CHAPTER 1
Introduction

1 INTRODUCTION AND GENERAL BACKGROUND

1.1 Overview of hazards and vulnerability

Every year natural hazards cause significant loss of life, and set back economic and social development by years if not decades. From 1980 to 2005, weather-, water- and climate-related hazards and conditions accounted for 90% of total number of disasters, 72% of the two million casualties, and 75% of total economic loss (Figure 1). Furthermore, the risk associated with the potential of increasing severity and frequency of hydro-meteorological hazards linked to climate variability within a changing climate, as reported in the fourth assessment report of the Intergovernmental Panel on Climate Change, appears to be on the rise.

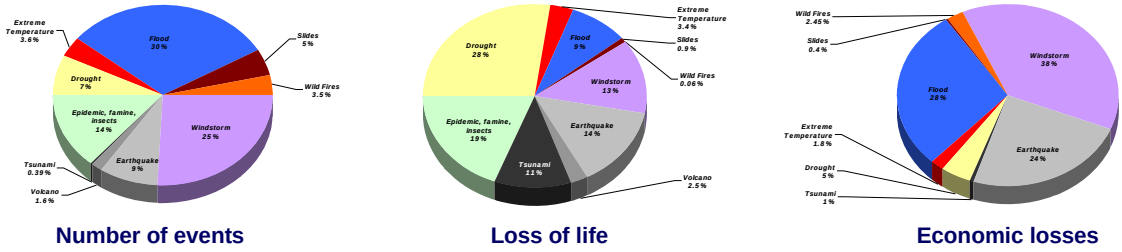

Figure 1. 90% of disaster events, 70% of loss of life and 75% of economic losses are related to hydro-meteorological hazards *(source: EM-DAT: The OFDA/CRED International Disaster Database)*

While on the global scale the number of disasters and related economic losses from weather-, climate- and water-related hazards have increased over the 1956-2005 period (respectively nearly 10-fold and 50-fold), the reported loss of life has decreased from 2.66 millions over 1956-1965 decade to 0.22 million over 1996-2005 decade, as illustrated in Figure 2. The reduction in loss of life is the result of enhanced disaster risk reduction policies and tools, including contingency planning and early warning systems.

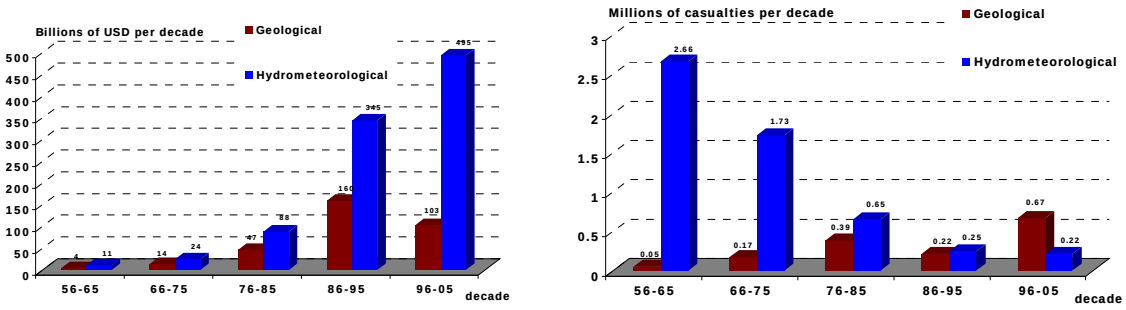

Figure 2. Decadal loss of life and economic losses related to geological versus hydrometeorological hazards *(source: EM-DAT: The OFDA/CRED International Disaster Database)*

In terms of human life, between 1980 and 2005, nearly 7500 natural disasters worldwide have taken the lives of over 2 million people. Least developed countries, accounting for 10% of the world's population, recorded 41% of the global losses of life. Furthermore, over the same period, small island developing states (SIDS) that correspond to 0.8% of the planet recorded 5% of disaster events that happened around the world. Thus, disaster risk reduction should be considered as a priority, and specifically in SIDS, developing and least developed countries.

