



Workshop on Multi-Hazard Early Warning Systems for Urban Areas

10-12 December 2013

*Radisson Hotel San José
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http://www.wmo.int/pages/prog/drr/events/MHEWSCITIEScentralamerica/index_en.html

Report

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1 Background

1. Between 1970 and 2012, 448 disasters were reported¹ in Central America caused by weather-, water- and climate-related hazards (e.g., tropical cyclones, storm surges, floods and heat waves), with floods accounting for 44% and storms 36%. Over 42,000 people were killed by such disasters, mainly due to severe storms such as hurricanes Mitch (more than 18,800 deaths in 1998) and Fifi (8,000 deaths in Honduras in 1974). Storms also accounted for 76% of total economic losses (which exceeded US\$ 58 billion).
2. The promise of jobs and prosperity, among other factors, pulls people to cities. In Central America and Mexico, the challenges faced by a growing urban population are compounded by increasing vulnerability and exposure to weather-, climate- and water-related hazards. These increasing risks denote the need for effective Multi-Hazard Early Warning Systems (MHEWS) as well as other risk reduction strategies engaging national agencies with local governments.
3. As part of its Disaster Risk Reduction (DRR) Programme, the World Meteorological Organization (WMO) supports member states with the development of MHEWS as one of its highest priorities. This engages close cooperation with international and regional partners. With Central America being one of its focus regions, WMO conducted a “Training Workshop on MHEWS with a focus on Institutional Partnerships and Cooperation”² in 2010. The outcomes highlight that EWS for both urban and rural areas need to be strengthened. The increasing concentration of people in urban areas makes this a matter of urgency. The successful implementation of the joint World Bank/WMO project on Early Warning System (EWS) for hydrometeorological hazards in Central America³ is an example for this type of capacity development.

2 About the Workshop

4. Thematic Focus: The thematic focus of the Workshop on MHEWS for Urban Areas was on the development of MHEWS for weather-, climate-, and water-related hazards for medium- to large-size cities. Within this context, it highlighted the importance of a strong partnership between the national Disaster Risk Management (DRM) Agencies and the National Meteorological and Hydrological Services (NMHSs) with local governments and the civil society.
5. Geographic focus: The geographic focus was on Central America. However, representatives from Mexico, the Caribbean (Cuba), and South America (Colombia, Bolivia, Brazil, Argentina, and Chile) also shared their experiences due to similar issues in these regions and for the benefit of all.
6. MHEWS survey: In order to carry out a preliminary assessment of national EWS capacities as the basis for discussions during the Workshop, a questionnaire titled “A Framework for Systematic Assessment of Capacities and Gap Analysis for MHEWS in Urban Areas” (Annex I) was sent out prior to the workshop to the countries.
7. Sponsors: The Workshop was hosted by the Costa Rican National Commission for Risk Prevention and Emergency Management (CNE) and WMO Regional Association IV – Central and North America and the Caribbean (RA IV), organized by WMO DRR Programme based at the Secretariat in Geneva, and sponsored by the Coordination Centre for the Prevention of Natural Disasters in Central America (CEPRENAC), the World Bank, the United Nations International Strategy for Disaster Reduction (UNISDR) Regional Office for the Americas, the International Federation of Red Cross and Red Crescent Societies (IFRC), and the United States Agency for International Development (USAID).

¹ Source: EM-DAT: The OFDA/CRED International Disaster Database – <http://www.em-dat.be>. All costs are expressed in US\$ billion, adjusted to 2012.

² http://www.wmo.int/pages/prog/drr/events/MHEWSCostaRica/index_en.html

³ <http://www.wmo.int/pages/mediacentre/news/HydrometeorologicalEarlyWarningSysteminCostaRica.html>

2.1 Objectives

8. The objectives of the Workshop were to:
- i. Share experiences of WMO members with the development of MHEWS in urban areas;
 - ii. Take a stock of risks as well as MHEWS capacities in urban areas in Central America, Mexico, Cuba, and some countries in South America;
 - iii. Review policy, institutional, operational, and technical needs and identify challenges and opportunities for strengthening and sustaining MHEWS in urban areas; and,
 - iv. Identify gaps, needs, and priorities of action for the development of MHEWS in urban areas (and rural, if relevant) in Central America.

2.2 Participants

9. The participants of the Workshop included executives, experts, and programme managers from NMHS and national DRM agencies of 13 countries in Central and South America, including Mexico and Cuba, as well as from the supporting organizations. A list of participants can be found in Annex II.

2.3 Workshop Format

10. The Workshop included five sessions (see the agenda in Annex III):
11. Session 1 – Opening and introduction: The Workshop was opened by Vanessa Rosales Ardón, President of CNE, and Juan Carlos Fallas, President of WMO RA IV. Objectives, structure, and procedure of the Workshop were presented in this session.
12. Session 2 – Background presentations: This session provided an overview of regional organizations and their activities relevant for EWS as a background for the following sessions. Representatives from CEPREDENAC, OAS, CRRH, IFRC as well as WMO (DRR Programme and RA IV) presented on their respective roles and the status of EWS in Central America, on the importance of community preparedness and coordination from regional to national and local levels, and on the latest technical advancements and opportunities for the development of MHEWS. Annex IV provides a synopsis of their mandates, structure, strategies, programmes, and related projects.
13. Session 3 – Presentations on good practices in urban MHEWS and lessons learnt: This session provided the opportunity for the participants from Central and South America, Mexico, and Cuba to share their national experiences focussing on four key areas for discussion:
- i. The four components of effective EWS (a) detection, monitoring and forecasting of hazards; (b) analyses of risks; (c) dissemination of warnings; and, (d) activation of emergency plans and response;
 - ii. Policy, institutional roles of and coordination among national agencies, local governments and authorities;
 - iii. Public awareness, education, and drills; and,
 - iv. Feedback mechanisms to improve the system.
- As a background, the ten principles of EWS that emerged from the synthesis of seven good national practices were reviewed (Annex V).⁴ Examples of (urban) MHEWS were presented, covering EWS for (a) Hydro-Meteorological Hazards in the Sarapiquí River Basin, Costa Rica; those of the Cities of (b) Medellín, Colombia; (c) La Paz, Bolivia; (iv) Santa Fe, Argentina; (d) Curitiba, Brazil; and EWS in (e) Chile, Cuba, and Mexico.
14. Session 4 – Identifying priorities, gaps and needs for the developing MHEWS in urban areas: In this session, the participants were divided into two regionally mixed working groups (Annex VI). Utilizing their draft responses to the MHEWS questionnaire, they reviewed and analyzed their national capacities, gaps, and needs and gave recommendations for priorities of action for the development and strengthening of urban MHEWS and improved cooperation at

⁴ Golnaraghi, M. (ed.) 2012: Institutional Partnerships in Multi-Hazard Early Warning Systems, DOI 10.1007/978-3-642-25373-7, Berlin, Heidelberg, Springer-Verlag.

local, national, and regional levels. The rapporteurs for each Working Group presented their respective outcomes (Annex VII) in the plenary.

15. Session 5 – Regional, national, and local coordination aspects of MHEWS: This session comprised two panels that discussed the following:
 - i. Panel 1 – National policies, institutional aspects, national to local operational coordination and feedback mechanisms as well as the roles of governments, civil society, and the private sector (highlighting the importance of their cooperation across sectors and levels): This panel consisted of five panellists from OAS, CNE, a Nicaraguan municipality, the National Meteorological Service of Belize, and the Nicaraguan Red Cross.
 - ii. Panel 2 – Regional coordination and cooperation aspects among countries and networks supporting national EWS: The panel consisted of seven panellists from IFRC, CEPREDENAC, WMO RA IV, CRRH, OAS, World Bank, and UNISDR Americas.

3 Multi-Hazard Early Warning Systems – a Core Element of a Comprehensive Framework for Disaster Risk Management

3.1 Components of an Effective Disaster Risk Management Framework

16. In 2005, governments of 168 countries adopted the “Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters” (HFA, Annex VIII, Figure 2) that has led to a paradigm shift in DRM from emergency response to a more proactive, holistic and systematic approach that encompasses risk assessment, risk reduction (through prevention and preparedness including EWS), and risk transfer and requires meteorological, hydrological, and climate services to support science-based risk management decisions.
17. An essential starting point for reducing risks is a quantitative risk assessment which combines information about the hazards with exposures and vulnerabilities of the population and assets. The hazard side of the equation uses historical data and forward-looking modelling and forecasting about environmental conditions such as tropical cyclones, rainfall, soil moisture, hill slope stability, or mountain weather patterns. This must be augmented with socio-economic data that quantifies exposure and vulnerability such as casualties, construction damages, crop yield reduction, or water shortages. Equipped with this risk information, countries can develop (a) risk management strategies using EWS to reduce casualties; (b) medium and long-term sectoral planning (such as land zoning, infrastructure development, water resource management, agricultural planning, energy, and transportation) to reduce economic losses and build livelihood resilience; and (c) weather-indexed insurance and risk financing mechanisms to transfer the financial impacts of disasters.

These components must be underpinned by (a) effective legal frameworks and policies; (b) institutional coordination and cooperation mechanisms; (c) appropriate allocation of resources; and (d) information and knowledge sharing, education, and training.
18. Among issues challenging these efforts are gaps in technical and institutional capacities and a lack of data concerning a country’s past climate to quantify hazard characteristics (e.g., frequency, severity and location) of local climatic extremes in the future. DRR is therefore one of the high priorities for the development of the Global Framework for Climate Services (GFCS). With an appropriate use of meteorological, hydrological and climate information as part of a comprehensive multi-sector, multi-hazard, multi-level (local to global) and service-oriented approach, considerable achievements and sustainability can be realized.
19. The emergence of climate prediction provides opportunities to increase the lead times of early warnings. For instance, seasonal climate outlooks help governments predict and manage excessive or deficient rainfall. Historical data has traditionally been used for analysis of hazards patterns. But this is no longer sufficient, because hazard characteristics are changing as a result of climate change. For instance a 100-year flood or drought may become a 30-year flood or drought or, simply said, more severe events could happen more frequently in the future. Weather and climate services with forecasts from the next hour to seasonal through to decadal time scales are therefore needed to warn for the short term and inform long-term investments and strategic planning.

3.2 Multi-Hazard Early Warning Systems

20. UNISDR defines EWS as “the set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities, and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss”⁵. EWS for multiple hazards have increasingly been recognized at the highest political level as a critical tool for saving of lives. Furthermore, spending on improving weather forecasting and data sharing for EWS has shown to have high returns on investment. Effective EWS have four operational components:

- i. detection, monitoring and forecasting hazards;
- ii. analyses of risks involved;
- iii. dissemination of timely warnings which should carry the authority of government; and,
- iv. activation of emergency plans to prepare and respond.

These four components need to be coordinated across many agencies at national to community levels for the system to work. Failure in one component or lack of coordination across them would lead to the failure of the whole system. The issuance of warnings is a national responsibility; thus, roles and responsibilities of various public and private sector stakeholders for implementation of EWS should be clarified and reflected in the national to local regulatory frameworks, planning, budgetary, coordination, and operational mechanisms.

