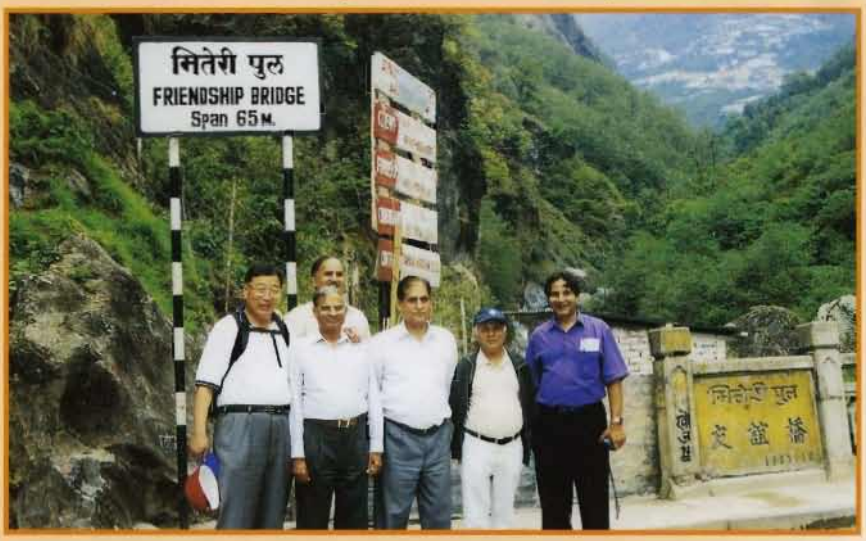
ICIMOD

INTERNAL REPORT

Regional Cooperation for FLOOD DISASTER MITIGATION

IN THE HINDU KUSH-HIMALAYAS

Report of the Consultative Meeting on
Developing a Framework for Flood Forecasting in the Hindu Kush-Himalayan Region
15-18 May 2001, Kathmandu, Nepal



Organised by
The International Centre for Integrated Mountain Development (ICIMOD)
and
The World Meteorological Organisation (WMO)

Co-hosted by
The Department of Hydrology and Meteorology, HMG/Nepal

ABOUT THE ICIMOD

The International Centre for Integrated Mountain Development (ICIMOD) is an international organisation devoted to the development of the Hindu Kush-Himalayan region covering all or parts of eight sovereign states, Afganisthan, Bangaladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan . The center is located in Kathmandu, Nepal. The primary objective of the center is to promote the development of an economically and environmentally sound mountain ecosystem and to improve the living standards of mountain populations.

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&
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Foreword

Most of the mighty river basins of the Hindu Kush-Himalayan (HKH) region – the Indus, the Ganges, the Yarlung Tzangbo-Brahmaputra, and the Mekong – start high in the Himalayas at altitudes exceeding 8,000 meters. The rivers then proceed to cross the geographic divide of the high Himalayas and are joined by thousands of tributaries, to discharge water into the aquifers, the agricultural fields, the villages and towns, the factories, and the powerplants that are the engines of our survival and economic growth - joining our countries - and eventually reaching the oceans that we all share.

But when the waters burst from lakes formed by landslides or glacial moraines, or when high quantities of rain falls on saturated grounds, we get floods, which devastate our region. Upstream, bridges and powerplants are wiped out – as they were in the Brahmaputra and Sutlej last year by landslides that created temporary dams and huge lakes in the Tibet Autonomous Region. Downstream, floods exceed the river banks and break river embankments to cause terrible loss of life and livelihoods to those poorest of farmers trying to live in these flood-plain areas.

Too often, the people in the path of these floods have no warning. We know that there are limitations on how much we can control floods in the short run without massive investments – the environmental costs of which can sometimes exceed the benefits. But we also know that we now have the technology and the capacity to provide timely forewarning to everyone downstream – to allow lives to be saved and property losses to be minimised.

We also know that this is necessarily a regional issue and that when the rivers draw us together into common basins, we must come together to link the upstream events with the downstream consequences, and the downstream policies with their upstream consequences. This was the purpose of this consultative meeting - to save lives and productive investments by exploring frameworks for flood forecasting in real time, or at least in time so short that people downstream have the most warning possible of floods coming their way from upstream.

The World Metereology Organisation (WMO) has initiated a World Hydrological Cycle Observation System which is increasingly being used as a framework for such collaboration

– as well as a basis for attracting development investments from bilateral and multilateral sources. WMO is our main co-sponsor and guiding partner in putting together this consultation. We are also inspired by the support for this endeavour by our other co-host the Department of Hydrology and Meteorology of His Majesty's Government of Nepal.

ICIMOD, which has as its member countries all of the HKH countries, has been active in supporting 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.

