WORLD METEOROLOGICAL ORGANIZATION

WMO PARTICIPATION IN THE NAIROBI PROGRAMME OF WORK

Specific topic:

Methods and Tools

Geneva, Switzerland

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Introduction

Different climatic regimes lend themselves to different trends in hydrometeorological extremes, some of which may pose considerable risks to life, infrastructure, socio-economic development and the environment. On the other hand, windows of opportunity afforded by favorable climatic conditions need to be seized in advance to enhance socio-economic development. Positioning climate information and services as effective tools to leverage opportunities as well as risk management has therefore a major thrust in WMO programmes, aimed at contributing to the well being of its Members. WMO in collaboration with its Members are the original climate networkers constantly striving to keep pace with the scientific and technological advancements and are a natural partner in dealing with climate related issues. It has a clear future goal, of reaching the benefits of rapidly advancing knowledge on climate to each and every section of the society.

A burgeoning variety of tools and processes are being developed to improve decision-making to reduce risks and avail opportunities associated with climate variability and change. Acknowledging that a much wider array of tools and approaches to adaptation exists, WMO adaptation related tools primarily focus on the specific context of capacity building, proactive role and awareness raising to support adaptation to climate variability and change.

As many communities are not prepared to cope with climate disasters facing them today, an ongoing challenge is to build their resilience. In answer to this challenge, disaster risk reduction activities should address a comprehensive mix of factors contributing to communities' vulnerabilities. There are numerous tools and methodologies that have been developed to put this approach into practice. The value of disaster risk reduction and the experiences gained by its practitioners have been increasingly tapped by organizations active in climate change adaptation. In this context, WMO believes that the Nairobi Work Programme will facilitate identification of options for extending, improving and linking different screening tools developed by other organizations involved in adaptation, such as UNDP, OECD, the World Bank, and others and explored linkages among their tools. It is also expected that reports of these organization to the UNFCCC Secretariat will highlight some of the common problems and issues in developing and implementing adaptation tools.

In the following paragraphs, some notable activities of WMO relevant to Methods and Tools for the implementation of the Nairobi Work Programme are highlighted, with indications of the potential contributions of the WMO and the National Meteorological and Hydrological Services (NMHSs).

Methods and Tools

Climate Watches

Weather extreme events such as hurricanes, thunderstorms, tornadoes, etc. require weather watches for which most NMHSs issue early warnings and undertake special monitoring. In a similar manner, 'climate watches' deal with climatic extremes like heavy monsoons, flooding, cold waves, heat waves, droughts, etc., which require long-term monitoring with historical observations and its integration into the context of global climate patterns. By incorporating recent climate analysis as well as outlooks, climate watches serve as advisories and forewarnings of climate anomalies, therefore enable continuous and timely climate related risk assessment and management to avoid damages to life and property. The necessary mechanisms have already been put in place in some parts of the world to issue climate watches (e.g., the North American Drought Monitor, the IGAD Climate Prediction and Applications Centre (ICPAC) and the SADC Drought Monitoring Centers in Gaborone, Botswana). WMO works with NMHSs and many institutions in the world to issue regional climate watch bulletins. Through its programs World Climate Data Management Programme (WCDMP) and Disaster Risk Reduction Programme (DRR) in collaboration with the Commission for Climatology (CCl) and NMHSs, WMO has planned for the coming four years period 2008-2011 to establish and implement climate watch systems at national

levels. The main focus for these efforts is to improve preparedness and reduce socio-economic vulnerability to climate hazards in developing and least developed countries. Through Disaster Risk Reduction (DRR) Programme, other agencies are expected to be part of the implementation process of climate watches including resource mobilization, partnership for an integrated early warning system as well as the outreach of the decision makers at regional and national levels. Additional information on climate watches can be found in the attached Annex.

RClimDex

There is a general consensus within the climate community that any change in the frequency or severity of extreme climate events would have profound impacts on nature and society. It is thus very important to analyze past data to find extreme events and understand future trends. The monitoring, detection and attribution of changes in climate extremes usually require daily resolution data which are observed by NMHSs. Under the supervision of WMO, 27 core indices have been defined based on daily temperature values or daily precipitation amounts to find extreme events and changing trends. Some are based on fixed thresholds that are of relevance to particular applications. WMO in cooperation with Environment Canada has developed two software packages for data homogenization (RHTest) and indices calculation (RClimDex) based on a very powerful and freely available statistical package R which runs under both Microsoft Windows and Unix/Linux. The RClimDex provides a friendly graphical user interface to compute all 27 core indices. This software will allow all interested parties to benefit from improved monitoring of change with broader spatial coverage that is currently unavailable.