3.3 The WMO Disaster Risk Reduction Programme

21. DRR is a priority for WMO because protection of lives, property and livelihoods are at the core of the priorities of the WMO Members (and their NMHSs, respectively). Furthermore, the implementation of the HFA by national governments is leading to changes in national DRR policies, legal and institutional frameworks, with implications on the role, responsibilities and new working arrangements for the NMHSs. These changes provide opportunities such as increased recognition of the NMHSs by their governments and stakeholders, which could result in strengthened partnerships and increased resources.

22. However, NMHSs face increasing demand and liabilities related to the provision of products and services to larger and more diverse group of DRR stakeholders (e.g., government authorities, public and private sectors, NGOs, general public and media, etc.) whom have direct responsibilities for DRR decision-making. To meet these new challenges, the crosscutting DRR Programme aims to facilitate better alignment of the activities of WMO constituent bodies and global operational network as well as strategic partners (Annex VIII, Figure 4). The thematic areas of the WMO DRR Programme therefore comprise:

- i. governance and institutional frameworks at the national to local levels;
- ii. Hazard and risk analysis;
- iii. MHEWS;
- iv. sectoral risk management through improved planning in land zoning, infrastructure and urban planning, agriculture, health, transport, water resource management;
- v. disaster risk financing and weather indexed financial risk transfer mechanisms; and,
- vi. information and knowledge sharing, education and training.

In order to assist NMHSs for providing services in these areas, efforts are underway to develop guidelines, standards, and training modules spanning institutional, technical and operational aspects, based on the WMO Service Delivery and Capacity Development Strategies and consistent with Quality Management Systems (QMS) principles.

23. The synthesis of seven good national EWS practices⁶ revealed ten principles for successful EWS that were common to all, irrespective of the political, social, and institutional setting in each country. These principles are provided in Annex V.

⁵ <http://www.unisdr.org/we/inform/publications/7817>

⁶ Golnaraghi, M. (ed.) 2012: Institutional Partnerships in Multi-Hazard Early Warning Systems, DOI 10.1007/978-3-642-25373-7, Berlin, Heidelberg, Springer-Verlag.

4 Synthesis of Discussions from the Sessions

4.1 The State of Early Warning Systems in Central America

24. This section provides an overview of the state of EWS in Central America and of related activities, based on input from (a) NHMS and national and municipal DRM agencies for EWS in the countries and from (b) regional organizations providing support to EWS. The presentations and discussions showed that there are a number of regional and national organizations dedicated to DRR and EWS in the region, with extensive knowledge and a broad network of partners from international to regional and local levels.

National

25. The presented studies and contributions highlighted that in terms of EWS, much progress has been made over the past 15 years in Central American countries. A number of early warning mechanisms exist, operated by NGOs (84%), NMHS (12%), and private companies (4%). It was highlighted that many of the EWS are dedicated to hydro-meteorological events and to a lesser extent to earthquakes or volcanic activity. Some of these EWS components are based at the national level, where they are centralized (e.g. in Guatemala, El Salvador, and Nicaragua) or decentralized (e.g. in Costa Rica and Panamá) and generally implemented by the state and/or scientific institutions, with no or little involvement of lower levels such as communities. These national systems generally use high-tech equipment which requires advanced technical expertise and high maintenance costs. Other working components of EWS are found at the community level and promote active involvement of community members and use rather low-tech equipment at relatively low costs.
26. However, many EWS in Central America need significant capacity development. Many systems are in reality nonexistent, poorly functioning or still in the development stage, or they are actually communication system that only detect and/or warn against a hazard. Moreover, various warning systems have been developed locally, in partnership with NGOs and international organizations, but are often disconnected from the national level and work in isolation from each other. Their equipment and maintenance is generally not within internationally accepted standards. The national and community systems that the studies distinguished are, however, not two alternatives but components of one single system, embracing the notion of people-centred EWS. It was highlighted by IFRC that although many efforts are community-based, they are not necessarily owned and driven by that community, which would have the most lasting impact.
27. The presentations on various national and urban EWS demonstrated that much progress has been made. Positive developments include:
- i. National legislation and policies: Several countries are initiating or have new legislation and policies to govern DRM. For example, Costa Rica adopted a legal framework for approaching risk management from a systems perspective (e.g. national to local land zoning which is continuously updated). Additionally, in other Latin American countries DRM-related legislation has been strengthened or developed (e.g. in Argentina, Colombia, Cuba, and Mexico) which led to the creation of DRM units at different administrative levels within their governments. In Colombia, long-term funding was secured for the City of Medellín.
 - ii. Warning dissemination mechanisms: Use of new media for the dissemination of warnings was highlighted in many countries with examples of the utilization of social media (Facebook, Twitter, etc.), YouTube, websites, and cell phones.
 - iii. Risk education: In many countries in Central America, public risk awareness is being raised through leaflets, comics, billboards, and periodic drills prior to the rainy season.
 - iv. Land-use planning: In Curitiba, Brazil, and Santiago de Chile, Chile, development-free buffer zones have been established along flood-prone rivers to reduce flood damage to human development, protect the environment, and to foster river ecology.
 - v. Role of the International Red Cross and Red Crescent Movement (RCRC) in the countries: National Red Cross Societies are an established and well-connected part of national DRM

systems in the countries in the region. In addition, IFRC provides a number of guides on EWS to facilitate capacity development.⁷

Regional support

28. **“Strengthening of EWS in Central America” project results:** From 2010-2012, CEPREDENAC and the United Nations Educational, Scientific and Cultural Organization (UNESCO), financed by DIPECHO, carried out a study⁸ on the state of EWS in Central America, including:

- i. regional and national inventories of EWS and respective strategies;
- ii. guidance on landslide EWS; and,
- iii. educational material.

It found that a number of regional capacities exist that are supporting national EWS for multiple hazards (e.g. flooding, earthquakes, hurricanes, volcanoes), for example:

- i. SATCA web⁹ (developed by WFP in collaboration with numerous other international, regional, and national partners); or,
- ii. the Flood EWS Regional Platform of the Central American Isthmus and the Dominican Republic (SATIIC)¹⁰.

Regional capacities are also available or at proposal stage for specific hazards (e.g. flooding and landslides), including:

- i. the Central American Flash Flood Guidance (CAFFG)¹¹; or,
- ii. EWS for landslides supported by BGR and NASA¹²;
- iii. a Regional Meteorological Radar System (proposed); and,
- iv. a regional branch of the Pacific Tsunami Warning System (PTWS)¹³ in Nicaragua (proposed).

Furthermore, positive experiences with bi- and tri-national EWS in transboundary river basins facing common threats were documented, such as in the Río Sixaola basin between Costa Rica and Panamá.

29. **Regional policies and strategies:** The Central American Risk Management Policy (PCGIR)¹⁴ is being promoted by CEPREDENAC and was adopted by the Central American Integration System (SICA)¹⁵ countries in order to provide guidance on DRR and to contribute to an integrated vision of development in Central America. Furthermore, CRRH promotes strategies which explicit reference to EWS such as the:

- i. Regional Agro-Environment and Health Strategy (ERAS);
- ii. Regional Climate Change Strategy (ERCC); and,
- iii. Central American Strategy on Integrated Water Resources Management (ECAGIRH).

30. **The WMO Network Supporting Central America:** WMO, through its ten Scientific and Technical Programmes, its eight Technical Commissions, the operational network of the NMHS of its Members, and in partnership with a number of leading technical agencies and centres of

⁷ For example the guide “Early warning early action” (2008, <http://www.climatecentre.org/site/early-warning-early-action>) or the Guiding Principles for Community EWS (2012, <http://www.ifrc.org/PageFiles/103323/1227800-IFRC-CEWS-Guiding-Principles-EN.pdf>)

⁸ <http://www.unesco.org/new/es/sanjose/natural-sciences/proyecto-dipecho/>

⁹ Sistema de Alerta Temprana para Centroamérica: Inicio (SATCA web, <http://www.satcaweb.org>)

¹⁰ Sistemas de Alerta Temprana ante Inundaciones Plataforma Regional del Istmo Centroamericano y la República Dominicana – SATIIC, building on SATIC

¹¹ http://www.hrc-lab.org/right_nav_widgets/realtime_caffg/

¹² German Federal Institute for Geosciences and Natural Resources (BGR, http://www.bgr.bund.de/EN/Themen/Zusammenarbeit/TechnZusammenarb/Laender/zentralamerika_en.html) and United States National Aeronautics and Space Administration (NASA, <http://www.nasa.gov>)

¹³ <http://ptwc.weather.gov/>

¹⁴ Política Centroamericana de Gestión de Riesgos (PCGIR, <http://info-gir.org/documentos/pcgir>)

¹⁵ Sistema de la Integración Centroamericana (SICA, http://www.sica.int/index_en.aspx)

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 conditions¹⁶ (an overview table is provided in Annex IX) In this respect, the following mechanisms and centres are of particular relevance for Central America:

- i. WMO RA IV Hurricane Committee – Established in 1978 with 26 members in the region, it coordinates the regional tropical cyclone programme for RA IV.
- ii. WMO Regional Specialized Meteorological Centre (RSMC) for tropical cyclones – Known as the Miami Hurricane Center, it is operated by the U.S. National Oceanic and Atmospheric Administration's (NOAA) National Weather Service and provides forecasts and bulletins to all NMHS in the region, and related regional activities including technical cooperation, planning and exchange of data and information in meteorology and hydrology in this context (Others include RSMC-Montreal and RSMC-Washington).
- iii. WMO Regional Climate Centres (RCCs) – There has been a strong interest in the establishment of WMO RCCs in RA IV, but concrete actions are yet to be initiated. A RCC network is being considered for the Spanish-speaking Caribbean and Central American countries. The Caribbean Institute for Meteorology and Hydrology (CIMH), Bridgetown, Barbados, informally expressed its intent to serve as a WMO RCC, with the domain of interest being the English-speaking countries of the Caribbean. Canada, Mexico, and the United States are moving forward with the establishment of the North America Climate Services Partnership (NACSP), providing a mechanism for sharing data, information, concepts, and knowledge on climate services between these three countries. The NACSP can be framed as an initiative that addresses issues unique to North America and that could contribute to and complement, rather than supersede, other existing regional and global efforts.
- iv. WMO Coordination Group for Meteorological Satellites (CGMS) Centres of Excellence – The Virtual Laboratory for Training and Education in Satellite Meteorology (VLab) is a global network of specialized training centres and meteorological satellite operators working together to improve the utilization of data and products from meteorological and environmental satellites (operators involved are: CMA, CONAE, EUMETSAT, INPE, JMA, and KMA). In Central America, this role is fulfilled by the Costa Rican National Meteorological Institute (IMN).
- v. WMO Regional Training Centres (RTCs) – For Central America, the Universidad de Costa Rica (UCR) San José was designated to become a RTC. In the Caribbean, CIMH was designated as an RTC by WMO in 1978 in recognition of the high standard of its training programmes. In South America, the role of RTCs is fulfilled by the Universidad Central de Venezuela (UCV) Caracas, the Universidad Nacional Agraria La Molina (UNALM) Lima in Peru, the Universidade Federal do Pará (UFPA) Bélem in Brazil, and the Universidad de Buenos Aires (UBA) in Argentina.
- vi. WMO Regional Telecommunication Hubs (RTHs) – Three World Meteorological Centres (WMCs) around the globe make up WMO's Main Telecommunication Network (MTN). Together with Regional and National Meteorological Telecommunication Networks they form the Global Telecommunication System (GTS). GTS communications and data management component that allows the World Weather Watch (WWW) and facilitates the flow of data and processed products to meet requirements in a timely, reliable and cost-effective way, ensuring that all Members have access to all meteorological and related data, forecasts and alerts. This secured communication network enables real-time exchange of information, critical for forecasting and warnings of hydrometeorological hazards. It is implemented and operated by National Meteorological Services of WMO Members and International Organizations, such as ECMWF and EUMETSAT.

