Strengthening Regional Cooperation to Support Forecasting with Multi-Hazard Approach in RA IV

(With focus on the gaps and needs identified through the Central American Pilot Projects and the Caribbean initiative for strengthening Multi-Hazard Early Warning Systems)

FINAL REPORT

11 April 2011

Ritz Carlton – Grand Cayman
George Town, Cayman Islands
7 March 2011

Meeting Website: http://www.wmo.int/pages/prog/drr/events/CaymanIslands/index_en.html

Table of Content

1. Background

1. In the WMO Regional Association IV (RA IV) (Central and North America and the Caribbean region), between 1980 and 2007, nearly 91% of disasters, 70% of casualties and 91% of economic losses related to natural hazards were caused by recurring meteorological-, hydrological- and climate-related events such as tropical cyclones, heavy rain, flooding, flash flooding, gales, high sea / swell, storm surges, and extreme temperature, which bring tremendous impact to the region, including halting and even reversing the socio-economic development.

2. In 2010, one of the major outcomes and recommendations of Regional Association IV (RA IV) "Training Workshop on Institutional Coordination in Multi-Hazard Early Warning Systems- MHEWS," (22-25 March, San Jose, Costa Rica) [1] was the need for addressing capacity development in support of disaster risk management and multi-hazard early warning systems within sub-regional initiatives in Central America and the Caribbean, due to differing organizational mechanisms, capacities and challenges in these sub-regions related to disaster risk management. Specifically, two initiatives are underway, including (i) Caribbean Initiative to Strengthen Risk Assessment and MHEWS, and (ii) Central America DRR Pilot Projects for Strengthening MHEWS. Strengthening of these capacities requires strengthening of regional cooperation in the RA IV.

Caribbean Initiative to Strengthen Risk Assessment and MHEWS

3. Caribbean Initiative for strengthening of risk analysis and MHEWS, with focus on meteorological, hydrological, marine and coastal and climate-related hazards emerged following the Costa Rica Workshop. The goal of this initiative is to strengthen regional cooperation engaging all components of WMO (Members, Regional Association, technical programmes and commission) and other national, regional and international agencies and partners for strengthening of capacities for metrological, hydrological, marine/ocean and climate services to support multi-hazard risk assessment and early warning systems. Through a series of consultations, training and assessment workshops with multi-stakeholder engagement [2], a reference "living" document [3] has been produced, providing: (i) institutional mapping and a list of agencies at national and regional levels engaged in various aspects of disaster risk management, (ii) analysis of the relationships between the Meteorological, Hydrological Services and the Disaster Risk Management Agencies in the Caribbean countries and territories, as well as the regional organizations and centres serving this region, (iii) mapping of existing or completed assessments and projects carried out bi-laterally or through various agencies, relevant to this initiative; (iv) analysis of existing capacities, gaps, needs and priorities for the strengthening of MHEWS Capacities in the Caribbean, and (v) recommendations for areas requiring long-term capacity development and priority

---

[1] - Training Workshop on Multi-Hazard Early Warning Systems with focus on Institutional Partnership and Coordination, March 22-25, 2010, San José, Costa Rica. Website: http://www.wmo.int/pages/prog/drr/events/MHEWSCostaRica/index_en.html

[2] These include: **(i)** Training Workshop on Multi-Hazard Early Warning Systems with focus on Institutional Partnership and Coordination, March 22-25, 2010, San José, Costa Rica. Website: http://www.wmo.int/pages/prog/drr/events/MHEWSCostaRica/index_en.html

(ii) National Disaster Coordinators and Meteorologists Dialogue Advancing Multi-Hazards Early Warning Systems in the Caribbean, Montego Bay, Jamaica, 6th December, 2010: http://www.wmo.int/pages/prog/drr/events/Jamaica/index_en.html

(iii) Technical Cooperation Workshop for Development of the Caribbean Regional Cooperation Programme in Multi-Hazard Early Warning Systems, 2-5 November 2010, Christ Church, Barbados. Website: http://www.wmo.int/pages/prog/drr/events/Barbados/index_en.html .

