chapter four

# Day Three: Development of Technical Concepts for Flood Forecasting

## Technical Presentations on Flood-forecasting Systems - Part 11

During this session, the invited regional and international experts made technical presentations on floods and flood forecasting systems. A summary of their presentations is given below.

Chairperson: Dr. Qin Dahe, Administrator, China Meteorological Administration, Beijing, China

### Flood Forecasting in the United States – An Overview, *Richard W. Paulson, National Weather Service, USA*

Mr. Richard Paulson began his presentation with an introduction to the framework for river and flood forecasting in the United States. This framework is supported by the combined efforts of local and federal institutions. He stated that the framework for river and flood forecasting, in terms of scale, is measured on the basis of monitoring, forecasting, and warning. The National Weather Service River Forecast System (NWSRFS) and the Automated Local Evaluation in Real Time (ALERT) Systems are used to measure the state of rivers and flood forecasting. Mr. Paulson stated that at the institutional level, the NOAA/NWS provides river and flood forecasts for large rivers in the United States and also cooperates with numerous other federal, state, and local agencies and the public. Thus, there is a multi-agency effort in the US for large-river forecasting.

Mr. Paulson explained that the thirteen NWS River Forecast Centres use the NWSRFS, and multi-day river forecasts are prepared every six hours for 4,000 forecast points on large rivers. More than thirty-five NWSRFS models are used for large rivers, snowmelt, soil-moisture accounting, rainfall-runoff, channel routing, reservoir, and hydraulic models. The ALERT System is used for flash-flood rivers and the local governments install, maintain, operate, coordinate, and warn about potential floods. The National Hydrological Warning Council is organised by local government officials and this provides links among users of the ALERT system and it holds national and regional flood-warning meetings.

Mr. Paulson explained further that at the international level, the US maintains boundary and water treaties with Mexico and Canada. Canada has used the Geostationary Operational Environmental Satellite (GOES) extensively and Mexico is implementing the NWSRFS of NOAA/NWS. Furthermore, the US fosters an international NWSRFS user group and shares weather and river forecasting technology with the international community, bilaterally or through the WMO.

He concluded by stating that data and forecast information is available to the public and private sector in real time at little or no cost. The benefit is value-added analysis and processing is done at no cost to the taxpayer. GOES is accessible to the data collection platform (DCP) users at no cost. Users may operate their own receiving stations. The benefit is that there are about 14,000 DCPs in operation and these provide data at no added cost to NOAA or other users.

**A Geospatial Stream-flow Model for Flood Hazard Monitoring in Africa - *Dr. James Verdin, International Programme, EROS Data Centre, U.S. Geological Survey, U.S. Department of the Interior***

Dr. Verdin informed the participants how geospatial methods are being used to monitor hydrologic conditions in the countries of Africa. He explained that the Famine Early Warning System Network (FEWS NET) monitors the food security situation in 17 African states: Mauritania, Mali, Gambia, Niger, Burkina Faso, Niger, Chad, Ethiopia, Southern Sudan, Somalia, Kenya, Uganda, Tanzania, Malawi, Mozambique, Zambia, and Zimbabwe. Since the mid-1980s, drought has been a major concern, and vegetation index images from NASA and dekadal satellite rainfall estimates from NOAA have been used to supplement ground networks for agro-meteorological monitoring. The adverse consequences regarding food security due to major regional flooding were brought to the fore in the Horn of Africa as a consequence of the El Niño of 1997-1998. A new initiative at USGS emerged to apply accepted methods of hydrologic analysis on a geospatial basis, using satellite rainfall estimates, numerical weather model output, and digital maps of topography, land cover, and soils. NOAA increased the frequency of the production of rainfall estimates (blending satellite and ground station data) from dekadal to daily. Thirty years of daily rainfall grids for Africa were produced by the University of California, Santa Barbara, to create a corresponding history of modelled stream flows. Flood flow frequency analysis was applied to this time series for several hundred sub-basins of Southern Africa to provide context and a basis for evaluating modelled flows in the current timeframe. Quantitative three-day precipitation forecasts from the U.S. Air Force Weather Agency were accessed and ingested into GIS for use by the model to extend stream flow estimates into the near future. A website was established to present model

output geographically and in the form of daily time step hydrographs. The system was used to operationally monitor conditions in Mozambique and the upstream areas during the rainy season of 2000-2001. This can be updated with observed stream flows, where available, and as such is complementary to HYCOS stream-gauging networks. Dr. Verdin explained that all inputs for such a system are available on a global basis, and therefore it could be implemented for the basins in Asia.

