



World Meteorological Organization

Working together in weather, climate and water

**Technical Cooperation Workshop for Development of  
the Caribbean Regional Cooperation Programme in  
Multi-Hazard Early Warning System**

**Background and objectives**

**Dr Maryam Golnaraghi**

**Chief of Disaster Risk Reduction Programme**

*2-5 November 2010*

*Accra Beach Hotel & Spa*

*Christ Church, Barbados*



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# Overall Background

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# WMO Leverages International and Regional Cooperation to support National Meteorological and Hydrological Services



## National Meteorological and Hydrological Services

Meteorological, hydrological and climate value-added products and warning advisories

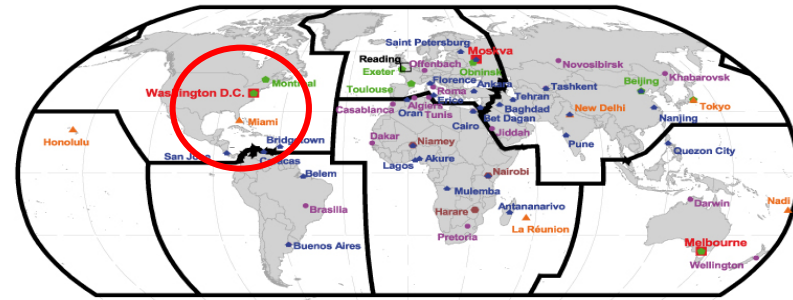
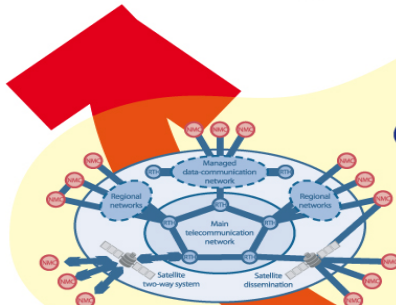
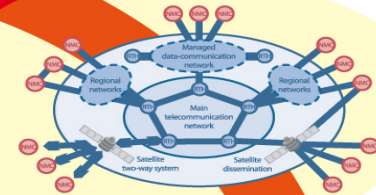
Meteorological, hydrological and climate observations

189 Members

Global Telecommunication System

Data policy and Exchange:

Resolutions 40 and 29

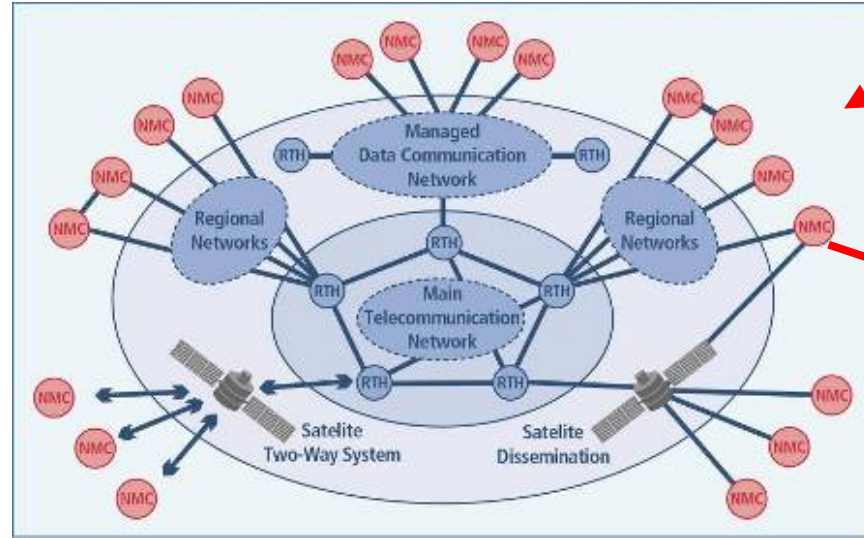
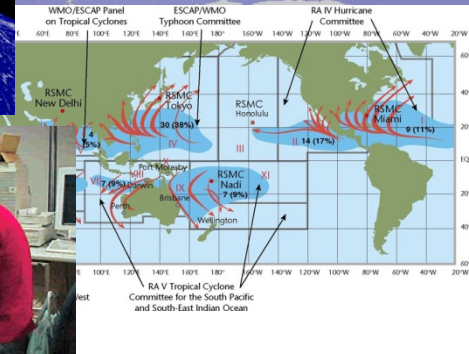
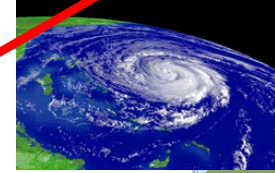


- Regional Meteorological Training Centres
- Environment Emergency Response Centres
- Drought Monitoring Centres
- Regional Meteorological and Hydrological Specialised Centres
- Medium Range Forecasting Centre
- World Meteorological Centres
- ▲ Tropical Cyclone Forecasting Centres

## Global Data Processing and Forecasting System



# Communication and Dissemination of Processed information



4

**National Meteorological and Hydrological Services**

**Examples:**

**Global Tropical Cyclone and Storm Watch System**

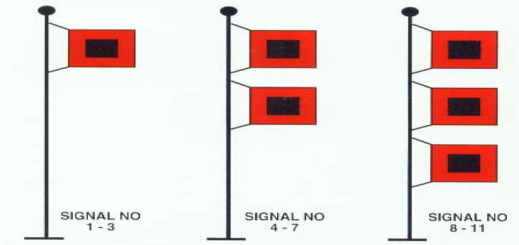
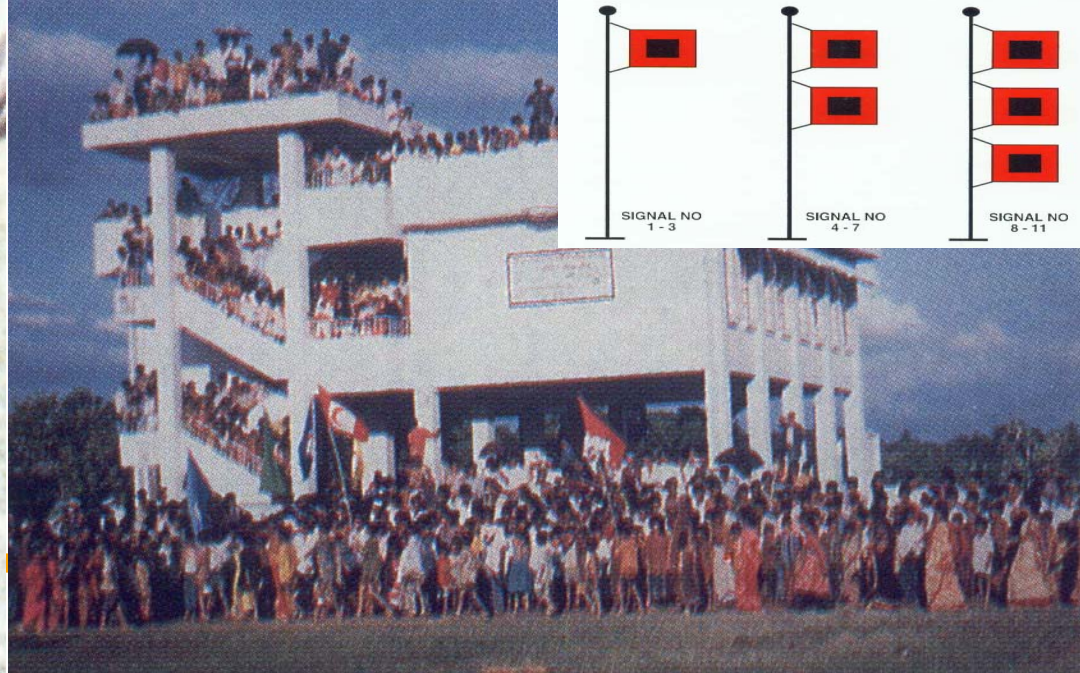
**Emergency Response Activities**