Climate Information and Prediction Services Project (CLIPS)

The 12th World Meteorological Congress (1995) considered that the provision of climate information and predictions would improve economic and social decision making, and that this would support sustainable development, and established a Climate Information and Prediction Services (CLIPS) project within the World Climate Applications and Services Programme (WCASP). WCASP and CLIPS build on the rapidly developing atmospheric and oceanographic research as well as the wealth of data, experience and expertise within the NMHSs and related entities and provide a framework to deliver operational user-targeted climate services. This programme has successfully demonstrated the immense potential of the concept in several regions across the globe, and a global network of CLIPS Focal Points has been established to ensure national and regional coordination of climate products and services. Capacity building and training are integral components of WCASP/CLIPS. The CLIPS project can thus be an effective framework within which regional climate change information and the associated adaptation issues can be integrated. Development of training curricula, training workshops and regional showcase projects, which are key components of CLIPS, need substantial resource mobilization to cater to the growing needs of climate information providers as well as user sectors, particularly in the Developing Countries and the Least Developed Countries.

Regional Climate Outlook Forums (RCOFs)

Specific institutional frameworks can be established, with appropriate stakeholders taking the lead, to address relevant climate change issues at the local and sector levels. In this context, the Regional Climate Outlook Forums (RCOFs), a concept conceived and supported by WMO as part of Climate and Prediction Services (CLIPS) activities, need special mention. RCOFs constitute an important vehicle in developing countries for providing advanced information on the future climate information for the next season and beyond, and for developing a consensus product from amongst the multiple available individual predictions. RCOFs stimulate the development of climate capacity in the NMHSs and facilitate end-user liaison to generate decisions and activities that mitigate the adverse impacts of climate variability and change and help communities to build appropriate adaptation strategies. There is a great potential for the regional climate activities that currently take place under RCOFs and through CLIPS training to expand, through the actions of the WMO regional associations and the NMHSs (facilitated by the Secretariat) to expand the use of currently available tools (e.g., PRECIS, MAGIC, etc.) to more countries and to include information

on climate change scenarios assembled by World Climate Research Programme (WCRP) such as climate projections created for the IPCC Fourth Assessment Report (AR4). This would enable NMHSs to contribute to their national communications to the UNFCCC and to develop or enhance their dialogue with users of climate information on climate risks and vulnerability, and would also support improved regional coordination on climate matters, standardization of tools and increased evaluation (feedback) on model outputs. This evolution from the current state (ability in some sub-regions to undertake RCOFs and develop seasonal predictions) would require technology transfer (to enhance computational capability) including hardware, software, models and data storage devices; stable Internet; ability to download data through the Internet; trained climate experts; research. WMO will continue to support the RCOFs initiatives as they contribute significantly to building capacity of the NMHSs.

The Observing system Research and Predictability Experiment (THORPEX): A Global Atmospheric Research Programme

THORPEX, a part of the WMO World Weather Research Programme (WWRP), is an international research and development programme responding to the weather related challenges of the 21st century to accelerate improvements in the accuracy of 1-day to 2- week high impact weather forecasts for the benefit of society, the economy and the environment. THORPEX research topics include: global-to-regional influences on the evolution and predictability of weather systems: global observing system design and demonstration; targeting and assimilation of observations; societal, economic and environmental benefits of improved forecasts. The programme establishes an organizational framework that addresses weather research and forecast problems whose solutions will be accelerated through international collaboration among academic institutions, operational forecast centres and users of forecast products. THORPEX contributes to the development of a future global interactive multi-model ensemble forecast system, which would generate numerical probabilistic products, available to all WMO Members including developing countries. The purpose is to provide accurate, timely, specific and definite weather warnings in a form that can be readily used in decision support tools, to improve and demonstrate such tools in order to reduce the impact of natural hazards and to realize societal and economic benefits of improved weather forecasts.

