last name	Country	Name of agency	Phone number	e-mail address

1 Governance and Institutional Arrangements

1.1 Please describe the policy, institutional and legal frameworks that support emergency preparedness and response planning and how the role of the NMHS is reflected.

Answer:

1.2 Describe the process of emergency preparedness and response planning at national to local levels and how the NMHS supports it.

Answer:

1.3 Please, provide:

- A list of agencies that are responsible for management and implementation of different components of early warning systems,
- An organizational chart of the EWS and,
- An organizational decision-making diagram, showing roles and responsibilities of different agencies, including the NMHS.

Answer:

1.4 Give a brief description of how your early warning system works operationally. In this context, identify the working relationships among agencies listed in 1.3 above.

Answer:

1.5 Describe how the different components of the early warning system are financed. Are there dedicated financial resources for maintenance and sustainability of the system (e.g. observing networks, communication systems, emergency response, etc.)

Answer:

2 Utilization of risk information in emergency planning and warnings

- Is hazard-risk information utilized in emergency preparedness and response planning? If yes, please describe how and who is responsible for what?
- Do you have national to local hazard-risk maps, for what risks?

Answer:

3 Hazard monitoring, forecasting, and mandates for warning development

- For which natural hazards (see Annex I for a list of Natural Hazards), the National Meteorological and Hydrological Service
 - has sole mandate for the development of the warning for the hazard (**Type I Hazard**);
 - has joint mandate with other agency(ies) for the development of the warning for the hazard (**Type II Hazard**);
 - provides information to other agencies that have the mandate for the development of the warning for the hazard (**Type III Hazard**).

Please note that: A reference list of hazards is provided at the end of this text),

- Are there challenges for institutional coordination for the development of the warnings? If yes please describe the challenges and how they are addressed.

Answer:

4 Warning dissemination mechanisms

- Specify the dissemination mechanism(s) for delivery of warnings to the authorities and the public? Who is involved in this dissemination mechanism(s)?
- How do you assess the effectiveness of the dissemination mechanism(s) to ensure that the warnings reached their target audiences in a timely manner?

Answer:

5 Emergency preparedness and response activities (national to local)

- Describe the national to local emergency plans and response procedures.
- Are warning levels used in your early warning system? Who determines them? How are these levels linked to emergency preparedness and response decisions and actions at national to local levels?

Answer:

6 Improvement of overall operational framework of the early warning system

- Please identify and describe evaluation and feedback mechanisms within the operational early warning system that help to improve:
 - The system as a whole.
 - Products and services provided by the National Meteorological and Hydrological Service to disaster risk management agencies and other stakeholders.
 - Operational coordination mechanisms of the disaster risk management stakeholders with the National Meteorological and Hydrological Services.
- Has there been specific disaster(s) or hazard event(s) that has lead to a significant re-evaluation and improvement of your EWS? If yes, please specify and elaborate.

Answer:

7 Please provide example of events where your EWS saved lives and explain how.

Answer:

8 Which of the following areas are your priorities for the improvement of your EWS? Please elaborate.

- Governance and Institutional Arrangements
- Utilization of risk information in emergency planning and warnings
- Hazard monitoring, forecasting, and mandates for warning development
- Warning dissemination mechanisms
- Emergency preparedness and response activities (national to local)

Answer:

9 Provide concrete areas of regional cooperation which could benefit your country's early warning system?

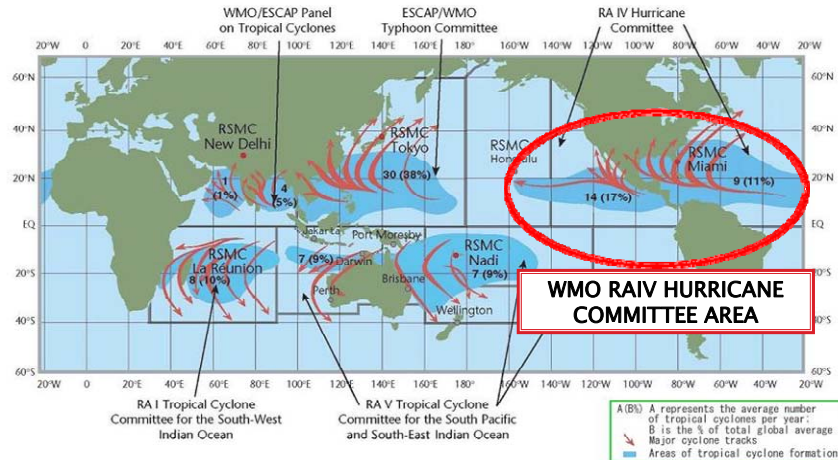
Answer:

Annex V: List of Countries that Responded to the Early Warning Questionnaire

COUNTRIES	Answer to survey	Language
RA IV COUNTRIES (invited to answer the survey)		
1. ANTIGUA AND BARBUDA	YES	
2. BAHAMAS	YES	
3. BARBADOS	YES	
4. BELIZE	YES	
5. BRITISH CARIBBEAN TERRITORIES		
• ANGUILLA	YES	
• BERMUDAS	NO	
• BRITISH VIRGIN ISLANDS	YES	
• CAYMAN ISLANDS	YES	
• MONTSERRAT	YES	
• TURKS AND CAICOS ISLANDS	YES	
6. COLOMBIA	YES	
7. COSTA RICA	YES (RED CROSS)	
8. DOMINICA	YES	
9. DOMINICAN REPUBLIC	YES	
10. EL SALVADOR	YES	
11. GUATEMALA	YES (2)	
12. GUYANA	YES	
13. GRENADA	YES	
14. HAITI	NO (COLECTED AT A LATER DATE)	
15. HONDURAS		
16. JAMAICA	YES (2)	
17. MEXICO	YES	
18. NETHERLANDS ANTILLES AND ARUBA	YES (2)	
19. NICARAGUA - NICARAGUA	YES	
20. PANAMA	YES	
21. SAINT LUCIA	YES (3)	
22. ST VINCENT AND THE GRENADINES	YES	
23. TRINIDAD AND TOBAGO	YES	

Annex VI: Hurricane Committee Capacities in Technical Development and Regional Cooperation

WMO TROPICAL CYCLONE PROGRAMME BODIES



WMO Regional Association IV Hurricane Committee was established in 1978. It has 26 members including: Antigua & Barbuda, Bahamas, Barbados, Belize, British Caribbean Territories, Canada, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, France, Guatemala, Haiti, Honduras, Jamaica, Mexico, Netherlands Antilles and Aruba, Nicaragua, Panama, St. Lucia, Trinidad and Tobago, UK (Bermudas), USA – (RSMC Miami-Hurricane Center), and Venezuela.

Every year, prior to the Atlantic and Eastern Pacific hurricane season, the Hurricane Committee, reviews the RA IV Hurricane Operational Plan, which defines the responsibilities of all the members to ensure the most effective coordination and cooperation for the provision of meteorological information, forecasts and warnings of all tropical cyclones affecting the region. The review incorporates new facilities, advances and developments in the region, which would be of benefit to all its members.

The Operational Plan defines the sharing of responsibilities among members for the various segments of the system throughout the region. In particular, it records the agreed arrangements including, amongst others, those for standardization of operational procedures, provision and efficient exchange of various data related to hurricane warnings and the issuance of tropical cyclone advisories, and other products from a central location, i.e. RSMC Miami - Hurricane Center.

There are several components in the operational plan which include a (i) General Component which is concerned with technology transfer, information and scientific knowledge for members, etc. (ii) Operational Meteorology component which includes the provision of the required basic meteorological data, analyses and other processed products together with the application of appropriate techniques to ensure accurate tropical cyclone forecasting and timely warnings, (iii) Hydrology component which are based on the WMO Operational Hydrology Programme (OHP) and are concerned with the provision of the required basic hydrological data and the application of the appropriate techniques to ensure accurate flood forecasting and timely warnings (iv) Prevention and Preparedness component that includes structural and non-structural measures required to ensure the maximum safety of human life and the reduction of damage to a minimum, (v) Training for each of the components above, and (vi) Research in meteorology and hydrology.

