

# about the organisations

#### ICIMOD

The International Centre for Integrated Mountain Development (ICIMOD) is an independent 'Mountain Learning and Knowledge Centre' serving the eight countries of the Hindu Kush-Himalayas – Afghanistan , Bangladesh , Bhutan , China , India , Myanmar , Nepal , and Pakistan , and the global mountain community. Founded in 1983, ICIMOD is based in Kathmandu, Nepal, and brings together a partnership of regional member countries, partner institutions, and donors with a commitment for development action to secure the future of the Hindu Kush-Himalayas. The primary objective of the Centre is to promote the development of economically and environmentally sound mountain ecosystems and to improve the living standards of mountain populations.

#### WMO

The World Meteorological Organization (WMO) is the specialised agency of the United Nations system responsible for monitoring and forecasting the state of the world's atmosphere, climate and water resources. In the field of freshwater, its stated aim is "to apply hydrology to meet the needs for sustainable development and use of water and related resources; to the mitigation of water-related disasters; to ensure effective environmental management at national and international levels."

The Organization has its origins in the 1860s and operates on the basis of cooperative action by the National Meteorological and Hydrological Services of its Member countries and territories, which numbered 186 in June 2003.

While WMO's principal contacts are with the National Meteorological and Hydrological Services of countries, its collaborative work embraces joint projects with many other intergovernmental and non-governmental organisations and regional bodies. It receives support from a wide range of donor institutions and countries. This also involves participation in many high-level intergovernmental meetings and programmes. Whether at the local level or intergovernmental level, WMO's aim is to help countries develop the knowledge base that they need to manage their water resources and combat the threats of flood and drought.

#### USDS/REOSA

The Department of State's Regional Environment Office for South Asia supports transboundary cooperation in dealing with environmental, other scientific and health challenges among the countries of South Asia. Water issues are a major focus of its efforts. The office is based in the U.S. Embassy in Kathmandu.

#### USAID/OFDA

The United States Agency for International Development's (USAID) office of U.S. Foreign Disaster Assistance (USAID/OFDA) is responsible for providing international disaster assistance and coordinating the U.S. government (USG) response to declared disasters in foreign countries. USAID/OFDA's Mission is to minimize and where possible, prevent loss of life, human suffering, and damage to economic assets in disaster affected countries. The sub-regional office of USAID/OFDA is based in Kathmandu.

#### **REGIONAL COOPERATION FOR**

# **Flood Disaster Mitigation**

#### IN THE HINDU KUSH-HIMALAYAN REGION

Report of the 2<sup>nd</sup> High Level Consultative Meeting on Establishment of a Regional Flood Information System Kathmandu, Nepal, 10-13 March 2003

Organised by
International Centre for Integrated Mountain Development (ICIMOD)
Kathmandu, Nepal

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Note: The affiliation and professional positions of the various participants were those current at the time of the meeting.



The mountains of the Hindu Kush-Himalayas (HKH) are some of the largest storehouses of freshwater in the lower latitudes in the world and the source of many mighty rivers including the Indus, Ganges, Brahmaputra, Meghna, and Mekong. These rivers provide water for drinking and food production, and contain the potential for generating the hydropower that could improve livelihoods and support economic development throughout the region. Equally, these same rivers, untamed and uncontrolled, yearly cause such extensive floods as to threaten the lives of millions of people downstream and cause untold damage to property.

The project has been substantially supported by the W.S. Department of State Regions

Too often, the people in the path of these floods have no warning, and in many cases it is the poorest of the poor, those with the least resources for recovery, who are exposed most. Controlling these floods is a daunting, and perhaps impossible, task – but much can be done to reduce the damage they cause by providing sufficient warning of the impending disaster for threatened populations to protect their property or move to safer areas. Most of the rivers that rise in the HKH region flow through more than one country and thus, by their nature, floods are a regional issue. The countries of the region are drawn together through common river basins, and must come together to link upstream events with downstream consequences, and downstream policies with upstream consequences. To forecast floods with any degree of accuracy, timely and reliable hydrometeorological information is needed from the whole of each river basin, thus information must be exchanged across national borders, and all countries need a sufficient and compatible capacity in data collection, transmission, and flood forecasting.

The International Centre for Integrated Development (ICIMOD) has been concerned with issues of water management and disaster prevention in the HKH region for some twenty years, and has supported regional efforts to increase scientific and technical collaboration on water issues – from watershed management and micro-water harvesting to regional data sharing through the HKH-FRIEND project supported by UNESCO. At the global level, the World Meteorological Organization (WMO) has been promoting regional cooperation in hydrometeorological observation for a number of years through its World Hydrological Cycle Observing System (WHYCOS), which is increasingly being used as a framework for collaboration and development of resources.

In 2001, ICIMOD joined with WMO, with the support of ICIMOD's regional member countries, to initiate a project designed to address flood data and information exchange in the HKH region and its downstream plains areas, in particular the establishment of a regional flood information system. ICIMOD and WMO are ideally situated to help forge the active partnership between countries in the region that will be pivotal in the project's success, as all the HKH countries are members of both organisations.

The project has been substantially supported by the U.S. Department of State Regional Environment Office for South Asia (USDS/REOSA) and the U.S. Agency for International Development Office of Foreign Disaster Assistance (USAID/OFDA), with further support from the Department of Hydrology and Meteorology of His Majesty's Government of Nepal and a small contribution from the Danish International Development Agency (DANIDA). The overarching goal of the project is to reduce the flood vulnerability of the HKH region and minimise the loss of lives and property, focusing in the first instance on the Ganges-Brahmaputra-Meghna and Indus river basins. The two major challenges are collection of the necessary high quality hydrometeorological data in all parts of the major river basins, including in remote areas with limited infrastructure, and facilitating a system for exchange of this data in real-time between the countries through which each river runs which builds on the bilateral arrangements already established in some cases.

The project has proceeded through a series of meetings: a 1<sup>st</sup> High Level Consultative Meeting held in May 2001, during which a framework was developed for a regional flood information system based on the proven concept of the WHYCOS, now called HKH-HYCOS; a Consultative Panel Meeting held in May 2002, at which a concept note was drafted and short, medium, and long term action plans outlined; and the 2<sup>nd</sup> High Level Consultative Meeting held in March 2003 which is the subject of this report. HKH-HYCOS has been formalised as a joint project of WMO and ICIMOD, as facilitating organisations between the regional member countries, through a Memorandum of Understanding between the two organisations.

This publication summarises the development of the project to date and provides a detailed report of the 2<sup>nd</sup> High Level Consultative Meeting held in March 2003, including summaries of the technical papers, and an outline of future plans. The full text of the technical papers is being published in a supplementary volume. The meeting provided a valuable opportunity for high-level government representatives, directors of national hydrological and meteorological services, technical experts from the region and from the United States United States Geological Survey (USGS) and National Oceanic and Atmospheric Administration (NOAA), and representatives of international organisations, to share information and discuss organisational and technical approaches to flood forecasting and mitigation of flood-related damage. The participants discussed the draft project document and agreed on the action plan for the next stage. In the ongoing process, national consultations are now being held to identify the specific needs and priorities of each country for the establishment of the regional flood information system.

The people of the region have learned to seek in the Himalayas both spiritual solace and the means to improve the livelihoods of the people, both upstream and downstream. We hope that the optimism and cooperative spirit displayed at the meeting will imbue the commitment to follow through in each country and that we will be successful in establishing a regional flood information system, building on bilateral arrangements, that will provide the basis for ensuring physical security, saving lives, and reducing economic loss, while safeguarding the environment. ICIMOD is proud to be a part of this valuable initiative, and hopes that this publication will help to stimulate interest in and support for the project.

### acknowledgements

This report was substantially compiled by Mandira Shrestha and other members of ICIMOD's Water Hazards and Environment Management Programme, with support from Wolfgang Grabs and the ICIMOD editorial team. We thank all those who have contributed to the development of the project and the preparation of this report.

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Starting in 2001, a long-term project was initiated aimed at establishing a regional flood information system to reduce flood vulnerability and minimise the negative impacts of floods in the Hindu Kush-Himalayas. As part of this project a series of meetings have been held and reports and papers prepared, and a website <www.southasianfloods.org> has been set up to facilitate sharing of data and information. The present publication presents the outcomes of the most recent meeting: a 2<sup>nd</sup> High Level Consultative Meeting held on 10-13 March 2003 in Kathmandu, Nepal, at which a draft project document was discussed that will lay the basis for securing funding for the implementation of the project. The March 2003 meeting followed a First High Level Consultative Meeting held in May 2001, at which the basic framework for flood information exchange to facilitate flood forecasting in the region was developed, and a Consultative Panel Meeting held in May 2002, at which a concept note was approved and short, medium, and long-term action plans outlined.

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The meeting was organised jointly by the International Centre for Integrated Mountain Development (ICIMOD) and the World Meteorological Organization (WMO), co-hosted by the Department of Hydrology and Meteorology (DHM) of His Majesty's Government of Nepal (HMGN), and was sponsored by the US Department of State, Regional Environment Office for South Asia (USDS/REOSA); the U.S. Agency for International Development, Office of US Foreign Disaster Assistance (USAID/OFDA); and the World Meteorological Organization (WMO). The participants were high-level government representatives of the national hydrological and meteorological services and organisations involved in flood disaster management of Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan, and representatives from the organising and sponsoring organisations.

The principle objectives of the meeting were to discuss a draft project document on the development of a regional flood information system and agree on technical, managerial and implementation aspects; to present state-of-the-art accounts of flood forecasting and information systems; to develop an action plan to help promote the project with national implementing agencies, regional organisations, and donor agencies; and to provide input to WMO and ICIMOD on the final version of the project proposal. When finalised, the proposal will be submitted to the relevant ministries of the participating countries for their approval.

The meeting was held in two parts - a Technical Conference and the 2<sup>nd</sup> High Level Consultative Meeting itself. The background information for the discussions was presented at the Technical Conference, with twelve presentations by international and regional technical experts on flood forecasting and information exchange. The

Consultative Meeting itself focused on discussion of the draft project document and conceptual, technical, organisational, and operational issues related to the project implementation. The representative from India provided an additional note that documents the official stand of the Government of India with respect to the further development of the project.

Funds have been secured for national consultation and a study to be carried out in 2003 to 2005 to test the technical feasibility of the project, and participants discussed the approach to be used. They recommended that the experiences of the regional countries be taken into consideration in the selection of the equipment and flood information system to be used in the test phase and made suggestions about the national consultations to be held in each country as a component of the feasibility study. These national consultations will be used to identify and assess individual countries' needs and priorities for a flood information system, and to suggest pilot basins as possible test sites.

The participants also agreed on an action plan for further implementation of a regional flood information system and adopted a resolution endorsing the project subject to the revision of the draft project document. The draft project document will be revised to incorporate the participants' comments and suggestions and submitted to the countries for final approval.

This publication provides background information on the project, short summaries of the presentations at the technical conference, and a brief account of the presentations at the consultative meeting and the results of the discussions of the draft project document. The technical papers are published in full in a supplementary volume. The action plan is presented in the Annexes together with background material gathered from the preceding meetings and consultations.

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# acronyms and abbreviations

ADB Asian Development Bank

ADPC Asian Disaster Preparedness Centre

RGOS Satellite-Based Data Collection and Localisation System of CNES/CLS

Hindu Yush Himalaysa How Kejumis Lam internation

BUP Bangladesh Unnayan Parishad

BWDB Bangladesh Water Development Board

CFAB Climate Forecast Application in Bangladesh

CLS Collecte Localisation Satellite (France)

CNES National Centre for Space Studies (French Space Agency)

China Meteorological Administration

CWC Central Water Commission (India)

DANIDA Danish International Development Assistance

DCP data collection platform

CMA.

DEM digital elevation model

DHI Danish Hydraulic Institute

DHM Department of Hydrology and Meteorology (Nepal)

DWIDP Department of Water Induced Disaster Prevention (Nepal)

ECMWF European Centre for Medium Range Weather Forecasting

EFFS European Flood Forecasting System

FFWC Flood Forecasting and Warning Centre (Bangladesh)

GBM Ganges-Brahmaputra-Meghna

GIS geographic information system

GLOF glacial lake outburst flood

GPS geographic positioning system

GTS global telecommunication system

Hindu Kush-Himalayas(n) HKH-FRIEND Hindu Kush-Himalayan Flow Regimes from International Experimental and Network Data HKH-HYCOS Hindu Kush-Himalayan Hydrological Cycle Observing System HMGN His Majesty's Government of Nepal ICIMOD International Centre for Integrated Mountain Development IMD India Meteorological Department Japan International Cooperation Agency JICA MRC Mekong River Commission NCAR National Centre for Atmospheric Research (USA) NCEP National Centre for Environmental Prediction (USA) NCMRW National Centre for Medium Range Weather Forecasting (India) national hydrological service NMS national meteorological service NOAA National Oceanic and Atmospheric Administration POES Polar Operational Environmental Satellite (NOAA) UNDP United Nations Development Programme UNESCO United Nations Educational, Scientific and Cultural Organization USAID/OFDA United States Agency for International Development, Office for Foreign Disaster Assistance USDS/REOSA United States Department of State, Regional Environment Office for South Asia

United States Geological Survey

World Meteorological Organization

World Hydrological Cycle Observing System

USGS

WMO

WHYCOS

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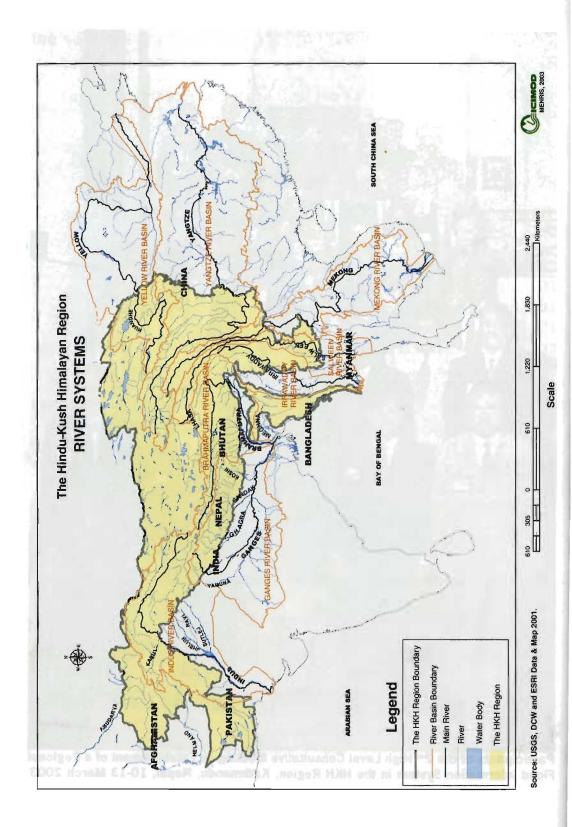
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Participants of the 2<sup>nd</sup> High Level Consultative Meeting on Establishment of a Regional Flood Information System in the HKH Region, Kathmandu, Nepal, 10-13 March 2003



# introduction to the project

#### Background

The mountains of the Hindu Kush-Himalayas (HKH) extend over 3,500 km from east to west covering all or part of eight countries: Afghanistan, Pakistan, China, India, Nepal, Bhutan, Bangladesh, and Myanmar. These mountains are some of the largest storehouses of freshwater in the lower latitudes in the world, and together with the Tibetan Plateau the source of the mighty rivers of south and south-east Asia – the Indus, Ganges, Brahmaputra, Meghna, Mekong, Yangtze, and Yellow rivers (see map opposite). These rivers not only provide water for drinking and food production, they also contain the potential for generating the hydropower that could be used to accelerate the pace of economic development throughout the region. Equally, these same rivers, untamed and uncontrolled, yearly cause such extensive floods as to threaten the lives of millions of people downstream and cause untold damage to property.

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Of all the countries in the Ganges-Brahmaputra-Meghna (GBM) region, Bangladesh suffers the greatest impact of the flooding: four-fifths of the country (containing approximately 52% of the population) lies in the flood prone area; during the 1988 and 1998 floods, 50-60% of the country was affected. In the GBM plains of India, floods have become an annual debilitating feature, with an estimated 68% of the total flood damage in the country occurring in the Ganges and Brahmaputra basins, mostly in Assam, West Bengal, Bihar, and Uttar Pradesh.

Collectively, the four largest floods between 1987 and 2000 were responsible for the loss of more than 6,000 lives, displaced more than 57 million people, and caused an estimated \$7 billion in damage. The floods in 1998 alone were responsible for over 2,600 flood-related deaths; displaced 25 million people, and caused an estimated \$3.4 billion of damage in India and Bangladesh. The impact of these floods can only increase as the population in the flood plains continues to grow and the value of the infrastructure increases.