(iv) George Town, Grand Cayman, Cayman Islands, 22-23 November 2010. Website: http://www.wmo.int/pages/prog/drr/events/Jamaica/index_en.html

[3] Report of Assessments of the Capacities, Needs and Priorities for the Strengthening of Multi-Hazard Early Warning Systems in the Caribbean. Website: http://www.wmo.int/pages/prog/drr/events/CaymanIslands/index_en.html

areas for Phase I proposal development. Specifically, the region highlighted the importance of long-term commitment to the development of:

(i) Established legislation and institutional arrangements;

(ii) Risk assessments capacities developed and applied to various sectors for planning;

(iii) Quality Management Systems (QMS) and Standard Operating Procedures (SOP) developed between National Meteorological and Hydrological Services (NMHS), Disaster Risk Management (DRM) agencies and other Early Warning System (EWS) stakeholders (institutionalizations);

(iv) Strengthening core capacities (e.g., observations, telecommunications, forecasting, data management and exchange and service delivery) for operational meteorological, hydrological and climate services to support disaster risk management within a multi-sectoral approach; and,

(v) Need for better integration of various projects and enhance coordination across multi-Hazards EWS in the region.

4. Within these areas, it was recommended by the regional and national stakeholders, that the development of phase-I project proposals should address:

(i) National Policy dialogues in DRR and reflection of the role of NMHS in policy, legislative, multi-sectoral coordination, planning and budgetary aspects,

(ii) Capacity development for strengthening of forecasting capacities;

(iii) Capacity development for warning dissemination and communication and Common Alert protocol (CAP) particularly noting the need for website development for information dissemination, relation with media and CAP development;

(iv) Building on NMHS QMS and SOP development for aeronautical to extend to SOPs between NMHS and DRM agencies;

(v) Data rescue, data management systems and hazard analysis training pilot.

Central America DRR Pilot Projects for Strengthening MHEWS

5. In Central America, three pilot projects have been initiated in Costa Rica, El Salvador and Mexico to demonstrate the benefits of end-to-end early warning systems, engaging the national and local DRM authorities, National Meteorological and Hydrological Services. These projects address heavy rain, riverine, flash and coastal flooding with the goal to strengthen forecasting and warning capacities and linkages with emergency preparedness and planning as part of strengthening or development of MHEWS.

2. About this Meeting

2.1. Scope

6. The scope of the technical meeting was to confirm the priority hazards of the region, and determine the means for improving current methods, tools, data and diagnostics, and forecasting products that could be available through various regional centres, regional institutional arrangements and capacity development needs of NMHS for effective monitoring and forecasting of these hazards. The meeting discussed issues related to strengthening regional cooperation, building upon existing arrangements, such as hurricane forecasts and guidance provided by RSMC-Miami Hurricane Centre, other products and services available through other regional and global meteorological centres and WMO. The meeting provided the basis for developing a way forward to improve forecasting and warning capacities and services in the region.

2.2. Objectives

7. The objectives of the Meeting were to:

(i) Identify current operational capacities and practices, products and tools that the Meteorological and Hydrological Services for monitoring and forecasting priority hazards;

(ii) Identify the best available forecasting products and tools for priority hazards (severe weather floods including, flash floods and coastal flooding, tropical cyclones, storm surge, and other ocean and marine hazards);

(iii) Determine the products and services that could be made available to the Meteorological and Hydrological Services through the regional and global centers to improve monitoring and forecasting of the priority hazards;

(iv) Determine a way forward for creating a work plan for capacity development for forecasting priority hazards that could support the proposal development of Caribbean MHEWS initiative and pilot projects in Central America. Participants

2.3. Participants

8. Please see Annex I for the participants list.

2.4. Format of meeting

9. The Meeting was comprised of five sessions (please see the Agenda in Annex II) including:

Session 1: Opening and Introduction

10. The meeting was opened by Mr. Fred Sambula, Director General of the Cyaman Islands National Weather Service with statements by Dr. Maryam Golnaraghi on behalf of Michel Jarraud the WMO Secretary-General, Mr. Donovan Ebanks, MBE, Deputy Governor, Mr. Arthur Rolle, President of WMO Regional Association IV and Mr. McLeary Frederick the Director of Hazard Management in the Cayman Islands.