Annex VII: WMO Technical Capacity Development Activities

The WMO has a number of activities for technical capacity development of the NMHS its Members, such as:

- a) **Technical capacity Development for hazard Monitoring and forecasting:**
 - i. **Severe Weather Forecasting Demonstration Project (SWFDP):** The meeting particularly highlighted the regional approach of the SWFDP. The SWFDP is a technology implementation project that is heavily focused on better access to and more effective use of numerical weather prediction outputs, including those of ensemble prediction systems, in operational severe weather forecasting in developing countries, as a basis for developing a strong end-to-end production-to-service delivery system. The project therefore addresses the enhancement of the technological means of developing countries that share similar needs for forecasting and the delivery of warning services that range from alerting of imminent severe weather to advanced lead-times of several days. The goals of the SWFDP, and the results being achieved, contribute to climate change adaptation through ever more skilful and useful forecast services with increasing lead-times. WMO has noted the important strengths of the SWFDP, which include user engagement, addressing specific regional needs, building of cross-programmatic integration to address multiple hazards and multiple technical areas, and creating sustainable legacies for regional handover.
 - ii. **Integrated marine and coastal hazard forecasting and winter storms and related high waves and Ocean Swells:** WMO through its Marine Meteorology Programme, Tropical Cyclone Programme and Hydrology and Water Resource Management Programme is working towards development of national and regional capacities for development of integrated operational capacities for hurricanes, storm surges, costal inundations and high waves caused by winter storms.
 - iii. **Integrated Flood Risk Management and Flash Flood Guidance System:** WMO through its Hydrology and Water Resource Management Programme and in cooperation with a number of partners provides significant training and capacity development in the areas of Integrated Flood Risk Management, where more information can be found at: <http://www.apfm.info/index.htm> and <http://www.apfm.info/helpdesk.htm>.
 - iv. **Drought Monitoring and Risk Management:** With the goal to improving drought management capacities in the Caribbean, the WMO with the Caribbean Institute of Meteorology and Hydrology (CIMH), has developed the Caribbean Agro-Meteorological Initiative (CAMI). Launched in 2010, this initiative involves the NMHSs of Antigua and Barbuda, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, St. Lucia, St. Vincent and the Grenadines and Trinidad and Tobago and the Caribbean Agricultural Research and Development Institute (CARDI) and is funded by the European Union's African, Caribbean and Pacific Group of States (EU ACP). The specific objectives are to assist the farming community in the Caribbean region through provision of information on predictors of the rainy season potential and development of effective pest and disease forecasting systems for improved on-farm management decisions.
 - v. **In addition, WMO through its Scientific and Technical Programmes provides technical capacity development** for air pollution monitoring and forecasting, heat-health warning systems, sand and dust storm forecasting and warning systems.

- b) **Technical Capacity Development for Standardization of Hazard Databases, Metadata and Mapping to Support Risk Assessment:** WMO through a number of its programmes, has developed guidelines for standardizations of hazard databases, metadata and analysis and mapping tools and have developed training workshops for capacity developments of NMHS particularly in areas of floods and droughts. Guidelines for other meteorological hazards are also underway.
- c) **Provision of Meteorological, Hydrological and Climate Services to the Insurance Sector:** One of the emerging opportunities in DRM is the expansion of insurance markets for weather-indexed insurance. WMO through its DRR Programme and in cooperation with NMHS of its Members with experience in serving the (re)insurance sectors, the World Bank, World Food Programme (WFP) and the insurance and reinsurance sector is developing guidelines for the NMHS for the provision of products and services to these sectors. In preparation for this work, WMO hosted a major workshop in 2007 with the sector to develop the approach for working with the sector. The Background and information can be found at: http://www.wmo.int/pages/prog/drr/events/cat-insurance-wrm-markets-2007/index_en.html.
- d) **Quality Management Framework:** The special emphasis of WMO on disaster risk reduction and service delivery including climate services requires a renewed effort in documenting that all relevant processes from physical measurements in observations to forecasts and warnings issued to all user and customer groups are subject to a rigorous quality management. Already, the aviation and marine user community are formulating clear requirements for the implementation of Quality Management Systems in the delivery of services to them. Decision makers in emergency management and response require a clearly demonstrated quality policy that is implemented by National Meteorological and Hydrological Services as a basis for a relationship built on professionalism and trust in the services provided. To this end, WMO is planning to produce a generic guide on Quality Management based on the excellent Guide originally written for QMS in Aeronautical Meteorology (AEM) (WMO No. 1001), web fora have been established , again with a AEM focus, in several regions, including one by the CIMH for the Members in the Caribbean, and another under construction for Spanish.-speaking countries of RA III and RA IV in a cooperative program led by the Spanish Agency for meteorology, “Agencia Estatal de Meteorología” (AEMET). All these efforts can serve as a starting point for QMS implementation for all WMO programmes, and Members seeking advice and guidance are invited to visit the WMO web site: <http://www.wmo.int/pages/prog/amp/QMF-Web/home.html> and contact the Secretariat using the information provided there.
- e) **Service Delivery:** Effective service delivery is a fundamental requirement for NMHSs to deliver effective products and services to a variety of users including for disaster risk management across a variety of sectors. The WMO Strategy for Service Delivery has been developed within the framework of i) Evaluation of user needs and decisions, ii) Development and improvement of delivery mechanisms, iii) Definition of service outcome effectiveness, and iv) Establishment of governance mechanisms for development, provision, evaluation and improvement of services. The Strategy provides a more uniform and structured approach for NMHSs on service development and delivery applicable to all weather, climate and water information, and enables NMHS to improve their national service delivery by the sharing of good practices, increase of user centered services, and enable capacity building within NMHS in order to make best use of resources. To address this strategy the WMO PWS Programme has published a number of guidelines for NMHS public weather services which can be found on their website