**Monitoring and Data Dissemination - Developing a Framework for Flood Forecasting in the HKH Region - *Mr. Mark N. Landers, USGS***

Mr. Landers began with a brief history of the USGS stream-gauging stations in the USA. He stated that the first USGS stream- gauging station started in 1889. Today, there is a multipurpose network with over 7,200 stream-gauging stations.

Mr. Landers noted that the use of stream-flow information in terms of resource appraisal and allocation are for water supply planning and interstate compacts. In terms of design, the stream-flow information is used for reservoirs, bridges, roads, culverts, and treatment plants. The stream-flow information is also used for flood hazard warnings, preparedness, mitigation, response, and recovery. In terms of flood hazard planning, the stream-flow information is used for flood frequency analysis and flood plain zoning. It is also used for operations such as power production and navigation. With regard to water quality, stream-flow information is used for conditions and trends, contaminant transport, and the total maximum daily loads (TMDL). For in-stream conditions, stream-flow information is used for habitat investigations, in-stream-flow requirements, and recreation.

He informed the participants that the stream-gauging network is funded by the USGS and over 800 federal, states, and local cooperators. The stream-flow monitoring is a true government function and the USGS operates the network on behalf of all and has made the data freely available.

The stream-flow monitoring in standard gauging stations are stilling wells with intake pipes to rivers, float, tape, pulley, digital recorder and/or telemetry equipment to record the water surface. The stage sensors used are float and tape, submersible pressure transducers, submerged acoustic sensors, and non-submerged radar sensors. Some features for stream gauging are 2-path plus stage, SDI -12 compatible, on-board data storage, and on board q-computation.

Mr. Landers concluded his presentation by informing the meeting that the NWIS (National Water Information System) has been distributed to 50 different working databases. Each district maintains their own data. The hydrologic data stored contains site information, time-series (flow, stage, and water quality), water quality discrete samples, ground water site inventory, water use, and peak flow. The data gives information on 1.4 million sites, 3.5 million analyses for water quality, 1.2 million sites for GW Site inventory, and 850,000 station years for time series. He presented a summary of the flow of data to users.

Summary of flow of data to users

- Data collected by field and district offices
- Processed on district NWIS system
- Real-time data released to the web
- Data quality assured for release to the public
- Data released to the web

### Comments/Questions from the Participants

The participants asked questions, commented on the three presentations, and made suggestions during the question and answer sessions. In connection to Mr. Paulson's presentation of EROS monitoring in Africa, he was asked which components would be of use to the HKH region? Mr. Paulson stated that the data collection activity would be useful to the region. He further said that forecast systems such as the weather service forecast system would also be beneficial. It is, however, important for one to know more about the communication infrastructure in this area; this would be an important aspect to enable information gathering, etc. Virtually all aspects would be useful in this region. In the US there is a network of weather radars and satellites as well as gauge networks.

Questions were asked regarding flow measurement in terms of size of the stream by using the laser technique. Other questions concerned the maximum width of the channel and how much can experts accommodate this with the laser equipment. Mr. Landers explained that the key is in designing individual intakes so that it will get a static water representation and there is good information regarding how to do it. He stated that the laser technique is good for unsteady flows.

Mr. Guna Paudyal cautioned participants about the source of data they use. He stated that the data in Bangladesh came from 60-year old maps and thus they are useless. They are not accurate; large-scale infrastructure has not been put on the maps. He recommended that effort should be made by all to collect more accurate information and data.

### Concluding Remarks by the Chairperson

In his concluding remarks, Dr. Qin Dahe congratulated the presenters for their excellent contributions. He highlighted in particular the successful use of satellite-based systems used for flood forecasting and the use of the Internet to disseminate data and information to a large variety of users. He said that it became clear from the presentations that the success of information systems is to a large part based on the accessibility of data and information. He noted that even though the presentations mainly focused on cases and experiences in the United States and Africa, the techniques introduced can be very helpful to countries in the HKH region for flood forecasting. He then thanked all participants for their contributions.