**Drought Monitoring and Forecasting**





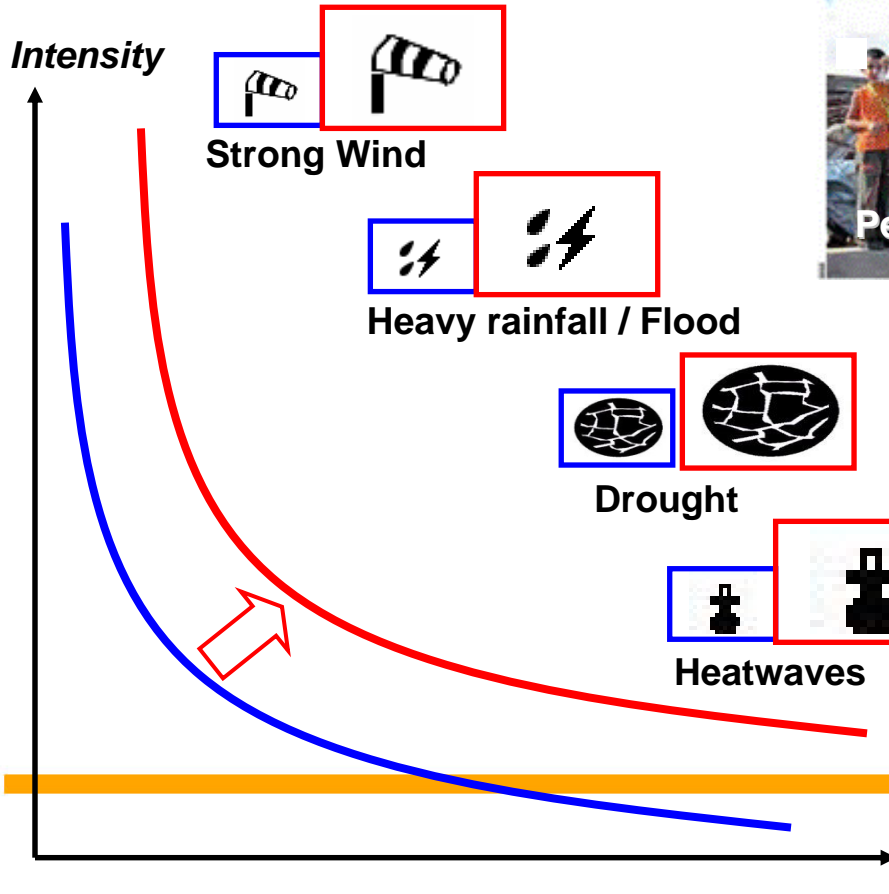
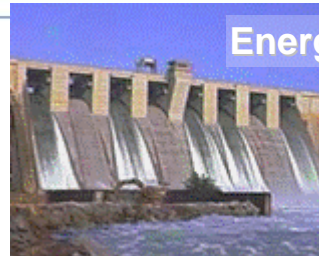
# WMO Network Supports National Early Warning Systems such as the Cyclone Preparedness Programme in Bangladesh