¹⁶ http://www.wmo.int/pages/prog/drr/wmoOppNetwork_en.html

31. Other regional cooperation mechanisms: Various initiatives in support of EWS were highlighted:
- i. OAS has been providing technical advice on flood EWS in several small valleys in Central America since 1995 through the Central American Small Valley's Flood Alert and Vulnerability Reduction Program (SVP).
 - ii. OAS also initiated a EWS Platform for the Central American Isthmus and the Dominican Republic (SATIIC)¹⁷ that will contribute to the consolidation of the Regional Platform for DRR in the Americas and the implementation of the National Platforms under the Hyogo Framework for Action (HFA).
 - iii. CRRH organizes the Central American Climate Forum (FCAC)¹⁸ and the Forum on Applications of Climate Outlooks to Food and Nutrition Security (FAPC).
 - iv. The Regional Disaster Information Center (CRID)¹⁹, sponsored by six organizations (WHO, UNISDR, CNE, IFRC, CEPREDENAC) aims at ensuring the compilation and dissemination of disaster-related information in Latin America and the Caribbean.
32. Regional hazard information: Initiatives related to storing and sharing of climate and hazard/risk assessment data were highlighted, including:
- i. CRRH has established a: (a) system that shows how climate information has been utilized by different users, (b) platform for open source information sharing that should be fully operational in 2014 and for which NHMS of the region have committed to upload their data, (c) regional climate database²⁰, and (d) Central American Meteorological and Hydrological Integration Center (CIMHAC)²¹.
 - ii. CEPREDENAC, in collaboration with Central American governments, UNISDR, the Inter-American Development Bank (IDB), and the World Bank, set up the Probabilistic Risk Assessment Program (CAPRA²²), a disaster risk information platform for use in decision-making that is based on a unified methodology and tools for evaluating and expressing disaster risk. Building on and strengthening existing initiatives, CAPRA was developed by experts to consolidate hazard and risk assessment methodologies and raise risk management awareness. CAPRA is to support decision makers in sectors such as emergency management, land use planning, public investment, and financial markets for risk transfer.

4.2 Gaps, Needs, and Priorities of Action for the Development of Multi-Hazard Early Warning Systems in Urban Areas in Central America

33. Outcomes of the Workshop Sessions 3-5 including the Working Group results (detailed in Annex VI), preliminary responses to the MHEWS questionnaire, and the CEPREDENAC survey results revealed clear evidence of gaps and opportunities for capacity development in Central American EWS. The following is a synthesis of the gaps and opportunities identified at the national and regional levels.

National level

34. Governance and institutional arrangements: It was found that the legal foundation for a number of EWS in Central America is insufficient or does not exist. Furthermore, national laws pertaining to DRM often do not define the roles of the NMHS and their interaction with the DRM agency and other EWS stakeholders. It was also highlighted that in many countries the EWS stakeholders are not well aligned and lack harmonized operational procedures. It was also

¹⁷ SATIIC. <http://sat.rimd.org/index.php>

¹⁸ Foro del Clima de América Central, also known as Central America Climate Outlook Forum (CA-COF), one of the oldest and most successful ones within WMO's Regional Climate Outlook Forums network (<http://www.rekursoshidricos.org/inicio/96-sample-news/1223-xxxix-foro-del-clima-de-america-central>).

¹⁹ <http://www.cridlac.org>

²⁰ Base de Datos Climáticos de América Central (BDCAC, <http://www.rekursoshidricos.org/actividades/programas-y-proyectos/11-proyecto-bid-base-de-datos-climaticos-de-america-central>), developed with the support of the Regional Fund for Public Assets of the Inter-American Development Bank (IDB)

²¹ Centro de Integración Meteorológica Hidrológica de América Central (CIMHAC, <http://www.simepar.br/cimhac/definicion.html>)

²² Originally "Central American Probabilistic Risk Assessment" (CAPRA, <http://www.ecapra.org/taps-map>)

revealed that there exists non-standardized, incompatible, and duplicated EWS-related equipment (e.g. different agencies or institutions have their own and often proprietary observing networks). Many community-level components of EWS in the countries are not linked to their respective national system, which has resulted in a lack of coordination and hinders the ability of national institutions to coordinate EWS activities. This has been attributed to the multitude of international, regional, and national aid agencies (e.g. NGOs, bilateral donors) that have implemented EWS at local levels that operate independently.

With respect to these gaps, the following priorities of action were highlighted:

- i. Strengthen the legal basis for EWS by inclusion of: (a) clear EWS stakeholder roles & responsibilities, (b) standards for EWS input data and information, and (c) risk-based data and information into building codes and land-use planning;
- ii. Strengthen and promote coordinated national to local policies, strategies and guidelines for DRM and EWS with support from regional and global partners;
- iii. Improve vertical integration (i.e. the coordination across all levels) and horizontal integration (e.g. aligning different plans for sanitation, land use, or drainage of a city).
- iv. Strengthen operational arrangements such as Memorandum of Understandings (MoU) and Standard Operating Procedures (SOP) among EWS stakeholders (e.g. NMS, NHS, DRM agency, and local authorities in urban and rural areas) to ensure that EWS stakeholder roles and responsibilities are clearly documented and aligned;
- v. Develop and strengthen institutional mechanisms for obtaining feedback from EWS stakeholders and general public for improvement of the system over time;
- vi. Mainstreaming of DRM with other policy areas such as ecological risk management and urban planning; and,
- vii. Provide adequate funding for the above actions.

35. Hazard monitoring, forecasting, and mandates for warning development at the city level: It was found that most EWS lack hydrological information and data. This was attributed to the lack of monitoring stations in the small river catchments or existing observing stations/networks are proprietary and designed for different purposes (e.g. hydropower, irrigation) and their data are not available. In this regard, it was highlighted that flash floods pose a major challenge due to the lack of observational data and short lead times. It was discussed that the hazard characteristics (e.g. hazard severity and uncertainty) are not always well-specified in warnings, which hinders decision makers to react appropriately. Additionally, it was discussed that the triggers of land- and mudslides and related preparedness and response measures are not well understood by the public.

With respect to these gaps, the following priorities of action were highlighted:

- i. Evaluate and enhance operational infrastructure and technical capacities of NMHS in terms of sustained and expanded observation networks, data management, and information sharing especially at sub-national levels;
- ii. Improve spatial-temporal scales of forecasts, including better real-time information as well as the consideration of slow-onset disasters (drought, fires) and longer timeframes²³ for EWS;
- iii. Develop warnings also for local events, not only for large-scale events;
- iv. Develop warnings that communicate the uncertainties, thresholds and criteria for specific actions and are sensitive to the characteristics of the territory (e.g. multiculturalism, customs);
- v. Review and strengthen warning protocols to include thresholds that lead to actions on the ground (e.g. precipitation thresholds);
- vi. Strengthen institutional mandates that govern the accessibility of information to ensure that data and information are available to all EWS stakeholders;

²³ It was recommended that climate variability (e.g. El Nino, or recently the first hurricane ever recorded in Brazil) and climate change need to better taken into account in EWS.

- vii. Leverage academic and other relevant partners in the region to enhance / design and when appropriate develop operational products that could strengthen EWS implementation; and,
 - viii. Strengthen public education on landslide triggers and causes.
36. Utilization of risk information in emergency planning and warnings at the city level: Common issues that were discussed included the weak consideration of the specifics and dynamics of urban areas in emergency planning and warnings. Rapid urban growth and increasing urbanization (more people living in cities, new cities emerge, etc.) are occurring, but are often poorly planned and with insufficient infrastructure (especially drainage systems), creating new patterns of risk. It was highlighted that hazard and vulnerability analyses especially on city/community levels are lacking.

With respect to these gaps, the following priorities of action were highlighted:

- i. Incorporate technological/human-made hazards (e.g. pollution, urban fires) where appropriate in risk reduction measures, emergency planning, and warnings;
 - ii. Identify risk zones at adequate scales as an important component of EWS;
 - iii. Create, improve, and regularly update exposure and vulnerability data and maps with current data (national and community data);
 - iv. Incorporate the requirements of various EWS stakeholders when designing hazard risk maps;
 - v. Ensure and improve risk-related (exposure/vulnerability) data and maps by: (i) ensuring exposure and vulnerability data is consistently updated in databases, (ii) strengthening of data quality standards, and (iii) improving accessibility of information (e.g. through flexible but coordinated data exchange mechanisms that comply with legal requirements, and standardized data formats); and,
 - vi. Conduct cost-benefit analyses of possible DRR measures to help identify where the limited resources can be most efficiently invested.
37. Warning dissemination mechanisms (linking national to local levels): It was discussed that some warning messages come from unofficial sources (international media, other agencies) and that official warnings are not always clear and the uncertainties are not always specified. It was highlighted that communications networks during hazard events often break down which prevents bulletins and warnings from reaching EWS stakeholders and the general public in a timely manner.

With respect to these gaps, the following priorities of action were highlighted:

- i. Disseminate warnings through official civil protection/DRM agencies, ideally as a single unambiguous message;
 - ii. Establish dissemination frameworks and related review procedures (e.g. compulsory transmission of official warnings in private media, raising awareness of media professionals);
 - iii. Expand dissemination to modern technologies such as websites, social media, SMS;
 - iv. Foster two-way communication from national to local and local to national in order to improve the EWS system and build trust in the institutions that issue official warnings; and,
 - v. Strengthen the stability of communication networks in emergency situations by investing in the respective infrastructure.
38. Emergency preparedness and response activities (national to local): It was identified as a major gap that emergency plans in many countries were not complied with and/or described as often being outdated and not reflecting development in urban areas and specific hazard characteristics. Additionally, it was highlighted that Red Cross Societies, municipal committees and community-based organizations (CBOs) play an important role in EWS in the region, namely as first responders and for facilitating public participation. However, their role is not well reflected in policies and plans throughout the region.