## Break-out Session 1: Development of a Technical Concept for Flood Forecasting

***Chairperson: Dr. R. R. Kelkar, Director General, India Meteorological Department, New Delhi, India***

The first two break-out sessions were held on the third day of the meeting. Three groups were formed to discuss key issues relating to flood forecasting and information exchange. The details of the group outcomes and plenary discussions are presented below.

Dr. Grabs introduced the morning break-out session and proposed guidelines for discussions to the working groups. The Chairperson, Dr. Kelkar, set the timeframe for group discussions. The three groups were given three different topics to discuss.

Group 1 discussed on the topic of Cooperative Framework for Flood Forecasting focussing on cooperative links between hydrological and meteorological services in the region, existing regional cooperation mechanisms, and a conceptual framework for cooperation.

The expected deliverable for this group was an a concept outline for Regional Cooperation in Flood Forecasting with focus on institutional and practical aspects.

**Group 2** discussed on Technical Requirements with focus on required hydrological and meteorological data, satellite and radar information, use of real-time data, data transmission, network requirements, and models for flood forecasting.

The expected deliverable for this group was an outline of a technical system for regional flood forecasting

**Group 3** discussed on the topic of Dissemination and Use of Flood-forecasting Products with emphasis on regional exchange of data and information, regional forecasting products, dissemination of forecasts, communication facilities, institutional feedback, and river basins.

The expected deliverable from this group was an organisational concept for dissemination and use of flood-forecasting products

A summary of the group discussions is presented below.

### Group 1: Cooperative Framework

In their presentation, the group focused on three key areas, which were as follows:

- bilateral and regional agreements,
- cooperation in meteorological and hydrological services in the region, and
- the conceptual framework for cooperation.

#### Existing Bilateral and Regional Agreements

The group listed the bilateral agreements existing between countries of the region as follows.

*Nepal-India:* The exchange of real-time flood data has been taking place in a joint project using wireless radio. Thirty-seven stations have been established in Nepal and two sites have been selected for pilot real-time transmission. There is readiness to upgrade the system and provide more data. This will require more resources and capacity building.

*Nepal-Bangladesh:* A Flood Forecasting and Management Team has been constituted. The countries agreed to exchange river data and will be finalising priorities and stations for flood forecasting.

*Bangladesh-India*: Limited exchange of hydrological and meteorological data takes place regarding the Ganges, the Brahmaputra, and the Meghna. The two countries are in the process of increasing cooperation.

*Bhutan-Bangladesh/Bangladesh-China:* No agreement yet, but would like to have cooperation

*Pakistan-India:* The agreement in the Indus basin has been a model for bilateral cooperation. However, the exchange of and access to data is somewhat limited. For flood forecasting, there are morning telephone information sharing and 6-hourly radio contacts.

*Pakistan-China:* The representatives of these countries expressed their interest to enter into cooperation in information sharing.

**Group 1 Participants**

| | | |
|---|---|---|
| Dahe Qin | - | China |
| Kaylzang Tsering | - | Bhutan |
| Riaz Ahmad Khan | - | Pakistan |
| R.R. Kelkar | - | India |
| S.Y.B.I. Siddiqui | - | Bangladesh |
| K. Shida | - | WMO |
| Q.Z. Chaudhry | - | Pakistan |
| Anwarul Kabir | - | Bangladesh |
| Wolfgang Grabs | - | WMO |
| Rainer Loof | - | German IHP/OHP National Committee |
| Gabriel Campbell | - | ICIMOD |
| Adarsha P. Pokhrel | - | Nepal |
| Geerinck Lieven | - | MRC |
| Tauhidul Anwar Khan | - | Bangladesh |
| B. Bhadra | - | ICIMOD |

## Country Activities and Cooperation

Individual countries are pursuing activities in flood forecasting and data collection and dissemination. Some of the country activities are supported by international organisations. A summary of current activities of the countries is given below.

China

- Meteorology – in collaboration with WMO
- Flood forecasting for the Yellow River and the Yangtze River
- The Western Himalayas have very limited stations and data centres. These are mostly run by scientific institutions with no links to operational services
- Research cooperation with Nepal, Pakistan, and ICIMOD

There is a need to continue this cooperation (with Nepal, Pakistan, WMO, and ICIMOD). There is also a need to collect meteorological data from the Indian Ocean.