WMO Disaster Risk Reduction Programme

From 1980 to 2005, natural disasters worldwide have taken the lives of nearly two million people and produced economic losses above one trillion (or one thousand billion) US dollars. During this period, weather-, water- and climate-related hazards and conditions accounted for 89% of total number of disasters, 72% of loss of life and 75% of total economic loss. However, over the last few decades, significant developments with monitoring, detecting, analyzing, forecasting and warning of weather-, water- and climate-related hazards have led to significant opportunities for reducing impacts of related disasters. For example, over the last 25 years, there has been nearly a 4-fold increase in the number of disasters and a 5-fold increase in the associated economic losses, whereas the loss of lives has in fact decreased to nearly one-third of its previous value. This is due to several factors, a critical one being the continuous development of natural hazard monitoring and detection and of development of specific end-to-end early warning systems, such as those for tropical cyclones.

The international movement in disaster risk reduction is supported by the Hyogo Framework of Action 2005-2015, drafted and approved at the World Conference for Disaster Reduction, Kobe, Japan, January 2005, which represents a set of outcomes and results that must be achieved if disaster risk is to be reduced. The HFA describes a range of key thematic areas that need to be addressed, particularly in high-risk nations and communities. These include:

- Governance: organizational, legal and policy frameworks;
- Risk identification, assessment, monitoring and early warning;
- Knowledge management and education;
- Reducing underlying risk factors; and

- Preparedness for effective response and recovery.

Implementation of HFA is a critical contribution to development of capacities for climate adaptation and climate-related risk management. The overall framework of DRM seeks to reduce the likelihood of undesired, negative outcomes such as disasters in the course of pursuing positive goals. This involves three types of actions and activities including, risk identification, risk reduction and risk transfer.

- Risk identification involves the identification of risk levels and the risk factors that cause losses. Risk identification creates the evidence base needed to support risk reduction and risk transfer decision and activities;
- Risk reduction involves measures to prevent losses. Examples of such measures include hazard-resistant infrastructure development, land use planning and zoning, early warning systems based on sound science but targeted at mobilizing action at the local level. Other measures include educational and preparedness programmes for a wide variety of actors such as decision makers, operational emergency planning and response staff and the development of contingency plans;
- Risk transfer involves the use of financial mechanisms to share risks and transfer them among different actors (e.g., at-risk populations, government, private sector). Examples of such tools include weather derivatives, catastrophe bonds and different types of insurance.

WMO, through its Fourteenth Congress (Cg-XIV, May 2003) established a new cross-cutting Disaster Risk Management Programme, (now changed to Disaster Risk Reduction Programme after Congress Fifteenth, 07-25 May 2007) with the vision to strengthen further international and national collaboration in disaster risk management This Programme addresses capacity development of NMHSs and their partnerships in supporting disaster risk management (DRM) decisions at the national level in the complete cycle of disaster risk management including prevention and mitigation as well as emergency preparedness, response, recovery and reconstruction. With the threat of the climate change and its potential impacts on the trends and severity of natural hazards, WMO is deeply committed to ensure that the latest knowledge and capacities in climate are translated into operational products that would enable our Members to enhance their capacities in climate-related risk management.

WMO Disaster Risk Reduction Programme addresses seven priority areas, to provide systematic support to strengthen Members' NMHSs capacities for strengthened disaster risk reduction. These include:

(a) Mainstreaming technical capacities such as hydro-meteorological risk assessment and early warning systems in the national disaster risk management plans, legislations and development planning. (Adaptation Planning);
(b) Strengthening capacities for meteorological, hydrological and climate-related hazard monitoring, databases, and methodologies for hazard analysis in support of risk identification, risk reduction and risk transfer activities. (Data and Observations, Methods and Tools);
(c) Strengthening capacities for operational meteorological, hydrological and climate-related hazard early detection and warnings built upon strong governance, organizational and operational processes (Adaptation Planning and methods and Tools);
(d) Strengthening capacities for provision of meteorological services in support of pre- and post-disaster emergency response and relief operations (Methods and Tools);
(e) Facilitation of partnerships among NMHSs and other key national agencies for a more coordinated approach to disaster risk management (Adaptation Planning);
(f) Strengthening educational and training programmes of NMHSs and their key stakeholders in DRM such as authorities, emergency response operators and media (Adaptation Planning and Socio-economic Information);

(g) Development of public outreach programmes and materials (Environmental and Socio-economic Information).