Timely warning of impending floods is crucial not only to save lives and property, but also for the development, operation, and management of large water resource projects. In order to forecast floods with any degree of accuracy, however, it is necessary to have timely and reliable hydrometeorological information from the whole of a river basin. Since most of the rivers that rise in the HKH region flow through more than one country, information must be exchanged across national borders. The state of flood forecasting and warning systems in the different countries within the region is variable. There are a number of successful bilateral agreements among countries in the region for cooperation in the area of information exchange and flood warning; these need to

be developed and built upon under a regional framework to facilitate the sharing across an entire river basin of the real-time data which is crucial for timely flood warning and forecasting.

There is a need to improve flood forecasting and develop early warning systems in the HKH region and its downstream plains areas. Better systems for collecting good quality hydrometeorological data and for their quick transmission, based on thorough understanding and cooperation among the regional countries, are needed to facilitate effective management of the vast water resources and the mitigation of flood disasters.

#### The History of the Project

The pressing need for a regional programme on flood disaster mitigation has been clear for a number of years, and especially since the disastrous floods of 1998 when thousands of lives were lost and property worth millions damaged. The two major challenges are collection of the necessary high quality hydrometeorological data in all parts of the major river basins, including in remote areas with limited infrastructure, and facilitating a system for exchange of this data in real-time between the countries through which each river runs. In 2001, the International Centre for Integrated Mountain Development (ICIMOD) and the World Meteorological Organization (WMO) initiated a project with the support of ICIMOD's regional partner countries designed to address these issues and to promote regional cooperation in flood disaster mitigation. The goal of the project is to reduce the flood vulnerability of the HKH region and minimise the loss of lives and property. The project is focusing on the Ganges-Brahmaputra-Meghna and Indus river basins.

#### The initial meetings

In May 2001, ICIMOD and WMO organised a high-level consultative meeting on Developing a Framework for Regional Cooperation in Flood Forecasting and Information Exchange in the HKH Region' with the objective of developing a framework for a regional flood information system to support disaster prevention and flood disaster management. The meeting was supported by the U.S. Department of State Regional Environment Office for South Asia (USDS/REOSA), the U.S. Agency for International Development Office of Foreign Disaster Assistance (USAID/OFDA), and the Danish International Development Agency (DANIDA). Participants from Bhutan, Bangladesh, China, India, Nepal, and Pakistan recognised the potential for mutual technical assistance and the need for regional cooperation in flood forecasting and data and information dissemination, reached a consensus on the need to share high flow data, and adopted an action plan for future activities (see Annex 1 for Executive Summary) These countries expressed an interest in establishing a regional flood information system for the HKH based on the proven concept of the World Hydrological Cycle Observing System (WHYCOS), now called HKH-HYCOS. This first high-level meeting paved the way for regional collaboration to support flood disaster mitigation through information exchange.

During the following year, a Consultative Panel was formed with technical and government representatives from the participating countries following the recommendations of the first consultative meeting, and a website (www.southasianfloods.org) was developed as a platform for sharing near real time data and information – both with funds provided by USDS/REOSA and USAID/OFDA. The task of the Consultative Panel is to advise and support representatives of the participating

countries and ICIMOD and WMO. The Panel met in Kathmandu in May 2002 under the motto 'Making Information Travel Faster than Flood Waters' (see Annex 2 for Executive Summary). It reviewed a draft concept document for the project that now forms the reference document for the project development, especially with regard to the framework and implementation strategy. It was agreed that the project design should build on existing bilateral agreements put in a regional context, and on technical cooperation in flood forecasting and the sharing of real-time data and flood-related information. The participants drafted the short, medium, and long-term action plans needed to serve as a road map and carry the process forward. The Panel further recognised the need to determine the technical and financial feasibility of the project, including studies in pilot basins and status and needs assessments in individual countries. They recommended that a draft project document be prepared based on the concept note, and that it be presented at a second high level consultative meeting and then endorsed at appropriate governmental level in the individual countries. The Panel also recommended that Afghanistan and Myanmar be invited to join the regional initiative.

#### The draft project document

A draft project document was prepared by ICIMOD and WMO on the basis of the concept paper and the information obtained in response to a questionnaire sent to participating countries that looked at the way in which the collaborating institutions deal at present with the impacts of flood-related disasters; their aspirations for a regional flood information system; their needs for technical resources and capacity building to implement the project; their perception of the potential benefits of regional cooperation on flood forecasting; and their preparedness to share data and information with the region. This project document was circulated to the member countries prior to the Second High Level Consultative Meeting, which is the subject of this report.

#### The Second High Level Consultative Meeting

The Second High Level Consultative Meeting was held in Kathmandu in March 2003. More than sixty participants, including representatives of the eight countries of the HKH region – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan, international experts, and representatives of the organising and sponsoring agencies gathered to discuss the draft project document. The meeting was jointly organised by ICIMOD and WMO, co-hosted by the Department of Hydrology and Meteorology (DHM) of His Majesty's Government of Nepal (HMGN), and sponsored by USDS/REOSA, USAID/OFDA, and WMO. The Programme is given in Annex 3 and the list of participants in Annex 4.

The actual consultative meeting was preceded by a technical conference at which regional and international experts presented twelve papers on floods and flood-related issues. The papers discussed state-of-the-art methods for flood forecasting, transmission systems, integrated hydrological information, network design, flood management, and information dissemination. The technical conference provided a venue for participants to share experiences and learn more about how each country approaches data collection and dissemination, and provided the necessary background for the later discussions. The draft project document was then discussed and revised at the consultative meeting.

<sup>\*</sup>WMO and ICIMOD (2003) The Hindu Kush-Himalayan Hydrological Cycle Observing System (HKH – HYCOS).

Establishment of a Regional Flood Information System in the Hindu Kush-Himalaya. Unpublished draft prepared by WMO, Geneva, Switzerland, and ICIMOD, Kathmandu, Nepal

Details of the discussions and outcomes of this two-part meeting are presented in the following chapters. The technical papers and discussions that followed are summarised in Chapter 2, the sessions and outcomes of the consultative meeting in Chapter 3, and the conclusions and key outcomes in Chapter 4. Background information from the previous meetings and related activities is presented in the Annexes. The full text version of the technical papers will be published as a supplement to this volume.





The human face of flooding: an inundated house and flood victims housed in temporary shelters

# the technical conference

The Technical Conference was divided into four sessions: an opening session followed by sessions on hydrometeorological data acquisition and transmission systems, integrated hydrometeorological information and network design, and flood forecasting and flood management. The full text of the technical papers is provided in a supplementary volume to this publication.

#### Opening Session

Ms. Mandira Shrestha, Water Resources Specialist at ICIMOD, welcomed the participants. She highlighted the devastating effects of floods in the region and summarised the role that ICIMOD had played in the HKH over the past two decades in helping to alleviate these. ICIMOD's involvement has included both a direct role in actively supporting regional efforts to increase scientific and technical collaboration on water related issues, and an indirect role in helping to support sustainable natural resource management in order to mitigate the ill effects brought on by environmental degradation. She went on to give a brief overview of the background of the meeting and expressed her hope that the meeting would contribute in a significant way to reducing the negative impacts of flooding in the region.

Dr. J. Gabriel Campbell, the Director General of ICIMOD, extended a warm welcome to the participants. He extended a special greeting to the distinguished officials and experts from the seven mighty river systems that originate in the Hindu Kush-Himalayas and summarised the importance of the meeting by outlining some of the issues and problems that face the people that live here. The mountains of the HKH are young and dynamic, but its glaciers are beginning to shrink rapidly and the implications for the people of the region are worrying. The 150 million mountain people of the HKH are subject to intense economic, social, and physical vulnerabilities on many fronts, and these vulnerabilities are undermining the efforts being made to reduce poverty and increase sustainability. Over the past 20 years ICIMOD has played a role in trying to alleviate the burden of the people in this region by concentrating on the sustainable development of mountain resources. In particular, ICIMOD has launched a special programme on water, hazards, and environmental management. This programme focuses on the mitigation of natural hazards such as landslides and floods and on increasing regional knowledge sharing to reduce the vulnerability of the poor.

The HKH is one of the poorest and most densely populated regions in the world and its flood prone river areas are home to the poorest of this population. These people have moved to river areas because, given no other options, it is here that they can farm and make a livelihood. All too often these people have inadequate warning of impending

floods and they lack the resources to respond and recover without outside assistance. Unfortunately floods cannot be controlled without massive investments in structural measures, and in the HKH region this is a regional issue since the river basins straddle international boundaries. It is thus crucial to come together to link upstream events with downstream consequences. This project has so far successfully drawn together member countries to explore concrete ways of increasing voluntary cooperation on timely flood forecasting and upgrading technological infrastructure and human capacity. While the usefulness of existing bilateral agreements is widely recognised, a regional system to assist implementation would help to reap increased tangible benefits from these. Dr. Campbell concluded by voicing the collective hope of the member countries that this project would enable continuation of the development of the humanitarian and technical cooperation needed to ensure environmental security for the poor people of the region.

Dr. Wolfgang Grabs, Chief of the Water Resources Division, WMO, outlined the background and objectives of the meeting. He began by discussing different programmes around the world that had addressed problems of hydrological forecasting through an integrated approach using the capabilities of national meteorological and hydrological services and that had used different forecasting products to mitigate water related disasters. He outlined the role of WMO in facilitating the effective exchange of hydrological and meteorological data and products. Since floods in large river basins such as the Ganges cannot be controlled, the alternative is to consider disaster prevention. Disaster preparedness, flood forecasting, and appropriate information dissemination to the local communities all need to be looked at to reduce the vulnerability of the people most at risk in the flood-prone areas. While some real-time data collection does take place in this region, the use of this data for flood forecasting can still be much improved. Countries with more advanced data collection methods and flood forecasting techniques can assist by helping to build capacity on these topics in the HKH region. This meeting should provide ICIMOD and WMO with the recommendations needed to finalise the project document so that it can be submitted for approval to ministries and relevant institutions, and to develop an action plan for implementation of the project. Dr. Grabs emphasised that the ownership of the project lay with the countries themselves, and that ICIMOD and WMO are merely acting as facilitators in the process of implementation.

The objectives of the meeting were

- to discuss technical, managerial, and implementation aspects related to the establishment of a regional flood information system;
- to provide guidance to WMO and ICIMOD in the finalisation of the project proposal to be submitted for approval by the relevant Ministries of participating countries;
- to familiarise participants with the latest state-of-the-art flood forecasting and information systems through the presentation of technical papers; and
- to develop an action plan to promote the project among national implementing agencies, regional organisations and donor agencies.

#### Session 1: Hydrometeorological Data Acquisition and Transmission Systems for Flood Forecasting

Chair: Mr. Adarsha Pokhrel, Director General, Department of Hydrology and Meteorology, Nepal

#### State-of-the Art Methods of Hydrological and Meteorological Data Acquisition Systems for Flood Forecasting

Shaukat Ali Awan, Chief Meteorologist, Flood Forecasting Division, Pakistan Meteorological Department, Pakistan

Mr. Awan noted that many areas in the HKH region experience floods that are driven by rainfall rather than snowmelt; therefore, rainfall and rainfall producing systems are the most important in flood forecasting. Accuracy is of the utmost importance in the measurement of precipitation, and it is necessary to guard against the many different sources of error in manual recording. A dense network of hydrometeorological stations and quick transmission of data are needed to ensure accurate forecasting with sufficient lead-time. In areas where it is not possible to establish an observation/communications network, it will be necessary to use remotely sensed data. Three criteria are essential in the selection of equipment for an effective flood forecasting system, regardless of the different platforms or methods used in the actual hydrometeorological data collection. These are precision measurements, operational compatibility, and sensitivity check/error elimination. Mr. Ali Awan concluded by emphasising that the meteorological data acquisition system is of utmost importance for successful flood forecasting.

# Telecommunication Systems for Real-time Hydrometeorological Data Collection and Transmission

Richard Paulson, Water-Resources and Flood Management Consultant, NOAA, and Verne Schneider, Chief, International Water Resources Branch, USGS, USA

In this joint presentation, Mr. Paulson and Dr. Schneider highlighted the need for multiple communications systems and discussed the various possibilities. Telecommunications technologies that are well-established in most of the world include line-of-sight radio, extended line-of-site radio, satellite-based telephone, and meteor burst. Numerous factors can dictate the selection of a technology; these include the geographical extent of the network, meteorological conditions, river-response times, staff capacity, and cost. Most instrument manufacturers advocate the use of multiple communications systems; redundancy is the best safeguard to ensure effective communication under adverse conditions. Even under ideal conditions, equipment must be periodically monitored, power systems need to be recharged, instruments need to be serviced, and repairs made – since vandalism of antennas and communication equipment is a constant nuisance. When equipment is turned off, a second communications system provides a back-up. Furthermore, quality assurance reviews of real-time hydrometeorological data and regular maintenance are essential.

One issue to keep in mind is that all users of radio-based technologies must secure permission to use radio frequencies from the national radio-spectrum management. For small-scale areas, cellular telephone communication can be appropriate; however, to effectively cover the entire Ganges-Brahmaputra-Meghna basin, it is necessary to consider polar-orbiting and geostationary satellites and meteor burst. Important issues

related to cost-of-access with respect to satellite-based systems would have to be considered separately. A careful needs analysis is probably the best approach on which to base the selection of the most appropriate technology. Establishment of the Ganges-Brahmaputra-Meghna information system would need to use a phased approach that included communication evaluation, pilot stage, initial implementation, and final implementation.

At the end of the presentation, Dr. Schneider gave the audience a tour of the USGS website to demonstrated how data can be collected and disseminated through the Internet.

#### Discussion

A number of participants asked what Mr. Paulson might recommend as an ideal system for the HKH region. He replied that the appropriate system would probably become apparent once all of the relevant considerations, including the size of the network and the volume of data to be carried, had been taken into consideration. Several participants voiced concerns about the fact that telecommunications technology in this area is changing rapidly and it would be challenging to select a system at this point in time. Another concern was equipment maintenance. Mr. Paulson considered that the technology will continue to change, and there will always be a need to adapt to those changes.

#### Briefing on the ARGOS Telecommunication System

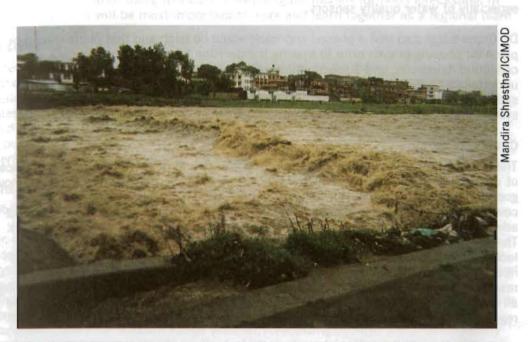
Wolfgang Grabs, Chief, Water Resources Division, WMO

Dr. Grabs described the global and regional ARGOS networks and the ARGOS application platforms. The ARGOS DCS is a data collection and relay system that also provides global coverage and platform location. The system consists of in-situ data collection platforms equipped with sensors and transmitters and uses the Argos instrument aboard the NOAA Polar Operational Environmental Satellites (POES). This versatile system also allows for the option of manual data input whereby a station observer can transmit data via the satellite network. Meteorological, hydrological, and other data are collected at telemetry ground stations, processed, and relayed to users in near real-time (this can be at an interval of up to several hours depending on the latitude of the observation network). Data are available 30 minutes after the pass of the satellite from the ARGOS global processing centres. The ground equipment is inexpensive and its power consumption is low. The cost of the telemetry is shared with WMO on a non-profit basis. The ARGOS programme is administered jointly by the US National Oceanic and Atmospheric Administration (NOAA) and the French space agency, Centre National d'Etudes Spatiales (CNES).

ARGOS is one example of a successful system that has been implemented globally and that should be seriously considered for the HKH region. Given the particular regional requirements of any environment, there is probably no single 'best' system, and regardless of the system chosen in all likelihood it will need to be adapted for optimal use.

#### Discussion

The participants enquired about the other kinds of information can be transmitted by the ARGOS system and whether there was any flexibility to allow for the collection of



information on logics such as water quality (in basis, epiled that while the capacity of AticOS allows for additional data collection increasing the constitutions).



The reality of floods: river in full spate, and boulders left by receding floodwaters

information on topics such as water quality. Dr. Grabs replied that while the onboard capacity of ARGOS allows for additional data collection, increasing the number of sensors used in the system could lead to an increase in the failure rate of the sensors, especially of water quality sensors.

Dr. Grabs suggested that a phased approach would be best; and that plans should be in place for phasing in even prior to making the decision to adopt a specific data collection, telemetry, and dissemination system. Initially it will be necessary to undertake a technical feasibility study that will include the consideration of hybrid-systems that use more than one data collection and transmission option, e.g. GTS systems linked by Internet facilities.