With respect to these gaps, the following priorities of action were highlighted:

- i. Update emergency plans, where appropriate, to reflect changes in urban development and to include hazard characteristics;
 - ii. Strengthen compliance of local to national emergency plans;
 - iii. Strengthen the management of evacuation shelters, esp. during recurrent events: (a) ensure that they are operationally ready when needed and (b) develop simple operational plans that reflect the needs of local communities (especially those of women and children);
 - iv. Ensure the needs of migrant and temporary populations (with different cultures, knowledge, and experiences) as well as disabled people are reflected in emergency plans;
 - v. Ensure that DRM headquarters, NMHS, and other agencies with roles in the operational EWS are located in secure areas and are resilient to hazard impacts; and,
 - vi. Provide training to municipal committees, CBOs, NGOs, etc. on: (a) hazard awareness and protection measures, (b) adaptation measures in communities and households, and (c) risk management in complex industrial, commercial, and municipal scenarios.
39. Improvement of the overall operational framework of the EWS: A number of overarching issues were addressed. One is the lack of a functional EWS in some rural and urban areas. Another problem is the lack of funding for maintenance and sustainability of EWS over the long term. Many local EWS rely only on international financial aid and are not or insufficiently linked to the national level. These systems tend to work only for a few years until the funding has been used and implementing organizations and trained staff have left. Often, new EWS related projects are launched without taking into account existing structures and good practices from other areas. It was highlighted that many EWS stakeholder institutions have a high turnover rate of staff which has led to institutional memory being lost. There was also a common consensus in among the participants that there is a generally a lack of standardized feedback and verification (e.g. warnings, bulletins) processes for improvement of the EWS in the Central American Countries. It was also found that EWS in the region are not well-embedded in the national and urban development frameworks and plans of their respective countries.

With respect to these gaps, the following priorities of action were highlighted:

- i. Establish standards for the acceptance and coordination of international technical and development assistance in the form of infrastructure and training;
- ii. Strengthen the long-term budgetary basis for institutions providing and disseminating the warnings and for capacity development;
- iii. Build on existing capacities instead of continuously introducing new things;
- iv. Replicate good experiences from cities/countries with good practices where appropriate;
- v. Strengthen education and training mechanisms for (a) monitoring and analyzing hazards and risk information, (b) verification, disseminating, and interpreting warnings, and (c) national EWS operations;
- vi. Facilitate institutional memory through the development of common policies, tools and manuals especially in view of frequent staff changes;
- vii. Evaluate and monitor EWS (in terms of material, staff, warnings, etc.) in a participatory manner and make necessary adjustments;
- viii. Build a service-oriented culture within the EWS-stakeholder community;
- ix. Ensure that EWS is built within a framework of sustainable urban development; and,
- x. Ensure that EWS take on an integrated, holistic and multi-hazard approach to leverage costs and resources.

Regional cooperation

40. It was highlighted that progress has been made over the last 10-15 years in terms of EWS in Central America and regional support for them. However, there is a need for harmonization of EWS and disaster response actions in the region, especially in transboundary areas where the local population is often confused by different messages and actions of the adjacent countries. A clear regional vision and a harmonized methodology for designing and implementing EWS on different levels are still missing. For example, it was mentioned that in the PCGIR, the EWS aspect is not yet well integrated. WMO (e.g. through the Hurricane committee) and its working

groups in RA VI have been active in the region for a long time with extensive coordination mechanisms, but have so far focussed on NMHS. However, a regional platform needs to involve many other agencies and decision makers from the countries and the region to develop frameworks that can be adjusted by the countries.

With respect to these gaps, the following priorities of action were highlighted:

- i. Strengthen regional cooperation and improve regional policies, ensuring that these are reflected in national policies;
- ii. Clarify the roles of humanitarian and development donors and implementing partners across the region and develop national standards for humanitarian and donor assistance;
- iii. Support and facilitate knowledge sharing, transfer of experiences and good practices, staff exchange with countries that share catchments and similar hazards, such as Guatemala and Mexico, or El Salvador and Honduras and within south-south cooperation;
- iv. Support and foster the harmonization of standards and protocols for regional data exchange; and,
- v. Ensure that support from WMO RSMCs and RCCs is effectively utilized.

5 Overall Conclusions and Next Steps

41. During this Workshop, high-level representatives from national DRM agencies, NMHS, and municipal governments in Central and South America, Cuba, and Mexico shared their experiences with the development of MHEWS at different levels. They provided an overview of the status of EWS in their cities, countries and respective regions and discussed policy, institutional, operational, and technical needs and challenges as well as opportunities for strengthening MHEWS and for cooperation and coordination. These discussions were to contribute to a consolidated Central American regional vision on how to develop or improve MHEWS for urban and rural areas that are embedded in activities at the national level.
42. By sharing and reflecting on own experiences, participating countries and cities were able to see where they stand in the region and in the world. The presentations and discussions revealed that there is clear evidence of a lack of development of EWS in Central America, with critical needs for (a) the development of policy & legislation on EWS to clarify roles & responsibilities and for (b) institutional capacity development & operational cooperation of NMHS, DRM agencies, and local authorities in urban and rural areas. It needs to be pointed out that there is still a disconnect between the many community-driven EWS (often supported by bi- and multi-lateral development agencies/donors) and the respective national EWS, contributing to gaps in coordination and limited sustainability of these systems. In addition, feedback mechanisms from the communities back to the national level are often absent.
43. Therefore, countries in Central America expressed a strong interest in creating and/or improving EWS at the national and local levels, both for rural and urban locations, with the engagement of WMO over the long term. They would like to see a documentation of good practices from Central America similar to the book on Institutional Partnerships in MHEWS²⁴. This would be a significant resource for countries in Latin America for strengthening their EWS. In addition, participating countries from South America requested holding similar workshops as this workshop in their region to facilitate dialogue and knowledge transfer among the South American countries.
44. Next steps:
 - i. It is intended to develop national EWS projects for interested Member States in the region, accompanied by a regional cooperation and capacity development project.
 - ii. MoUs need to be established between WMO and CEPREDENAC and other agencies and organizations for coordinated engagement when developing such projects for national

²⁴ Golnaraghi, M. (ed.) 2012: Institutional Partnerships in Multi-Hazard Early Warning Systems, DOI 10.1007/978-3-642-25373-7, Berlin, Heidelberg, Springer-Verlag.

- EWS and for their support through regional cooperation and capacity development (Q1 2014).
- iii. Interest from governments and key agencies (NMHS, DRM, etc.) in such national projects needs to be sounded out through missions. Currently, national projects on EWS in urban and rural areas in Costa Rica, Nicaragua, El Salvador, and Guatemala are being considered (Q2 2014).
 - iv. Upon confirmation of interest, project proposal development with the Member States (need of technical and advisory support from WMO RA IV and its Working Groups) may be initiated.
 - v. A regional cooperation and capacity development project should be developed in parallel, aiming at, amongst other things, strengthened and improved regional products from RSMCs and RCCs, training and capacity development of NMHS and DRM agencies, and improved data sharing. Furthermore, it should specifically address transboundary issues. Possible funders and partners are the World Bank, IFRC, and CEPREDENAC.
 - vi. Possibilities of holding a similar workshop in South America in autumn 2014 should be explored.
 - vii. It was recommended by the participants to present the results of this Workshop at the Regional Platform for DRR for the Americas on 27-29 May 2014, in Guayaquil, Ecuador.
 - viii. Final responses to the EWS survey need to be obtained. To date, nine of 13 countries have submitted draft versions of their responses. It was decided to extend the time allotted for submission of the final survey responses to 1 March 2014. A list of countries that have provided draft responses can be found in Annex IX.

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6 Annexes

A Framework for Systematic Assessment of Capacities and Gap Analysis for Multi-Hazard Early Warning Systems in Urban Areas

Guidance for Completing the Questionnaire

The following set of questions have been prepared as the basis for: (i) discussions during the Working Group session of the workshop on “Multi-Hazard Early warning Systems for Urban Areas,” (ii) documenting the experiences on national capacities, gaps and needs related to Multi-Hazard Early Warning Systems (MHEWS) in Urban Areas and, (ii) identifying priorities of action for MHEWS development and concrete areas for regional cooperation for the region.

Please discuss and answer these questions within your national delegation, involving representatives from National Disaster Risk Management Agency, National Meteorological and Hydrological Service and other relevant agencies and stakeholders involved in EWS in your country that are present at the workshop.

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 Characteristics of urban areas in your country

- 1.1 Please identify major urban areas in your country, provide information about size (population, area of coverage, location) and types of hazards posing risks, any information about history of impacts of meteorological, hydrological and climate-related hazards.
- 1.2 For each city urban area you have identified, is there currently an operational early warning system in place? If yes for which hazards?

Answer:

2 Governance and institutional arrangements

- 2.1 Please describe the policy, institutional and legal frameworks that support emergency preparedness and response planning (at national level, at municipal level and at city level).

Answer:

- 2.2 Describe the institutional process of emergency preparedness and response planning at national to city levels and who are the key authorities responsible for development of emergency plans and their activation? Do all the identified priority cities have developed local emergency plans? Have these been implemented?

Answer:

<p>2.3 Describe the process of in which the National Meteorological and Hydrological Service (NMHS) support the provision of early warning and meteorological and hydrological services to support emergency planning and preparedness in the urban areas? I</p>
<p align="center">Answer:</p>
<p>2.4 Please, provide:</p> <ul style="list-style-type: none"> • A list of agencies that are responsible for management and implementation of different components of early warning systems in the urban areas, • An organizational chart of the EWS linking national, municipal and local agencies and, • An organizational decision-making diagram, showing roles and responsibilities of different agencies at different levels, local, municipal and national, including the NMHS.
<p align="center">Answer:</p>
<p>2.5 Give a brief description of how your early warning system works operationally nationally and how it is supported by agencies at different levels of the government. In this context, identify the working relationships among agencies listed in 2.4 above.</p>
<p align="center">Answer:</p>
<p>2.6 Describe how the different components of the early warning system are financed for urban EWS development. Are there dedicated financial resources for maintenance and sustainability of the system (e.g. observing networks, communication systems, emergency response, etc.)</p>
<p align="center">Answer:</p>
<p>3 Utilization of risk information in emergency planning and warnings at the city level</p> <ul style="list-style-type: none"> • 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?
<p align="center">Answer:</p>
<p>4 Hazard monitoring, forecasting, and mandates for warning development at the city level</p> <ul style="list-style-type: none"> • For which natural hazards (see Annex I for a list of Natural Hazards), the National Meteorological and Hydrological Service <ul style="list-style-type: none"> - 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). <p>Please note that: A reference list of hazards is provided at the end of this text,</p> <ul style="list-style-type: none"> • Are there challenges for institutional coordination for the development of the warnings at the city level? If “yes”, please describe the challenges and how they are addressed.
<p align="center">Answer:</p>
<p>5 Warning dissemination mechanisms (linking national to local levels)</p> <ul style="list-style-type: none"> • Specify the dissemination mechanism(s) for delivery of warnings to the authorities and the public at risk in the urban areas? 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:
<p>6 Emergency preparedness and response activities (national to local)</p> <ul style="list-style-type: none"> • Describe the national to city-level 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:
<p>7 Improvement of overall operational framework of the early warning system</p> <ul style="list-style-type: none"> • Please identify and describe evaluation and feedback mechanisms within the operational early warning system that help to improve: <ul style="list-style-type: none"> - The system as a whole linking city, municipal and national levels. - 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:
<p>8 Please provide example of events where your EWS at the national levels had saved lives and explain how.</p>
Answer:
<p>9 Which of the following areas are your priorities for the improvement of your EWS? Please elaborate.</p> <ul style="list-style-type: none"> • Governance and Institutional Arrangements national to local levels • Utilization of risk information in emergency planning and warnings at the city level • Hazard monitoring, forecasting, and mandates for warning development at the city level • Warning dissemination mechanisms at the city level benefiting from information provided by national agencies such as NMHS • Emergency preparedness and response activities (national to local) • Coordination among agencies at the national level and cooperation with local authorities and governments
Answer:
<p>10 Provide concrete areas of regional cooperation which could benefit your country's early warning system in urban and rural settings?</p> <ul style="list-style-type: none"> • Sharing of good practices and expertise (policy, legal framework, institutional cooperation and operational systems) • Improved technical cooperation, data sharing and exchanging expertise • Education and training at management, technical and operational levels • Etc.
Answer:

Hazards list

- Tornado (rotational high winds)
- Flash flood
- Strong winds
- Hailstorm
- Thunderstorm or lightning
- Heavy snow
- Freezing rain
- Dense fog
- Tropical cyclone
- Storm surge
- Coastal flooding
- Heat wave: period of abnormally high temperatures
- Cold wave: period of abnormally low temperatures
- Drought
- River flooding
- Marine hazards (storm, sea ice, icebergs, etc.)
- Sandstorm
- Landslide or mudslide
- Airborne hazardous substances (i.e., nuclear, biological, chemical, etc.)
- Waterborne hazards (i.e., nuclear, biological, chemical, oil spills, etc.)
- Desert locust swarm
- Hydrometeorological hazards to aviation (i.e., turbulence, icing)
- Avalanche
- Forest or wild land fire
- Smoke, Dust or Haze
- Earthquakes
- Tsunami
- Volcanic events
- Others, please specify

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Agenda

Day 1 – Tuesday 10 December 2013 Plenary Room: Zurqui 4	
0800 – 0900 Registration (Registration desk will be open throughout the Workshop)	
Session 1: Opening and introduction	
0900 – 1000	<ul style="list-style-type: none"> ➤ Welcome remarks by senior official from Costa Rica and official opening of the workshop ➤ Welcome remarks by the Workshop Co-Chairs: Ing. Vanessa Rosales Ardón (Presidency of CNE) and Mr Juan Carlos Fallas (President of WMO Regional Association IV – Central and North America and the Caribbean) ➤ Objectives, structure, document list and working arrangements of the workshop – Maryam Golnaraghi (WMO)
Session 2: Background presentations Chair: Ing. Vanessa Rosales Ardón	
1000 – 1100	<ul style="list-style-type: none"> ➤ Early Warning Systems in Central America – Wilfried Strauch (CEPREDENAC) ➤ Latest Technical Advancements and Opportunities for Development of Multi-Hazard EWS – Maryam Golnaraghi (WMO) ➤ The Organization of American States and Early Warning Systems: The Central American Experience and Decision-making Support Tools – Pablo González (OAS) ➤ The Regional Committee on Water Resources (CRRH): Regional Activities and Mandates Supporting Early Warning Systems – Patricia Ramirez (CRRH) ➤ Importance of Community Preparedness and Coordination Through National to Local – Daniel Ureña Cot (IFRC)
1100 – 1130	Group Photo Coffee break
Session 3: Presentations on good practices in urban MHEWS and lessons learnt Chair: Ing. Vanessa Rosales Ardón Key issues for discussions:	
<ol style="list-style-type: none"> 1) <i>Four components of an effective early warning systems: (i) monitoring, detection and forecasting of the hazards, (ii) translating hazard warnings into risk-based warning, (iii) communication of “authoritative” warning information with authorities and general public, (iv) activation of emergency preparedness plans and response systems</i> 2) <i>Policy, institutional roles and coordination among national agencies, local governments and authorities</i> 3) <i>Public awareness, education and drills</i> 4) <i>Feedback mechanisms to improve the system</i> 	
1130 – 1300	<ul style="list-style-type: none"> ➤ Ten Principals for Effective Early Warning Systems – Maryam Golnaraghi (WMO) ➤ 30 minute presentations with 10 minute Q&A (5-minute videos could be shown as part of the 30 minute presentation) <ul style="list-style-type: none"> ▪ Early Warning System for Hydro-Meteorological Hazards in the Sarapiquí River Basin, Costa Rica – Juan Carlos Fallas (IMN) ▪ Early Warning System of the City of Medellín, Colombia – Jaime Enrique Gómez Zapata (DAGR)
1300 – 1400	Lunch
Session 3: Presentations on good practices in urban MHEWS and lessons learnt (Continued)	
1400 – 1600	<ul style="list-style-type: none"> ➤ 30 minute presentations with 10 minute Q&A <ul style="list-style-type: none"> ▪ Early Warning System and the Role of the Cuban Meteorological Service – Magdiel Carrasco ▪ Early Warning System of the City of Santa Fe, Argentina – Luis Eduardo Aguirre Madariaga ▪ Tendencies and some Observations on Risk Management and Early Warning Systems in the City of Curitiba, Brazil – Renato Eugenio de Lima

	<ul style="list-style-type: none"> ▪ Early Warning Systems in Chile – Guillermo Madariaga Meza ▪ Flood and Landslide Early Warning System of the City of La Paz, Bolivia – Pamela Diana Pozo Luna ▪ Overview of Early Warning Systems and the Role of the National Meteorological and Hydrological Services in Mexico – Antonio Cruz Sánchez
1600 – 1630	Coffee break
Session 4: Identification Priorities, gaps and needs for the development of Multi-Hazard EWS in Urban Areas Chair: Ing. Vanessa Rosales Ardón	
1630 – 1700 (with interpretation)	<ul style="list-style-type: none"> ➤ Presentation of the handout on “A Framework for Systematic Assessment of Capacities and Gap Analysis for Multi-Hazard EWS in Urban Areas” – Maryam Golnaraghi (30 minutes) <ul style="list-style-type: none"> ▪ Representatives from participating countries will work within their respective country teams to discuss the distributed questionnaire and prepare for the working group discussions on day 2
1700 – 1800	
Cocktails (1830 in Room: Zurqui 2)	
Day 2 – Wednesday 11 December 2013	
Session 4 (Continued): The meeting is divided up into two working groups to review and analysis of capacities, gaps and needs and recommendations for priorities of action for the development and or strengthening of urban multi-hazard early warning systems. Chair: Mr Juan Carlos Fallas Note: All participants are requested to meet at 0900 am in the main conference room (Zurqui 4), before breaking up into working groups.	
Working Group 1: Panama, El Salvador, Costa Rica, Nicaragua, Colombia, Chile, Argentina Room: Zurqui 4 Co-Facilitators: Armando Guzman (World Bank) and Daniel Ureña Cot (IFRC) Rapporteurs: Breyner Mora Garcia Secretariat Support: Jochen Luther (WMO)	Working Group 2: Mexico, Guatemala, Honduras, Belize, Brazil, Cuba, Bolivia Room: Europa Co-Facilitators: Mayra Valle (CEPREDENAC) and James Douris (WMO) Rapporteurs: Pamela Diana Pozo Luna & Antonio Cruz Sanchez Secretariat Support: Rubén Vargas (UNISDR)
0900 – 1030	<ul style="list-style-type: none"> ➤ Review and analysis of capacities, gaps and needs of the various national cases based on the presentation of the results of their respective cases using handout on “A Framework for Systematic Assessment of Capacities and Gap Analysis for Multi-Hazard EWS in Urban Areas”.
1030 – 1100	Coffee break
Session 4 (Continued) – Continuation of discussions in Working Groups	
1100 – 1300	<ul style="list-style-type: none"> ➤ Review and analysis of capacities, gaps and needs and recommendations for priorities of action for the development/strengthening of urban multi-hazard early warning systems and related cooperation at local, national and regional levels.
1300 – 1400	Lunch
Session 4 (Continued) – Continuation of discussions in the Working Groups to summarize discussions and prepare presentations	
1400 – 1530	<ul style="list-style-type: none"> ➤ The Working Groups will prepare presentation on common issues, challenges and priorities identified among countries.
1530 – 1600	Coffee break

<p>Session 4 (Continued) – Presentations by the Working Groups Note: All participants are requested to convene in the main conference room for review of the outcomes of the Working Groups Chair: Mr Juan Carlos Fallas Room: Zurqui 4</p>	
1600 – 1730	<ul style="list-style-type: none"> ➤ 20 minute presentations by each working group on the outcomes with 10 minute Q&A: <ul style="list-style-type: none"> ▪ Workgroup 1 ▪ Workgroup 2 ➤ Discussions on challenges, opportunities and priorities of action for strengthening MHEWS in urban areas in the region.
<p>Day 3 – Thursday 12 December 2013 Plenary Room: Zurqui 4</p>	
<p>Session 5: Regional, national, local coordination aspects of MHEWS Chair: Mr Juan Carlos Fallas Room: Zurqui 4</p>	
0900 – 1045	<p>Facilitator: Pablo Gonzales (OAS) Panel 1: Policy, institutional roles and importance of national to local operational coordination and feedback mechanisms, role of government, civil society and private sector and importance of cooperation across sectors and levels Panellists:</p> <ul style="list-style-type: none"> ▪ Panellist 1 – Edgardo Acosta (DM Director of CNE) ▪ Panellist 2 – Absalón Martínez Navas (Mayor of Corinto, Nicaragua) ▪ Panellist 3 – Catherine Cumberbatch (National Meteorological Service of Belize) ▪ Panellist 4 – Marcia Sánchez (Red Cross of Nicaragua)
1045 – 1115	<p>Coffee break</p>
1115 – 1230	<p>Facilitator: Maryam Golnaraghi (WMO) Panel 2: Regional coordination and cooperation among countries and networks supporting national early warning systems Panellists:</p> <ul style="list-style-type: none"> ▪ Daniel Ureña Cot (IFRC) ▪ Wilfried Strauch, of the Geographical Analysis Unit and CAPRA program (CEPREDENAC) ▪ Juan Carlos Fallas (WMO) ▪ Patricia Ramírez (CRRH) ▪ Rubén Vargas (UNISDR) ▪ Pablo González (OAS) ▪ Armando Guzman (World Bank)
1230 – 1245	<ul style="list-style-type: none"> ➤ Workshop summary and next steps – Maryam Golnaraghi (WMO) ➤ Official closing of the Workshop – Co-Chairs
1245 – 1400	<p>Lunch</p>

Summary of Mandates, Structure, Strategies, and Programmes / Projects of Participating Organizations