http://www.wmo.int/pages/prog/amp/pwsp/publicationsguidelines_en.htm. In this regard the WMO PWS Programme is working in a number of areas such as:

- i. *Health, Weather and Climate* - Weather and climate impact people's health in a number of ways. The impact may be direct, through cold or heat stress, or indirect through weather and climate extremes causing floods, droughts, food insecurity, social disruption, population displacement, and communicable diseases. According to the World Health Organization, a significant number of communicable diseases such as malaria, meningitis, cholera and dengue are climate sensitive and many non-communicable coronary and respiratory diseases are climate sensitive. The WMO, in partnership with other international, regional and national organizations is working on the development of climate-informed early warning systems for a variety climate related health hazards. This work will contribute to strengthening the capacities of NMHS to provide information, data, products and services required by the public health authorities for the development of their strategies and interventions. The capacities of the public health authorities to understand and integrate weather and climate information, products and services in their decision processes will also be improved. The establishment of Climate and Health Working Groups in a number of countries in Africa aim at integration of weather and climate data with health data to forecast and respond to outbreaks of diseases such as malaria. Noting the large proportion of excess deaths due to air pollution during heat waves, the WMO is also focusing on better coordination between air quality forecasting and heat health warning systems as well as working with other organizations and health authorities for improving UVI products and services.
- ii. *Media and Communication* - One of the principal roles of NMHSs is to provide to the general public and also to specialized users, reliable and accurate weather products and services in support of safety and protection of people and goods at times of extreme weather phenomena as well as assisting in the efficient and economic pursuit of business and domestic activity of citizens. These products and services are highly perishable goods and must be disseminated and communicated rapidly in the most efficient way to the intended audience. To ensure that this information is received in the best possible manner, it is necessary that the public not only be able to take in and understand the message, but that they be attracted to the product and have sufficient interest and motivation to consult it, read it, listen to or look at it. Thus the manner of communication as well as the dissemination infrastructure both becomes equally important in order to achieve the optimum distribution of the information.
- iii. *"Single Official Voice" for hazard warnings* - Information dissemination by the media about meteorological events may not be the same as the official information issued by NMHSs. This is of most concern with regard to warnings issues by NMHSs before, during and after severe weather events. The broadcast of erroneous or multiple versions of meteorological information, or inadequate dissemination of the information, can easily give rise to public confusion, particularly when, where and what kind of severe weather is going to occur, its degree of severity, who is likely to be affected, how they should respond and where they should go for further information or updates. This issue is of significant concern for WMO Members and has been subject of discussions for a number of years.
- iv. *Warning Dissemination* - The most common means of dissemination of weather information is the mass media, namely television, radio, internet

and newspapers, whereas facsimile, telephone, pagers, internet and mobile phones can specifically target certain user groups. Usages of social media such as Facebook, Twitter and blogs have grown enormously in recent years. Other technologies such as enhancements and add-ons that download and display forecasts on the status bar of a web browser also make accessing weather information very easy. Redundancy in dissemination methods is very important especially at times of extreme weather events. In choosing the most important dissemination methods, cultural and social conditions as well as, level of national infrastructural capacity and development are important considerations. WMO has issued guidelines on "The Improvement of NMSs-Media Relations and Ensuring the Use of Official Consistent Information" available on its website mentioned above

- f) **Public Education and Outreach** - For a warning or a forecast to be successful, in spite of its accuracy and skill, it has to be disseminated and presented in a way that allows the intended user to actually receive, understand, believe and act upon the information. An effective public weather service delivery will always aim to enhance: (i) User awareness: to receive the information the user must be aware of the services available and the means by which they can be accessed; (ii) User understanding: to understand the information the product must be presented in plain, concise language and the user must know the meaning of the meteorological terms used; (iii) User faith: for a user to believe the information the NMHS must have a public image of credibility, reliability, accuracy and timeliness. (iv) This goal can only be achieved by a well-organized and coordinated public education and awareness.