# IPCC 4th Assessment: Socio-economic Impacts of Climate-Related Extremes on the Rise !

**Hazard intensity and frequency increasing linked to climate variability and change!**



**Vulnerability and exposure on the rise !**

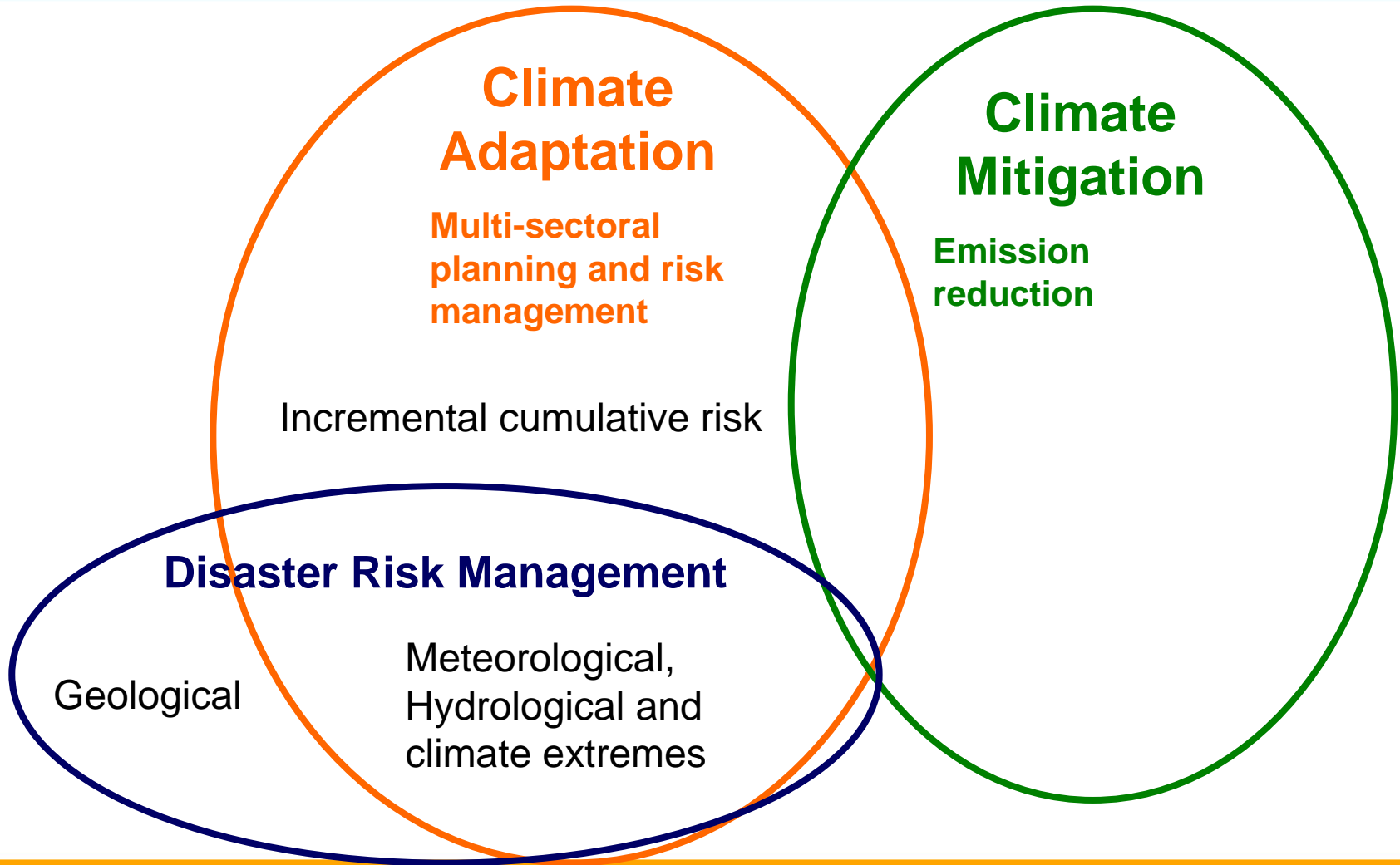


**Need for Multi-sectoral risk management**





# Simplified Schematic of Linkages in Climate and Disaster Risk Management





# Development of WMO DRR Strategic priorities approved by CG XIV

**Hyogo Framework  
for Action**

**2005-2015**

**(World Conference on  
Disaster Reduction)**

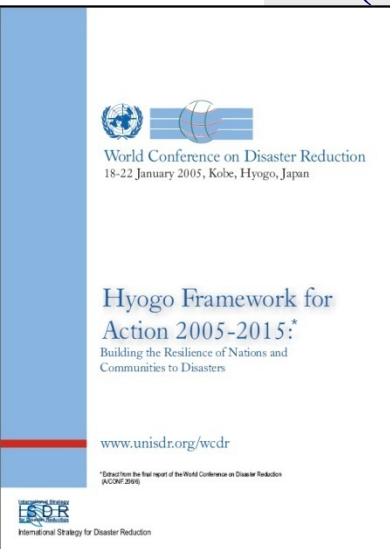
**WMO  
Strategic Plan**

**2008-2015**

**(Top Level Objectives and  
Five Strategic Thrusts)**

**Consultations with WMO governing  
bodies, Regional and National  
network and partners**

**WMO strategic priorities  
in Disaster Risk Reduction**







# Comprehensive Disaster Risk Management involves ....

## 1 Alignment of policies, legislation, planning, resources at national to local Levels (Multi-sectoral, Multi-agency)

### Risk Assessment

- 2 Historical Hazard databases
- Hazard statistics
- Climate forecasting and forward looking hazard trend analysis
- Exposed assets & vulnerability

### Risk Reduction

Preparedness (saving lives):  
 early warning systems  
 emergency planning and response

Prevention (Reduction of economic losses):  
 Medium to long term sectoral planning (e.g. zoning, infrastructure, agriculture)

### Risk Transfer

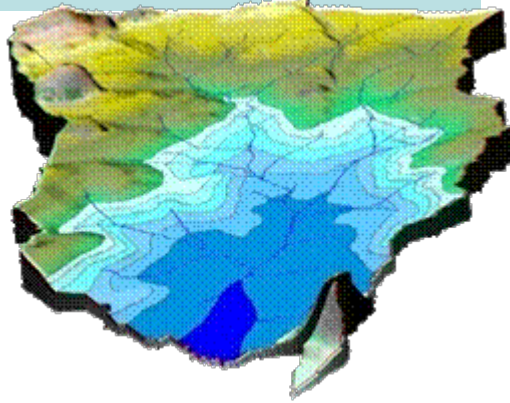
- 5 CATastrophe insurance & bonds
- Weather-indexed insurance and derivatives

6 Information and Knowledge Sharing  
 Education and training across agencies



# Understanding the Risks Provides the Foundation for Preventing Disaster Risks!

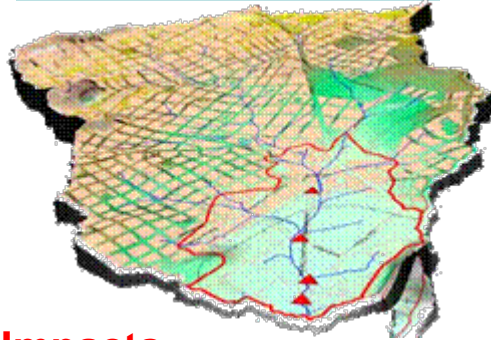
## Hazard Analysis and Mapping



Heavy Precipitation and flood mapping

Need for historical and real time data  
Statistical analysis tools  
climate forecasts and trend analysis

## Exposure and Vulnerability



- Impacts:
- ✓ population density
  - ✓ agricultural land
  - ✓ urban grid
  - ✓ Infrastructure
  - ✓ Businesses

Need for Socio-economic impacts data and analysis tools

## Potential Loss Estimates

Number of lives at risk

\$ at risk

- ✓ Destruction of buildings and infrastructure
- ✓ Reduction in crop yields
- ✓ Business interruption

Need for risk assessment tools combining hazard, asset and exposure information

This information is critical for decision-making and development of strategies to reduce the risks