1. CEPREDENAC (Centro de Coordinación para la Prevención de los Desastres Naturales en América Central, <http://www.sica.int/cepredenac/>) is a specialised institution of the Central American Integration System (Sistema de la Integración Centroamericana – SICA) dealing with the prevention, mitigation, preparedness and response to the occurrence of natural disasters. It promotes the Central American Risk Management Policy (Política Centroamericana de Gestión de Riesgos – PCGIR) that was adopted by all SICA countries in order to provide guidance on risk reduction and disaster prevention and to contribute to an integrated vision of development in Central America.
2. CRRH (Comité Regional de Recursos Hídricos, <http://www.recursoshidricos.org/>) is a further specialized institution of SICA, mandated to coordinate and facilitate project in the fields of meteorology, climate, and water resources. This includes searching for funding and regional or international agencies that run these projects, improve the management of integrated water demand and transboundary resources, and strengthen ties between Central America with regional and global programmes for monitoring weather, the hydrological cycle, and climate change. In addition, it promotes the following strategies which all refer to the improvement of EWS: (a) Regional Agro-Environment and Health Strategy (Estrategia Regional Agroambiental y de Salud – ERAS); (b) Regional Climate Change Strategy (Estrategia Regional de Cambio Climático – ERCC); and (c) Central American Strategy on Integrated Water Resources Management (Estrategia Centroamericana de Gestión Integral del Recurso Hídrico – ECAGIRH).
3. OAS (Organization of the American States, <http://www.oas.org/en/default.asp>) is a continental organisation founded for the purposes of regional solidarity and cooperation among its members, being the 35 independent states of the Americas. Its Department of Sustainable Development (OAS/DSD), through its Risk Management and Adaptation to Climate Change section (RISK-MACC, <http://www.oas.org/osde/Working%20Documents/Naturaldesasterandland.htm>), supports the priorities of OAS Member States in adapting to and managing the increasing risks associated with natural disasters. The ultimate goal is to mainstream risk management into development policy and planning across all sectors and government levels, by building on work underway at the regional and international levels, and by taking into account the changing priority needs of the Member States. OAS has been providing technical advice on flood EWS in several small valleys in Central America since 1995, e.g. through the Central American Small Valley's Flood Alert and Vulnerability Reduction Program (SVP).
4. The International Federation of Red Cross and Red Crescent Societies (IFRC, <http://www.ifrc.org/>) Americas Zone Office (AZO) supports the over 5,000 local branches of the 35 Red Cross National Societies in the Americas to address key humanitarian trends and challenges for millions of people living in conditions of high risk by working with them to ensure that they are modern, relevant and influential actors in their own countries. Out of its seven programming and service units, two are especially relevant for EWS: (a) Urban risk and community resilience (Unidad de Riesgo Urbano y Resiliencia Comunitaria); and (b) Disaster and crisis response and early recovery.
5. The World Bank (<http://www.worldbank.org/>) is an international financial institution that provides loans to developing countries to reduce poverty. It comprises two institutions: the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA) and is part of the World Bank Group. Over the past 10 years, the World Bank Group has emerged as a global player in disaster risk management (DRM), supporting client countries as they assess exposure to hazards and address disaster risks. It provides technical and financial support for risk assessments, risk reduction, preparedness, financial protection, and resilient recovery and reconstruction. A large part of the World Bank's work in DRM is led by the Global Facility for Disaster Reduction and Recovery (GFDRR),

<https://www.gfdr.org/>). Established in 2006, GFDRR is a partnership of 41 countries and 8 international organizations committed to helping developing countries reduce their vulnerability to natural hazards and adapt to climate change. The partnership's mission is to mainstream disaster risk reduction (DRR) and climate change adaptation (CCA) in country development strategies by supporting a country-led and managed implementation of the Hyogo Framework for Action (HFA). The GFDRR is managed by the World Bank on behalf of the participating donors and other partnering stakeholders. GFDRR's governance, mission, operating mechanisms, and organizational structure are clearly defined in its Partnership Charter that was adopted in February 2007 and amended in April 2010 to include selected developing country governments invited by the Consultative Group on a two year staggered-rotation basis as non-contributing members.

6. The International Strategy for Disaster Reduction (ISDR) was adopted by the UN General Assembly in December 1999 and established UNISDR (<http://www.unisdr.org/>), the secretariat to ensure its implementation. UNISDR, the UN office for disaster risk reduction, is also the focal point in the UN system for the coordination of disaster risk reduction and the implementation of the international blueprint for disaster risk reduction – the "Hyogo Framework for Action 2005-2015: Building the resilience of nations and communities to disasters" (HFA). Located in Panama City, Panama, the UNISDR Regional Office for the Americas (<http://eird.org/americas/index.html>) strives to provide support to actors throughout the region, including North America, Latin America and the Caribbean, in fostering a culture of disaster prevention and contributing to build disaster resilient nations and communities. Current campaigns focus on safer schools and hospitals and more resilient cities. The office organizes in coordination with OAS the Regional Platform for DRR every two years, bringing together all relevant parties involved in DRR to assess progress on policy implementation.
7. The World Meteorological Organization (WMO, http://www.wmo.int/pages/index_en.html) is a specialized agency of the United Nations. It is the UN system's authoritative voice on the state and behaviour of the Earth's atmosphere, its interaction with the oceans, the climate it produces and the resulting distribution of water resources. WMO is an intergovernmental organization with a membership of 191 Member States and Territories (as of 1 January 2013). It originated from the International Meteorological Organization (IMO), which was founded in 1873. Established in 1950, WMO has its headquarters in Geneva, Switzerland, and is a member of the United Nations Development Group (UNDG). WMO plays a leading role in international efforts to monitor and protect the environment through its Programmes. In collaboration with other UN agencies and the National Meteorological and Hydrological Services (NMHS), WMO supports the implementation of a number of environmental conventions and is instrumental in providing advice and assessments to governments on related matters. WMO facilitates the free and unrestricted exchange of data and information, products and services in real- or near-real time on matters relating to safety and security of society, economic welfare and the protection of the environment. In the specific case of weather-, climate and water-related hazards, which account for nearly 90% of all natural disasters, WMO's programmes provide vital information for the advance warnings that save lives and reduce damage to property and the environment. WMO also contributes to reducing the impacts of human-induced disasters, such as those associated with chemical and nuclear accidents, forest fire and volcanic ash.
8. Six regional associations are each composed of Members whose task it is to coordinate meteorological, hydrological and related activities within their respective Regions (Africa – I; Asia – II; South America – III; North America, Central America and the Caribbean – IV; South-West Pacific – V; and Europe – VI). Region IV consists of a total of 25 member states and two member territories, including three nations based in Europe with dependencies within the region.

Leveraging its extensive international and regional coordination and collaboration networks, WMO's DRR Programme (<http://www.wmo.int/pages/prog/drr/>) addresses the information needs of the highly diverse DRR community, which includes risk managers, socio-economic sectors and urban infrastructure planners, among others. Its work in 2012 – 2015 involves (1) Development of guidelines, manuals and standards for weather-, climate- and water-related

hazard definitions, monitoring, standardization of hazard databases, metadata, statistical and forecasting techniques, early warning systems with a multi-hazard approach, and requirements for climate services for risk financing and insurance as well as for humanitarian planning and (2) Implementation of DRR and climate adaptation in national capacity development projects within regional cooperation frameworks, engaging a number of development and technical partners. Currently such projects are underway in South East Europe, South East Asia, Central America and the Caribbean, with plans for expansion to Africa and the Middle East. The Programme is working to assist NMHSs to (a) Engage effectively in national DRR governance; (b) Identify, prioritize and establish partnerships and service delivery agreements with the national DRR user community engaged in activities such as risk analysis, Multi-Hazard Early Warning Systems (MHEWS), sectoral risk management, disaster risk financing and transfer; (c) Establish partnership agreements with other national technical agencies (e.g., hydrological services, ocean services, etc.) and with global and regional specialized centers (e.g. Global Producing Centres (GPC), Regional Specialized Meteorological Centres (RSMCs), Regional Climate Centres (RCC), Tsunami Watch Centers, etc.), and agree with them on standard operating procedures; (d) Develop and deliver high-quality, specialized meteorological, hydrological and climate services such as data, forecasts, analysis and other value-added products to DRR stakeholders; (e) Modernize and strengthen monitoring, forecasting and telecommunication capacities and training to support product development and service delivery functions; and (f) Develop risk information for large-scale and trans-boundary hazards, through strengthened regional and global cooperation.

9. The National Commission for Risk Prevention and Emergency Management (Comisión Nacional de Prevención de Riesgos y Atención de Emergencias de Costa Rica – CNE, <http://www.cne.go.cr/>) is the entity in Costa Rica responsible for the coordination of prevention work on risk and for the mitigation and response to emergency situations. The development of the National Law for Emergencies, on the 14th of August, 1969, was the foundation for the National Commission. Since 2006, the National Law for Emergencies and Risk Prevention No. 8488 has addressed a number of gaps in earlier legislation that limited the actions of the institution and the concept of risk prevention. It also empowers CNE to coordinate the National System for Prevention and Emergency, where each institution must participate in the specific matters within its competence and collaborate with local risk prevention and emergency management committees. It promotes, organizes, directs and coordinates the operation of the National Risk Management and the implementation of its National Plan. It thereby helps reduce vulnerability, safeguarding human life and welfare of the citizens of the country.
10. The Costa Rican National Meteorological Institute (Instituto Meteorológico Nacional – IMN, <http://www.imn.ac.cr/>) is a scientific body under the Ministry of Environment and Energy (MINAE) that is responsible for the coordination of all meteorological activities in the country. It systematically monitors the weather in order to support the security of the country's air navigation and to minimize the impact of hydrometeorological events. It collects, studies and analyzes all weather information that is recorded in the country and takes measures necessary for the preparation of studies and research in the fields of meteorology, climatology, climate variability, climate change, air pollution, ocean-atmosphere interactions and others in order to support national development. It also gives out water concessions and gives advice for water resources management (hydroelectric production, irrigation, human consumption, etc.).
11. The United States of America Agency for International Development (USAID, <http://www.usaid.gov/>) is the lead U.S. Government agency that works to end extreme global poverty and enable resilient, democratic societies to realize their potential. USAID's works through a decentralized network of resident field missions that manage foreign civilian aid programmes in low-income countries. These programmes serve a range of purposes, for example (a) disaster relief, (b) poverty relief, (c) technical cooperation on global issues, including the environment, (d) U.S. bilateral geopolitical interests, and (f) general socioeconomic development.

USAID, through its Office of U.S. Foreign Disaster Assistance (USAID/OFDA), supports a variety of disaster risk reduction programmes to prevent or minimize damage cause by disasters through EWS, disaster preparedness and mitigation efforts, as well as training for

disaster response. Many programmes improve collection and use of data on disaster risks, including building capacity and infrastructure to observe, analyze, and forecast hazards. This may include mapping hazards, developing people-centered EWS, and facilitating exchange of information on risks. USAID/OFDA also supports the development of information-sharing systems and services, which may involve strengthening networks and promoting dialogue and cooperation among scientific communities and practitioners. USAID/OFDA funds training and learning programmes at a community level, for local authorities, and for targeted sectors. Preparedness for response addresses the need to plan for events where managing the risk proves too costly or not feasible. In this vein, USAID/OFDA works to strengthen policy; build technical and institutional capacities; support dialogue, information exchange, coordination and stakeholder engagement; stockpile commodities that may be needed in a response; and review and update disaster preparedness and contingency plans.

Other EWS run by USAID are the Famine Early Warning Systems Network (FEWS NET) in Africa, Central America and the Caribbean, a leading provider of early warning and analysis on acute food insecurity created in 1985, and Disease Early Warning Systems (DEWS).