Session 2: Background and Review of Major Hazards and Forecasting Capacities

11. This session reviewed the status of the disaster risk reduction initiatives in Central America and the Caribbean and the objectives and structure of this Meeting. Lessons learnt were presented from regional cooperation in the WMO Severe Weather Forecasting Demonstration Project (SWFDP) in other regions as well as the existing tropical cyclone cooperation in RA IV. The outcomes of the extensive consultations in RA IV on priority meteorological, hydrological and marine-related hazards and needs for strengthening forecasting capacity development were also discussed.

Session 3: Review of Latest Forecasting Capacities, Tools and Technologies for Meteorological, Hydrological and Marine-Related Hazards

12. This session took stock of the latest products and tools in forecasting for meteorological hydrological and marine-related hazards in RA IV. This session reviewed the latest tools and technologies for forecasting severe weather and other meteorological conditions (e.g. tropical cyclones, heavy rainfall, high winds), hydrological hazards such as flash and riverine flooding as well as marine and coastal hazards such as storm surge, coastal inundation and high impact oceanic swells. It was discussed that some of the tools and methodologies for flash flooding and storm surges were already being implemented in the region.

Session 4: Global and Regional Centres and Other Institutions that could Contribute to the Development of Technical Forecasting Capacities in RA IV

13. Session 4 reviewed current capacities of the WMO Global and Regional Specialized Meteorological Centres and other institutions that could contribute to the development of technical forecasting capacities for priority hazards in the region. In this session, current forecast and satellite products and services available through a number of centres such as WMO RSMC-Miami Hurricane Center, European Centre for medium-range Weather Forecasting-ECMWF, Météo-France, and USA-NOAA-National Centre for Environmental Prediction (NOAA-NCEP) satellite data and product, were presented and discussed as well as training products and services available through the Caribbean Institute for meteorology and Hydrology (CIMH). Observation requirements for real-time monitoring and forecasting of priority hazards were presented and discussed including how to leverage and synergize various platforms across existing projects (e.g. Carib HYCOS, CARIB WIGOS) to support nowcasting and forecasting of the priority hazards. The current status of the Tsunami Early Warning System for the Caribbean and adjacent seas was also presented and discussed.

14. Specifically, in regards to the potential areas of cooperation with UNESCO-IOC and ICG- Tsunami EWS. The meeting discussed that although there are areas of convergence among the meteorological and tsunami systems, its important to keep in mind the following;

    (i) The models that are used to determine tsunami inundation and storm surges are different, given the difference in the source (seismic, mass movement displacement versus wind/pressure). Areas indicated to be under threat from tsunami inundation might be greater or smaller than storm surge;

    (ii) While the sea level technology used for Meteorology and Tsunami are the same, the criteria for the placement of the stations vary;

    (iii) Because of the nature of tsunamis, much expertise is required in the field of seismology, and therefore a major component of the professionals that are required for a tsunami warning centre are Seismologists, followed by Oceanographers;

    (iv) Recall the recommendation of the ICG that a Regional Tsunami Warning Centre be established in the region to deliver the most timely and effective tsunami products for the decision makers;

    (v) Short lead times between first warning and impact, minutes vs days for tropical cyclones and storm surges;

    (vi) Less than 50% of the Tsunamis Warning Focal Points in the countries and territories are not the Meteorological Services, but Emergency Management, Seismological Institutions, Security Agencies (Police, Fire). A list of the focal points within the NMS community is to be obtained from UNESCO-IOC and CMO for clarification of roles and responsibilities of the Meteorological Services;

    (vii) However, a critical need for both tsunami and storm surge modelling and coastal inundation is the need for coastal bathymetry, which needs to be mapped for counties/territories in the region and opportunities for more integrated network of sea level stations. In this regard, there is need for development of clear regional work plan related to:

        (a) Bathymetry, using Airborne LIDAR, Multi-beam scanning instruments mounted on marine vessels. Leveraging can be sourced from

shipping, cruise ship, oil and/or fishing industries, and digitising of existing charts;

(b) Sea Level Stations: Perhaps some technical advice could be given by those jurisdictions which already have extensive Sea Level Networks in the region, particularly the USA. The ideal scenario is to facilitate an integrated network that is compatible with existing systems and data.