This meeting has started a collective dialogue in which **we are** also benefited by the technical knowledge and support of agencies outside the region. In addition to WMO and UNESCO, we are particularly grateful to the Governments of the United States and Denmark for bringing invaluable expertise, financial support, and enthusiasm to this effort.

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 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 on 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.

The cooperative spirit demonstrated by all participants and the valuable contributions provided by the invited technical experts were essential to successfully achieve the objectives of the meeting. The tangible expression of this success is the agreement on activities and milestones to be achieved within the next twelve months.

The present report contains both a record of the outcome of the discussions that took place and the papers presented. The people of the region have learned to seek in the Himalayas both spiritual solace and the means to improve the livelihoods of people living both upstream and downstream. We hope that the optimism displayed at the meeting will be imbued with commitment to follow through in each country and that collective wisdom and practical experience will save lives and improve economies while safeguarding the irreplaceable environment from floods.

Dr. J. Gabriel Campbell

Director General

ICIMOD

Executive Summary

Participants from six countries, namely Bangladesh, Bhutan, China, India, Nepal, and Pakistan came together for a 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 Organisation (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 States -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 the 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 hydro-meteorological 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. At 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 the 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, the 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 hydro-meteorological 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 to serve as the platform for 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.

a) All countries expressed the need for improvements in flood-forecasting systems, extension and upgrading of hydro-meteorological 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 principles 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 of 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 centre would be the formulation and establishment of protocols for the exchange of data and information to:
    I. identify the focal points for data exchange,
    II. exchange standards (formats, etc) of data and information,
    III. exchange real-time data on water levels, flows, extent of snow cover, precipitation, and flood-prone areas, and
    IV. establish one common website as a regional communication platform for the exchange of data and information.
c) The 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 a 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:** Asecond HKH-HYCOS consultative meeting will be held to assess the progress and to advise on the operationalisatiion 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 on 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.

List of Abbreviations

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Centre
AFWA	Airforce Weather Agency
ALERT	Automated Local Evaluation in Real Time
APT	Automatic Picture Transmission System
BDP	Basin Development Plan
BMD	Bangladesh Meteorological Department
BWDB	Bangladesh Water Development Board
CMA	China Meteorological Administration
CNMC	Cambodia National Mekong Commission
CWC	Central Water Commission
DANIDA	Danish International Development Assistance
DCP	Data Collection Platform
DHI	Danish Hydraulic Institute
DEM	Digital Elevation Model
DHM	Department of Hydrology and Meteorology
DPTC	Disaster Prevention Technical Centre
EROS	Earth Resources Observation Systems
FEWS NET	Famine Early Warning System Network
FFWC	Flood Forecasting and Warning Centre
FMO	Flood Meteorological Offices
FRIEND	Flow Regimes from International Experimental and Network Data
FWC	Flood Warning Centre
GBM	Ganga-Brahmaputra-Meghna
GIS	Geographical Information Systems
GLOF	Glacier Lake Outburst Floods
GOES	Geostationary Operational Environmental Satellite
GPS	Geographical Positioning System
GTS	Global Telecommunication System
HKH	Hindu Kush-Himalayas
HMG/N	His Majesty's Government of Nepal
HYCOS	Hydrological Cycle Observing System
ICIMOD	International Centre for Integrated Mountain Development
IMD	India Meteorological Department
IHP	International Hydrological Programme

JICA	Japan International Cooperation Agency
JRCB	Joint River Commission of Bangladesh
LNMC	Laos National Mekong Commission
MRC	Mekong River Commission
NASA	North American Space Agency
NFFB	National Flood Forecasting Bureau
NGO	Non Government Organisation
NHSs	National Hydrological Services
NMO	National Meteorological Office
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
NWIS	National Water Information System
NWSRFS	National Weather Service River Forecast System
OFDA	Office of US Foreign Disaster Assistance
OHP	Operational Hydrological Programme
PARDYP	People and Resource Dynamics Project of ICIMOD
PMD	Pakistan Meteorological Department
PMS	Pakistan Meteorological Service
PRC	The Peoples Republic of China
QPM	Quantitative Precipitation Measuring
TAR	Tibetan Autonomous Region
TMDL	Total Maximum Daily Load
TNMC	Thailand National Mekong Commission
TU	Tribhuvan University
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USAID	United States Agency for International Development
USEDF	United States Environmental Diplomacy Fund
USGS	United States Geological Survey
VHF/HF	Very High Frequency/High Frequency
VNMC	Vietnam National Mekong Commission
WAPDA	Water and Power Development Authority
WECS	Water and Energy Commission Secretariat
WB	World Bank
WMO	World Meteorological Organisation
WHYCOS	World Hydrological Cycle Observing System
WUP	Water Utilisation Programme
WWW	World Wide Web