Bhutan

- Meteorology – Responsibility of the Ministry of Agriculture
- Hydrology – Responsibility of the Ministry of Trade and Industry (Power)
- Bhutan-India collaboration

The government is planning to set up a new hydrological system in collaboration with the Central Water Commission (CWC) of India.

Bhutan will seek membership of WMO.

India

- Valuable meteorological services provided routinely in the exchange of meteorological data and forecasting products on an international scale and in cooperation with WMO.
- Data sharing amongst hydrological services takes place in part between the states of India on rivers of common interest. Most flood forecasting for the territory of India is provided by CWC. Data sharing on an international basis has not been established in an institutionalised manner.

## Suggestions

- WMO should take the lead to develop approaches for a successful regional cooperation in hydrology and water resources and, in particular, with regard to the development of flood-forecasting systems in a regional context.
- Bilateral cooperation has been successful in many cases. There is a strong need to further improve bilateral cooperation.

- The development of a flood-forecasting system in the region also needs considerable advisory services. It was made clear that the responsibility for flood forecasting lies with the institutions within a participating country and that forecasting is prepared for its territory only. The sharing of data and information takes place by making the data and forecasting information available to other users.
- Real-time data is a basic necessity for flood-operational forecasting. Focus should be given to the development of regional capacity for real-time data acquisition and dissemination.
- Websites should be used and strengthened for sharing hydrological data and information.
- The group suggested the establishment of a regional website with voluntary contributions from each country. WMO is expected to encourage and collaborate in this effort based on it's experience in WHYCOS.
- Models need validating as they are often developed outside the region and have different processes and conditions.
- A workshop on hydrological model validation was suggested. WMO is requested to assist in the development and organisation of such a workshop.

## Further Information and Suggestions by the Group

The issues presented below were shared by the group and are therefore reported here.

*WMO:* WHYCOS is built on WMO's World Weather Watch (WWW) system which is a global system. The WHYCOS model is recommended as a basis for cooperation. Hope was expressed that existing bilateral arrangements become elements of regional coordination. There is a need to promote a political will for regional cooperation in flood forecasting within the countries of the region.

*Bangladesh:* Recommended linkages between existing bilateral components, i.e., to set up mechanisms for unrestricted flow of hydrological data. How much can be made open information on a website?

*Pakistan:* Recommended the establishment of a common regional website that is established and supervised by ICIMOD/WMO and to make certain information available to each government. The establishment of a model calibration programme was also suggested; there should not be barriers to pass on data but focus should be on data sharing during flood seasons at the initial stage. Advisory/data sharing and forecasting are the responsibilities of individual countries.

## Regional Cooperation for Flood Information

*Model calibrations by countries:* WMO should prepare a draft proposal with pilot sites for a regional data centre on humanitarian grounds.

*Conceptual framework for cooperation:* The group agreed on the use of the WHYCOS concept of WMO as the basis for the development of a regional cooperative framework. The group highlighted that the concept to be developed needs to be tailored to the specific needs of the HKH region. To this end, a concept paper should be developed as a basis for discussion at both national level and in the regional context.

### Additional Comments and Suggestions on the Group 1 Presentation

- There is an urgent need to set up a regional data centre to coordinate flood information sharing with the commitment of all governments.
- All initiatives must be implemented steadily so that it will take roots and be sustainable.
- Flood forecasting is the responsibility of governments. Therefore it is of the highest importance that only designated institutions with government recognition and authority should issue flood-forecasting information.
- There should be a very strong political will to ensure the implementation of what will be agreed upon at this meeting.
- If we keep waiting we will not save lives – we need to act now.

## Group 2: Technical Requirements

The group discussed the topic given to them with a strong focus on the following:

- network requirements,
- use of real-time data, and
- models used for flood forecasting in the region.

### Suggestions Made by Group 2

**a. Hydro-meteorological Data Required:** Preparation and sharing of an inventory of the hydro-meteorological data of the HKH region with the following parameters:

- location,
- station history,
- quality rating, and
- frequency of data collection.

**b. Satellite Information:** Regional Flood Information Centre for data acquisition, processing, and dissemination including:

- regional satellite data,
- real-time requirement, and
- frequency of data.