Annex VIII: Analysis of Responses to the Early Warning System Questionnaire

(a) Summary of Responses to the Questionnaire for Priorities of Action for Strengthening of national early warning systems			
Priority area for improving the national early warning systems, highlighted by countries in the region	Central America (10 countries – including Guyana, Colombia, Belize and Mexico)	Caribbean (11 countries and 7 territories of which respectively 10 and 6 answered to the survey)	Total
Strengthening of coordination and cooperation across agencies at different levels (national to local)	All	All	All
Hazard monitoring, forecasting, and mandates for warning development	7	13	20
Utilization of risk information in emergency planning and warnings	5	9	14
Warning dissemination mechanisms	3	9	12
Governance and Institutional Arrangements	4	6	10
Emergency preparedness and response activities (national to local)	3	6	9
(b) Summary of Responses to the Questionnaire for Priorities of Action for Regional Cooperation to support Strengthening of national early warning systems			
Central America	<ul style="list-style-type: none"> ▪ Sharing of real time meteorological and hydrological information and data between NMHS in the region on meteorological systems moving from one country to another (cold front, tropical waves) and / or on transboundary river basins ▪ Exchanging of technical expertise and good practices ▪ Capacity development (forecasting, modelling, etc) ▪ Developing and integrated regional network of meteorological radars, GIS and satellite capacities ▪ Initiatives and projects such as the Central American Probabilistic Risk Assessment (CAPRA), the WMO RA IV Hurricane Committee, OAS and JICA projects on Flood Early Warning Systems (FEWS) 		
The Caribbean	<ul style="list-style-type: none"> ▪ Sharing of real-time data and information on hazard events among the NMHS, and the regional technical institutions ▪ Sharing of technical expertise and capacity building in areas of maintenance and calibration, GIS, databases, warning dissemination systems, numerical models, remote-sensing and hazard assessment and risk mapping ▪ Development of a regional risk assessment programme and capacity development that can assist the countries in building their hazard and risk mapping and analysis capacities ▪ Harmonization of watch and warning systems ▪ Initiatives and projects implemented by regional and international agencies such as CDEMA, CMO, CIMH, the Caribbean Tsunami Warning System, the WMO RA IV Hurricane Committee and the EU Funded Regional Risk Reduction Initiative in the Overseas Caribbean territories 		

**Annex IX: Summary of Discussions and Recommendations of Working Group A
(Central America) and Working Groups B and C (The Caribbean)**

Theme	Central America (Working Group A)	Caribbean (combined Working Groups B AND C)
Governance and Institutional Arrangements	<p>National</p> <ul style="list-style-type: none"> • All countries in Central America have legislation governing civil protection and the NMHS, however these laws are often not enforced operationally • Funding for NMHS and geological services needs to be linked to the national development budgeting process • Need to institutionalize civil protection agencies and the NMHS to reduce the vulnerability of these services to government changes that cause a truncation of their programmes 	<p>National</p> <ul style="list-style-type: none"> • Some countries need legislation that establishes an autonomous Meteorological service with adequate resources (e.g. financial) • Many countries require additional political will to effect the needed changes in their EWS • Many countries need to strengthen their documentation for EWS operational procedures and plans • Joint planning on theme of EWS around the climate change and tsunami agendas could provide an opportunity to coordinate for a multi-hazard EWS. • Institutionalization of relationships between disaster management and NMHS which should ensure accountability for the action at the national level <p>Regional</p> <ul style="list-style-type: none"> • A mechanism for guiding the process of EWS implementation at the regional level linked to the national level, involving key actors such as CMO, CIMH, CCCCC, and Meteorological agencies etc. building on the Comprehensive Disaster Management (CDM) initiative of CDEMA in the Caribbean. • Utilization/strengthening/establishment (when needed) of Centres of Excellence or regional centres to support EWS implementation and advancement at the regional and national level.
Utilization of Risk Information in Emergency Planning and Warnings	<p>National</p> <ul style="list-style-type: none"> • Development and standardization of hazard and vulnerability risk data and information. • Need for more vulnerability information for different sectors <p>Regional</p> <ul style="list-style-type: none"> • The Central American Probabilistic Risk Assessment (CAPRA) is a cooperation initiative that should be continued and expanded 	<p>National</p> <ul style="list-style-type: none"> • Capacity development of institutions to utilise hazard/risk information for decision making • Training for authorities to fulfil warning functions (understanding of risk information to disseminate warnings e.g. tsunami) <p>Regional</p> <ul style="list-style-type: none"> • Need a regional programme for the development and application of multi-hazard mapping and risk assessment for operational decision making (including early warning systems) building on and sustaining of national and regional initiatives, through: <ul style="list-style-type: none"> ○ Regional / bi lateral projects ○ Development of a regional methodology ○ Capacity development of