#### Chair's Remarks

The Chair, Mr. Adarsha Pokhrel, noted that hydrology and meteorology are two sciences of uncertainties. Diversity of rainfall is a common topic of discussion in Nepal. Without good data it is difficult to effectively forecast floods. It is essential to have a good coverage of hydrological and meteorological stations in the mountain region. Without adequate knowledge of all parameters, the selection of equipment would be difficult. The ultimate choice would depend on many factors including the type of data, the location, the resources, the sustainability, and the maintenance. The selection would need to be based on availability of equipment, the type of output required, the resources available, and the kind of flood forecasting system chosen. After considering all of these factors, it will be possible to develop the most appropriate system for the region, but we should be very cautious when choosing the type of system to be used.

#### Session 2: Integrated Hydrometeorological Information and Network Design for Flood Forecasting

Chair: Professor Dulal Goswami, Professor and Head, Department of Environmental Science, Gauhati University, India

#### Use of Short-term and Long-term Meteorological Forecasting Information in Flood Forecasting

Shyam V. Singh, Director, National Centre for Medium Range Weather Forecasting, India

Dr. Singh began by saying that the ability to forecast the meteorological conditions that can cause heavy rainfall in the Ganges-Brahmaputra catchment basin is important, since it can provide longer lead times for flood forecasting. The National Centre for Medium Range Weather Forecasting (India) provides medium range (up to 4 days) weather forecasts by running global circulation models on supercomputers and has been doing so for the past ten years. The numerical models used assimilate all relevant data including both conventional and satellite data received at the regional telecommunications hub. The particular global circulation model used is able to predict meteorological conditions, movement of lows and depressions, monsoon troughs, and others several days in advance. The severe weather conditions present over a complex mountain terrain pose a special challenge, and for this reason a multi-institutional programme on mountain meteorology has been developed. For this programme, two meso-scale models, an MM5 model from NCAR and an ETA model from NCEP, are run daily. Various kinds of weather data are supplied daily to local communities, especially

farmers. Dr. Singh concluded by emphasising the importance of validating weather forecasting data over different regions, in cooperation with the neighbouring countries where needed, and of using this data in hydrological models for flood forecasting. In this endeavour it will be most important to work and learn together as a regional team.

#### Discussion

A few questions addressed the issue of model performance during extreme weather conditions such as the monsoon and the winter season. Dr. Singh commented that collecting relevant data and predicting weather patterns were easier during the winter season than during the monsoon. Other questions addressed issues related to oceanic and atmospheric models. Dr. Singh remarked that oceanic models provide valuable input during the monsoon season. He also expressed his willingness on behalf of the Centre to share information with the region.

#### The Flood Forecasting System in Europe

Wolfgang Grabs, Chief, Water Resources Division, WMO

Dr. Grabs described how meteorological and climate information is used for regional flood forecasting in Europe in general, and discussed the European Flood Forecasting System (EFFS), which is now in its testing phase, in particular. The EFFS was developed to provide a European flood forecasting system with a 4-10 day lead time. Uncertainties in the operational discharge forecasting are dealt with by using ensemble forecasts derived from medium-range weather forecasting products provided by the European Centre for Medium Range Weather Forecasting (ECMWF) and subsequently applying downscaling methods for the hydrological models. The definition of a near real-time discharge network and the unrestricted exchange of hydrological and meteorological data are essential to the operation of the system. This system represents a major step forward in extended flood forecasting; the lead time for previous systems was only 48 hours. The data is disseminated in a harmonised data management environment using dedicated Internet facilities. Graphical products are made available to test basins across Europe where they can be used to detect developing regional flood situations, and the whole process is geared to the establishment of a near-real-time discharge data network.

#### Discussion

There were a few questions about whether the HKH region could be compared with Europe given the seasonally extreme tropical precipitation pattern. Dr. Grabs replied that European weather systems can also be highly complex since they are subject to much greater variations throughout the year than those experienced by the Indian subcontinent. However, none of the model basins studied were in the Alps, since in these high mountain areas storage in reservoirs posed a problem.

# Integrated Hydrometeorological Network Design and Operation for Flood Forecasting

Qin Dahe, Administrator, China Meteorological Administration, China

Dr. Qin Dahe's paper was presented by Mr. Shi Peiliang, who began by stating that topographical, geographical, hydrological, and meteorological data, both historical and real-time, are all necessary for effective flood forecasting. Meteorological data collection requires synoptic observations, rain gauges, Doppler radar, and satellite and

climate information. Flood forecasting can be divided into four stages: (1) meteorological and hydrological observations; (2) data collection and exchange; (3) data processing and forecasting; and (4) delivery of warnings to the user. Most hydrological problems are regional rather than global. The structure and network of GTS (which is the key component of the WMO) was discussed and its current role in the effective routine collection of observed data and the automatic dissemination of scheduled products was highlighted. The GTS has evolved to adapt to changing requirements and new technologies that have become available and now there is a need to exchange more categories of hydrometeorological data.

Mr. Shi Peiliang described the phase-wise development of the Chinese meteorological network and its components, as well as the satellite-based data broadcasting network, and discussed the example of Jiangxi province which has a river basin forecasting system. Here basin-wide data exchange and monitoring is facilitated by the provincial forecasting centre, and forecasting products are disseminated via a web server, terminal access, TV broadcasts, satellite telephone, and national/domestic and private broadcasting networks. Mr. Shi Peiliang concluded by saying that operational information networks are the key to effective collaboration among countries for flood forecasting and warning in the HKH region.

## Data and Information Management in Integrated Hydrological and Meteorological Networks

Adarsha P. Pokhrel, Director General, and Dilip K. Gautam, Hydrologist/Engineer, Department of Hydrology and Meteorology, Nepal

Mr. Pokhrel began by emphasising the importance of hydrological and meteorological data. This data has a myriad uses and is indispensable for use in water resource projects such as hydropower, irrigation, water supply, and flood control. However, for these applications the data needs not only to be reliable, it needs to be processed so as to be ready for use by the different agencies. This additional requirement implies a need not only for data collection but also for effective data and information management.

Integrated hydrological and meteorological networks have several technical advantages in terms of data collection, data processing, and analysis, and integrated systems are also more economical. Mr Pokhrel described the data management cycles. An effective data and information management system comprises many linked steps including assessment of the data and information requirement, data and information acquisition, quality assessment and control, data transfer, building and managing databases, data retrieval and analysis, data and information dissemination, analysis and application, and reassessment of data requirements. The various methods for exchange and transfer of data and information were discussed, together with the techniques required to acquire high quality data, and the requirements for a database in which all the information could be stored. The hydrological database and analysis programs HIS ADM, MIKE, and WINHYDRO, used by HMGN/DHM (Department of Hydrology and Meteorology of His Majesty's Government of Nepal) were presented as examples, and the various vehicles used to disseminate analysed data and information and make it available to specialist users and the public were described. Some disastrous hydrological events including GLOFs were discussed. Mr. Pokhrel concluded by emphasising the need for hydrological and meteorological data and the need for effective data management.

#### Discussion

The participants agreed that standardisation of the data is essential for quality control, and that uniformity in the collection of field data is also necessary. The participants agreed that as a first step each country would be requested to submit the formats they use at present to provide a basis for developing standard formats for the whole region. The participants also considered that global warming and GLOF events should also be taken into consideration in developing an information system for flood warning.

#### Chair's Remarks

The Chair, Prof. Dulal Goswami, reiterated the need, voiced by all of the presenters in this session, for an integrated hydrological and meteorological database. Some really good models have been developed and tested in various environments around the world. The participating member countries in the region need to examine the different technologies carefully and assess how effective they could be in the HKH region given the infrastructure available and the long-term requirements. One asset not to be overlooked is the tremendous regional capability in terms of know-how and expertise, and the importance of using the manpower available in the region cannot be overemphasised. Maintaining a monitoring/observation system in isolated and remote areas will remain a continuous challenge that needs to be met. Another challenge is the uncertainty caused by the variations in geodynamic processes and here there is a real need to generate knowledge. Prof. Goswami concluded by saying that meteorology and hydrology are two sides of the same coin – and that problems create inherent uncertainties.

#### Session 3: Flood Forecasting and Flood Management

Chair: Mr. Shi Peiliang, Deputy Director-General, National Meteorological Center, CMA, China

#### Flood Management in Integrated River Basin Development

Rama S. Prasad, Former Chair, Central Water Commission, India

Mr. Prasad discussed the different causes of the various types of floods in the region. Maximum use should be made of integrated river basin development as a tool to minimise the negative impacts of floods and droughts in the basin. Effective flood management needs to consider the whole basin as an integral hydrological unit in order to develop water resources sustainably. He advocated the containment of monsoon flow for future use during the dry season. Not all aspects of flooding are negative; positive effects include the deposition of silt in agricultural fields.

Indian authorities have attempted to control floods for the last quarter of a century but have been forced into the realisation that total protection cannot be provided to all areas in all cases. As a result, the concept of flood control has evolved to one of flood management. Flood management activities in India now include attempts to keep flood waters at bay, limiting the damage caused by floods by keeping people and development away from flood prone areas, reducing the financial burden and social impact through flood assistance/relief and insurance, and, where inevitable, bearing the loss and living with the floods. Over the past half century, considerable progress has been made towards protecting against floods and ensuring flood management.

Indian experience during the last half century in the field of flood management has shown that the river basin as a hydrological unit is the most appropriate unit for management and planning of water resources, including flood management. There should be a master plan for flood management for the entire basin. Sound watershed management needs to be promoted with extensive soil conservation, catchment area treatment, and construction of check dams, to reduce the intensity of floods. Wherever feasible, adequate flood cushions should be provided in water storage projects to facilitate improved flood management. A judicious mix of structural and non-structural measures can optimise the benefits that accrue from structural measures. An extensive network of flood forecasting stations should be established in the basin to facilitate timely warning, and combined with regulation of settlements and economic activities in the flood plain zones to minimise the loss of life and property. Establishment of a network of flood forecasting stations in the basin can be taken up as a priority as the first step.

# Development of a Flood Forecasting and Warning System in Bangladesh, a Case Study

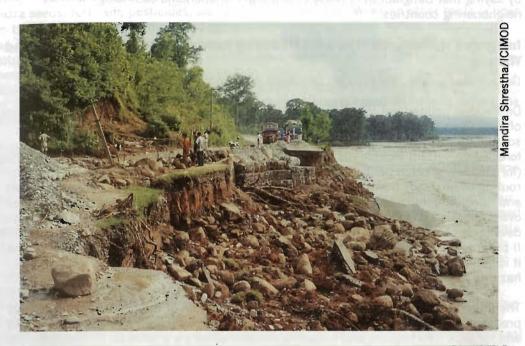
Akhtar Hossain, Director, Processing and Flood Forecasting, BWDB, Bangladesh

Mr. Hossain highlighted the problems of Bangladesh, which because of its unique topography, river systems, and rainfall pattern is particularly prone to flooding, and described the different types of floods that can occur. Floods of various magnitude and frequency occur yearly, and every five to ten years these floods cause devastating disasters. The country's flood vulnerability could be reduced with the help of early warning systems and advanced disaster preparedness programmes.

The three stages in the development of the Flood Forecasting and Warning System (FFWS) in Bangladesh were discussed, as were the various models that were being used and the data that they require. The FFWS began as a very simple flood forecasting system and eventually developed into an advanced real-time flood forecasting system that uses the MIKE Zero Hydrodynamic Model – an interactive GIS model that is able to show flood inundation with full digital elevation model (DEM) capability. The morphological component is very important when estimating affected areas, and for this DEM models are indispensable. Good model performance is limited by rapid changes in channel morphology, and the fact that the upstream data needed for the estimation of water levels at boundary stations is not available on a continuous basis. The limitations, future scope, and the areas that need improvement in the FFWS were discussed. Disseminating information on flood forecasts to those who can use it is essential, and it is equally important that information forecasts can be easily understood by local people and other stakeholders. Mr. Hossain concluded by saying that the exchange of experiences and information between and among regional countries was indispensable, and that the help of developed countries with advanced methods can play a vital role in capacity building.

#### Discussion

The participants voiced the importance of disseminating flood-forecasting information down to the community level. Mr. Hossain explained that people at both local and official levels were now being trained on how to interpret the information being disseminated. Others pointed out the effectiveness of danger level maps as a tool for better community level dissemination and that DEM resolution could be improved with



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After the flood: road collapse by a river, damaged river embankment and flooded fields

the help of GPS. Mr. Hossain also stressed the need for real-time data from the entire catchment to increase the lead time and provide reliable flood forecasts. He concluded by saying that Bangladesh is ready to share information and technology with its neighbouring countries.

# Integrated Hydrological-Hydraulic Modelling Approach for Flood Forecasting and Warning

Guna Nidhi Paudyal, Team Leader, DHI-Water & Environment, BWDB, Bangladesh

Dr. Paudyal pointed out that flood forecasting systems that produce real-time forecasts of river flows and levels can provide a cost-effective and environmentally acceptable solution to many flood management problems. The various components of a flood forecasting system include data acquisition and management, rainfall-runoff modelling (for simulating catchment processes), hydrodynamic modelling (for determining the routing of unsteady flows through rivers and flood plains), and estimating water levels and flows. The importance of integrated hydrological and hydraulic models cannot be overemphasised. Flood forecasting should be considered an integral part of river basin development and the tools are now available to do this routinely. For example, the MIKE II program can integrate spatial data and create flood maps. In using these programs, it is still important to know the input and output of reservoirs and the potential hazards to people living downstream of a dam.

The integrated modelling system includes dissemination of information and warnings predesigned for transmission to the relevant target groups, both as regional overviews and for local information, and including dissemination via a website. Dr. Paudyat concluded by emphasising the need for concrete action for flood management apart from reports, seminars, and meetings.

#### Discussion

Several participants addressed the issue of lead time, but in the end were forced to conclude that a lead time of more than seven days is unrealistic due to uncertainties in precipitation. But during this time preparations can be made by developing different scenarios. There was much discussion about the need for sufficient lead time to allow people to relocate. Dr. Paudyal expanded on this by saying that flood forecasting in itself is not sufficient, it must be linked to disaster preparedness. In Bangladesh, for example, there are now multi-storied cyclone shelters in the coastal area; and in the instance of cyclones a two-hour lead time is now sufficient for this area.

#### Flood Management and Local Adaptation and Response Strategies

Qazi K. Ahmad, Chair, BUP, Bangladesh

Dr. Ahmad began by emphasising the importance of human capability and added that regional cooperation brings benefits to all. The hidden costs of disaster relief on overall development are not always recognised. There is a need for a regional flood information system in order to reduce the loss of life and property. People develop different responses and strategies according to the situation at hand – before floods, during floods, and after floods. The local population always uses its own resources and knowhow to minimise the adverse consequences of floods. Over time, people in flood affected areas have learned to deal with some aspects of floods. For example, they have learnt to adjust crop calendars, keep certain commodities in store, arrange for the

temporary migration of children, the old, and the sick, arrange safe drinking water, and procure needed medicines. During times of crisis, people come together and help each other – human relations are very strong. After floods, people borrow money, and lend extra seeds, fertiliser, pesticides, and so on to one another. When no other route is open to them, they eventually migrate to other areas including urban centres and often end up in slums where the conditions are worse than the ones they left behind and their futures are uncertain. Government and non-government organisations can help by providing information and supplying certain critical inputs that would strengthen the ability of local people to respond more effectively to floods. The international sharing of data, local capacity building, and coordination of efforts could all help to reduce the losses.

#### Climate Forecast Applications in Bangladesh

Glenn Dolcemascolo, Project Manager, Extreme Climate Events Programme, ADPC, Thailand

Mr. Dolcemascolo explained that in addition to the many devastating floods that occur periodically there are also less severe floods that occur more frequently. Here increased lead time can offer the opportunity to make decisions and take actions to help mitigate the destruction. In Bangladesh there is a data problem insofar as hydrological data is collected only at boundary points. There is a lack of both adequate stream flow data from India and numerical models. The aim of the Climate Forecast Application in Bangladesh (CFAB) is to predict the discharge at the boundary points and provide a forecast of discharge at sea level. Since it is well recognised that there is a relationship between those who produce data and those who use it, the importance of working together has been recognised and will hopefully lead to an optimally applicable forecast for a particular problem. Short-term forecasts (1-6 days) are based on the rainfall over the Ganges and Brahmaputra catchment areas, while the medium-term forecasts are based purely on a statistical model. The medium-range forecast is aimed at giving farmers the ability to prepare well in advance. Long-range forecasts indicate the probability of discharge 1-6 months in advance. The forecast team has worked closely with the agricultural ministry to find ways of disseminating understandable information to communities. Mr. Dolcemascolo concluded by summarising future plans such as the one for the summer period of 2003 when the standard like to the standard

# the second high level consultative meeting

The consultation on the further development of the project was carried out at the official 'Second High Level Consultative Meeting' that took part after the technical conference. The Minister for Water Resources from Nepal, Academician Dipak Gyawali, was the chief guest of the Opening Session and inaugurated the meeting. Opening remarks by Dr. J. Gabriel Campbell and Mr. Eisa Al-Majed set the scene for the meeting, and after further elucidation by various speakers of the background to the project and the objectives of the meeting, discussions were held on the draft project proposal. This chapter summarises the deliberations.