1.2 Hyogo Framework

Traditionally in disaster management, attention has been focused almost exclusively on actions taken immediately before, during and shortly after a disaster, in what can be called "crisis management" approach.

Today, it is recognized that attention needs to be given to preparedness and prevention strategies. For this to be true, a paradigm shift was called for, which requires a move from “crisis management” to a much more proactive, holistic and systematic approach.

The need for a strategic approach to improving the effectiveness and efficiency of disaster management and disaster risk reduction resulted in the Hyogo Framework for Action 2005-2015 (HFA): Building the Resilience of Nations and Communities to Disasters; a resolve of 168 Governments for action, adopted at the Second World Conference on Disaster Reduction, held in Hyogo, Kobe, Japan in January 2005. HFA is the primary international agreement for disaster risk reduction as it identifies the main actors, the guiding principles, priorities and key activities for achieving disaster risk reduction from the international to the community-level. HFA is a global blueprint for disaster risk reduction efforts during the decade 2005 – 2015.

HFA recognises the inextricable link between natural disasters, poverty, development and environmental issues. It emphasises that disaster risk reduction should be part of every day decision making, as each decision one takes can make us either more vulnerable or more resilient to disasters. It also stresses the need for strong collaboration and cooperation among various agencies. Therefore, efforts to reduce disaster risk require the mainstreaming of disaster risk reduction, through a systematic approach, into development policies, strategies and plans and underpinned by appropriate governance and organizational mechanisms and supported by bilateral, regional and international cooperation, including partnerships. Effective disaster risk management often marks the difference between a natural hazard and a disaster.

Within HFA, the State is considered as primarily responsible for taking measures to reduce disaster risks. However, due to limited capacities, particularly of developing and least developed countries, regional and international cooperation is required to assist high-risk and low-capacity countries, so as to stimulate efforts towards building the resilience of countries and communities concerned.

1.3 Disaster Risk Management

A systematic approach to disaster risk management, as derived from HFA, encompasses risk identification, risk reduction and risk transfer, underpinned by effective governance and organizational coordination mechanisms and effective sharing of knowledge as shown in Figure 3 below.

Figure 3. Conceptual framework of disaster risk management

1.3.1 Governance

The success of disaster risk management efforts is critically dependent on good governance. Good governance includes the adoption and promotion of robust and sound policies, legislation, coordination mechanisms, regulatory frameworks and the creation of an enabling environment that is characterized by

appropriate decision making processes to allow effective participation of stakeholders, including the general population, and assisted by appropriate allocation of resources. Other features of good governance include the rule of law, transparency, equity, efficiency, effectiveness, responsiveness, consensus orientation, accountability and a strategic vision that is based upon sound data and information.

1.3.2 DRR Coordination Mechanisms

Many governments, in response to the HFA first Priority for action "*ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation*", have been and are setting up several types of multi-stakeholder coordination mechanisms within their countries. Some examples include:

- Governmental Inter-Ministerial Coordination Mechanisms, usually under the head of the government, to coordinate activities of various ministries related to disaster risk reduction;
- National Platforms for Disaster Risk Reduction involving different stakeholders (government institutions, private sector, NGO, academic and research institutions, communities, etc.);
- The role of the Office of the UN Resident Coordinator for the coordination of disaster risk reduction activities among UN agencies and with governments.

1.3.3 Risk identification and Assessment

Risk identification involves quantification of risk through understanding hazard, vulnerabilities and exposure patterns. This knowledge is essential for development of strategies and measures for reducing the risks.

Risk identification provides the first essential step for development of sound risk management strategies. A fundamental requirement is the availability of historical and real-time, systematic and consistent, observations of hydro-meteorological parameters, complemented with other forecast products providing information on expected patterns of hazards from the next hour to longer time frames. This must be complemented with vulnerability and exposure information, tools and methodologies for hazard analysis, mapping as well as sectoral risk assessment and modelling.