Ten Common Principles for Successful Early Warning Systems

1. There is a strong political recognition of the benefits of EWS reflected in harmonized national to local disaster risk management policies, 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, and, (iv) community 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;
3. EWS stakeholders are identified and their roles and responsibilities and coordination mechanisms clearly defined and documented within national to local plans, legislation, directives, MoUs, etc., including those of the technical agencies such as the NMHS;
4. EWS capacities are supported by adequate resources (e.g., human, financial, equipment, etc.) across national to local levels and the system is designed and implemented accounting for long-term sustainability factors;
5. 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;
6. 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 colour, flags, etc) and understood by authorities and the population, (iii) issued from a single (or unified), recognized and “authoritative” source;
7. Warning dissemination mechanisms are able to reach the authorities, other EWS stakeholders and the population at risk in a timely and reliable fashion;
8. 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 women, children, the elderly and the hospitalized), coordination mechanisms and various EWS stakeholders;
9. Training on risk awareness, hazard recognition and related emergency response actions is integrated in various formal and informal educational programmes and linked to regularly conducted drills and tests across the system to ensure operational readiness at any time;
10. Effective feedback and improvement mechanisms are in place at all levels of EWS to provide systematic evaluation and ensure system improvement over time.

Source:

Golnaraghi, M. (ed.) 2012: Institutional Partnerships in Multi-Hazard Early Warning Systems, DOI 10.1007/978-3-642-25373-7, Berlin, Heidelberg, Springer-Verlag.

Composition of the Working Groups

Working Group 1 (Room: Zurqui 4)

Facilitator: Armando Guzman (World Bank) and Daniel Ureña Cot (IFRC)

Rapporteur: Breyner Mora Garcia

Secretariat support staff: Jochen Luther (WMO)

Interpretation: English / Spanish

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		Chile	Madariaga Meza, Guillermo
		Argentina	Aguirre Madariaga, Luis Eduardo Ferreira, Lorena Judith Marcel Competella, Claudia
		Panama	Centanaro, Diana Lee Osorio Vergara, César
		Nicaragua	Sánchez Ulloa, Marcia Martinez Navas, Absalón
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Rapporteurs: Pamela Diana Pozo Luna & Antonio Cruz Sanchez

Support: Rubén Vargas (UNISDR)

Interpretation: English / Spanish

Countries	Persons	Countries	Persons
Mexico	Cruz Sánchez, Antonio Prieto Gonzalez, Ricardo Saavedra, José Raúl	Brazil	de Lima, Renato Eugenio
Guatemala	Alvarez, Raul Estuardo Monterroso, David	Cuba	Planos, Eduardo Carrasco, Magdiel
Honduras	Castillo Serrano, Glenda Elizabeth Silva, Eliseo Solorzano, Jorge Ivan Urruita Aguilar, Luis Enrique	Bolivia	Pozo Luna, Pamela Diana
		Belize	Cumberbatch, Catherine Williams, Isani

Summary of Discussions and Recommendations of Working Group 1 and Working Group 2

Theme	Working Group 1	Working Group 2
Characteristics of urban areas	<p>Common Issues:</p> <ul style="list-style-type: none"> • Many urban areas are growing rapidly, creating new patterns of vulnerability but also of hazards • Drainage and other infrastructure often does not keep up with this growth • Difficult to forecast small-scale, but intense rainfall and issue respective warnings • Keep a holistic picture of DRM with all phases, strengthen especially the prevention phase and legal frameworks <p>Challenges:</p> <ul style="list-style-type: none"> • In some urban areas EWS do not yet exist • Update and adjust EWS and emergency plans to new urban developments • Align the actions of the many actors involved <p>Priorities:</p> <ul style="list-style-type: none"> • Replicate good experiences from some cities to others within and outside the countries and integrate them in national policies / systems • (Consolidate earthquake and tsunami EWS on both coasts) • 	<p>Common Issues:</p> <ul style="list-style-type: none"> • Extensive, unplanned urban growth, emergence of new cities, there are developments that require strengthening <p>Challenges:</p> <ul style="list-style-type: none"> • Need for land use planning • Mapping of vulnerable areas and hazards • Identification of risk areas. • Improve building codes • Sustainable development of cities considering cultural factors • Develop and implement risk management tools • Reduction of current risk and new risks • Focus on drainage systems. • Cities are generators of hazardous processes • Relocation of populations at high risk. • Risk communication • Cost-benefit analysis for risk reduction <p>Priorities:</p> <ul style="list-style-type: none"> • Legislation for building regulations • Cost-benefit analyses of risk reduction
Governance and institutional arrangements	<p>Common Issues:</p> <ul style="list-style-type: none"> • Define operational procedures at each level for timely actions • adjust the language of local and national jurisdiction <p>Challenges:</p> <ul style="list-style-type: none"> • Decentralisation needs to be further explored/supported while keeping coherence with the national level • involve more the private and community sectors in EWS and 	<p>Common Issues:</p> <ul style="list-style-type: none"> • Organizations exist that provide technical information to a governing body • Consideration of local to federal/national levels <p>Challenges:</p> <ul style="list-style-type: none"> • Need for a process of negotiation between the government and the community • Improve mechanisms for coordination of local and national authorities

Theme	Working Group 1	Working Group 2
	<p>establish respective institutional agreements/ arrangements</p> <p>Priorities:</p> <ul style="list-style-type: none"> Strengthen the cooperation between DRM agencies and the NHMSs (even if it already exists) 	<p>(specify in the regulations).</p> <ul style="list-style-type: none"> Realize detailed protocols of assistance. Improve the management and quality of technical information to the governing authorities. Obtain adequate budgets for the necessary instrumentation. <p>Priorities:</p> <ul style="list-style-type: none"> Agreement on a legal basis for improving the quality of the input information to the EWS for risk management. Need for mitigation measures in the long term. Involvement of different actors
<p>Utilization of risk information in emergency planning and warnings at the city level</p>	<p>Common Issues:</p> <ul style="list-style-type: none"> Acknowledge the specifics and dynamics of urban areas (e.g. flooding occurred where it never occurred before, new vulnerabilities are created), update maps and plans regularly <p>Challenges:</p> <ul style="list-style-type: none"> Explore precipitation thresholds for EWS and respective protocols Better link science and municipal and local structures <p>Priorities:</p> <ul style="list-style-type: none"> Promote vulnerability analyses esp. on the city/community level Particularization of meteorological information, improve models and risk metrics Improve the scale of risk maps Communicate uncertainties and the limits / accuracy of warnings Establish risk maps for all levels All actors involved need to communicate back to the NHMS (Met Service) 	<p>Challenges:</p> <ul style="list-style-type: none"> Agility/flexibility when exchanging priority information Quality and accessibility of information. Mandatory registration of historical information. <p>Priorities:</p> <ul style="list-style-type: none"> Maintain quality information with legal requirements. Effective coordination of information. Establishment of standardized formats and reporting requirements (case-specific, as appropriate), and for data/information processing and risk analysis
<p>Hazard monitoring, forecasting and mandates for warning development at the city level</p>	<p>Common Issues:</p> <ul style="list-style-type: none"> Reduce the scale of forecasts! Better real-time information Sustainability/maintenance of the observation networks, also expand/strengthen these! Better interaction between hydrological and meteorological services <p>Challenges:</p> <ul style="list-style-type: none"> Decision makers need to better understand warnings issued by the Met Service, the warning needs to clearly indicate the seriousness of the forecasted event –improve knowledge and awareness 	<p>Challenges:</p> <ul style="list-style-type: none"> Identify thresholds of/for forecasts to calculate risk: criteria, standards and models Multinational collaboration for monitoring and forecasting at the

Theme	Working Group 1	Working Group 2
	<ul style="list-style-type: none"> • Take staff turnover into account • Better specify the hazard that it threatening the city <p>Priorities:</p> <ul style="list-style-type: none"> • Some countries are establishing regional forecasting centres with e.g. new radars, but this also needs strong partners (e.g. universities) in the region 	<p>regional level, break political boundaries for the flow of information.</p> <ul style="list-style-type: none"> • Improve the capacity of data / computer processing <p>Priorities:</p> <ul style="list-style-type: none"> • Strengthen the mandates that cover the accessibility of information • Allocation of budgets for updating, improving and creating appropriate products • Evaluation by country of information management, including institutional relationships • Search for academic support to design operational products
<p>Warning dissemination mechanisms (linking national to local levels)</p>	<p>Common Issues:</p> <ul style="list-style-type: none"> • Expand dissemination to social media, using modern technologies but also the basic means (radio, etc.), warnings should be transferred through official civil protection agencies • Basic communication elements <p>Challenges:</p> <ul style="list-style-type: none"> • It needs a framework to do that, how to regulate this complementarity, structuring this information • Keep it to one, unambiguous message – channel the large amount of information and keep it “official” • to maintain a two-way communication – from national to local but also from local to national <p>Priorities:</p> <ul style="list-style-type: none"> • Improve communication depending on the characteristics of the territory, overcome the bias towards other stakeholders involved • Establish /check procedures –incl. non-traditional communication channels, even if manuals exist 	<p>Challenges:</p> <ul style="list-style-type: none"> • Issuing warnings for local events and not just for large events • Awareness of the mass media, compulsory transmission of warnings through private media channels • Preventing the collapse of information networks in emergency situations • Complement the official information with social networks <p>Priorities:</p> <ul style="list-style-type: none"> • Strengthening education for risk perception • Increase confidence and credibility of the people in the alerts • Positioning and visibility of the institution responsible for issuing warnings
<p>Emergency preparedness and response activities (national to local)</p>	<p>Common Issues:</p> <ul style="list-style-type: none"> • Many plans and procedures have not been updated according to more recent developments, they also have to be officially issued and enforced • Manage shelter and evacuated groups (have simplified plans there), esp. during recurrent events <p>Challenges:</p> <ul style="list-style-type: none"> • To have emergency response strategies (incl. evacuation maps) at hand in a timely manner • Transfer emergency plans to urban areas and to specific types of 	

Theme	Working Group 1	Working Group 2
	<p>events</p> <ul style="list-style-type: none"> • Local / regional plans need to comply with the national plan / policy (e.g. if produced by NGOs) • Adapt the plans to specific hazards • Migrant / temporary population (different culture, knowledge, experience) in cities needs to be taken into account in emergency plans <p>Priorities:</p> <ul style="list-style-type: none"> • Analyze the security situation in cities and the influence on warning uptake, headquarters of DRM/NHMS need to be located in safe places • Consider disabled people (e.g. include more visual elements in plans etc.) 	
<p>Improvement of overall operational framework of the EWS</p>		<ul style="list-style-type: none"> • Monitoring and continuous evaluation of the established EWS (human and material components), make the necessary adjustments and make evaluations in a group manner • Support for drills and simulations • Strengthen communication while acknowledging multiculturalism in the region and respecting customs • Implement mechanisms to (a) support those responsible for emergencies and (b) capacity development programmes. • Support investment in equipment, human capacity development for monitoring, analysis and dissemination of information.
<p>Priorities for the improvement of your EWS</p>		<ul style="list-style-type: none"> • Strengthening the legal and budgetary basis for institutions providing warnings. • Identification of synergies for creating MHEWS. • Validation of information for monitoring and planning. • Sustainable urban development and detailed mapping. • Training of personnel for the timely and correct interpretation of the EWS. • Education and involvement of the population, of decision makers, and of social institutions to design and appropriately use EWS. • Identify and use the value of social networks for the dissemination of alerts. • Promoting the visibility of existing EWS.
<p>Concrete areas of regional cooperation which</p>	<ul style="list-style-type: none"> • Support and facilitate knowledge sharing and south-south cooperation 	<ul style="list-style-type: none"> • Coordination among countries that share river basins, volcanoes, etc., for example Guatemala and Mexico.