# Early Warning Systems Require Coordination Across Many Levels and Agencies

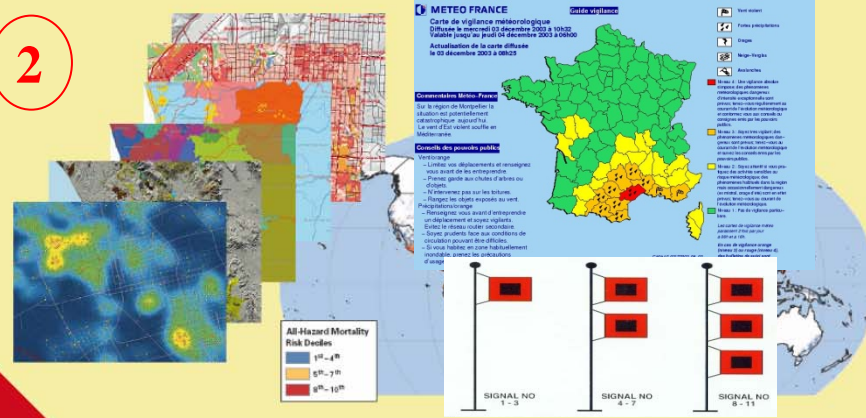
National to local disaster risk reduction plans, legislation and coordination mechanisms



**Hazard Data and Forecasts**

1

2



**Risk Information**



**Communication and Dissemination Mechanisms**

3

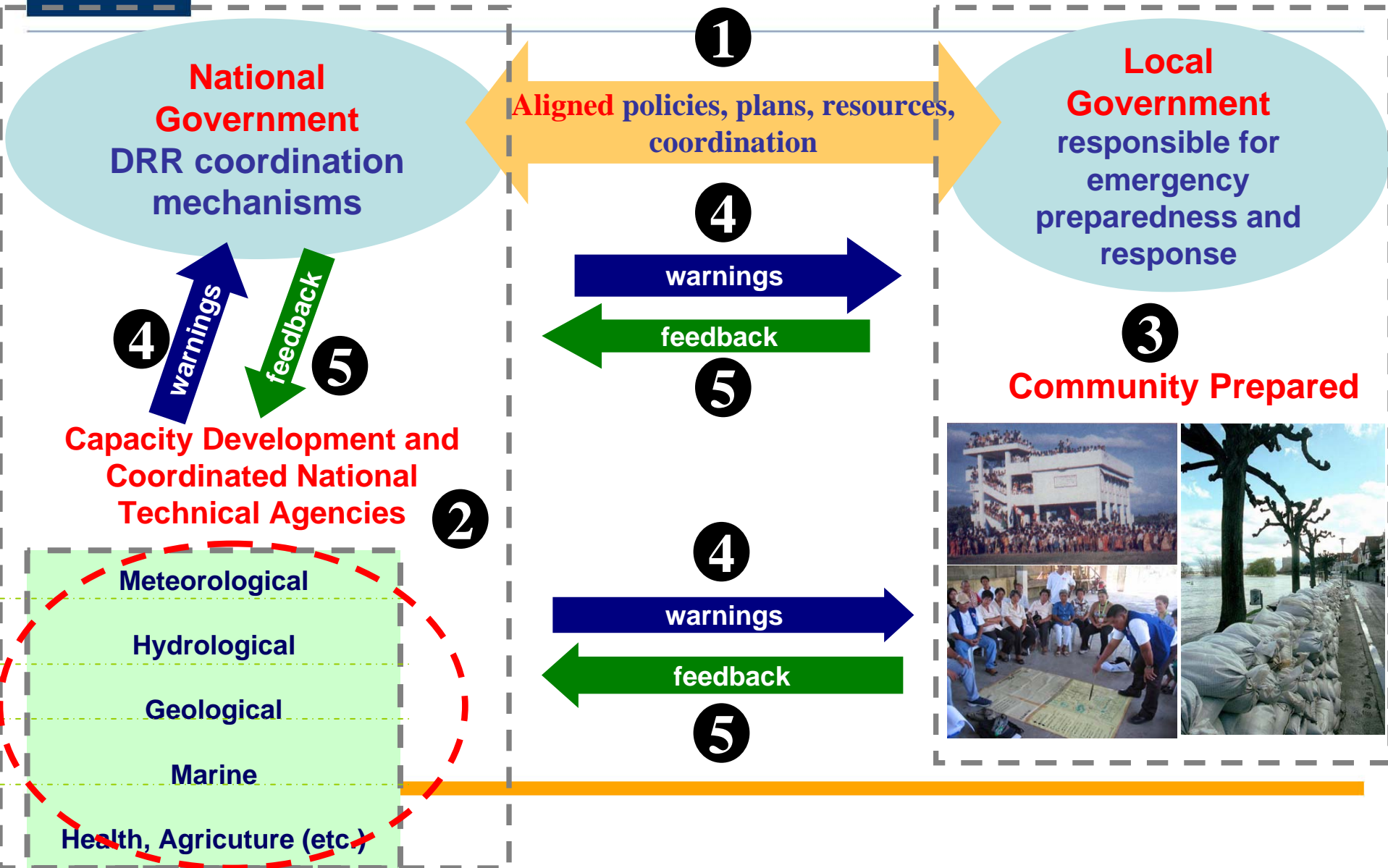
4



**Preparedness and Early Response**



# There is need for investments in all components of Early Warning Systems !





# Documentation of Good Practices and Guidelines on Institutional Partnerships in Early Warning Systems

**Guidelines on Institutional Aspects EWS with Multi-Hazard Approach**  
**Planning, legislative, financing, Institutional Coordination and Roles of NMHS**

**Synthesis of First set of 7 Good Practices (4 more in the pipeline)**  
**Role of National Metrological and Hydrological Services**

**Japan**  
Multi-Hazard  
Early  
Warning  
System

**Bangladesh**  
Cyclone  
Preparednes  
s  
Programme

**Cuba**  
Tropical  
Cyclone  
Early  
Warning  
System

**France**  
“Vigilan  
ce  
System  
”

**Shanghai**  
Multi-Hazard  
Emergency  
Preparednes  
s  
Programme

**USA**  
Multi-Hazard  
Early  
Warning  
System

**Germany**  
The  
Warning  
Management  
of the  
Deutscher  
Wetterdienst

**First EWS Publication** being published in 2010  
**Next Phase: Concept of Operations**



# 10 Basic principles for effective Early Warning Systems

1. **Political recognition** of the benefits of EWS along **with effective planning, legislation and budgeting**
2. **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 with clarity on the responsibilities and mandate for issuance of warnings;
  - (iv) community emergency planning and preparedness and the ability to activate emergency plans to prepare and respond
3. **Roles and responsibilities of all EWS stakeholders and their collaboration mechanisms clearly defined and documented**
4. **Capacities aligned with resources across national to local levels (sustainability)**
5. **Hazard, exposure and vulnerability information are used to carry-out risk assessments at different levels**



# 10 Basic principles for effective Early Warning System (Continued)

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6. Clear, consistent and actionable **hazard warnings**, with **risk information** and issued from a single recognized **authoritative source**
  7. Timely, reliable, redundant and sustainable **warning dissemination mechanisms**
  8. **Emergency response plans targeted** to the individual needs of the vulnerable communities, authorities and emergency responders
  9. **Regular training and education programmes** in risk awareness and emergency response actions
  10. **Effective feedback mechanisms** throughout levels of the EWS for system improvement over time
-



# Climate forecasting and trend analysis tools provide unprecedented opportunities

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.... to support sectoral risk assessment and management!