Session 5: Challenges and opportunities for global and regional products and services to support capacity development in forecasting for priority hazards in the region and planning and organizing for the development of an implementation plan for strengthening hazard forecasting

15. Session 5 reviewed the preliminary outcomes of a questionnaire (See Doc 3 on the meeting website, *Survey Questionnaire to Assess Forecasting and Observing Capacities of the National Meteorological and Hydrological Services to Support Multi-Hazard Early Warning Systems*), which was sent to the participants prior to the Meeting. The questionnaire was designed to assess capacities, gaps and needs in forecasting tools and products for various hazards in the region. To-date 18 responses have been received of 25; however 14 responded to the marine section and nine responded to the Hydrology Section to this questionnaire (See Annex III for a list of responders). WMO Secretariat will follow up with all members to whom the questionnaire was sent, to obtain their complete responses. The preliminary responses indicated that while capacities at the national and regional levels exist for meteorological, marine, hydrological forecasting, the region could benefit from, (i) strengthening of observation networks to include blind areas, (ii) enhanced interoperability across various observing networks, (iii) systematic sharing of real-time hydro-meteorological and marine-related observation data to support forecasting, (iii) development and coordination of user-specific regional forecast products and services for priority hazards and availability to all NMHS, (iv) strengthening of national – local forecasting capacities, and (v) strengthening of existing and development of new regional training programmes related to technical aspects of monitoring and forecasting for priority hazards.

16. During this session areas requiring further development through concrete projects were discussed and recommendations for drafting a project proposal for Phase-I of the Caribbean initiative were highlighted.

3. Outcomes and Recommendations

17. It was recommended that specific needs for strengthening monitoring and forecasting of all priority hazards in the region, should be carried out through a strong regional cooperation framework, and demonstrated through concrete projects being developed under the Caribbean Initiative for strengthening Risk Assessment and MHEWS and the Pilot Projects in Central America.

18. A potential project concept was discussed for phase-I Caribbean Initiative for strengthening Risk Assessment and MHEWS based on discussions and consultations at this Meeting, including:

    (i) Facilitate national policy/legislation dialogues and risk management workshops for strengthening of meteorological, hydrological and climate services and identification of roles and responsibilities of National Meteorological and Hydrological Services as reflected in national policy, legal framework and institutional coordination mechanisms, within a comprehensive Disaster Risk Management Framework;

(ii) Develop and demonstrate operational capacities in EWS for severe weather (heavy precipitation) and flooding (flash floods and coastal inundation) spanning all components of regional cooperation and all components of national EWS including monitoring and forecasting, risk analysis, dissemination and communication and development Standard Operating Procedures for emergency contingency planning and activation of emergency plans based on warnings issued on the levels of risks.

19. This preliminary project concept was presented by the chair of the RA IV DRR Task team and the Chair of the RA IV DRR Task Team-Caribbean during a special session on Disaster Risk Management at the 33rd Hurricane Committee meeting on March 8, for further consultation with the participants. The concept was endorsed and the Meeting noted that the design of the proposal should be carried out with consideration for a number of factors, including:

(i) The concept should be consulted with the DRM agencies and other regional and international partners for further development and buy-in. It was noted that consultation with these stakeholders are planned in Q2 and early Q3 2011;

(ii) The alignment of the project with the elements of the Caribbean Disaster Management Framework (CDM);

(iii) Development and implementation of a multi-stakeholder and transparent mechanism for project/proposal development, implementation planning, resource mobilization and establishment of project governance engaging Members and key partners. It was discussed that a proposal document for both components should be developed with a clear project management framework and implementation planning with consideration for the roles and responsibilities of different stakeholders, to leverage technical, operational, coordination and funding capacities within WMO and with other partners. The following issues should also be considered;

(a) Criteria for country/territory selection for implementation of the project should be based on multiple benefits and governments' and agencies' receptivity for active participation in and contributions to the project;