Theme	Working Group 1	Working Group 2
<p>could benefit your country's EWS in urban areas</p>	<ul style="list-style-type: none"> • Support cooperation at the sub-national level (cities) with a national view • Foster scientific and know-how transfer of experiences and good practices • Support and foster harmonization of standards • Enhance forecasting capacities and data management at the sub-national level • Improve use of existing and new tools and technologic products (satellite) • Enhance countries capacities to develop and implement a regional severe weather events virtual centre • Link meteorological and hydrological models • Mainstream remote sensing information in forecast modelling • Validation of forecasting information at the local level, expected vs. actual impact 	<ul style="list-style-type: none"> • Training programmes and their implementation in/among countries in the region. • Staff exchange stays for the development and implementation of EWS. • Mexico and Cuba can send personnel to support training in other countries. • Build on established programmes of UN bodies. • Establishment of joint programmes between El Salvador and Honduras.

WMO DRR Programme Framework

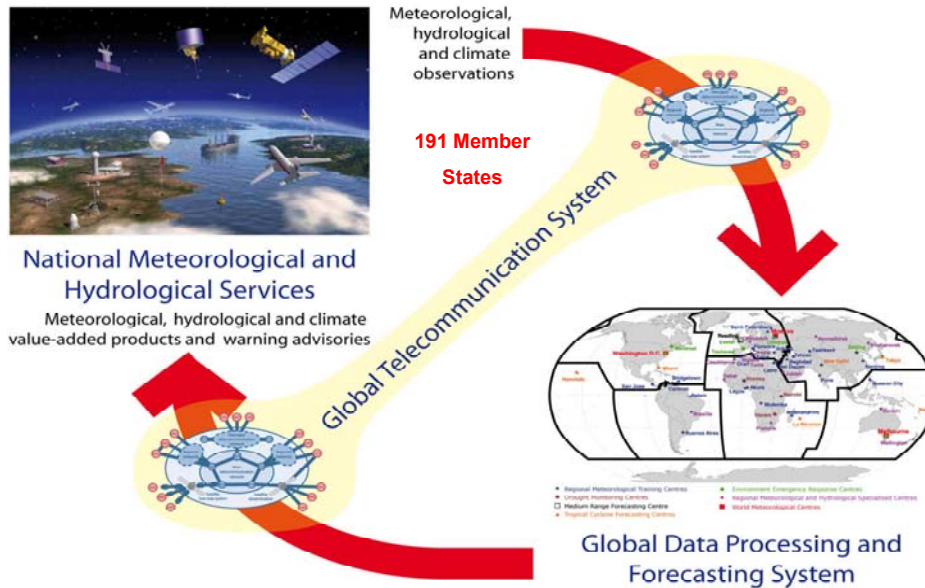


Figure 1 60 Years of National, Regional and Global Coordination: Systematic Global Data Collection, Analysis and Forecasting

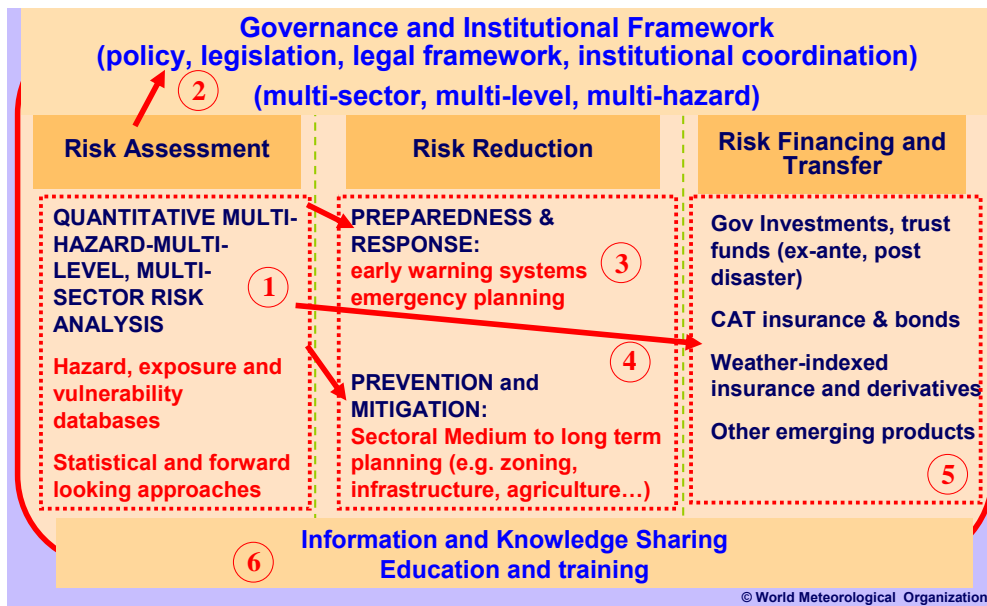


Figure 2: Elements of a comprehensive DRR Framework based on the Hyogo Framework for Action 2005-2015.



Figure 3: Four pillars of Early Warning Systems

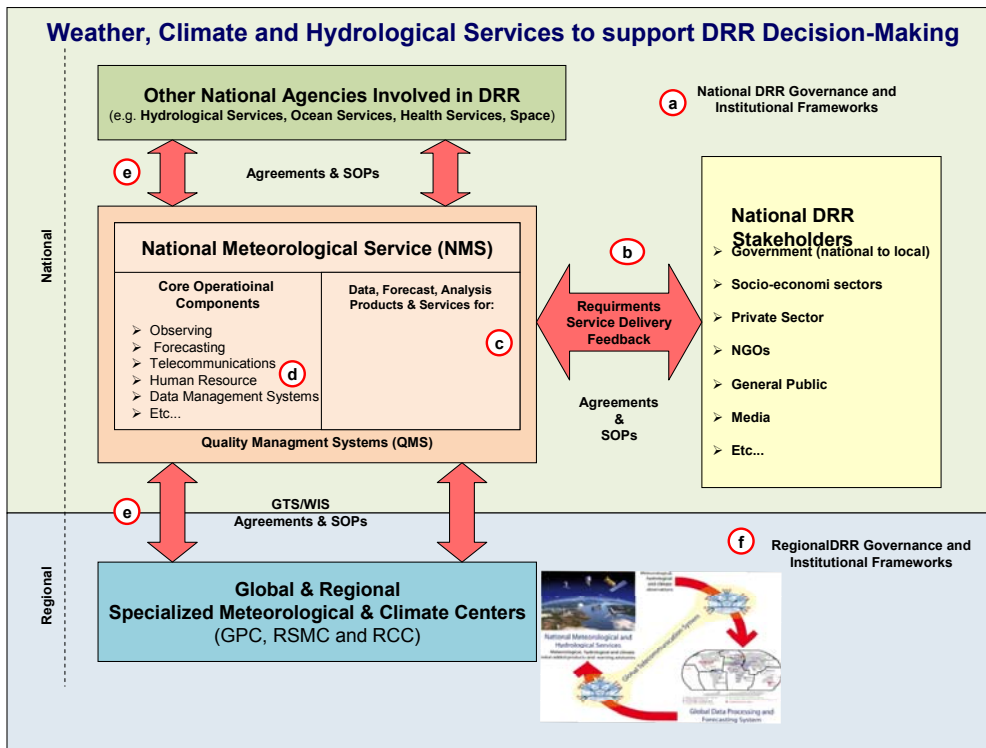


Figure 4: Schematic representation of linkages between meteorological services and DRR stakeholders

The WMO Network Supporting Central America

WMO regional specialized centre	Location	Serving the following WMO Members	Website
<i>WMO Regional Specialized Meteorological Centres (RSMCs) and tropical cyclone regional coordination committees in RA IV</i>			
RA IV Hurricane Committee		Antigua and Barbuda, Bahamas, Barbados, Belize, the British Caribbean Territories (Anguilla, Bermuda, British Virgin Islands, Montserrat, Turks and Caicos Islands), Canada, Colombia, Costa Rica, Cuba, Curaçao and Sint Maarten, Dominica, Dominican Republic, El Salvador, France (Guadeloupe and Martinique), Guatemala, Haiti, Honduras, Jamaica, Mexico, the Netherlands (representing Aruba which is currently not a WMO member, Bonaire, Saba, and Sint Eustatius), Nicaragua, Panama, Saint Lucia, Trinidad and Tobago, United Kingdom, United States (Virgin Islands), Venezuela	http://www.wmo.int/pages/prog/www/tcp/RA-IV-Hurr-Com.html
World Meteorological Centre and RSMC–Miami Hurricane Center	Miami, United States of America		http://www.nhc.noaa.gov
World Meteorological Centre and RSMC–Montreal, operated by the Meteorological Service of Canada	Montreal, Canada		http://ec.gc.ca/meteo-weather/default.asp?lang=En&n=07E09FE3-1
World Meteorological Centre and RSMC–Washington	Washington, United States of America		http://www.ncep.noaa.gov
<i>WMO Regional Climate Centre (RCCs)</i>			
No RCC is currently established	CIMH is being considered as a potential organization to become the RCC for the English-speaking Caribbean. An RCC network is being considered for the Spanish-speaking Caribbean and Central America. Furthermore, an RCC network is being considered engaging Canada, Mexico and the United States.		
<i>WMO Coordination Group for Meteorological Satellites (CGMS) Virtual Centres</i>			
WMO–CGMS Costa Rica			
WMO–CGMS Barbados			http://www.wmo-sat.info/vlab/barbados
<i>WMO Regional Training Centres (RTCs)</i>			
RTC–Costa Rica	University of Costa Rica, San José, Costa Rica		http://192.91.247.60/etr/aspscripts/result_map_RTC_S_n.asp?InstID_form==11
RTC–Barbados (incorporated within CIMH)	Barbados		http://192.91.247.60/etr/aspscripts/result_map_RTC_S_n.asp?InstID_form==7
RTC–Venezuela	Central University of Venezuela,		http://192.91.247.60/etr/aspscripts/result_map_RTC_S_n.asp?InstID_form==44

WMO regional specialized centre	Location	Serving the following WMO Members	Website
	Caracas Venezuela		
<i>WMO Regional Telecommunication Hubs (RTHs)</i>			
Region IV WMC/RTH	Washington, United States of America	Zone of responsibility: North America, Central America and the Caribbean	http://www.wmo.int/pages/prog/www/ois/RTHFocalPoints/Country_en.html

**List of Countries that Responded to the
Early Warning System Questionnaire
(as of 11 February 2014)**

Country		Received	
		Draft Survey Response	Final Survey Response
1	Argentina	Yes	No
2	Belize	No	No
3	Bolivia	No	No
4	Brazil	No	No
5	Chile	Yes (Two versions by (i) Javier Bardona, and (ii) Guillermo Madariaga)	No
6	Colombia	Yes	No
7	Costa Rica	Yes (also a PPT)	No
8	Cuba	No	No
9	El Salvador	Yes	No
10	Guatemala	No	No
11	Honduras	No	No
12	Mexico	No	No
13	Nicaragua	No	No
14	Panamá	Yes	No