- Infrastructure and Urban planning
  - Land zoning
  - Insurance / Finance
  - Agricultural productivity and food security
  - Tourism
  - Health epidemics
  - Water resource management
-





# Example of Climate Services in Risk Reduction (Many other examples exist)

<b>DECISION MAKERS</b>	<ul style="list-style-type: none"> <li>✓ Emergency Services</li> <li>✓ Government Authorities</li> <li>✓ Insurance</li> <li>✓ Public, Media</li> </ul>	<ul style="list-style-type: none"> <li>✓ Local – National Government</li> <li>✓ Insurance</li> <li>✓ Suppliers</li> <li>✓ Public, Media</li> </ul>	<ul style="list-style-type: none"> <li>✓ Urban planners</li> <li>✓ Local to national Governments</li> <li>✓ Banks</li> <li>✓ Insurance</li> </ul>	<ul style="list-style-type: none"> <li>✓ Negotiators</li> <li>✓ Parliamentarian</li> <li>✓ Local/national governments</li> <li>✓ Private sector</li> </ul>
<b>DECISIONS</b>	<ul style="list-style-type: none"> <li>✓ Emergency planning activation and response</li> <li>✓ Evacuations, inventory, preparing houses</li> </ul>	<ul style="list-style-type: none"> <li>✓ Urban &amp; coastal Emergency Preparedness</li> <li>✓ Inventory: Food, Construction Materials, Shelter, Emergency funds</li> </ul>	<ul style="list-style-type: none"> <li>✓ Strategic Planning</li> <li>✓ Building codes</li> <li>✓ Infrastructure &amp; Urban Development and Retrofitting</li> <li>✓ Land Zoning and Planning</li> </ul>	<ul style="list-style-type: none"> <li>✓ International negotiations and agreements</li> <li>✓ National policies and legislation</li> </ul>
<b>SERVICES</b>	<p>Short to medterm weather forecasts: <b>Tropical cyclone Forecasts and warnings</b></p>	<p>Probabilistic seasonal forecasts: <b>Probabilities of severity and intensity of tropical cyclones</b></p>	<p>Future Decadal trend analysis: <b>of severity and intensity of tropical cyclones</b></p>	<p>Climate Change scenarios – <b>IPCC Process</b></p>
<p><b>Next hour to 10 days      Season to year      Decade      Long term Scenarios</b></p>				



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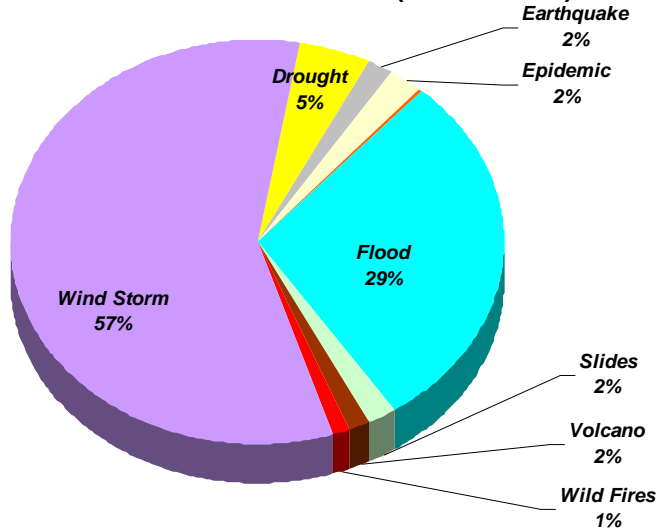
# Background on the Caribbean Region

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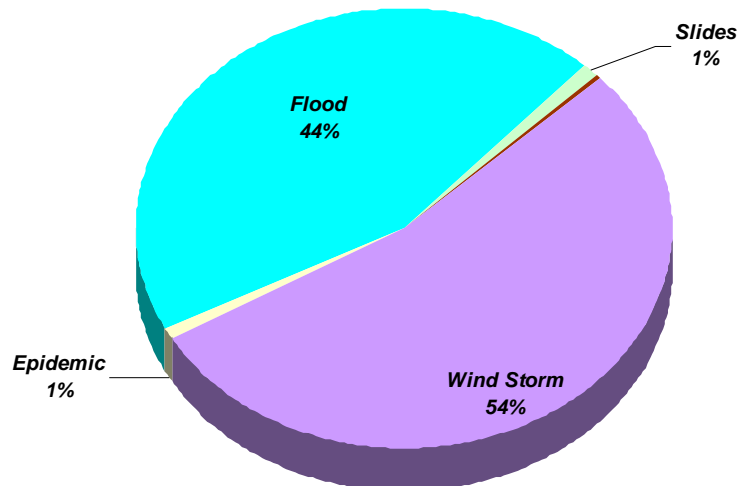


# The Caribbean - 1980-2007

Number of events - 1980-2007 (Caribbeans)



Casualties - 1980-2007 (Caribbeans)



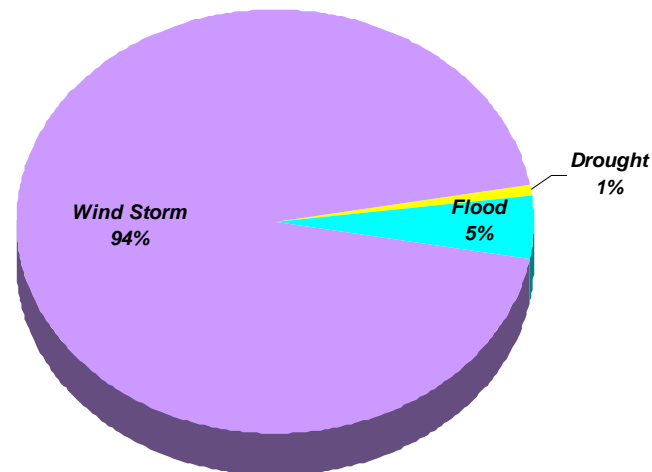
**98 % of events**

**99 % of casualties**

**99 % of economic losses**

**are related to hydro-meteorological hazards and conditions.**

Economic losses - 1980-2007 (Caribbeans)