(b) Relevant partners (national, regional, international) should be identified and engaged in the planning, implementation, and resource mobilization and development of project governance mechanism;

(c) Concrete experiences and lessons learnt from the good practices in Multi-Hazard EWS documented by WMO, from the region and globally such as France/French West Indies, Cuba, Italy, the USA, Japan, Bangladesh, etc. would provide significant insight and expertise in all aspects of the projects;

(d) Mapping of all relevant existing projects in the region and determining leveraging opportunities should be explored, particularly highlighting the following projects:

i. Finish and Canadian QMS/SOP development

ii. OAS/CDEMA/UNDP DRR Legislative/planning/governance initiative

iii. CIMH/UNDP/CDEMA/Italian Cooperation project on risk identification for EWS purposes

iv. The EU funded Regional Risk Reduction Initiative (R3I) project of OCTs being implemented by UNDP

v. CIMH/CCRIF project on indexing of floods for Flood insurance products

vi. Caribb WIGOS, Caribb HYCOS, and the Radar projects;

(e) Consideration of funding opportunities;

(f) Establishment of an annual Regional forum or meeting for monitoring, discussions, evaluations and improvements within the context of these multi-stakeholder projects, leveraging relevant annual meetings in the region.

Annex II

AGENDA

Early Registration – Sunday 6 March 2011	
Monday, 7 March 2011	
0730 – 0900	Registration
Session 1: Opening Session	
0900 – 0930	Master of Ceremonies: Mr. Fred Sambula Director General, Cayman Islands National Weather Service ➢ Welcome Remarks - Mr. Fred Sambula (1 min) ➢ Prayer ➢ The National Song and National Anthem ➢ Remarks on behalf of WMO Secretary general - Dr. Mary Golnaraghi, Chief of Disaster Risk Reduction, WMO (5 min) ➢ Mr. Donovan Ebanks, MBE, Deputy Governor (5 min) ➢ Mr. Arthur Rolle, President of Regional Association IV (4 min) ➢ Vote of Thanks, Mr. McLeary Frederick, Director Hazard Management Cayman Islands (3 Min)
Chair: Mr. Arthur Rolle, President of WMO Regional Association IV	
Session 2: Background and Review of Major Hazards and Forecasting Capacities	
0930 - 1015	➢ Overview of the DRR initiatives in Central America and the Caribbean – Maryam Golnaraghi, WMO (10 Minutes) ➢ Objectives and structure of the Technical Meeting – Peter Chen, WMO (10 Minutes) ➢ Regional cooperation in forecasting - lessons learned from regional cooperation in the WMO Severe Weather Forecasting Demonstration Project (SWFDP) in other regions and Tropical Cyclone Cooperation in RA IV - Peter Chen, WMO (15 Minutes) - Bill Read, Chairman of the Wmo RA IV Hurricane Committee (TBC) (15 Minutes) ➢ Outcomes of consultations in RA IV pertaining to priority meteorological, hydrological and marine-related hazards and needs for forecasting capacity development – - Juan Carlos Fallas Sojo – Chair of WMO RA IV DRR Task Team (15 Minutes)
Session 3: Review of Latest Forecasting Capacities, Tools and Technologies for Meteorological, Hydrological And Marine-Related Hazards	
1015 – 11:30	➢ Latest meteorological tools and technologies for forecasting severe weather and other meteolrogical conditions (e.g. tropical cyclones, heavy rainfall, high winds) - Jean Noel Degrace, Météo-France (20 Minutes) ➢ Latest tools and technologies for forecasting hydrological hazards (e.g. flash flooding, riverine flooding) - Robert W. Jubach, Hydrologic Research Center (20 Minutes) ➢ Latest tools and technologies for forecasting marine and coastal hazards (e.g. storm surge, costal inundation, high impact oceanic swells - Daniel Brown, U.S. National Weather Service (20 Minutes)
1130 – 1145	**Coffee break**
1145 – 1230	**Discussion: Challenges and opportunities for the provision of tools and technologies to support monitoring forecasting and warning of priority hazards in RA IV to be demonstrated through the Central American Pilot Projects and the Caribbean Initiative**