#### Session 1: Opening

Chair: Mr. Md. Sayef Uddin, Secretary, Ministry of Water Resources, Bangladesh

**Dr. J. Gabriel Campbell**, Director General of ICIMOD, welcomed the honourable Minister for Water Resources and the participants. He set the tone for the meeting by saying that this was an excellent opportunity to exchange information and come to a mutual understanding on the current state of flood forecasting in the region. He thanked those who had participated in the technical conference and said that their presentations had helped to clarify the existing capabilities and to outline the complexities and difficulties that face this region. While the region still has much to learn and needs to acquire additional technology, there is already a considerable pool of local expertise here to build on. The challenges are especially great since the flood plains of the Hindu Kush-Himalayan region are unlike those found elsewhere in the world. The HKH region has a very distinct physiography, and the water resources, the land use, and the socioeconomic institutions in the region are unique. Accordingly, the solutions most appropriate for this region will be different from those found elsewhere.

Dr. Campbell hoped that the meeting would focus on the opportunities for flood forecasting, which is the most cost-effective way to help save the lives and property of the poor people of flood prone areas, and which is the highest policy priority accorded them by the governments of the region. He also hoped that it would provide an opportunity for the joint learning that would pave the way to a better understanding of the dynamics of flooding in the region. This complex phenomenon is a function not only of hydrological and rainfall events, but also of the topographic and geomorphologic processes that create landslides, flash floods, and other disasters. For this reason it is best to work together to share information and jointly develop communication and mitigation strategies. Investment in a regional framework for flood forecasting can also provide some scope for economic development in the region. It is also important to look at the economic opportunities for the poor people who depend on the flood plains for their livelihoods and whose investments, though small in dollars

and euros, may represent their entire life's savings. Economic development must be approached in a broader sense – and this applies to all types of investments whether in hydroelectric facilities, infrastructure, increasingly sophisticated water regimes, or the regional water transfer between river systems.

Much of this new investment will hinge on first providing regional communication and information sharing, the essential first step that builds confidence and prepares the groundwork for large investments to take place. Here there is an opportunity to provide the kind of framework that will not only save lives but possibly also provide scope for investment within the region. Technology can help to increase opportunities and to do it in a way that is more efficient and more effective. Everyone was encouraged to keep in mind the big picture, and he hoped that everyone would join in these efforts in a fully committed, but voluntary, way. Here there is a real opportunity to take the region to the next step.

Mr. Eisa Al-Majed, the Regional Director for Asia and the Pacific of WMO, thanked the organisers and remarked that it was an honour to address the participants on behalf of the Secretary-General of WMO. The exchange of know-how, data, and information is an important prerequisite to strengthening the resilience of those societies and national economies that are prone to floods and other water and weather related disasters. Anything that can be done to protect the lives and property of these people will surely help lead to the sustainable development of their nations as well as directly helping to alleviate poverty. The analysis of recent and historical flood disasters throughout the region (especially in the Ganges, Brahmaputra, Indus, Mekong, Yangtze, and Yellow River basins) demonstrate that timely access to reliable hydrological and meteorological data and information is essential. Timely and reliable data can improve flood forecasting, flood management, disaster prevention, and preparedness.

The WMO has developed the concept of a World Hydrological Cycle Observing System (WHYCOS) based on its over 50 years of experience with the implementation of global, regional, and national programmes and initiatives aimed at improving the services of national meteorological and hydrological agencies to the general public. WHYCOS has a global mandate and is being implemented world-wide through regional projects, the first of which started in 1995 There are two projects being developed with a view to implementation in Asia in addition to HKH-HYCOS: the Mekong HYCOS and the Aral Sea HYCOS. WMO is willing to work in close collaboration with regional members in the HKH region to support the development of a regional flood information system, which it is hoped can be achieved in close cooperation with the national meteorological and hydrological services in the region. The very successful cooperation between WMO and ICIMOD, now formalised through a memorandum of understanding, is an important basis.

On behalf of WMO, Mr. Al-Majed thanked the regional and international organisations and the development partners like ADB, DANIDA, JICA, USAID, UK, World Bank, and others for their support to the hydrological and meteorological services and to this regional initiative. Building on the experience from the existing bilateral agreements between countries in the region, it will be possible to develop a regional framework which could pave the way for uniform region-wide access to real-time data, information, and know how. The objective of this regional framework will be to improve flood forecasting as an important element in integrated river basin management, and to increase the capacity of national meteorological and hydrological services to provide

timely and accurate forecasts, warning, and information. WMO was pleased to see how much progress the consultative process had made since 2001; the review and approval of the project document is an essential step towards the implementation of this important project. He assured participants of WMO's support of the project and hoped that the objectives of the meeting would be achieved.

**Dr. Wolfgang Grabs**, Chief of the Water Resources Division of WMO, outlined the **objectives and expected results of the meeting**. He began by saying that floods are an impediment to socioeconomic development in the region; the flood plain areas of many countries of the HKH have witnessed an increase in poverty rather than development. In order to enhance socioeconomic development and investment opportunities, it is first necessary to safeguard investments in these areas by seeking a framework for integrated, basin-wide flood management. While there is no simple way to effectively control large floods in the region, there do exist a number of both structural and non-structural measures that can help to mitigate the damage. These measures were discussed earlier in the meeting and include improved flood forecasting (using improved meteorological and hydrological models) and information dissemination.

The sharing of flood data and information is an important first step towards regional cooperation for flood forecasting that can build confidence between countries and agencies. There had been significant progress since the first meeting in May 2001. Dr. Grabs again outlined the objectives of the current meeting, which had been presented prior to the technical conference (Chapter 2 Opening Session). The main points were to discuss and agree on the technical, managerial, and implementational aspects presented in the draft project document, help in finalising the project proposal, prepare an action plan, and provide inputs to the national consultations to be held in 2003 on the practical implementation issues.

It is necessary to follow a phased approach that will first look at the technical feasibility of the project. Dr. Grabs took positive note of the fact that all the countries of the region had met together in a spirit of cooperation. It was important to recognise the constraints, but within these to see the opportunities and seize them to move forward.

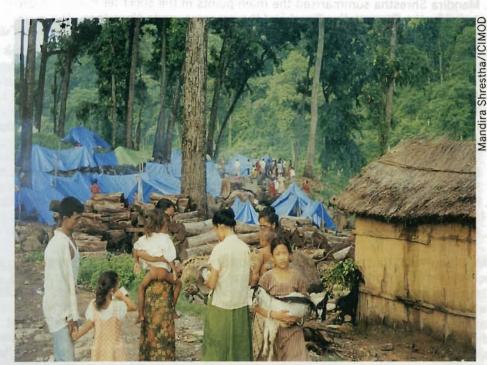
Professor Suresh Chalise, Senior Associate Scientist at ICIMOD, gave a brief review of the project background. The growing awareness of increasing environmental degradation and poverty in the HKH had led to the establishment of ICIMOD some 20 years previously. From the very beginning, ICIMOD's concerns and activities have centred on regional consultations, assessment studies, and publications and have aimed at understanding – and thus redressing – the processes that lead to environmental degradation and poverty in the HKH. ICIMOD has focused on both human processes (particularly land use and land cover changes) and natural processes. Professor Chalise highlighted the role of water not only as a valuable natural resource, but also as an agent of the natural processes that can have an impact on the mountain environment.

Over the past 20 years, ICIMOD has implemented several projects for the improved understanding of the role of water in watershed management and in the management of landslides and floods. Many of these led to the realisation that it was vital to improve our understanding of the hydrology of the HKH region, and that this could only happen with improved regional cooperation. The HKH-FRIEND initiative, funded by UNESCO's International Hydrological Programme, was a good example of a cross-

cutting project aimed at just this. HKH-FRIEND was developed as a regional collaborative network for hydrological research, its six research groups include a flood group. HKH-FRIEND has established a functional regional hydrological data centre that is housed at ICIMOD, and it was the discussions held during the second HKH-FRIEND steering committee meeting that suggested that WHYCOS would provide a good framework for a regional flood forecasting and information system. These discussions had led to the steps that had resulted in the Regional Flood Project.

Ms. Mandira Shrestha, Water Resources Specialist at ICIMOD, provided more detail about the first meeting of the Consultative Panel. Amongst others, the Consultative Panel had reviewed and revised the original concept paper for the project, and laid out the general objectives of the programme, laying the foundation for the development of the draft project document (see Chapter 1 and Annex 2 for more details). The Panel summarised the expected results of the project as follows: 1) establishment of effective transmission and dissemination systems for sharing hydrological and meteorological data and information; 2) availability of comprehensive, basin-wide flood information; 3) improved institutional capacity and training of personnel; and 4) approval from individual governments to disseminate more of the data and information that is relevant for flood control and flood forecasting in other countries. It was noted that capacity building should be an important component of the project in order to improve national and regional scientific, technical, and managerial capacities and capabilities. The Panel prepared short, medium and long-term action plans covering such topics as the status and needs assessments that would be needed to design an effective project; preparation of concept and strategy papers and a draft project document; development and upgrading of measurement and dissemination networks; resource planning; systems maintenance; and development of models.

The Honourable Minister for Water Resources of His Majesty's Government of Nepal, Academician Dipak Gyawali, presented the Keynote Address. (The full text is presented in Annex 5.) He underlined the importance of the meeting: floods were a major humanitarian issue and it is incumbent upon the governments of the region to help protect life and property, and upon scientists and technical people to find ways to do so equitably and efficiently. The increasing frequency of extreme events, including cloudbursts and floods, is worrying especially since the drainage capacity of existing streams, water channels, and courses is already insufficient during peak periods, and there is a need to find better ways and better scientific tools to deal with them. Regional cooperation is indispensable to facilitate flood forecasting across manmade boundaries and Nepal is keen to participate in any regional effort aimed at mitigating flood damage. Mr. Gyawali emphasised the importance of technical cooperation, capacity building of professionals, and the establishment of a common scientific laboratory or data lab for analyses, as well as of improved understanding of the underlying processes. Mr. Gyawali went on to discuss some of the more structural issues related to irrigation and flood control projects, and the need to consider smaller rivers as these too can devastate entire villages when they flood. He also suggested a novel approach to the problem of collecting data in an area where dense data networks were needed as a result of the geographic extremes by using high school students to read and maintain rain gauges and other measuring stations. Mr. Gyawali hoped that the meeting would bring to the fore appropriate ideas, methodologies, and overall a commitment to pursue developments that would give additional impetus to the policies of all of the governments in this region.





After the flood: temporary shelters for flood victims, silt and boulders left behind by the floodwaters

#### The Progress to Date

Ms. Mandira Shrestha summarised the main points in the short-term action plan developed by the Consultative Panel and the progress made since then. The main points in the short-term action plan were as follow.

- 1. Assess existing hydrological networks and areas for improvement
- 2. Identify existing data and institutional set-ups and needs for capacity building
- 3. Identify requirements for capacity building and training
- 4. Assess flood forecasting models used in the region
- 5. Report on the data and information formats used within each country
- Identify institutions that can help devise data and information standards/protocols within the different countries
- 7. Collate flood histories at hydrological stations used for flood forecasting
- 8. Distribute the report of the meeting to governments officially through WMO
- 9. Prepare a concrete strategy paper for the ministerial meeting
- Prepare a final concept paper with project elements to be taken to governments for approval
- 11. Prepare a project document

ICIMOD and WMO had presented a questionnaire to representatives of the six governments of the original participating countries, most of whom had responded, and collated the results. The questionnaire was designed to obtain a better understanding of what the collaborating institutions perceived to be the impacts of flood-related disasters, what they expected from an efficient flood information system, and what technical requirements and capacity building they would need to implement the project. It also aimed to identify the potential benefits of regional cooperation on flood forecasting as perceived by the collaborating institutions and to assess their preparedness to share data and information with the region to add maximum value to existing and future flood information systems. With the exception of point 5, it had more-or-less covered points 1 to 7 of the short-term action plan. The report of the meeting had also been distributed to governments (point 8). Preparation of the concrete strategy paper (point 9) was actually part of the medium-term plan. The final concept paper had been prepared and had been published as part of the Report of the Consultative Panel meeting (point 10). The draft project document had been prepared and was the subject of this meeting (point 11).

A further recommendation had been to find funds for national consultations to elicit the needs and priorities of individual countries and identify mechanisms whereby the new regional information system could fit into the existing national contexts. Proposals had been submitted to USDS/REOSA and USAID/ODFA and funds secured for 2003-2005.

Project activities were not limited to seminars and meetings, but were moving towards achieving tangible benefits such as the testing of a flood information system on the ground. Continued inputs and experiences from the participants were important, as this would help in identifying the most appropriate system for the region. Many encouraging responses had been received since the launch of the website www.southasianfloods.org. The participants and countries were encouraged to visit the site, make suggestions, and provide information. Substantial progress had already been made towards including new information from Bhutan, Bangladesh, China, India, and Pakistan. The usefulness and efficiency of the website would depend on the contributions from all member countries. The website is well maintained, news and events are updated on a regular basis; and the photo gallery and maps have been updated.

After the presentation the floor was open to discussion. Mr. Krishan K. Gupta from the Ministry of Water Resources, India, read out the official stand of the Government of India with regard to the further development of the project (Annex 6). He emphasised the need to build and strengthen the existing bilateral agreements and arrangements within the framework of this project.

#### Chair's Remarks

Md. Sayef Uddin, Secretary of the Ministry of Water Resources, Bangladesh, expressed his satisfaction with the outcome of the Technical Conference. He added that the areas that need intervention can be identified and the time has come to address these issues and to take appropriate measures. The need for real-time data to enable mitigation of the impacts of floods cannot be overemphasised. Information needs to travel faster than floods, and the participants here today had come to discuss and approve a project document that would provide the framework to ensure that this could happen. The technology is available and the path for action is fairly clear. Md Uddin stressed the need to make an effort to translate our good intentions into actions for the common benefit of the region with the hope of reducing the loss of life and property; and concluded by saying that while it may not be within our power to control nature, it is indeed within our power to mitigate its negative impacts, with a great joint effort this goal is reachable.

## Session 2: Discussion of the Draft Project Document – Conceptual and Technical Aspects

Chair: Mr. R. S. Prasad, Ex Chair of Central Water Commission, India

#### Introduction to the Draft Project Document

Wolfgang Grabs (Chief, Water Resources Division, WMO)

Dr. Grabs reiterated that the purpose of the present meeting was to discuss improvements to the draft project document by soliciting concise comments. (Comments received prior to the meeting are summarised in Annex 7). He gave an overview of the structure and content of the draft project document and described the different sections. Part A contains a basic description of the background of project development, water resource management, water resource issues, and the national and international policies developed as a result of the first and second meetings; Part B is a justification of the project developed with inputs from the Consultative Panel Meeting of May 2002; Part C provides the project description, including the goals and objectives taken from the concept paper; Part D discusses organisation and management; Part E outlines project implementation; Part F gives the key assumptions; Part G the risks; and Part H discusses sustainability issues. The separate sections were discussed in turn. The main recommendations are summarised as bullet points below.

#### Part A

 For the purpose of clarification, the existing water treaties between member countries should be incorporated into the project document. This will help to elucidate what cooperation on flood forecasting and data exchange already exists in the region. Regional member countries were requested to please provide details of their respective treaties.

- The title of the project document should be changed from "Establishment of a Flood Forecasting Information System in the Hindu Kush-Himalaya" to "Establishment of a Flood Information System in the Hindu Kush-Himalayas", "Flood information system" should be used consistently throughout the document.
- The map of "River Systems in the HKH Region" should be amended to include information on the Meghna river basin and other major Chinese rivers that originate in the HKH. The map should be enlarged to A 4 size.
- If feasible, socioeconomic information should be updated.
- Where possible additional information on other river basins should be added to augment that on the Indus Basin.

#### Part B

- The data in most of the tables needs to be updated and data on areas and population in flood prone areas should be added. Member countries were requested to provide relevant (corrected) data.
- Each member country will nominate a designated person to liaise with ICIMOD and WMO in order to submit the correct data.

Dr. Grabs explained that there were discrepancies in the data since they were not all extracted from the same source. The new data and information to be provided by the member countries will be incorporated and accepted as definitive.