*Source: EM-DAT:  
The OFDA/CRED  
International Disaster  
Database - Université  
Catholique de  
Louvain - Belgium*



# Three decades of Regional Cooperation in Tropical Cyclone Warning Systems in the Caribbean and Central America

WORLD METEOROLOGICAL ORGANIZATION  
TECHNICAL DOCUMENT

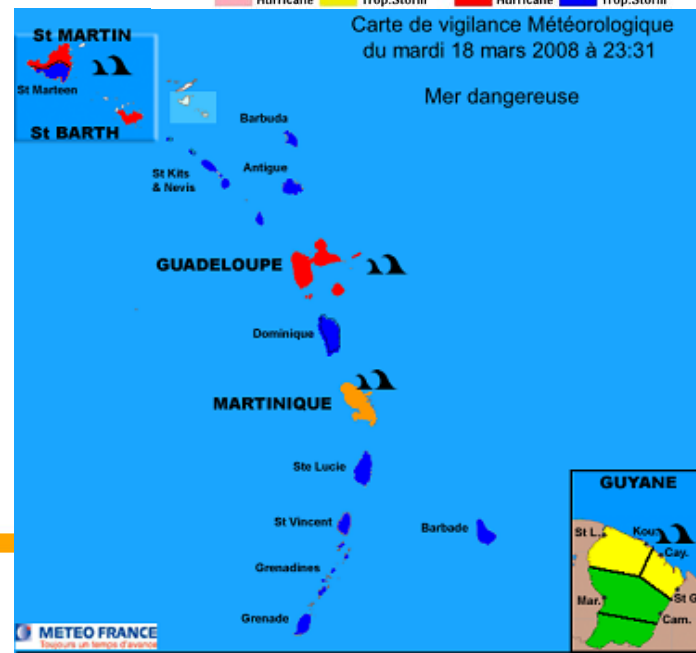
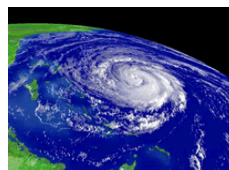
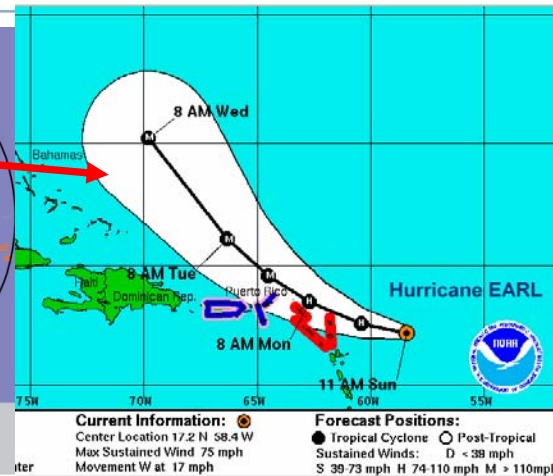
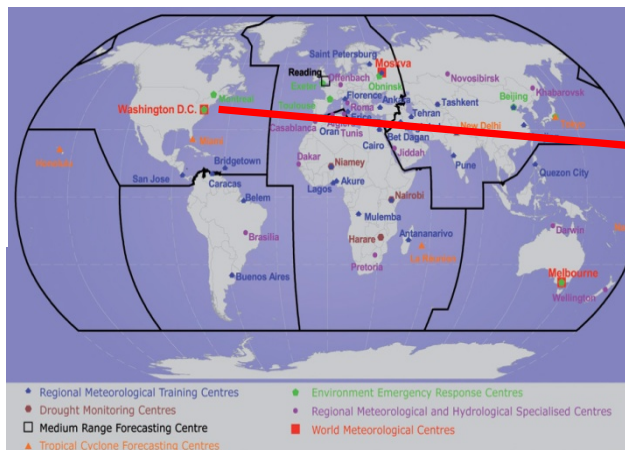
WMO-TD No. 494

TROPICAL  
CYCLONE PROGRAMME

Regional Association IV  
(North America, Central America and the Caribbean)  
Hurricane Operational Plan

RSMC – Miami Hurricane Center

RA IV Technical Working Groups





# Training and Coordination Workshop on Multi-Hazard Early Warning Systems (1/5)

(22-26 March 2010, Costa Rica)

[http://www.wmo.int/pages/prog/drr/events/MHEWSCostaRica/index\\_en.html](http://www.wmo.int/pages/prog/drr/events/MHEWSCostaRica/index_en.html)

## SCOPE

Policy, planning, legislative, institutional partnerships and cooperation aspects of EWS at national level and recommendations for regional cooperation.

## AUDIENCE

- Senior executives from 36 National Meteorological and Hydrological Services
- Directors of 33 of National DRM agencies
- 8 Regional agencies (ACS, CDEMA, CEPREDENAC, CIIFEN, CMO, CIMH, CRRH, OAS)
- 6 International Organizations (World Bank, UNDP, ISDR, UNESCO-IOC, IFRC, WFP)
- Donors (USA, Canada, Finland, Italy, Japan, Spain, World Bank)

## Report of the MHEWS Workshop as Ref 1





# Training and Coordination Workshop on Multi-Hazard Early Warning Systems (2/5)

(22-26 March 2010, Costa Rica)

[http://www.wmo.int/pages/prog/drr/events/MHEWSCostaRica/index\\_en.html](http://www.wmo.int/pages/prog/drr/events/MHEWSCostaRica/index_en.html)

## OUTCOMES And Recommendations

**Strengthening of Capacities in Multi-hazard EWS in the Caribbean region building on existing capacities and projects:**

- 1. To strengthen national and regional institutional capacities and cooperation among the National Meteorological and Hydrological Services and Disaster Risk Management Agencies in early warning systems hydro-meteorological hazards**
- 2. To enhance coordination and harmonization among hydro-meteorological warning systems (building on the existing regional coordination for tropical cyclones) and other hazards (e.g., tsunamis)**