Climate Modeling and Downscaling

Concerted efforts are being made by some of the NMHSs and leading international climate modeling groups, under the coordination of the WCRP, to develop Regional Climate Models so that they become capable of providing regional scale (typically 25 x 25 km, and higher resolution with appropriate computing facilities), climate information for impact studies, and to facilitate their use within the modest computational infrastructure of the developing countries. Global efforts can be spearheaded by WMO to bridge the existing gaps between developed and developing countries in their understanding of climate change impacts through capacity building and regular updates of occurrence of extreme events and associated damages. Developing countries NMHSs may be provided with appropriate tools to respond rapidly to trends and developments of regional scenarios, changing needs, emerging issues and specific challenges. In particular, the application of the regional climate models in developing countries need adequate local observational data for model evaluation, and regional expertise to diagnose and interpret the simulated regional features. In order for the regional models to become reliable tools to generate high-resolution climate scenarios, these models need comprehensive validation for specific applications, nesting within higher resolution verified global models and the developing countries need assistance from the modeling groups to incorporate user feedback in resolving the model deficiencies, which can be facilitated by the WMO and WCRP. Regional climate models provide more useful local information needed by policy makers and planners on adaptation policies and to enhance the capacity of communities to cope with the future. Since fine resolution climate change information for use in impact studies can also be obtained via sophisticated statistical downscaling methods, coordinated efforts must also be undertaken to use these methods to develop and implement useful and plausible regional scale climate scenarios. These methods are computationally inexpensive with respect to regional climate models and they can be used to provide site-specific information, which can be critical for many climate change impact studies. Consequently, a coherent strategy is needed to facilitate the transfer of expertise from developed countries and to provide access to downscaling tools in developing countries with limited or modest computational resources, since all downscaling methods are complementary.

Annex

Title	**World Meteorological Organization's *Guidelines on Climate Watches***
Description	The guidelines describe how to establish a climate watch system and the information required in a climate watch. Governments typically react to extreme climate events through "crisis management" rather than through continuous risk reduction. Decision makers have cited the lack of information about approaching climate hazards with sufficient notice to take action. Climate watches aim to deliver this necessary, accurate information to end-users through the national meteorological services (NMSs) in a timely and useful manner.
Appropriate use	This tool targets "the special situation and needs of smaller NMSs, which have limited resources" in establishing the system and issuing climate watches. The process is based on continuous collaboration with climate information users, and it should serve as a mechanism to initiate preparedness activities to limit impacts from climate anomalies (e.g. excessive rainfall over several months). The guideline discusses the rationale for a climate watch system, current activities and capacity in NMSs, characteristics and operation of a climate watch system, format and criteria for issuing a climate watch, and various annexes, including examples of climate watches. Climate watch format: • A standard heading, issuing authority, and time and date of issue • Areas for which the advice is current (the appropriate regions) • Period during which the climate watch is valid • Where appropriate, an indication of the reason for the climate watch, which may include graphical information • Relevant skill of long range forecasts • Possible follow-on effects of the climate anomaly • Date at which the next update will be issued
Scope	National level; meteorological services
Key output	Information about significant climate anomalies for the forthcoming season(s) that may have substantial impacts on a sub-national scale. A. Establishment of national climate watch system B. Capacity built for the climate watch system C. Operation of national climate watch D. Climate watch system evaluated
Key input	A. A network of observation stations; an understanding of the current and recent past climate of the region in question; linkage with regional/global monitoring systems; dissemination channels to reach users; partnerships with key stakeholders B. Understanding of users' needs; criteria for issuing a Climate Watch defined (e.g. average rainfalls below a certain level for the season); technical training; strengthening of communication links C. Monitoring and analysis of climate data; communication with other organizations that maintain their observation systems; communication with intermediaries to translate information for user groups D. Periodic reviews of the system and process; dialogue with users on their needs to identify gaps in dissemination or content

Ease of use	Usable by National Meteorological Services
Training required	Requires expertise in meteorology/climatology and understanding of climate information users' needs
Training available	(see Contacts)
Computer requirements	Software for forecasting; word processing
Documentation	WMO, 2005. *Guidelines on Climate Watches*, Geneva: World Meteorological Organization. http://www.wmo.ch/web/wcp/wcdmp/html/Guidelines%20on%20Climate%20Watches.pdf
Applications	
Contacts for framework, documentation, technical assistance	Omar Baddour Chief, World Climate Data and Monitoring Programme WMO, 7bis Ave. de la Paix C.P. 2300, CH-1211, Geneva 2, Switzerland Tel: (41-22) 730-8268 or 730-8214 Fax: (41-22) 730-8042 E-mail: obaddour@wmo.ch
Cost	Free
References	(See references and links in document) Technical documents published under the WMO World Climate Data and Monitoring Programme (WCDMP) http://www.wmo.ch/web/wcp/wcdmp/html/wcdmpreplist.html