- Afghanistan and Myanmar had been invited to the present meeting as per the recommendations of the first meeting of the Consultative Panel and their representatives were now participating here as observers. Both countries had expressed a desire to participate in the project and may join the project officially at a later stage.
- To clarify which geographical areas are encompassed by the project, it was recommended that the maps indicate not only the Hindu Kush-Himalayas but also those adjoining areas that can be affected by floods.
- Six national consultative meetings will be held during the first 18 months of the implementation phase of the project. Since some phases of the project will run parallel to others, it was felt that the time proposed was appropriate. However, members were urged to make efforts to implement their parts of the project in a timely manner and before the set time where possible.
- It was recommended that the weather forecasting models of the National Centre for Medium Range Weather Forecasts in India should be tested during the first phase of the project and their suitability for use in the second phase assessed.

#### Component 2: Regional Flood Observation Network

- The data collection platform (DCP) must be carefully assessed and selected.
- Those member countries that have well-established networks of NGOs and government departments with very good documentation capabilities should be identified during the national consultative meetings.
- Equipment selection should be based on the experience, needs, and requirements of the regional countries, as well as the equipment cost.



The final place of ampiementalization is pendiculated.



Flooded village: water creeping up to animal sheds and into woodlands

#### Component 3: Regional Flood Information System

 The final phase of implementation will depend on the results and information gathered during the pilot and testing phase.

#### Component 4: Training and Public Awareness Programme

- The public awareness programme is a very important aspect of the project, but it
  is beyond the scope of the project to bring public awareness to the field level. This
  is the responsibility of national institutions and the project will provide them with
  information, tools, and strategies for this task.
- The issue of public awareness should be discussed in detail during the national consultative meetings.
- A glossary should be provided in the project document in order to clarify the meanings of possibly confusing terms.

#### Chair's Remarks

The Chair, Mr. Prasad, thanked the participants for taking part and contributing so actively to the discussion. He asked that they provide their inputs and comments on the project document in writing to facilitate its accurate revision.

#### Session 3: Discussion of the Draft Project Document – Network Design, and Organisational, Managerial, and Funding Aspects of the Project

Chair: Mr. Tahir Malik, Chair, Federal Flood Commission, Pakistan

#### Part C: Selection of basins and hydrometeorological networks

There was a lively discussion on the selection of basins and hydrometeorological networks for the pilot studies. Some participants suggested river basins in their countries while others wanted to consult their governments before they voted on the final selection of the pilot basins. Others suggested that the existing networks be upgraded and used for the pilot studies so that they could eventually also be used in any future implementation of the project. The criteria for selecting basins were also discussed. It was recommended that in selecting basins, it would be best to select rivers that cross national boundaries, since this would also help to study the regional flood outlook and test upstream-downstream linkages. The severity of floods is another important criterion.

#### Part D: Organisational and managerial aspects

- The necessary additions and corrections should be made to the list of implementing partners. Some individual participants also asked to be included in part of the project.
- The confusion between the terms 'executing' and 'implementing' agencies was
  clarified and the proposed organisational structure for the project was modified.
  Both ICIMOD and WMO will be designated 'facilitating' agencies and member
  countries would participate through their designated implementing agencies such
  as their respective national hydrological and meteorological services.

#### Part E: Project Implementation

 The budget proposed in the document has not been finalised. Changes can still be made to the budget as per the requirements of the project - there is still considerable flexibility and the proposal can still be modified.

#### Part F: Key assumptions:

Donor support should be added under Key Assumptions.

#### Part G: Risks:

- Risk 2: NHSs and NMSs staff may be overburdened and have limited time to
  participate in project implementation due to other commitments. One common
  problem is that in general the staff selected for various field level tasks also have
  other responsibilities and may not be completely dedicated to this project. The
  project should consider this issue very carefully and find some suitable compromise.
- Risk 3: Field equipment installed by the project may be damaged or destroyed due to vandalism or natural disasters such as floods and thus impact on the project activities. This risk can be minimised by the careful selection of stations.

#### Part H: Sustainability

- The longer duration of the project will help ensure its sustainability. Sustainability
  is directly related to long-term but low-key inputs, which is what will be done in this
  project.
- The participating countries themselves are the owners of this project. Accordingly, each country needs to implement the project to the best of its ability using its own resources to augment the resources that would be made available through the donors.
- The project budget should include a post-project phase to provide continued (but scaled-down) technical assistance over the subsequent two years. This would enable countries to fully match financial responsibilities at the end of the regular project phase.
- Sustainability also hinges on the technical and institutional capabilities of the institutional partners. The project should review the existing institutions of participating countries and suggest appropriate capacity building where needed.
- Core funding of the budget does not incorporate matching budgets. Participating countries need to make clear what amount of funds they will match to provide a full, bankable project budget.

#### **Funding Opportunities**

The representatives of the donor agencies present at the meeting were requested to express their views on the project and to comment on the probability of funding by their respective agencies.

#### USAID/OFDA

Dr. Michael Ernst, Hydrological Hazards Advisor, said that USAID/OFDA has been very happy to support this project; it is especially interested in reducing the loss of lives and property. It is very difficult to secure funding in the current economic environment

and donors are looking for a strong commitment from the participating institutions. He was pleased and encouraged by the progress of the meeting and added that more cost-effective alternatives are becoming available for use in this region to substitute some of the more expensive technologies. He said that he would like to see the project being built taking full advantage of the existing infrastructure. He remarked that the project has world-class experts and great potential, but there are no guarantees in the donor community. He recommended that the project should be presented to the donors highlighting its sustainability. He reiterated that USAID/OFDA does not support large water-related projects but that DANIDA, The Netherlands, Japan, and other US donors might be interested. Donors are interested in receiving creative ideas and in knowing what can be done with existing infrastructure, and especially when the projects can demonstrate a potential to really save lives. It is probably most effective to approach those donors that have a mandate to support regional collaboration. Donors in general would be most receptive to a project that had already demonstrated some short-term success.

#### DANIDA

Dr. Guna Paudyal, Team Leader, DHI-Water & Environment, said that while he was not representing DANIDA here officially, he could still say that this project was being favourably discussed. While DANIDA will not fund regional cooperation at this stage, it might be interested in funding the different national agencies. He suggested that ICIMOD and WMO keep in touch with DANIDA as well as with JICA (which is currently considering a large telemetry network in Bangladesh).

## Session 4: National Consultations, Project Endorsement and Action Plan

#### The Mekong River project

The last day of the meeting began with a presentation by Mr. Richard Paulson, water resources and flood management consultant of NOAA on the Mekong River Project which had been initiated by USAID/OFDA, NOAA, and USGS with the aim of strengthening information dissemination. This project is very relevant as it is an example of the type of project and cooperation that is taking place in the region and internationally.

US flood mitigation and preparedness activities in Asia are funded by USAID/OFDA. Two USAID/OFDA projects have evolved over the past two years involving USAID/OFDA, NOAA, and USGS. The first is the Asia Flood Network (AFN), which estimates precipitation over an area in Asia making use of images from the Japanese meteorological satellite and ground-based precipitation gauges. Short-term rainfall forecasts are based on an atmospheric model. Other AFN activities in the region could develop given a clear rationale for the kind of help that could be provided. At present there are two AFN tasks focused on South Asia. The first is to strengthen the southasianfloods, website and the second is to familiarise OFDA, USGS, and NOAA with what technology is available in the member countries in order to assess if US technologies can be of any assistance. There is also some possibility that the OFDA may redirect some funds to enable USGS and NOAA to work with ICIMOD and provide expertise for national consultations. There is a second cooperative project between USAID/OFDA and the Mekong River Commission (MRC) which aims to strengthen and improve flood warning information transfer down to the community level and to see how effective this process is. This co-operative MRC project will last five years.

## Objectives and organisation of national consultations for the implementation of the project Professor Suresh Chalise

Professor Suresh Raj Chalise, Senior Associate Scientist at ICIMOD, presented the outline of the note on national consultations that had been circulated for discussion during the meeting. He stressed the importance of national consultations to elucidate expected outcomes, expected participation, duration, and financial provisions. National consultations are necessary to assess the needs and requirements of each country and will help to determine the types of capacity building needed. Other expected outcomes would include the final nomination of basins and realistic assessment of institutional needs and requirements. National partner institutions and other key institutions are expected to participate in the consultations. A revised version of the National Consultation Document is presented in Annex 8.

A number of questions were raised during the discussions on the national consultations. The participants suggested that the national consultations should include the Ministries of External Affairs, Home Affairs, and Disaster Management Services, in addition to those previously identified. The duration of the meetings was also discussed and it was decided that the principal partner institution in each country would decide for themselves what was appropriate. The participants felt that there was a need to conduct preparatory work prior to the consultations that would include identification and nomination of pilot basins/sub-basins for the testing of real time data acquisition and transmission/communication. Preparations for the national consultations would be mainly undertaken by the countries themselves with assistance from ICIMOD and WMO (as needed) and prior to the formal in-country discussions with ICIMOD and WMO. The funding aspect of holding the national consultations was also discussed. Some participants felt that the budget allocated would be inadequate and recommended that, if needed, each country should seek a co-sponsor.

#### Endorsement procedure for the project and project implementation

National commitment was essential for the project to go forward. National hydrological and meteorological services and other institutions would need to show their willingness to share data, information, technology, and know-how on a regional level in order to implement the project. The participants agreed that there was indeed a need for improved hydrological and meteorological forecasting in the HKH regional countries in order to provide timely and accurate flood forecasting for saving lives and property.

The participants drafted a resolution and discussed each clause. The participants noted the progress that had been made towards the establishment of a regional flood information system since the first high level meeting in May 2001. The member countries supported the further development of the project and agreed that ICIMOD and WMO should undertake further activities, including resource mobilisation for the implementation of the project. They awaited the revised project document that would incorporate the comments/observations made by member countries during the meeting.

#### Action plan

Ms. Mandira Shrestha, Water Resources Specialist, ICIMOD, summarised the action plan that had been developed based on the discussions held during the meeting (Annex 9). The action plan included revising the draft project document, compiling the meeting proceedings, holding the national level consultations, holding a secretary level meeting,

#### Closing remarks by the participants

The participants thanked ICIMOD and WMO for organising such a successful and fruitful meeting. Afghanistan and Myanmar reiterated their interest in participating in the project. Participants who had taken part in the two previous meetings remarked that the Project had made significant progress. The participants agreed that the meeting had been a great opportunity to discuss important and pressing issues and the result was very positive. This meeting is a step in the right direction towards regional cooperation on the establishment of a flood information system that would help minimise the loss of lives and property.

#### Chair's concluding remarks

In his concluding remarks, the Chair, Mr. Adarsha Pokhrel, thanked the participants for contributing to the success of the meeting, in particular for contributing in a positive and co-operative manner and for agreeing on and endorsing the resolutions of the meeting. He concluded by saying that the outcomes of the meeting were a milestone towards promoting regional cooperation in flood disaster mitigation in the Hindu Kush-Himalayan Region.



Where is the road now?

## conclusions and key achievements

This meeting was attended by high-level country representatives from Afghanistan, Bangladesh, Bhutan, China, India, Nepal, Myanmar, and Pakistan, and international technical experts as well as representatives from donor agencies. The meeting was an ideal opportunity to exchange knowledge and know-how in state-of-the-art flood forecasting and information exchange in the HKH region. The participants agreed to further support the initiative to improve flood forecasting in the entire region. Supporting the initiative will entail establishing a Regional Flood Information System by improving hydrometeorological networks, improving telecommunication and dissemination of real-time data and information, improving forecasting techniques and reliability, facilitating access to data and information, and building capacity within the individual national institutions. The development of the flood information system will be a fully voluntary, participatory effort of the countries of the HKH region.

The existing and successful bilateral agreements between countries could be the starting point for the development of a regional framework. This framework would then allow for the exchange of data and information beyond the limitations of bilateral agreements in the context of regional and even global interests. The participants agreed on the goals and objectives for the establishment of a regional flood information system. In this way, the aims and objectives of a regional flood information system would be implemented through an HKH-HYCOS. The participants drafted a resolution of the meeting and endorsed it subject to the revision of the draft project document. The participants also agreed on an action plan for further development of the project. The participants agreed to hold national consultations to identify the specific needs and priorities of each country for the establishment of a regional flood information system. A road map for further development of the project was agreed. This includes a testing phase to demonstrate the technical feasibility of the project.

#### **Key Achievements**

The key achievements of the meeting were as follow.

- Exchange of knowledge in state-of-the-art flood forecasting and information exchange both from within the region and from outside it
- Detailed discussions on the draft project document for the establishment of a regional flood information system
- Adoption of a set of recommendations in the form of a resolution of the meeting upon revision of the draft project document (see Box).
- The regional countries present unanimously agreed to encourage both WMO and ICIMOD to continue in their endeavours to pursue further steps that would ensure project implementation – this could also including mobilising resources

- · Adoption of an action plan
- · Willingness of the regional countries to hold national consultations
- Participants approved the commencement of a testing phase during which the technical feasibility of the project will be demonstrated
- General consensus by all participants to continue to support the development of this important regional initiative

#### Resolution of the 2nd High Level Consultative Meeting

Considering the urgent need for improved hydrological and meteorological forecasting to provide timely and accurate flood information for saving lives and property from water induced disasters in the Hindu Kush-Himalayan Region;

Considering the existing bilateral agreements between some of the participating countries and the need to support and build on these agreements within the framework of the project;

Noting the recommendations of the First High Level Consultative Meeting on "Developing a Framework for Flood Forecasting in the Hindu Kush-Himalayan Region," from 15 to 18 May 2001 in Kathmandu, Nepal;

**Noting** further the results of the first meeting of the Consultative Panel for the establishment of an HKH-HYCOS project, from 19 to 21 May 2002 in Kathmandu, Nepal;

**Recognising** the Concept Document for the Establishment of a Flood Information System in the Hindu Kush-Himalayan Region, which has been finalised by the Consultative Panel on the basis of the recommendations from the First High-level Meeting;

**Recalling** the request by the Consultative Panel to develop a draft project proposal for the establishment of a flood information system in the Hindu Kush-Himalayan Region;

#### It is agreed that

The Draft Project Document circulated by ICIMOD in January, 2003 which was discussed in the 2<sup>nd</sup> High Level Consultative Meeting held during 10-13 March 2003 will be revised incorporating the comments and observations of the member countries. The Revised Draft Project Document would then be circulated by ICIMOD to the member countries for further consideration.\*

The member countries expressed their willingness to support the further development of the project, after the incorporation of the comments/observations of the member countries in the revised draft project document.

The facilitating organisations in the development of this project, namely WMO and ICIMOD, will undertake further adequate activities, including resource mobilisation, for the implementation of the project.

<sup>\*</sup> The Revised Draft Project Document was circulated to member countries in early August 2003.

## executive summary of the first meeting of the consultative panel, May 2002

tregional flood information system aims to provide the operational course

- 1. A Consultative Panel for the establishment of a flood information system in the Hindu Kush-Himalayan (HKH) region has been set up following a decision by participants of the First High-Level Consultative Meeting on the Development of a Framework for Flood Forecasting in the Hindu Kush-Himalayan region that was held in Kathmandu, Nepal on 15-18 May 2001 (ICIMOD, 2002). The principal task of the Consultative Panel is to advise and provide support to representatives of participating countries, the International Centre for Integrated Mountain Development (ICIMOD) and the World Meteorological Organization (WMO) in the development of a flood information system in the Hindu Kush-Himalaya.
- 2. The first meeting of the Consultative Panel was organised jointly by ICIMOD and WMO in May 2002, and was co-sponsored by the US Department of State's Regional Environment Office for South Asia and the US Office for Foreign Disaster Assistance (OFDA). The basis for discussion during the meeting was a concept document that had been prepared by ICIMOD and WMO. The draft version of this document had been circulated to participants prior to the meeting. The motto coined for the meeting was 'Making information travel faster than flood waters.'
- 3. The meeting was attended by government representatives of national hydrological and meteorological services from Bangladesh, Bhutan, China, India, Nepal and Pakistan, and representatives from the organising and sponsoring organisations.
- The two main objectives of the meeting were as follow.
  - Discuss and reach agreement on the text of the concept document that forms the basis for further development of a project proposal for the establishment of a flood information system in the Hindu Kush Himalayan region.
  - Provide guidance in the development of the project using the conceptual framework of the World Hydrological Cycle Observing System (WHYCOS) of WMO
- 5. During the meeting, the concept document was extensively reviewed and its text agreed by all participants. The representative from India provided an additional note that documents the official stand of the Government of India with regard to the further development of the project. Agreement on the concept document is an important milestone for the promotion of the project's objectives and deliverables in the countries of the Hindu Kush-Himalayan region. The concept document is viewed as the reference document for the development of the project, especially with regard to the framework and implementation strategy. The document will be used to promote the development of this regional project at the level of relevant ministries and hydrological as well as meteorological services in the concerned countries.
- 6. Members of the panel agreed that the project design should build on existing bilateral agreements put in a regional context within a regional dialogue, and on technical cooperation in flood forecasting and the sharing of real-time data and flood-related information
- 7. To facilitate the development of the draft project proposal, the meeting defined the logical framework for the project including its objectives, expected results and key activities that need to be undertaken during the project. As a result, the following objectives were identified.