Hazard events are characterized by magnitude, duration, location and timing. Calculating the probability of occurrence of hazard events in terms of these characteristics is the key in understanding fully the hazard component of disaster impacts. These defining characteristics provide a basis for extracting information on hazard frequency and severity from observational datasets. The fundamental requirement is the availability of, and access to, high quality historical meteorological and hydrological data that is provided by the NMHSs. This requires:

- Ongoing, systematic and consistent observations of hazard-relevant hydro-meteorological parameters;
- Quality assurance and proper archiving of the data into temporally and geographically referenced, and consistently catalogued, observational datasets; and
- Ensuring that the data can be located and retrieved by users.

1.3.4 Risk Reduction

Risk reduction involves actions taken to reduce the overall risks associated with disasters. Such actions would include early warning systems, emergency preparedness mechanisms and short-, medium- and long-term sectoral planning.

1.3.4.1 Early Warning Systems

The second priority for action of the Hyogo Framework for Action, stresses the need for "identifying, assessing and monitoring disaster risk and enhancing early warnings" as pre-conditions for natural disaster risk reduction. Availability of well-functioning early warning systems with an integrated multi-hazard approach that deliver accurate, reliable and understandable warnings, in a timely fashion to authorities, operational managers and the population at risk, is essential to enable early actions to prevent and reduce the impacts of potential disasters.

Effective early warning systems involve four components, including:

- Observing, detecting and developing hazard forecasts and warnings;
- Assessing the potential risks and integrating risk information in the warning messages;
- Distributing, rapidly and reliably, understandable warnings to authorities, risk managers and the population at risk;
- Emergency preparedness and response to warnings at all relevant levels to minimize the potential impacts.

1.3.4.2 Emergency planning and preparedness

Emergency planning and preparedness includes actions and activities that are taken before a disaster happens, which reduce or mitigate its effects on the population's lives and livelihoods and enable them to more effectively respond and cope. These actions and activities can include:

- Establishment of national to local emergency response policies, standards, organizational linkages between emergency response stakeholders, and operational plans to be followed after a disaster
- Education and training of officials and the population at risk
- Operational education and training for emergency responders
- Development and regular testing of warning systems, response and evacuation plans, etc

The goal of these preparedness activities is to ensure that the government and the population at risk are ready and able to respond quickly and effectively in the event of an emergency.

1.3.4.3 Sectoral planning

The economic and social impacts of weather, climate and water continue to grow year to year. Today, up to 30% of developed country's GDP is sensitive to meteorological, hydrological and climate conditions, while the sensitivity is even higher in developing and least developed countries,

With the increasing risks associated with climate variability and change (as indicated by IPCC's 4th Assessment Report), the socio-economic system for food, water, shelter, energy, etc could be significantly disrupted. Meteorological, hydrological and climate information underpins better informed decision making and planning for the protection of lives and livelihoods.

For example, NMHSs have the potential capacity to provide, and in some cases do, provide, hazard information such as frequency, magnitude and trends that are required for the development of policy and legislation pertaining to disaster risk reduction such as mainstreaming of hydrometeorological risk assessment infrastructure and urban planning, costal zoning and land use planning.

NMHSs are the primary authoritative source of hydrometeorological data, products and services that provide the basis for informed sectoral planning that insures community resilience to weather climate and water hazards.

1.3.5 Risk Transfer

Financial risk transfer mechanisms enable distribution of the (i) risks associated with extreme events (e.g. floods, droughts, earthquakes and tropical cyclones) and (ii) accumulated risks linked to deviation of meteorological conditions from "normal" (e.g. late on-set, warmer or cooler than normal seasons). These markets have primarily focused on developed countries, involving a wide range of standardized and customized financial products targeted at various sectors through catastrophic insurance, catastrophic bonds, and weather risk management products. However, under the new paradigm of disaster risk management, a number of international agencies including the World Bank, World Food Programme (WFP), WMO and the reinsurance sector are joining forces to facilitate the development of these markets in the developing and least developed countries.

1.3.6 Knowledge Sharing and Training

Knowledge sharing and training in disaster risk reduction, involves a wide range of actors and disciplines with a view to improve people's understanding of how they can best protect themselves, their property and livelihoods. It is carried out through formal education and training at schools and universities, specific training

activities carried out by specialized institutions and informal education structures such as social networks, interest groups and others.

