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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

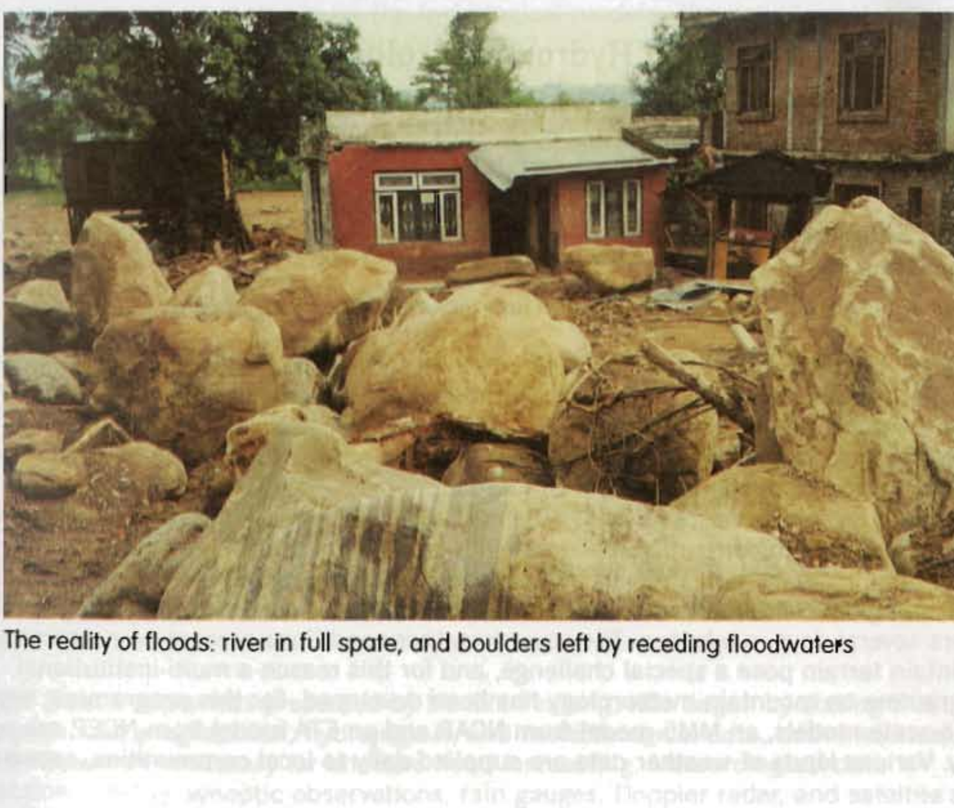
Dr. Grabs described the global and regional ARGOS networks and the ARGOS application platforms. The ARGOS DCS is a data collection and relay system that also provides global coverage and platform location. The system consists of in-situ data collection platforms equipped with sensors and transmitters 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


Mandira Shrestha/ICIMOD


Mandira Shrestha/ICIMOD

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

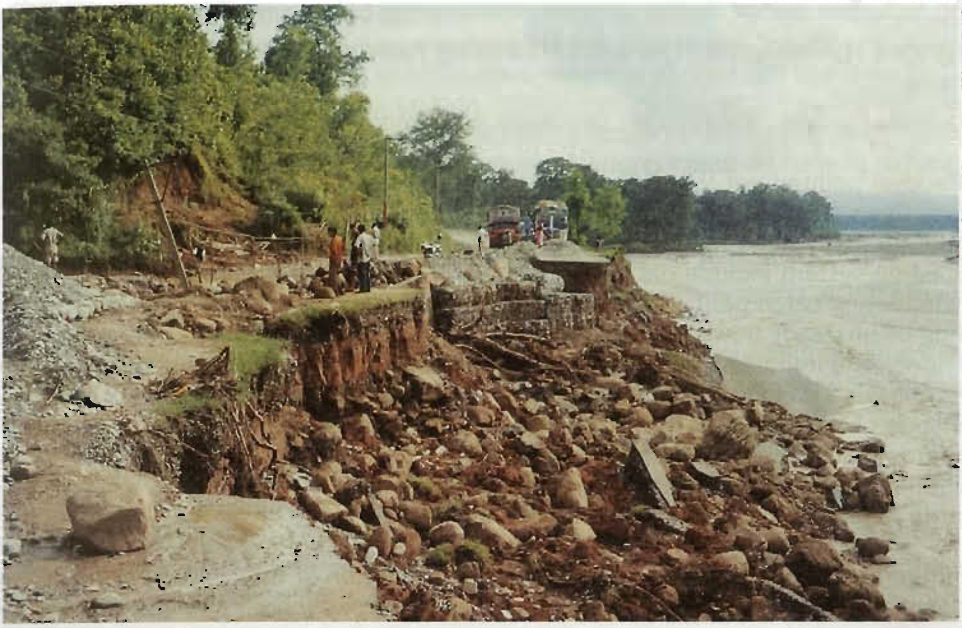
Akhtar Hossain, Director, Processing and Flood Forecasting, BWDB, Bangladesh

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



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. Paudyal 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 know-how 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