- Strategic objective
  - The proposed regional flood information system aims to provide the operational concepts and tools for improving integrated river basin management – specifically, by managing floods – and thus contribute to minimisation of the loss of lives and property, reduction of poverty, and acceleration of economic development in shared river basins affected by recurring flood events.
- Specific objectives
  - Planning and implementation of a regional HKH HYCOS focusing on the establishment of an efficient and operational flood forecasting information system based on real-time data and information.
  - Provision of relevant data and information products for disaster preparedness and reduction plans, and activities by and among participating countries.
- 8. To achieve the objectives, participants agreed on the following expected results.
  - Establishment of effective transmission and dissemination systems for sharing meteorological and hydrological data and information.
  - Approval from governments to disseminate more data and information that is of interest to other countries.
  - Availability of comprehensive, basin-wide flood information.
  - Improvement of institutional capacity and training of personnel.
- 9. Participants felt that the project, if implemented, will contribute significantly to the reduction of flood disasters through the inclusion of meteorological forecasts and extreme events warning, the full sharing of real-time data and information, the improvement of accuracy of flood forecasting, especially in large river basins, and the extension of the lead-time for timely flood mitigation actions. In discussion of the regional context of the project, the panel recommended that Afghanistan and Myanmar should be invited to join the regional initiative.
- 10. The panel agreed on the need to identify pilot basins to test the technical feasibility of the project and encouraged its members to identify such basins. Two basins were nominated during the meeting: the Kosi River Basin was nominated by Nepal, and the Chenab Basin by Pakistan. The results of the envisaged pilot projects are expected to demonstrate the on-the ground efficiency and effectiveness of the proposed flood information system.
- 11. Participants welcomed the establishment of a prototype webpage that will be built into a regional, flood-related information base. This webpage can be viewed at www.southasianfloods.org. Participants further recommended that national agencies should feed this web portal with information relevant to the needs of the region. The preparedness of participants to exchange good practices, know-how and expertise in modelling, flood forecasting and dissemination of information is seen as the basis for building a knowledge base in the region and beyond.
- 12. Panel members recommended that capacity building should form an important cross-cutting component of the project to improve national and regional scientific, technical and managerial capabilities to establish, operate and maintain complex flood information systems.
- 13. The meeting recognised that this project with its regional scope needs the full government support of participating countries and, therefore, recommended that the project document, once agreed by the planned Second High-Level Consultative Meeting (originally scheduled for December 2002; at present, planned for March 2003), requires endorsement at the appropriate governmental level in participating countries. This is envisaged to be achieved in the first half of 2003.
- 14. The meeting also provided planning inputs to the Second High-Level Consultative Meeting. A prominent agenda item for this meeting will be the discussion, review and subsequent agreement of a draft project proposal.
- 15. The panel agreed on short-, medium-, and long-term action plans for regional cooperation in flood forecasting and information exchange. The short-term action plan is to be completed prior to the Second High-Level Consultative Meeting.

## executive summary of the first consultative meeting, May 2001

Participants from six countries, namely Bangladesh, Bhutan, China, India, Nepal, and Pakistan came together for high-level consultative meeting on the development of a framework for flood forecasting in the Hindu Kush-Himalayan (HKH) region. The meeting was organised by the International Centre for Integrated Mountain Development (ICIMOD) and the World Meteorological Organization (WMO) and was co-hosted by the Department of Hydrology and Meteorology (DHM) of His Majesty's Government of Nepal in Kathmandu from 15-18 May 2001. The meeting was sponsored by the US Department of State-Regional Environment Office for South Asia, the Office of the United States Foreign Disaster Assistance (OFDA), and the Danish International Development Assistance. Recognising the tangible benefits of a regional framework for flood forecasting, representatives from the six participating countries agreed to develop strategies for flood forecasting, and a regional flood information system. The consultative meeting served as an important platform for the initial development of these strategies. The participants agreed on an initial Action Plan for Regional Cooperation for Flood Information Exchange in the HKH region to be implemented by 2002.

#### Rationale for the Meeting

The HKH region is shared by Afghanistan, Bhutan, China, India, Nepal, Myanmar, and Pakistan and is the source of six of the world's largest rivers. The Indus, the Ganges, the Brahmaputra, the Mekong, the Yangtze, and the Yellow River originate in the mountains of HKH region. These rivers are vital for the socioeconomic development of millions of people in South and Southeast Asia through their potential for irrigation, hydropower generation, fishery, inland navigation and the sustenance of wetlands and their biodiversity. Large snow and ice fields in the Himalayas are important for maintaining the flow margin of these rivers during the dry season. An important characteristic of many of the rivers in the HKH region is that they are shared by several countries before reaching the ocean. In this respect, Bangladesh is included in the HKH region because Bangladesh receives the waters of the Brahmaputra and its tributaries which originate in the Himalayan range.

Devastating floods are an annual phenomenon of the HKH region. While weather-forecasting systems have reached a high level of accuracy and weather data and forecast products are shared on a regional and global basis, there is, at present, no regional mechanism for regular exchange of hydrological data and information. Without a reliable hydrological database and a flood information system which is linked to the weather forecast systems operated by the meteorological services in the region, it is not possible to forecast floods and mitigate their devastating effects. Recurring floods of large magnitude and frequency are also a big impediment to more rapid development of the HKH countries. An institutionalised exchange of real-time hydrological and meteorological data and information, primarily for flood-forecasting purposes, is therefore a prerequisite for the development of strategies to mitigate the negative effects of floods. Better quality data and state-of-the-art data transmission and dissemination technologies are needed to share information and data on a real-time basis. Although there has been some success in the sharing of historical data, very little has been achieved with regard to sharing real-time data, which is critical for flood forecasting to save lives, property, as well as costly physical infrastructure.

#### **Objectives**

The meeting was held to develop a framework for regional cooperation in flood forecasting and flood information sharing, to discuss options for its implementation, and to agree on a strategy, using the concept of the World Hydrological Cycle Observing System (WHYCOS) formulated and implemented by

the WMO. Another objective was to prepare an initial action plan for regional cooperation for timely flood information exchange to save lives and property in the HKH region. Identification of capacity building needs for personnel and hydrometeorological services entrusted with activities related to data acquisition, dissemination, modelling, and flood forecasting in the participating countries was also an integral part of the agenda of the meeting.

#### Results

#### Country case studies

The case studies presented by participants from Bangladesh, Bhutan, China, India, Nepal, and Pakistan showed great diversity in technological, scientific, and institutional know-how in dealing with floods. The participants recognised the potential for mutual technical assistance and sharing of technical expertise and know-how. Common to all case studies was the need for an enhanced capacity for flood modelling, real-time data acquisition, and improved accuracy in forecasts. Almost all case studies reported insufficient communication with meteorological services to improve input information for flood forecasting, inadequate hydrological networks and data quality, and technological deficiencies in real-time data acquisition and dissemination. Some countries also cited the need to improve the institutional capacity to deal with floods, including the need for trained personnel and institutional structure and organisation. Deficiencies in the dissemination of information to vulnerable communities were also cited as a major area where improvement is necessary. Some countries have made significant progress in the implementation of flood-forecasting systems on a national level and the possibility for technical cooperation between these countries and those that could benefit from improved flood-forecasting systems was highlighted. On the regional level, improved exchange of data was seen as essential for the improvement of flood information, especially in shared river basins.

#### Technical Concepts for Flood Forecasting

The participants were informed about the concepts, activities, and lessons learned by regional cooperative projects such as WHYCOS, HKH-FRIEND (Hindu Kush-Himalayan-Flow Regimes from International Experimental and Network Data) and the Mekong River Commission. Political will, sound technical concepts, and full ownership of the plans, results, and benefits of regional cooperation are essential for successful regional cooperative efforts. The participants agreed that the WHYCOS concept of WMO is a proven and suitable technical concept for the establishment of an operational flood information system. The results of the HKH-FRIEND working groups, especially those on floods and on Databases, could add value from a scientific point of view. Exchange of information and experiences from organisations involved in river basins, such as the Mekong River Commission, was seen as highly useful in the development and implementation of an HKH regional framework for cooperation.

At the conceptual and technical levels, participants learned of the activities in relation to the Flood Action Plan in Bangladesh, National Oceanic and Atmospheric Administration (NOAA), and the United States Geological Survey (USGS). It became apparent, that hydrometeorological networks and related databases (i.e., topographic databases) need to be integrated using modern communication and information exchange protocols. Full use should be made of the capabilities of GIS, weather and climate related information, and satellites for regional observation, forecasting, data transmission, and relay platforms. The Internet was seen as a clear favourite serving as the platform for the regional and global exchange of data and information for flood-forecasting purposes and the dissemination of forecasting products down to the level of national flood-warning centres.

#### The Framework for Regional Cooperation

A framework for regional cooperation was elaborated during break-out sessions and presentations of and discussion on the results of the subgroups took place in the plenary. The basic components of the framework are summarised below.

- All countries expressed the need for improvements in flood-forecasting systems, extension and upgrading of hydrometeorological networks with real-time capacity, data quality, and information collection and dissemination.
- b) Capacity building in terms of institutional capacity and professional expertise was recognised as essential for the development and implementation of an operational, multilateral flood information system.
- c) In all countries, there is a multitude of cooperating organisations and government agencies. There is a need to coordinate their activities for the establishment of a regional flood information

system. Improved consultation and exchange of data and information was recognised as the principal approach to achieve this goal.

- d) Effective organisational concepts and mechanisms for the dissemination and use of flood-forecasting products need to be developed to ensure the use of flood-forecasting services at the local, national, and regional levels. This includes the dissemination of information to flood-prone areas in order to ensure effective disaster preparedness.
- e) A review of existing flood-forecasting systems based on the country papers and additional information and concepts to improve information collection, data sharing, data transmission, and data screening is needed for the development of an effective flood-forecasting information system.
- f) In this regard, national procedures for data collection, processing, quality control, archiving, access, modelling, flood forecasting, and dissemination of flood warnings and forecasts need to be improved through joint effort towards regional cooperation.

#### Strategy for Regional Cooperation in Flood Forecasting

There was a general consensus that the implementation of the framework should be based on a number of key strategic principals and approaches. These are outlined below.

- a) The development of the flood information system is a fully voluntary, participatory effort of the countries of the HKH region.
- b) The existing national activities related to hydrological networks and flood forecasting should be integrated into the regional system based on prioritisation. Likewise, full use should be made of the ongoing activities undertaken through bilateral agreements.
- c) For regional cooperation, the flood information system needs to be built on a proven concept. Therefore, the WHYCOS concept of WMO was chosen as a blueprint to be adapted to the specific needs of the HKH region.
- d) Upgrading of hydrological networks, including real-time capacity for data acquisition and dissemination, and a mechanism for the exchange of hydrological data and information is at the core of the anticipated system. As all participating countries (with the exception of Bhutan, at present) are members of the WMO, the WMO resolutions addressing the exchange of meteorological data (12th WMO Congress, Resolution 40) and the exchange of hydrological data (13th WMO Congress, Resolution 25) will form the basis for exchange of data and information in the HKH region.
- e) Flood forecasting is primarily a national task and responsibility. Therefore, flood forecasting is confined to national territories but the data and flood-forecasting products are shared on a regional basis.
- f) Full integration of weather and climate information related to modelling and forecasting and improvement of observations from satellites, including rapid image processing and interpretation, is required to improve real-time flood forecasting and the accuracy and timeliness of forecasts.
- g) Capacity building and technical cooperation at the regional level are an integral part for the development and implementation of the framework.

At the technical level, the following activities were chosen as start-up activities leading to the technical development of the system.

- a) Preparation and exchange of an inventory of existing hydrological and meteorological data of the HKH Region.
- b) Establishment of a regional centre for data acquisition, processing, and dissemination and assessment of the existing network for flood forecasting (real-time network data). Part of the initial activities of this center would be the formulation and establishment of protocols for the exchange of data and information to:
  - identify the focal points for data exchange.
  - ii. exchange standards (formats, etc) of data and information,
  - exchange real-time data on water levels, flows, extent of snow cover, precipitation, and floodprone areas, and
  - iv. establish one common website as a regional communication platform for the exchange of data and information.
- c) Participants agreed that, based on its capacity, ICIMOD should be designated as the regional centre and also as the focal point for the Regional Hydrological Data Centre within the framework of the HKH-FRIEND project of UNESCO, with active involvement of WMO.

#### Action Plan

An action plan was prepared on the basis of the recommendations made by the break-out groups and these were discussed in and endorsed by the plenary. The participants agreed on a detailed initial action plan on the basis of the WHYCOS concept with an objective to further develop an HKH-Hydrological Cycle Observing System (HYCOS) project with emphasis on the establishment of a regional flood information system. The action plan entails the following activities and schedule to be completed within June-July 2002.

- a. Preparation of the Meeting Report: Preparation and circulation of the draft report to all participants for feedback and revision of the report on the basis of comments received from the participants (June September 2001).
- b. Establishment of a Consultative Panel: The Participating countries are encouraged to nominate members for the panel which will meet to discuss concept papers on regional cooperation for information exchange (June – October 2001).
- C. Formulation of a HKH-HYCOS Concept Paper: A draft concept paper for regional cooperation for flood information exchange will be developed and circulated to participants for their feedback and endorsement resulting in the production of a project document (November 2001 – June/July 2002).
- d. Exchange of Regional Information: The participating countries are expected to contribute to the preparation of a web page and establish an open system database as well as regional hub for exchange of data/information. (March 2002).
- e. Preparation of Technical Papers: Technical papers will be developed by experts selected mainly from the HKH region for presentation at the HKH-HYCOS consultative meeting (May/June 2002).
- f. Second HKH-HYCOS Consultative Meeting: A second HKH-HYCOS consultative meeting will be held to assess the progress and to advise on the operationalisation of HKH-HYCOS. ICIMOD and WMO will be responsible for organising the meeting and preparing the meeting documents (June/ July 2002).

#### Conclusions

The meeting created a unique opportunity for high-level government representatives, directors of national hydrological and meteorological services, and technical experts from the region and international organisations to share information on the extent of flood problems in the region and to discuss organisational and technical approaches to flood forecasting and mitigation of flood-related damages. The participants fully recognised the significant benefits that can be derived from multilateral efforts in sharing of data and information to improve timeliness and accuracy of flood-related information. During the three-day meeting, the participants discussed and agreed on a framework for the development of a Flood Information System including state-of-the-art observations, communication technology, modelling, capacity building, and sharing of hydrological and meteorological data and information in the HKH region. The meeting agreed on an initial Action Plan for Regional Cooperation for Flood Information Exchange which will be coordinated by ICIMOD in cooperation with regional countries and the WMO.