1230-1245	**Group Photo**
1245 – 1400	**Lunch**
Session 4: Global and regional centres and other institutions that could contribute to the development of technical forecasting capacities in RA IV	
1400 - 1600	This session will include presentations on availability of technical capacities, products and services relevant to all priority hazards in RA IV: ➢ Technical capacities, forecast and satellite products and services available through USA Centers (RSMC-Miami Hurricane Center, NCEP, satellite data and products such as for heavy precipitation estimation, etc) (20 Minutes) – Bill Read, Chairman of the Wmo RA IV Hurricane Committee ➢ Technical capacities, forecast and satellite products and services available through Météo-France and ECMWF (20 Minutes) – Jean Noel Degrace by Météo-France ➢ Technical capacities, training, products and services available through CIMH – Dr. David Farrell (15 Minutes) ➢ Requirements for various observations for real-time monitoring and forecasting of priority hazards through various platforms and synergies across existing projects (e.g., Carib HYCOS, CARIB WIGOS) to support nowcasting and forecasting of various hazards – CMO, WIGOS/CBS, Carib-Hycos (20 Minutes) ➢ ICG Tsunami Early Warning Systems for the Caribbean and Adjacent Seas – Rafael Mojica (15 Minutes)
1600-1615	**Coffee break**
Session 5: Discussion: **Challenges and opportunities for global and regional products and services to support capacity development in forecasting for priority hazards in the region and planning and organizing for the development of an implementation plan for strengthening hazard forecasting** *The following topics will be addressed in this discussion session:* ▪ Prioritization of capacity development for hazards in the region ▪ Country groupings for implementation of hazard capacity development in context of Caribbean MHEWS initiative and central America DRR Pilot projects ▪ Integration of existing projects/initiatives (e.g. Carib WIGOS, CARIB-HYCOS) with latest forecasting tools and methodologies ▪ Mechanisms for the provision of global and regional guidance products in RA ▪ Demonstration of capacity development through the Caribbean and the Central America pilot projects with phased approach, priorities for phase I (2 years)	
1615 - 1745	➢ Regional Capacities of NMHS in forecasting of priority hazards (Results of the Questionnaire) – - Peter Chen - Gabriel Arduino WMO (15 Minutes) - Jose Rubiera (outcomes of the storm surge workshop in DR and the questionnaire) (10 minutes) ➢ Proposal for the Phase-I project in the Caribbean – Dr. Albert Martis, Chair of DRR RA IV Task Team for the Caribbean
1745 – 1800	Summary of Outcomes and closing of the Meeting

Annex III

Survey Questionnaire to Assess Forecasting and Observing Capacities of the National Meteorological and Hydrological Services

Survey Questionnaire Response list

As of: 11 April 2011

Country	Questionnaire Sections Received		
	Meteorology (Section I)	**Hydrology (Section II)**	**Marine (Section III)**
1) Antigua et Barbuda	**Yes**		**Yes**
2) Bahamas	**Yes**		**Yes**
3) Barbados	**Yes**		
4) Belize			
5) Bermudas/UK	**Yes**		**Yes**
6) British Caribbean Territories	**Yes**		**Yes**
7) Colombia	**Yes**	**Yes**	**Yes**
8) Costa Rica	**Yes**	**Yes**	**Yes**
9) Cuba			
10) Dominica	**Yes**	**Yes**	**Yes**
11) Dominican Republic	**Yes**	**Yes**	**Yes**
12) El Salvador	**Yes**	**Yes**	**Yes**
13) Grenada/CMO	**Yes**		
14) Guatemala		**Yes**	**Yes**
15) Haiti			
16) Honduras			
17) Jamaica			
18) Mexico	**Yes**	**Yes**	**Yes**
19) Netherland Antilles and Aruba (Curacao)			
20) Nicaragua	**Yes**		
21) Panama	**Yes**	**Yes**	**Yes**
22) Saint Lucia	**Yes**		
23) St. Maarten	**Yes**		**Yes**
23) Suriname	**Yes**	**Yes**	**Yes**
24) Saint Vincent and Grenadines/CMO			
25) Trinidad and Tobago	**Yes**		

Total Responses	**18**	**9**	**14**