**CDEMA**  
The Caribbean Disaster  
Emergency Management Agency





# Training and Coordination Workshop on Multi-Hazard Early Warning Systems (3/5) (22-26 March 2010, Costa Rica)

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## PRIORITIES FOR THE CARIBBEAN REGION

- i. Strengthening of disaster risk management and emergency preparedness **coordination frameworks and governance as linked to MHEWS**
  - ii. Strengthening of the **observing networks**, regional **harmonization**, interoperability and **data sharing**
  - iii. **Risk assessment and modeling capacity** hydro-meteorological hazards with considerations for risks associated **with climate variability and change**
-



# Training and Coordination Workshop on Multi-Hazard Early Warning Systems (4/5) (22-26 March 2010, Costa Rica)

## PRIORITIES FOR THE CARIBBEAN REGION

- iv. Strengthening of **operational forecasting capacities** for **hydro-meteorological and marine-related hazards** and stronger **coordination with Tsunami warning system**
- v. Strengthening of effective **warning dissemination mechanisms**, service delivery and **operational cooperation between NMHS and DRM** agencies including **Quality Management Systems** (e.g., Standard Operating Procedures)





# Training and Coordination Workshop on Multi-Hazard Early Warning Systems (5/5) (22-26 March 2010, Costa Rica)

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## PRIORITIES FOR THE CARIBBEAN REGION

- vi. Exploring possible **harmonization** and coordination of **different warning systems** in the region
  - vii. Strengthening **coordination and interoperability of crosscutting** activities across national and regional agencies  
**EWS**
  - viii. **Educational programmes** in EWS for hydro-meteorological hazards targeted at the public and officials.
-



# Caribbean countries and territories



Antigua and Barbuda, Aruba, the Bahamas, Barbados, Belize, Bermudas, the British Caribbean Territories, the Caribbean Netherlands, Cuba, Curacao, Dominica, the Dominican Republic, the French West Indies, Grenada, Guyana, Haiti, Jamaica, the Netherland Antilles and Aruba, Saint Kitts and Nevis, Saint Lucia, Saint-Marteen, Saint Vincent and the Grenadines, Suriname and Trinidad and Tobago.



# Roadmap for the design of a Caribbean regional MHEWS Programme with national development components

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## **A phased approach:**

- 2010-2011: Development of programmatic and technical aspects of the programme and phase-I project engaging consultations with all countries/territories, regional agencies and partners
  - 2011:
    - Institutional partnerships
    - Phase-I project implementation plan
    - Resource mobilisation strategy and coordination with the donors
    - Monitoring and evaluation processes
  - 2011-2012: Phase I Project to be Launched
-



# Consultation process for technical and programme/project development – 2010 (1/3)

CONSULTATIONS AND DELIVERABLES	ORGANIZERS/SPONSORS	EXPECTED OUTCOMES	DATE & VENUE
<p><b>1. Training and Coordination Workshop on Multi-Hazard Early Warning Systems with Focus on Institutional Partnerships and Coordination</b></p>	<p>WMO with NOAA, ISDR, CDEMA, CEPREDENAC, UNDP, World Bank, IFRC, NMHS and DRM of Costa Rica</p>	<p>•Identified and prioritized concrete areas for development and cooperation at national and (sub) regional levels in MHEWS</p>	<p>22 – 26 March 2010, San Jose Costa Rica</p>
<p><b>2. Consultants' missions in the region and assessment of all assessment and projects</b></p> <p style="text-align: center;"><b>MISSIONS:</b></p> <p>Trinidad and Tobago    Barbados            Dominica                    Antigua and Barbuda            Saint-Lucia                Martinique            Cuba                            Dominican Republic            Bahamas</p> <p>CMO      CIMH      CDEMA    ACS</p>	<p>WMO and UNDP</p>	<p>•Identification and confirmation of gaps and needs in MHEWS;            •Identification of national, regional and international stakeholders;            •Identification of priorities for design of the programme and phase I project.</p>	<p>1 July – 15 September 2010</p>
<p><b>3. Consultation at the 2nd Meeting of the Work Programme Development and Review Sub-Committee of the CDEMA Technical Advisory Committee</b></p>	<p>CDEMA</p>	<p>•Introduction of the road map and feedback.</p>	<p>21 July 2010, Barbados</p>



# Consultation process for technical and programme/project development – 2010 (2/3)

CONSULTATIONS AND DELIVERABLES	ORGANIZERS/SPONSORS	EXPECTED OUTCOMES	DATE & VENUE
<p>4. Consultation at the Sixth (6th) Meeting of the Comprehensive Disaster Management Coordination and Harmonisation Council (CDM CHC) and 2010 Programming Consultation on Comprehensive Disaster Management (CDM)</p>	<p style="text-align: center;">CDEMA</p>	<ul style="list-style-type: none"> <li>•Introduction of the road map and feedback for incorporation of the Caribbean MHEWS Programme in CDM Programming.</li> </ul>	<p>19 – 20 August 2010, Barbados</p>
<p>5. 18<sup>th</sup> meeting of the Committee on Disaster Risk Reduction</p>	<p style="text-align: center;">Association of Caribbean State (ACS)</p>		<p>9 – 10 Sept, 2010 Santo Domingo, DR</p>
<p>6. Technical Cooperation Workshop for the Development of Caribbean Regional Programme in Multi-Hazard EWS (MHEWS)</p>	<ul style="list-style-type: none"> <li>•WMO with CMO/CIMH, CDEMA, UNDP, World Bank, NOAA, NMHS and DRM agencies of Barbados</li> <li>•Other potential sponsors: ISDR, ACS, Finland Meteorological Institute and Ministry of Foreign Affairs, others (TBD)</li> </ul>	<ul style="list-style-type: none"> <li>•Development of priorities for Caribbean MHEWS Programme;</li> <li>•Prioritization of activities for Phase I project and development of a detailed project implementation plan.</li> </ul>	<p>2-5-November 2010 Barbados</p>
<p>7. Consultation with the Directors of NMHS (CMO) and Ministers (CARICOM) during the 50<sup>th</sup> session of the Caribbean Meteorological Council</p>	<p style="text-align: center;">CMO</p>	<ul style="list-style-type: none"> <li>•Feedback on the first draft of the Caribbean Regional MHEWS programme and phase I project</li> </ul>	<p>20 – 22 November 2010 Cayman Island</p>