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# 2<sup>ND</sup> HIGH LEVEL MEETING ON "THE DEVELOPMENT OF A REGIONAL FLOOD INFORMATION SYSTEM IN THE HINDU KUSH-HIMALAYAN REGION" 10-13 March, 2003 KATHMANDU, NEPAL

#### PART 1 - TECHNICAL CONFERENCE

Monday, March 10, 2003			
08:30	Registration		
09:30-10.30	<ul> <li>Opening Session</li> <li>Welcome remarks by Mandira Shrestha, Initiative Coordinator, ICIMOD</li> <li>Welcome remarks by Dr. Gabriel Campbell, Director General, ICIMOD</li> <li>Background and Objectives of the Meeting, Dr. Wolfgang Grabs, WMO</li> <li>Introduction of the participants</li> </ul>		
10.30-11:00	Теа		
	Session 1: Hydrometeorological Data Acquisition and Transmission Systems for Flood Forecasting Chair: Mr. Adarsha Pokhrel		
11:00	State-of-the art methods of hydrological and meteorological data acquisition systems for flood forecasting Saukat Ali Awan		
11:40	Telecommunication systems for real-time hydrometeorological data collection and transmission Richard Paulson		
12:05	Briefing on the ARGOS telecommunication systems Wolfgang Grabs		
12:20	Discussion		
12:45	Chair's remarks		
13:00	Lunch		
	Session 2: Integrated Hydrometeorological Information and Network Design for Flood Forecasting Chair: Professor Dulal Goswami		
14:00	Use of short-term and long-term meteorological forecasting information in flood forecasting Shyam V.Singh		

14:25	Flood Forecasting System in Europe Wolfgang Grabs		
14:40	Discussion		
15:00	Tea		
15:15	Integrated hydrometeorological network design and oper Shi Peiliang	ation for flood f	orecasting
15:40	Discussion		
16:00	Data and information management in integrated hydrolo networks  Adarsha. P. Pokhrel	gical and meter	orological
16:25	Discussion		
16:45	Chair's remarks		
17:00	End		
18:30 - 20:30	Reception dinner hosted by J. Gabriel Campbell, Director Ge	neral, ICIMOD	E- L mas
Tuesday, March	11, 2003		
	Session 3: Flood Forecasting and Flood Management Chair: Mr. Shi Peiliang		
09:00	Flood management in integrated river basin developmen Rama S. Prasad	t and the	
09:25	Discussion		
09:35	Development of the flood forecasting and warning system study  Akhtar Hossain	n in Bangladesi	n – a case
10:00	Discussion		
10:10	Integrated hydrological-hydraulic modelling approach for warning Guna Paudyal	r flood forecasti	ng and
10:35	Discussion		
10:45	Tea		
11:00	Flood management and local adaptation and response st Qazi K. Ahmad	trategies	
11:25	Discussion		
11:35	Presentation by Glenn Dolcemascolo		
12:00	Discussion		
12:10	Wrap up of technical session Richard Heggen		
12:25	Chair's remarks		
12:35	Lunch		

#### PART II: SECOND HIGH LEVEL CONSULTATIVE MEETING

	nale hal Session I: Opening Session and Market Market I to the land the lan
14:00	ts from Opening Remarks by Dr. J. Gabriel Campbell
	Opening Remarks by Mr. Eisa Al-Majed
14:15	Objectives and expected results of the meeting
14:25	Adoption of the meeting agenda
14:35	Background of the project
14:45	Outcomes of the Consultative Panel meeting
14:55	Inauguration and Keynote Address by the Honourable Minister of Water Resources, Academician Dipak Gyawali
15:20	Tea
16:00	Briefing of progress made to date
16:15	Comments from participants
16:25	Chair's remarks
16:30	Meeting adjourns

#### Wednesday, March 12, 2003

	aspects
09:00	Introduction to the draft project document
09:15	Summary of the comments received on the draft project document
09:30	Conceptual aspects of the project
10:45	Теа
11:00	Technical aspects of the projects
12:30	Lunch
	Session III: Network design, organisational, managerial and funding aspects of the project
13:30	Selection of basins and hydrometeorological networks
14:30	Теа
14:45	Organisational and managerial aspects of the project proposal
15:45	Review of recommendations for amendments to the project proposal
16:30	Funding opportunities of the project
17:00	Meeting adjourns
18:00	Cocktail at Hotel Yak & Yeti hosted by WMO

Session II: Discussion of the draft project document: Conceptual and technical

Thursday, March 13
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	Session IV: National consultations, project endorsement and action plan		
09:00	Objectives and organisation of country consultations for the implementation of the project		
10:00	Endorsement procedure of the project and its subsequent implementation		
10:45	Tea		
11:00	Review of results and main decisions		
11:30	Proposed Action Plan		
12:00	Comments from participants and observers		
12:30	Close		
	Becaling It: Discussion of the draft project document: Conceptual as		
	Summary of the comments received on the draft project defaulted		
	refer a tild hydrategical hydraulic modalling approach for flood forecassing		
	Technical aspects of the projects		
	Cocktail at Hotel Yak & Yell frosted by WMO		

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## keynote address

### Academician Dipak Gyawali, Minister of Water Resources, Nepal

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It is a great honour for me to have this opportunity to speak before such experts from the HKH region. This level of expertise is reason enough to add extra importance to this occasion to help us address this vital issue of floods and to devise policies to tackle these floods. This high level consultative meeting is an appropriate forum to discuss issues to find solutions to the problems relating to floods, which are primarily, from my personal perspective, a humanitarian issue. It is incumbent upon all of us to help protect life and property, and scientists and technologists, in particular, can help in finding out ways to do so equitably and efficiently. Devastations caused by the monsoon rains falling on the Himalayas have been a matter of serious concern to flood control authorities of the respective governments. Especially serious is the fact that we depend on a complex monsoon regime. I have found that the more I study, the less I seem to know about it. It's a weather anomaly and there are serious concerns right now of the problems in this regime due to possible climate change impacts. We are worried here about some distinct indications of the enlargement of the boundary of extremes; extreme events from cloudbursts, which seem to be happening more frequently. Maybe that's because we have more infrastructure development works going on and they get damaged more frequently. It could also be that our communication systems have improved and there is better reporting. I don't know, but when you talk to villagers around, they do mention that extreme events and cloudbursts are becoming more frequent. Extreme events are getting more extreme. We are also facing the problem of droughts more often. When expected rain doesn't arrive in time or arrives later than expected even by a few weeks it can have severe impacts on the agricultural production system especially to subsistence farmers. The availability of hydrometeorological data at the required time could be used for early warning. However, that is neither available to that degree of certainty nor can be generated so easily. Especially on extreme events, we may have a rain gauge station somewhere, but when we had 540 mm of rain in 'officially' 24 hours in July 1993, I say 'officially,' because it fell mostly within about 9 hours, it is difficult to forecast such rainfall and the damage it could cause at any place. The Kulehani Reservoir, the only big reservoir in Nepal, had filled up 20 m between 5pm and 1am. In 1998, Nawal Parasi (plains) in Nepal recorded 463 mm of rainfall in a similar period. These are flat plains and when we have that state of downpour, the drainage capacity of existing streams, existing water channels, and other water courses is highly insufficient to take the impact away. So, when we say we don't have data or data is poor, try telling that to the poor gentleman assigned to keep records at times like that. His bigger concern would be how to save his family. Hence there is a need to find out better means, better scientific tools to be able to capture extreme events, especially of cloudbursts and floods. This is a common problem across the region and Nepal is keen to participate as well as help.

Regional cooperation in this field would be most important in the matter of facilitating forecasting of floods across manmade boundaries, whether international or within a country. We find equally serious problems of being able to transcend administrative boundaries as we do across international boundaries. Technical cooperation in terms of sharing technology and experience, capacity building of professionals, and establishment of a common scientific laboratory or lab data analyses, for improved understanding of the underlying processes are other matters that would be extremely beneficial. We are hearing some reports on floods which would need better scientific study. A few months back it was reported that when we had these extreme floods in Europe, someone had found a correlation between the late arrival of monsoon in South Asia and the late Mediterranean rains in Europe. This implies that much of

the research would have to be transboundary and international. That is more serious for us who are dependent, the billion plus people of the region, on the monsoon regime. It's time to think the unconventional. On the one hand, we have to move farther faster with high science such as the use of satellite forecasting and sophisticated techniques have to be brought to our region, and have to be applied, and on the other hand those results have to be made publicly available. It has been noticed by people who travel a lot across South Asia, that our TV weather forecasts compare badly with weather forecasts around the world. Why is that? Why have we not been able to be better at public forecasting? Reliable public forecasting makes a lot of difference to farmers especially the 30 million plus tube well operators in India plus a large number of such operators in other countries in our region. If they are reliably sure that there is going to be rain tomorrow, they will not operate their pumps. If some degree of reliability can be provided to these farmers, imagine the amount of greenhouse gas emissions we would have contributed to cutting down on.

One of our problems has been that when we deal with water resources and river courses, very often and sadly, the science has been overtaken by runaway technologies in the implementation of development projects. I have been travelling, both in my previous incarnation as well as now, visiting project sites where I have severe problems when I look at the design of irrigation of flood control projects where very conventional thought seems to have been implemented. It will require more and more heavy expenditure in the years ahead as structures fail, where embankments are improperly located and designed and get washed away.

We have a new department right now, the Water Induced Disaster Prevention Department, an offshoot of the Department of Irrigation's river training programme. They are in the process of defining the whole department's agenda as well as the flood protection and river training policy that Nepal would have to follow. It's in the process of being designed, but before this august gathering, I don't think it would be out of place to do some loud thinking because your feedback to our experts here as you interact will be very valuable to us. I am of half a mind to make sure that irrigation/flood controlled structures are planned for these rivers, especially on what I call marginal rivers. Marginal rivers are very small rivers. As you notice on the map, across the Terai, we have large rivers, we also have medium-scale rivers, but there are lots of small rivers. I call them marginal because no programme has gone into doing any work or gathering data on these small rivers. They seem to be used effectively by lots of people now, growing extra crops. And these rivers seem to wash out villages to quite some extent, but we don't have any projects on these rivers. I'm of half a mind to make it obligatory to have model testing of development structures before we give construction licenses to these small/medium hydro-power projects and irrigation projects because I have just calculated that the cost of model testing (we have two hydrological labs) will be inconsequential but it will ensure that the structures are robust in design. That capacity is there, but it has not been used because there has been no need to have designs tested. These designs need to be tested before we give construction approval because the costs are marginal and otherwise very expensive afterthought and remodelling work will have to be done where millions will have to be spent redesigning the intake or rebuilding the embankments. If we spend less than a tenth of a percent of the cost of the project we can do these modellings. And the certainty that comes with it would save millions down the road. This is the kind of high science that needs to be merged with policy and legislation to made sure we are getting it right. Together with the Department of Hydrology and Meteorology, data democratisation (the broad basing of hydrological and meteorological sciences in the low sciences area) will be necessary. The low sciences are easily forgotten. In one of the initiatives that I was a part of, this was part of a small school NGO kind of initiative where rain gauge stations were established with schools to figure out what the flood regime in one of these marginal rivers would be like. We set up these rain gauge stations both in Nepal and India. This is the river which flows between the place of the Buddha's birthplace, Lumbini, Nepal, and the place where he passed away in Kushinagar in Uttar Pradesh, India. So Buddha must have crossed this river many times. I am told the first case of water conflict resolution done by the Buddha himself was on this particular river. It so happened that the 1998 flood occurred just after we put the rain gauges in, so we have some very interesting data. This showed us that we can have a programme in high schools as part of a science curriculum for collection of simple data on rainfall, temperature, soil moisture, etc. We found out that for minimal costs you could increase data density many fold. In a kind of ecological varied zone like in Nepal, where within 100/200 km you can find almost all the climatic zones from subtropical to arctic, this kind of extension of data density is necessary for

two purposes. One is just to increase the data for modelling and other purposes, and the other is to be able to free higher level bodies like the government, like ICIMOD and others, to engage in the high sciences so that the raw data collected from the low sciences can be calibrated, studied, and analysed through high science means. This also brings me to the point of incorporating the results of both the high and low sciences into the policy and practice arena. How can we incorporate the dangers posed by extreme events and disasters into the design of our development programmes? How do we make sure that our irrigation canal designs, our road designs, our school locations, settlement locations take into account these extreme events, because most of them are not within normal social memory. If we do that, we would have made our development more sustainable. I believe that these present consultations at the high level will bring out appropriate ideas and methodologies. I believe that your commitment to pursue the understandings that you will develop will give life and energy to the policies of all of the governments in this region.

## comments of the representative from india

A Flood Forecasting and Warning System is one of the effective non-structural measures to forewarn and manage flood disasters. This forewarns us as to when the river is going to use its flood plains, to what extent and for how long.

The International Centre for Integrated Mountain Development (ICIMOD) has been pursuing to develop a new framework for regional cooperation in flood forecasting in the HKH region and to consider options for its implementations using the World Hydrological Cycle Observing System (WHYCOS) concept of WMO as the basis.

The India position with respect to the Regional Flood Information System in the Hindu Kush Himalayan Region was made clear in the 1st High Level Consultative Meeting held in May, 2001 and subsequently in the 1st meeting of the Consultative Panel in May, 2002

The Executive Summary of the Proceedings of the 1st meeting of the Consultative Panel held in May 2002, did mention that the representative from India provided an additional note that documents the official stand of the Government of India with regard to the further development of the project but the same was not included as a part of the proceedings communicated by ICIMOD in their letter of September 27, 2002. The present draft Project Document also does not mention India's stand as brought out in the earlier meeting.

I take this opportunity to reiterate the stand of the Government of India:

- There are bilateral data exchange regimes existing between India and its neighbouring countries which are working quite satisfactorily on the sharing of real time data on flood forecasting. These arrangements have therefore to be continued bilaterally and certainly not substituted with a regional regime.
- It is considered that a regional approach would only be of academic interest for countries other than the immediate users of data under the bilateral regime. Sharing of such data with other neighbours is not considered necessary.
- Sharing meteorological and flood forecasting data sans real time data for the proposed regional web site may be considered as the requirement of real time data is already being well served under our bilateral regimes.

Regarding exchange of real time data it has been mentioned on page 15 of the draft document under Project Justification that "Some exchange of data has occurred through bilateral agreements between Nepal-India, Nepal-Bangladesh, and Bangladesh-India. Such effort has primarily been focused for sharing of historical, not real time hydrological data." This does not reflect the correct position. In fact India has bilateral data exchange regimes with Bangladesh, Bhutan, China, Nepal and Pakistan which are working satisfactorily on the sharing of real time data on flood forecasting.

## summary of comments on the draft project document received prior to the meeting

#### General Comments

- It is probably good to stress the key role of the member countries in the Executive Summary
  as well. It may be good to phrase this so that it is clear that ICIMOD will implement by being
  a coordination and facilitation point for the member countries.
- Where the Phase II costs are mentioned in the Executive Summary of the document, it would be good to include the time frame. It may be useful to put an estimate of Phase III cost and time frame at the start as well.
- The proposed project document is concerned with Pakistan, India, Nepal, Bhutan and Bangladesh. As two other countries, Myanmar and Afghanistan, are included in the HKH initiative the project document should also include them.
- More bilateral agreements than are mentioned exist between India and Nepal, India and Bhutan, and India and Bangladesh for the transmission of data on a real-time basis and are operational. These are not indicated here. This fact has been mentioned in paragraph A.2.4.Hydrology (page 8).
- The paragraph on the Ganges Treaty Section may be replaced by the following:

   The 30 year Treaty signed in December 1996 would share between India and
   Bangladesh the dry season flows of the Ganges available at Farakka by ten day
   periods from 1 January to 31 May every year with reference to the formula provided
   in the Treaty".
- Bangladesh might gain access to the hydrometeorological data and information of the GBM basins on real time or near real time basis through this programme. Similar kinds of programmes are already in practice in different parts of the world that are initiatives of WMO.
- WHYCOS has a broad goal of sharing water resource information. This project is focused on floods for many good reasons but it is being conducted within the WHYCOS framework. Aren't the stations transmitting data all the time floods or no floods?
- In the last paragraph before section B, add that the database would also serve to enhance climate scale prediction efforts that can directly improve decisions made in the agricultural and water management sectors, both for reducing flood impacts and for improving agricultural production.
- Comments on population and flood prone areas need revision.
- The document focuses on real-time information sharing, which is the core of the HYCOS project. While other flood information benefits are mentioned, the document will be stronger if those additional benefits are stressed more. For example, one of the benefits of participating in the WMO HYCOS system will be the opportunity to cooperate more effectively with other members of the international community, thus ensuring access to, and benefit from, state of the art forecasting and early-warning methods.
- The project is silent on (a) defining the "...positive communications opportunity..." with stakeholders and NGOs, (b) assessing the products that end users need to minimise the loss of life and property, and (c) assuring that the project will set up continuing communication mechanisms for local and regional stakeholders to assure the preparation of needed products. This is an important omission and the project needs to include a strong commitment to user participation. Phases I, II, and III are silent on user

participation, though in Phases II and III there is a commitment to "Assess the performance and the effectiveness of the system through regular meetings of technical experts and relevant decision-makers.

"There is mention of public awareness campaigns in the project document, but that presumes representative knowledge of what the public needs. There is mention of "...a fully participatory approach that involves national and international institutions...", but no mention of a fully participatory approach with respect to users. The project must allow users to participate or run the risk of the information system being supply driven, rather than demand driven.