Theme	Central America (Working Group A)	Caribbean (combined Working Groups B AND C)
		<p>institutions involved in risk assessment and mapping</p> <ul style="list-style-type: none"> ○ Development and application of multi-hazard mapping and vulnerability assessment for operational decision making ○ Development and maintenance of climatological databases and metadata and regional event database (i.e. regional GIS), and weather and climate forecasting tools need to be considered ○ Linked to existing activities of CIMH supporting risk management and the insurance, including the Caribbean Catastrophe Risk Insurance Facility (CCRIF). <ul style="list-style-type: none"> ● Specifically, there is need for exchange of good practices in risk modelling and analysis.
<p>Hazard Monitoring, Forecasting and Mandates for Warning Development</p>	<p>National</p> <ul style="list-style-type: none"> ● Strengthen/development of real-time meteorological information systems ● Increase the coverage of monitoring networks and their interoperability (e.g. hydro-meteorological observations, radar) to fill observational gaps <p>Regional</p> <ul style="list-style-type: none"> ● Standardization of protocols for warning dissemination (colours, formats, etc) at the regional level ● Coordination of implementation of latest technology to ensure regional compatibility of data formats ● Capacity development for downscaling of mesoscale models to allow for better scenario forecasting as well as better forecasts for large basins, especially for those with a history of flash flooding. ● Sharing of real time meteorological and hydrological information and data between NMHS in the region on meteorological systems moving from one country to another (cold front, tropical waves) and / or on trans-boundary river basins ● Developing of an integrated regional network of meteorological radars 	<p>National</p> <ul style="list-style-type: none"> ● Lack of maintenance and associated training for Monitoring networks ● Need training for user focused product (e.g. warnings) development ● Need for additional financial resources for the development of the NMHS (e.g. monitoring networks, forecasting and warning capacities) ● Capacity enhancement should also include training, equipment, software tools ● Training for the users of NMHS products and services <p>Regional</p> <ul style="list-style-type: none"> ● Need for increasing coverage of monitoring networks, harmonization and interoperability across different networks (e.g. Caribbean Doppler radar mosaic, observations east of the Eastern Caribbean islands) ● Improved coordination of regional data collection and monitoring (e.g. gauges buoys,) of Multi-Hazard nature ● Need for additional satellite bandwidth to download data and products ● Sharing of real-time data and information on hazard events among the NMHS, and the regional technical institutions ● Creation of a working group on information exchanges and protocols for the lesser or greater Antilles ● Strengthening/developing monitoring and forecasting capacities for a number of hazards (With CMO, CIMH, other relevant CARICOM agencies and other Islands that are not members of CARICOM) in the following areas: <ul style="list-style-type: none"> ○ Integrated marine and coastal hazard