# Consultation process for technical and programme/project development – 2010 (3/3)

<b>CONSULTATIONS AND DELIVERABLES</b>	<b>ORGANIZERS/SPONSORS</b>	<b>EXPECTED OUTCOMES</b>	<b>DATE &amp; VENUE</b>
<b>10. Consultations during the Conference of the Directors of the Ibero-American Hydrometeorological Services</b>	<b>Ibeto-American Cooperation</b>	<ul style="list-style-type: none"> <li>•Feedback on the first draft of the Caribbean Regional MHEWS programme and phase I project</li> </ul>	<b>November, 2010 Chile</b>
<b>12. 1/2-day High-level panel for presentation of priorities</b>	<ul style="list-style-type: none"> <li>•WMO with CDEMA, CMO/ CIMH, UNDP, NMHS and DRM of Jamaica</li> <li>•Other potential sponsors: ISDR, World Bank, ACS, NOAA, Finland Meteorological Institute and Ministry of Foreign Affairs, others (TBD)</li> </ul>	<ul style="list-style-type: none"> <li>•Revised draft of the Caribbean MHEWS programme and phase I project</li> </ul>	<b>6 December 2010 Montego Bay, Jamaica</b>
<b>13. Presentation of the Programme to the Seventh (7th) Meeting of CDM CHC</b>	<b>CDEMA</b>	<ul style="list-style-type: none"> <li>•Presentation of the Draft of the Caribbean MHEWS Programme and Phase I Project in CDM Programming</li> </ul>	<b>6 – 9 December 2010 Montego Bay, Jamaica</b>
<b>14. Draft of the Caribbean MHEWS programme + phase 1 project</b>			<b>Q1 2011</b>



# Key Stakeholders

## ✓ **National:**

- National Meteorological and Hydrological Services (NMHS) and Disaster Risk Management (DRM) Agencies of the beneficiary countries.
- Other EWS stakeholders such as media, economic sectors (health, agriculture,) (TBD)

## ✓ **Regional:**

- Regional centers and agencies of CARICOM: CDEMA, CMO and its CIMH;
- WMO RA IV and its DRR Task Team, WMO RA IV Hurricane Committee, the WMO RSMC – Miami Hurricane Center,
- Regional agencies and platforms: ACS, OAS, the Eastern Caribbean Donor Group, Caribbean Development Bank (CDB) and IADB.
- Other regional partners (TBD)

## ✓ **International and donors:**

- UN and International Agencies: WMO, UNESCO-IOC, UN-ISDR, UNDP, IFRC, etc.
- Bi-lat donors and development banks: World Bank, USAID/OFDA, Canada (CIDA), Finland (MFA), Spain (ACE), Japan (JICA), UK (DFID), EU, France, etc.



# Technical Cooperation Workshop for Development of the Caribbean Regional Cooperation Programme in Multi-Hazard Early Warning System (Doc 2)

## • **TARGET AUDIENCE**

Experts from National Disaster Risk Management Agencies, National Meteorological and Hydrological Services and other national, regional and international agencies engaged in EWS in the Caribbean.

## • **EXPECTED OUTCOMES**

1. Development of priorities for the Caribbean MHEWS regional programme;
2. Prioritization of activities and recommendations for for phase-I project;
3. Presentation and identification of good practices in areas highlighted in the Caribbean MHEWS regional programme



FINNISH METEOROLOGICAL INSTITUTE





# Technical Cooperation Workshop for Development of the Caribbean Regional Cooperation Programme in Multi-Hazard Early Warning System

## AGENDA (Doc 3)

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- **Session 1**  
Opening and introduction
  - **Session 2**  
Review of the assessment of the institutional capacities, gaps and needs in MHEWS in the Caribbean
  - **Session 3**  
Operational Cooperation of the National Meteorological and Hydrological Services and Disaster Risk Management Agencies and Service Delivery for MHEWS (National and regional perspectives)
  - **Session 4**  
Risk Analysis, Data Management and Exchange Issues to support DRM and EWS with Multi-Hazard Approach (National and regional perspectives)
  - **Session 5**  
Monitoring, Forecasting, and Watch and Warning Systems (National and regional perspectives)
  - **Session 6:**  
Discussions with donors and development agencies  
Final synthesis and recommendations
-



# Technical Cooperation Workshop for Development of the Caribbean Regional Cooperation Programme in Multi-Hazard Early Warning System **LIST OF DOCUMENTS**

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- **Doc. 1:** Roadmap for the Design of a Caribbean Regional Programme in Multi-Hazard Early Warning Systems (MHEWS) with National Capacity Developments.
  - **Doc. 2:** Brochure of the Technical Workshop for the Development of Caribbean Regional Programme in Multi-Hazard Early Warning Systems.
  - **Doc. 3:** Agenda of the Workshop.
  - **Doc. 4:** Preliminary Draft Report of the Assessments of the Capacities, Gaps and Needs for the Development of the Caribbean Regional Programme on Multi-Hazard Early Warning Systems and Phase-I Project Priorities. Focus on Hydrometeorological hazards warning systems and possible linkages with other warning systems.
  - **Doc. 5:** Guidance for Participants and Preparations for the Workshop (Panels and Working Groups).
  - **Doc. 6:** Questions and Issues to be addressed during the Working Group Sessions.
  - **Inf. 1:** Logistical Information Note for Participants.
  - **Inf. 2:** List of Participants.
  - **Ref. 1:** Common Alert Protocols
  - **Ref. 2:** Report from Costa Rica MHEWS Training Workshop
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# Other Highlights

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- Working Groups A, B, C, Please check the lists:
    - Countries/Territories have been assigned based on relationship of National Meteorological and Hydrological Services and Disaster Risk Management Agencies
    - Other countries and agencies to sign up
  - Doc. 4 will provide the basis for discussions and comments
  - Questionnaires (Doc. 6) will be discussed in the Working Groups
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# *Thank You*



## **WMO and UNDP Staff:**

### **Programmatic and Technical Issues:**

**Maryam Golnaraghi (WMO)**

**Ian King (UNDP)**

**Oscar Arango (WMO)**

**Alexandre Vacher (UNDP)**

**Samuel Muchemi (WMO)**

**Danielle Evanson (UNDP)**

**James Douris (WMO)**

**Charles Baubion (WMO)**

### **Logistical Issues:**

**Nadia Oppliger (WMO) , Annetha Davis (UNDP), Marlon Clarke (UNDP)**

### **Webpage of the Workshop:**

[http://www.wmo.int/pages/prog/drr/events/Barbados/index\\_en.html](http://www.wmo.int/pages/prog/drr/events/Barbados/index_en.html)