- The overall goal of the project is to minimise the loss of lives and property via the reduction in flood vulnerability in the HKH region with specific reference to the Ganges-Brahmaputra-Meghna and Indus river basins.
- Without user involvement in assessing the adequacy of the HKH flood information system, the suitability of this project and HKH-HYCOS to the donor and lending communities will be greatly diminished.
- Implementing partners of Bangladesh will be Bangladesh Water Development Board and Bangladesh Meteorological Department
- Key assumptions should also include the issue of donors' support.
- In the Risks section donors' support may be included.
- This is a more general comment that came from reading certain sections of the document: Rather than being poorly adapted, the inhabitants of the basin are actually extremely well adapted to recurring flood events, especially considering the level of poverty in the basin. Extreme events, however, do cause considerable harm to this extremely poor and vulnerable population. Real-time information sharing alone, will do little to reduce the vulnerability in the basin, but can be seen as a foundation for building an array of flood information and early-warning techniques to assist with vulnerability reduction. Rather than overstate the importance of real-time flood information, it may be better to stress the fundamental nature of this information and how it may be used to enhance the forecasting and early-warning capacity throughout the region.
- The draft proposal for establishment of the HKH-HYCOS as a regional component of the WHYCOS based on the recommendations made in the 1st Consultative meeting in Kathmandu in May 2001 which I had the privilege to participate in is a faithful and factual presentation of major ideas and recommendations that emerged at the end of the said meeting. The fine-tuning of some of the broad ideas has been done very satisfactorily. The phase-wise planning of activities, identification of infrastructural and manpower requirements, and the estimated financial outlays seem to me to be quite appropriate. I have no doubt proper implementation of the project as outlined in the proposal will go a long way in bringing about the much-needed cooperation among the countries in HKH region for the timely exchange of flood data and information. Thus it will eventually lead to appreciable reduction of flood vulnerability in the Ganga-Brahmaputra-Meghna and Indus basins.

#### Conceptual Aspects of the Project

 While there are many good points in the document, I would like to mention one specifically at No. XII of Basic Elements mentioned under C.3 Framework for Co-operation (page 24) which indicates that the framework will not infringe on national ownership of data, interfere with national responsibility and substitute bilateral efforts and agreements.

#### Technical Aspects of the Project

• The strategic objective is indicated in the Executive Summary (page 1) and also at paragraph C-3 (page 23) and it mentions "The proposed regional flood information system aims to provide the operational concepts and tools for improving integrated river basin management, specifically by managing floods and thus contributing to minimisation of the loss of lives and property, reduction of poverty and the acceleration of economic development in a shared river basin affected by recurring flood events." Creation of reservoirs to contain floodwater for utilisation in a lean or dry period is one of the long-term solutions for flood management

and reducing flood damage. Also the HKH region has plenty of dam sites still unutilised. Hence creation of reservoirs and regulated release of water will be an important option for long-term solution of flood problems in the HKH region. This fact may be mentioned in the 'Ultimate Goal' of the project.

- During implementation some modifications may be necessary to fulfil the objectives of the project.
- Structure of PMU may not be sufficient to ensure implementation of such a huge project at regional level. In order to ensure close cooperation at-least one professional staff from each of the participating countries as well as some international experts may also be included in the PMU.
- For implementation of the project, an Action Plan needs to be formulated and meetings at Secretary level of participating countries are urgently needed, followed by meetings at political level.
- Specific Objectives need to be looked at, reworded and some additions made. These specific
  objectives relate to the three phases of the project as described in Section C.2 below.
- The activities, which have been identified in the Annex 2 and the input requirement detailed in Annex 5 need further review in detail to achieve project objectives. It is presumed that it will be a regional project with international cooperation, which will require the services of both regional and international experts on full-time as well as part-time basis. Remuneration of regional and national experts should be assessed properly. Moreover, other works also need careful assessment before it is placed before the joint donors' meeting.
- If the assumptions are recognised and valid, and if adequate mechanisms can be devised to truly minimise the risks, the chances of success will be enhanced.
- Section F. Key assumptions is a critical section. Items 5 and 6 have caused us particular problems in some parts of the world. Earlier in the project document and then in Section H on sustainability, it is noted that the countries will be responsible for maintaining stations within their borders. It was also noted that long-term budget pressures cause degradation of networks. This can be reduced either by a long-term donor commitment or a long-term commitment of national funds or a combination of the two, a cooperative relationship maybe for as long as 10 years. In item 6, the report recognises that training is an ongoing process as well, because trained staff will move on when they can get a better paying job. Is it possible to have regional trainers? Finally, perhaps another assumption is that at least some of the international organisations/institutions will maintain a long-term interest in the project.
- Except for Risk 1, the risks (section G) may be understated. The design is an exciting time, so that is expected that will go well. The other risks deal with long-term issues and are all probably medium to high rather than low or low to medium, Maybe we have to be optimistic in the project document but considerable thought will be needed to devise means to reduce the risk. Ownership of the system is important and maybe there are ways to increase and sustain the ownership and the pride and obligations of ownership. For example, will there be some form of written agreement between each country for the operation and maintenance of any station located within that country?
- Sustainability issues may also be studied during the course of the project. SWOT analysis on sustainability issues in each of the countries may be undertaken so that the concerned country may be alerted beforehand.
- Need provisions for international/regional experts.

In the budged proposal Phase II at Annex 5, some items, e.g. rent of office premises, cost of maintenance of office like electricity, water, telephone, fax charges, travel expenses of personnel of Project Management Unit and other miscellaneous expenditure like taxes etc. do not appear. This may be looked into.

# national consultation meetings on the establishment of a regional flood information system in the hkh, May 2003

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(revised document\*)

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#### Acronyms

WMO World Meteorological Organization

ICIMOD International Centre for Integrated Mountain Development

HKH Hindu Kush-Himalayan region

WHYCOS World Hydrological Cycle Observing System HyCOS Hydrological Cycle Observing System

NGO non-government organization
CBO community-based organization
DCP data collection platform

After the discussions at the 2<sup>nd</sup> High Level Consultative Meeting (March 10–13, 2003), the original draft document on National Consultation Meetings was revised. This revised version incorporates the suggestions made during the discussions.

#### Background

The draft project document on the "HKH-HYCOS: Establishment of a Regional Flood Information System in the Hindu Kush Himalaya", which has been prepared as per the recommendations of the 1<sup>st</sup> High Level Consultative Meeting on "Developing a Framework for Regional Cooperation in Flood Forecasting and Information Exchange in the Hindu Kush Himalayan Region" in May 2001 and the First Meeting of the Consultative Panel in May 2002 was discussed during the 2<sup>nd</sup> High Level Consultative Meeting held from March 10-13, 2003 in Kathmandu.

The draft project document developed by WMO and ICIMOD proposes an implementation plan for the project in three interlinked phases. The First Phase of this implementation plan, which is proposed to be of 18 months duration, will be devoted to "Feasibility Study and Infrastructure Testing". This phase which is already in progress is expected to develop a full-fledged project on: "Regional Flood Information System in the Hindu Kush-Himalaya: The HKH-HYCOS", through a series of National Consultation Meetings in the participating member countries of the region, between April and December 2003. These consultation meetings, which are expected to assess national needs and priorities, will be participated in by representatives of the principal (nodal) and cooperating partner institutions of the participating countries. The next phase of the project beginning from April 2003, also includes pilot testing of data acquisition and disseminating systems including the possibility of using satellite communication within the framework of WMO's WHYCOS. The National Consultation Meetings will also assess the needs and requirements for pilot testing of such data acquisition and disseminating systems for government agencies responsible for flood forecasting and disaster mitigation for the benefit of communities in pilot basins/sub-basins that are exposed to floods. Following the National Consultation Meetings, WMO and ICIMOD are expected to finalize the draft of the regional project incorporating the recommendations and suggestions received during such meetings, which will then be submitted to participating national governments of the region for endorsement.

The National Consultation Meetings are obviously of critical importance to further identify national priorities within the framework of regional cooperation on the establishment of a regional flood information system in the HKH region and to obtain the first-hand technical and organizational information needed for the preparation of a detailed implementation plan for the project. The national consultations will be held from April to December 2003 (the tentative schedule is given in Annex 1).

These National Consultation Meetings will be organized by ICIMOD, WMO and the Principal National Partner Institutions or their nominees for which ICIMOD will provide necessary financial support.

### National Consultation Meetings

#### **Objectives**

- To assess the current institutional capacities (including technical know-how and human resources), needs, and requirements and make recommendations on specific institutional linkages, frameworks, and cooperative mechanisms required within the country and outside for a regional flood information system.
- To identify specific national needs of equipment and communication systems at a basin (subbasin) level to be installed for pilot testing of the technical feasibility of real-time data acquisition and communication systems for an operational regional network.
- To define a hydrometeorological network that is adequate for national requirements in the framework of the regional framework of the project.
- To help prepare a realistic assessment of funding requirements based on national needs and priorities for the full-scale regional project.

#### **Expected Outcomes**

- Nominations of candidate basins finalized.
- Assessment of institutional capabilities, needs, requirements (human, technical know-how, and equipment) and cooperation mechanisms for testing and development of a flood forecasting and

information system based on a fully participatory approach that involves national and international institutions and the definition of a contributing hydrometeorological network for the project.

#### **Expected Participants**

Representatives of the following institutions are expected to participate.

- Principal National Partner Institutions: National Hydrological and Meteorological Services
  including national flood forecasting agencies, who will be the principal organizers and regional
  coordinating agencies for the National Consultative Meetings in the participating countries
- Ministry of External Affairs
- Ministry of Home Affairs, Ministry of Planning, Planning Commission
- Other key institutions: to be identified jointly with/by the Principal National Partner Institutions.
   These will include national agencies in telecommunications and satellite communications, and other national institutions directly involved in water resources sector planning and development,
- Disaster Management Services /Institutions
- People-based institutions: to be identified jointly with/by the Principal National Partner Institutions. These will include elected representatives NGOs & CBOs from the basins (sub-basins) selected for pilot testing of the project.
- WMO & ICIMOD
- A WMO representative and the ICIMOD Coordinator will participate in the national consultation meetings in the participating countries. WMO and ICIMOD may also invite other experts or consultants to assist in these meetings.

Duration: 2 to 3 days as required (to be decided by the Principal Partner Institutions)

Venue: As decided by the Principal National Partner Institutions

Number of Participants: The Principal Partner Institution in consultation with ICIMOD and WMO will decide the number of participants. There is however no restriction to the number of participants.

#### Provisional Programme and Agenda

The full scope of participating organisations/agencies would be determined by the country's Principal Partner Institution and may therefore vary from country to country.

#### Day 1: Regional Project & National Needs and Priorities

- Brief highlights of the Regional Project, Objectives and Outcomes of Phase I Activities and the critical importance of National Consultation Meetings:
  - Presentations by Principal National Partner Institutions, WMO & ICIMOD.
- Nomination of basins (sub-basins) to test technical feasibility of all components of the proposed flood information system. (It is expected that these basins (subbasins) will be transboundary and may or may not be already a part of bilateral agreement between two countries):

Presentations by Principal National Partner Institutions.

- Needs and priorities of national institutions including NGOs & CBOs (human resources, technical know-how, equipment for data acquisition and transmission through satellite communication systems and financial resources):
  - Presentations by national institutions (including NGOs and CBOs and media representatives)
- Existing national and regional flood project websites on floods and flood-related information: coordination of information flow:
  - Presentations by Principal National Partner Institutions, other relevant institutions, and ICIMOD/WMO.

### Day 2: Identification of Specific Needs and Priorities of National Partner/Participating Institutions.

The following issues should be discussed in a suitable form (i.e. using working groups) and general agreement reached between the partners.

- Identification of needs in flood forecasting from national and regional viewpoints
- Existing hydrometerological networks and telecommunication facilities
- Resource requirements for the establishment of flood information systems as components of the planned regional system. This includes technical and financial resources and human resources
- Institutional capacities including coordination and communication efforts within the framework of specific responsibilities

Coordination and necessary project inputs for smooth flow of information from pilot test basins to national and regional data and information centers will also be discussed.

Annex 2 provides a list of activities that are expected to be undertaken to test the feasibility of the proposed regional flood information system.

### Day 3: Finalization of Specific Needs and Requirements of National Partner/Participating

Finalization of proposed pilot basins (sub basins) proposals and documentation of national requirements and policies for participation in the regional project to be included in the full project proposal.

#### Organization of the National Consultation Meetings

It is expected that the Principal National Partner Institutions or their nominees will be willing to organize National Consultation Meetings in their respective countries. It is also hoped that preparatory work for the identification and nomination of pilot basins/sub-basins and identification of institutions or individuals and experts (including people's representatives, NGOs & CBOs and media representatives) which will be invited to the National Consultation Meetings as well as to participate in the project will be undertaken by the Principal National Partner Institutions in collaboration with ICIMOD and WMO.

For the organization of National Consultation Meetings and necessary preparatory work. ICIMOD will provide some financial support to each Principal National Partner Institution of the participating countries.

Preparatory work prior to the National Consultations.

Preparatory work needs to be completed prior to the meetings by the Principal National (Nodal) Partner Institutions. The following paragraphs serve as guidance.

- Identification and nomination of pilot basins/sub-basins for the testing of real-time data acquisition and transmission/communication system.
- Identification of institutions or individuals and experts (including people's
  representatives, NGOs & CBOs and media representatives), which will be invited to
  the National Consultation Meetings as well as to participate in the project. This will
  be done by the Principal National (Nodal) Partner Institutions in consultation with
  ICIMOD and WMO.

 Identification of necessary equipment, training and other support (including financial support) to Principal National (Nodal) Partner Institution and other participating institutions including NGOs and CBOs.

ICIMOD has already secured funds for these meetings of about US\$ 6,000 per country. The Principal National (Nodal) Partner Institutions may also utilize a part of this fund for the necessary preparatory work.

Criteria for the selection of pilot basins.

It was also suggested to consider the following while selecting basins for pilot studies:

- Operational Feasibility: the basins (sub-basins) need to be operationally feasible for pilot studies
- Suitability for testing: the basins (sub-basins) need to be suitable for testing of different equipment and models
- Saving of lives and property: the implementation of the project in the basin (subbasin) should help in a tangible way to save lives and property through an improved framework for flood forecasting
- Expansion of coverage: the selected basins (sub-basins) should allow expansion of the existing station networks, i.e the network, selected for the pilot basins can become part of the regional flood information network
- Trans-boundary: basins (sub-basins) from trans-boundary rivers should be selected for pilot studies as a priority.

#### Annex (1)

Proposed Dates for the National Consultations\*

In the 2<sup>nd</sup> High Level Meeting some of the member countries proposed dates for the National Consultative Meetings in their respective countries. The proposed dates are as follow:

- Bangladesh: Middle of October
- Bhutan: Middle of July
- China: End of September
- Pakistan: Middle of November

The representatives from India and Nepal said that they would host the meeting as per ICIMOD and WMO's feasibility, for which they require prior notice. For meetings in Afghanistan and Myanmar it is necessary to first finalize their status.

#### Annex (2)

List of Testing and Demonstration Activities of HKH-HYCOS

- Institutionalized communication channels including satellite systems,
- Identification of test stations in the field,
- Data Collection Platforms (DCP) and telecommunication systems,
- Data and information dissemination system including the use of the internet,
- Prototype archival system for data and information
- Communication links and input of data for flood forecasting services
- Communication links to organizations responsible for disaster prevention
- Other Activities: as decided during the National Consultation Meetings

As of November 2003, National Consultations have been held in Bhutan (22-23rd July 2003), China (24-25th September 2003), Bangladesh (18-19th October 2003), and are planned for Pakistan, Nepal, and India in early 2004.

## action plan for the feasibility study and infrastructure testing phase

S No	Events/ Activities	Specific Outputs	Date	Responsibilities	Remarks
1	Revision of Draft Project Document	<ul> <li>Input from participating countries</li> <li>Revised project document</li> <li>Circulate the revised draft project document</li> <li>Finalise the project document</li> </ul>	March 2003 April 2003 April 2003 April 2003	Participating countries ICIMOD/WMO ICIMOD/WMO Partici. countries/ICIMOD/WMO	All comments/ suggestions from participants to be received in writing
2	Meeting Proceedings	<ul> <li>Preparation</li> <li>Draft to be circulated to all participants</li> <li>Feedback from participants</li> <li>Revise proceedings</li> </ul>	April/May 2003 June 2003 August 2003 Sept. 2003	ICIMOD/WMO ICIMOD/WMO Participants ICIMOD/WMO	
3	National Level Consultations	<ul> <li>Assessment of the institutional capacities, requirements (human, technical know-how and equipment) and cooperative mechanisms for the establishment of a regional flood information system</li> <li>Nomination of basins (hydrological and meteorological network) for the pilot phase/initial phase of implementation</li> </ul>	April-Dec. 2003		
4	Secretary Level Meeting		May 2004	ICIMOD/WMO/ Participating countries	
5	Testing of Technical Feasibility of the Project	Demonstration of the technical feasibility of the project of all components of the proposed flood information system		WMO/ICIMOD/ Participating countries/ International resource people and experts	
6	Website Development Including Update and Upgrade	Upgrade website	Continuing process	ICIMOD/WMO/ Participating countries	Experts from participating countries to contribute to the further development of the website
7	Donor Conference	<ul> <li>Secure funds for Phase II, the first implementation stage of the Project</li> </ul>	March 2004		