**Group II Participants**

| | | |
|---|---|---|
| 1. | K.P. Sharma | – Nepal |
| 2. | Gong Tongliang | – China |
| 3. | K.B. Thapa | – Nepal |
| 4. | Rajesh Yadav | – India |
| 5. | A.N.H Akhtar Hossain | – Bangladesh |
| 6. | J. Verdin | – USA |
| 7. | Muhammad Munir Sheikh | – Pakistan |
| 8. | Mark Landers | – USA |
| 9. | Guna Paudyal | – DHI |
| 10. | Li Tianchi | – China |
| 11. | Rupak Rajbhandari | – ICIMOD |
| 12. | P.K. Mool | – ICIMOD |
| 13. | Richard W. Paulson | – USA |
| 14. | Suresh Chalise | – ICIMOD |
| 15. | Michael Ernst | – USAID/ Dhaka |

**c. Network requirement:** Assessment of the existing network for flood forecasting (real-time network data) including:

- glacier floods,
- flash floods, and
- river floods.

**d. An extension of the network is required**

- An inventory of available models (access, linkage, and sharing) in use for flood forecasting
- Identify untapped resources

### Comments and Suggestions on the Group 2 Presentation

- Different regions have different mathematical models. Hence the inventory of available models (access, etc) will be different.
- List of stations should be shared
- Workshop on flood-forecasting models should be organised
- There is a need to find out what is available - quality, access, etc.

## Group 3: Dissemination and Use of Flood-forecasting Products

### Expected Results

- Exchange of data and information
- Communication facilities
- Dissemination and use of flood-forecasting products
- Institutional feedback
- Regional forecasting products
- Regional exchange of data and information

### Suggestions made by Group 3

**a. Dissemination - Modes of Dissemination:** Through focal points, through bilateral arrangements, and through both focal points and bilateral arrangements. (Target Groups: governments, specific departments, and the general public/flood affected areas)

**b. Methods of Dissemination:** Internet/e-mail/websites, telephones/fax, T.V. channels, and the print media

**c. Capacity Building:** Improved institutional arrangements, use of latest equipment, and organised training and field visits

**d. Organisational Concepts for Dissemination and Use of Products:** Timely dissemination of flood-forecasting information

### Comments and Suggestions on the Group 3 Presentation

This presentation attracted a number of comments and suggestions. The major comments and suggestions are given below.

- Radio dissemination is also important in areas where TV is unavailable.
- Capacity building should take place along with dissemination. However, if the information is disseminated directly to the population there might be, for example in India, a language problem.
- A community that has gone through a catastrophe is not the same. Communities are different and they act differently; some live on islands and some in the mountains, etc. Let individual governments deal with their communities.

**Group I1I Participants**

| | | |
|---|---|---|
| 1. | Liang Jiazhi | – China |
| 2. | S. B. Srivastava | – India |
| 3. | D.C. Goswami | – India |
| 4. | M. Akram Kahlown | – Pakistan |
| 5. | A.K.M. Shamsul Islam | – Bangladesh |
| 6. | Thanongdeth Insisiengmay | – MRC |
| 7. | Kamal Kishore | – ADPC |
| 8. | Dorji Namgay | – Bhutan |
| 9. | Asaduzzaman Khan | – Bangladesh |
| 10. | Chen Guangwei | – China |

- There is a lot of room for improvement in community information dissemination.
- WMO runs a programme that has a large capacity building component. Help could perhaps be provided to governments to develop some dissemination systems and provide technical advice to improve their dissemination methods.
- People should not be confronted with several sources of information, it confuses them and leads to lack of credibility.
- A regional centre should be given the mandate to disseminate flood-related information to the first-hand target group, which is the government. The centre could help the government to improve dissemination of information. However, some problems do exist despite various bilateral agreements.
- Dissemination through the Internet could be problematic in that most people in the villages do not know what the Internet is and even fewer have access to the Internet. However, we should use these technologies to our best advantage.
- Many countries have problems communicating flood forecasts to the communities. It would be most logical for a regional organisation to disseminate information.
- The large diversity in terms of communities and languages makes dissemination from a regional organisation very difficult.
- If information does not reach the people it is of no use. There is a need to sort out the language problems and other differences to save lives.