Theme	Central America (Working Group A)	Caribbean (combined Working Groups B AND C)
	<ul style="list-style-type: none"> • Trans-boundary basins require cooperation and information exchange between countries 	<ul style="list-style-type: none"> monitoring and forecasting (hurricane, storm surges, coastal inundation, as well as winter storms and related swells and high waves) <ul style="list-style-type: none"> ○ Drought monitoring and risk management (slow on-set, targeting different sectors) ○ Severe Weather Forecasting Demonstration Project and Flash Flood Guidance • Inter-regional website (through CMO and CIMH) for sharing of analysis and tools among the NMHS (GDPFS, HWR, PWS) • Strengthening the operational cooperation of NMHS and DRM agencies in EWS, establishment of Standard Operational Procedures (SOPs), through relevant training programmes
Warning Dissemination Mechanisms and Service Delivery of NMHS to DRM agencies	<p>National</p> <ul style="list-style-type: none"> • Training programmes are needed for institutional staff to ensure that forecasts and warnings meet the users needs • Technical institutions (e.g. NMHS) need staff training on how to communicate the warning with their different target communities (authorities, emergency responder, public) • Development of quality management framework developed between the NMHS and DRM agencies for product development and service delivery to support early warning systems. • <p>Regional</p> <ul style="list-style-type: none"> • Evaluate Global Telecommunication Systems' capacities as the communications mechanism for communicating watches/advisory issuance and information from international organizations (e.g. Tsunami watch centres, WMO Regional Tropical Cyclone Center- Miami Hurricane Center) 	<p>National</p> <ul style="list-style-type: none"> • Improved NMHS service delivery in EWS highlighted as one of the major gaps • i. Development of effective warnings and dissemination mechanisms to various stakeholders (e.g., need for effective websites was strongly highlighted, role of media, and other mechanisms for dissemination of warnings to government authorities and DRM agencies, health service, humanitarian agencies, public - to the last mile (including community based approaches). • Improve telecommunications and infrastructural capabilities to support dissemination <ul style="list-style-type: none"> ○ Need for both modern and traditional dissemination mechanisms with consideration for the sustainability of the systems (e.g., SMS and Fog Horn) ○ Enhance capacities (redundancy, consistency) for dissemination of multi-hazard warning messages for the population (e.g. adoption and utilization of Common Alerting Protocols -CAP) • Improve EWS public awareness and feedback mechanisms • Development of quality management framework between the NMHS and DRM agencies for product development and service delivery to support early warning systems. • Development of public / private partnerships for warning dissemination (e.g., Cell phone networks)

Theme	Central America (Working Group A)	Caribbean (combined Working Groups B AND C)
		<p>Regional</p> <ul style="list-style-type: none"> • Harmonization of regional watch and warning systems. Regional review of colour coding systems for warnings building on systems in the region (e.g. Trinidad and Tobago, Martinique) and the possibility of establishing a regional system
<p>Emergency Preparedness and Response Activities</p>	<p>National</p> <ul style="list-style-type: none"> • National emergency plans are too general and need to be refined for the local levels such as municipalities • EWS drills need to be systematic, regular and utilized for evaluation of the entire system • Strengthening the operational cooperation of NMHS and DRM agencies in EWS, establishment of Standard Operational Procedures (SOPs), relevant training programmes 	<p>National</p> <ul style="list-style-type: none"> • Need for capacity development in the broader sense which includes training, materials, data and information, including the ability to apply and understand both • Need for enhanced collaboration between NMHS and DRM and establishment of Standard Operational Procedures delivery of more effective emergency preparedness and public awareness and educational programmes. • Need to target specific vulnerable population with adapted dissemination systems (e.g. elderly, tourists) <p>Regional</p> <ul style="list-style-type: none"> • To develop, if needed, review, evaluate and improve regional contingency plans for EWS, such as back-up systems for NMHS
<p>Other Crosscutting Regional Recommendations</p>	<ul style="list-style-type: none"> • Need for strengthened flood and drought monitoring, data sharing and risk management • Need for enhanced technical capacity development (forecasting, modelling, etc) • Exchanging of technical expertise • There is need for enhanced coordination across many regional activities, initiatives and projects such as the Central American Probabilistic Risk Assessment (CAPRA), planning through the WMO RA IV Hurricane Committee, OAS and JICA projects on Flood Early Warning Systems (FEWS) could be used and strengthened for regional cooperation and development 	<ul style="list-style-type: none"> • Need for strengthened flood and drought monitoring, data sharing and risk management • To develop a list of expertise of the countries of the region, in a view of experience sharing. • Development and/or strengthening of bilateral plans of cooperation, protocols and agreements • Sharing of technical expertise and capacity building in areas of maintenance and calibration, GIS, databases, warning dissemination systems, numerical models, remote-sensing and hazard assessment and risk mapping • Initiatives and projects implemented by regional and international agencies such as CDEMA, CMO, CIMH, other agencies under the CARICOM umbrella, the Caribbean Tsunami Warning System, the WMO RA IV Hurricane Committee and the EU Funded Regional Risk Reduction Initiative in the Overseas Caribbean territories. • Public education targeted at population, children, communities, etc. was highlighted as a major gap in the region.