Effective NMHSs promote training of their stakeholders on aspects related to hydrometeorological hazards and early warning systems. In particular, these NMHSs play an important role in training users to understand risks associated with hydrometeorological hazards and the benefits of hydrometeorological products and services to support disaster risk reduction and socio-economic development.

1.3.7 Climate change

The 4th Assessment Report of the IPCC (established by WMO and the United Nations Environmental Programme in 1988), provides the latest scientific consensus on the implication of climate variability and change on expected trends and characteristics of meteorological, hydrological and climate –related hazards such as tropical cyclones, floods, droughts, etc. Such changes would result in new vulnerabilities and new patterns of risk.

Disaster risk management is a critical component of climate adaptation strategies. Emergence of capacities for forecasting the changing trends and characteristics of extreme events under climate variability and change scenarios provides critical information to supplement risk assessment capacities on the basis of statistical analysis of historical data.

1.4 Role of NMHSs in DRR

A fundamental mission of National Meteorological and Hydrological Services[1] (NMHSs) and the World Meteorological Organization (WMO) is to contribute to the protection of the lives and livelihoods of people by providing early warnings of meteorological and hydrological hazards and related information to reduce risks. WMO and the NMHSs have vital contributions to make to disaster prevention and preparedness, mitigation of the impacts of disasters, emergency response, recovery and reconstruction**.** Some examples of these contributions include:

- Monitoring and providing early warnings of meteorological and hydrological hazards ranging from tropical cyclones, tornadoes, flash floods and storm surges, and other short duration extreme events, to heat waves, cold spells and climate-related phenomena such as droughts;
- Providing operational support services to civil protection agencies involved in emergency response and recovery (e.g. weather, stream flow and storm surge forecasts, oil spill trajectory predictions, toxic plume dispersion forecasts and technical briefings);
- Supplying hydrometeorological data, statistics and analyses to support sectoral planning underpin structural design (e.g. buildings and structures), land use planning (e.g. designation of flood-prone areas), water resources planning (e.g. for water supply or hydro-electric power generation), operational planning (e.g. suitable seasonal “weather windows” for offshore oil drilling, delicate towing operations at sea, or the opening of fishing seasons) and for emergency preparedness;
- Conducting outreach activities to increase public awareness of hazards, understanding of warnings and other products and knowledge of measures that can be taken to avoid injury and losses;
- Participating in post-event analyses to identify weaknesses, recommend and implement improvements in warning systems and products, public awareness campaigns and in contingency planning for enhanced disaster prevention and preparedness.

1.5 WMO and the DRR Programme

The WMO, through its Disaster Risk Reduction (DRR) Programme, has a strategic work plan built upon strengthened cooperation and collaboration among its ten scientific and technical programmes, 8 technical commissions, six regional associations, 40 regional specialized meteorological centres, 30 regional meteorological training centres, 188 Members’ National Meteorological and Hydrological Services (NMHSs), and various partners to leverage capacities for improved disaster risk management decision-making at

[1] The term NMHS has been used rather loosely as a collective one that applies to the operations of National Meteorological and Hydrological Services without necessarily implying that the two Services are, in fact, combined in a single organization. Where it has been necessary to clarify the specific organizational situation, this has been handled by exception.

national to international levels. WMO's strategic goals in Disaster Risk Reduction are derived from Hyogo Framework for Action, and address those high priority areas that fall under the mandate of WMO and NMHSs.

The WMO disaster risk reduction strategy is focused on strengthening:

- NMHSs operational capacities in early warning systems with a multi-hazard approach;
- Hydro-meteorological hazard databases, hazard analysis and mapping and risk assessment tools;
- NMHS capacities to provide customer-driven products and services targeted at sectoral decision making
- Capacity development and enhancing public awareness.
- NMHSs' cooperation with civil protection authorities and other economic sectors;

This strategy is being implemented through concrete operational national and regional projects. These efforts are supplemented with initiatives at political and institutional level to (i) promote effective governance, legislation and legal framework for national to local disaster risk management planning, (ii) raise awareness to the benefits of hydro-meteorological services and role of the NMHS in disaster risk management decision processes and (iii) facilitate participation of NMHS in related regional and national coordination mechanisms.