### Chairperson's Remarks

The chairperson congratulated all the groups for their valuable inputs to shape the framework and technical content for the proposed regional flood-forecasting information system. He noted, in particular, that the central governments and local governments are responsible for flood forecasting and response. It is therefore imperative that these institutions are supported to help their communities. In this respect, the ultimate responsibility for flood forecasting rests with national authorities. The decisions of these authorities will be largely improved by the proposed regional flood forecasting information system which will provide both national and regional meteorological and hydrological services.

## Break-out Session II – Development of a Strategy for Regional Cooperation in Flood Forecasting

***Chairperson: Mr. Riaz Ahmad Khan, Chairperson, Federal Flood Commission, Pakistan***

The second break-out session was held in the afternoon of the third day. The three groups that were formed to discuss the key issues relating to flood forecasting and information exchange in the morning were asked to continue in the same groups and follow-up the morning process by developing a strategy for regional cooperation in flood forecasting. The details of the group outcomes and plenary discussions are given below.

### Introduction

Dr Grabs introduced the afternoon break-out session and proposed guidelines for group discussions. Mr. Riaz Ahmad Khan, the Chairperson for the session, outlined the time required for the groups to complete their tasks and report back to the plenary for presentations. The groups comprising of the same members as in the morning carried out the afternoon tasks. The groups' tasks are outlined below.

Group 1: Framework for cooperation (country support, institutional cooperation, project development, coordination, mutual information, etc.)

Group 2: Data and information exchange mechanism (selection of priority basins, networks, observation platforms, hydrological and meteorological information, application of WMO Resolutions 40 and 25, exchange of technologies and know-how, transmission of data and communication)

Group 3: Operational regional flood-forecasting system (development of system components, forecasting products, etc.)

### Group 1 - Framework for Cooperation: Next Steps

The discussion of the group focussed on the development of a:

- conceptual agreement,
- working arrangement, and
- governmental framework.

#### Group 1 Suggestions

To this end, the group recalled its suggestions during the morning session to prepare a concept paper outlining the justification, proposed working agreement, regional framework, and deliverables of the proposed regional cooperation.

The group made the following specific recommendations/guidelines with regard to activities leading to the formulation of a model for a regional cooperative framework using the WHYCOS programme:

- not to transgress government domain responsibilities as a guiding principle,
- no forecasts to be directly disseminated to communities from the regional system,
- enhance/improve existing network and flood-forecasting capacities,
- establishment of an institutional framework by the participating countries (WMO as facilitator),
- development and establishment of flood information on a regional web-page, and
- establishment of a consultative panel to assist in the development of a governmental framework.

#### Comments and Suggestions on the Group 1 Presentation

The main recommendation was that a follow-up meeting be organised by WMO and ICIMOD.

### Group 2 - Data/Information Exchange Mechanisms: Next Steps

The first step was to identify the agencies in each country that would undertake data sharing. The group suggested that it is the responsibility of the government to make flood forecasts. As there are differences between flood-forecasting systems in these countries, standards should be developed to ensure effectiveness in forecasting for each country.

#### Group 2 Suggestions

a. Suggestions for data development and information exchange

- Set up a flood information centre
- A regional approach to exchange data to be adapted
- Identify focal points for data exchange
- Encourage bilateral exchange of data

- Establish uniform standards of data
- Flood data communication in NMO

### Comments and Suggestions on Group 2 Presentation

The main comments and suggestions made during the presentations by Group 2 is highlighted below:

- Establishment of specific stations in the major rivers; would it be of much benefit?
- Select specified stations to collect real-time data
- As a pilot project the most important stations should be used to collect real-time data.
- Details are too early to suggest; before consultation with the respective governments more specific suggestions cannot be come up with.
- Flood forecast information from other countries is not very essential. The need is to know the rain position; how much rain is coming and how that will affect our rivers, etc.
- The need is for meteorological data, snow data, river data, and precipitation data.
- Can we exchange hydro-meteorological data? The WMO Resolution 40 has been effective in this regard but WMO Resolution 25 has not been so effective.
- Data exchange mechanisms are required so that the flow coming into the country can be calculated
- There is a problem as data may not be uniformly available from all countries
- Create one accessible website where all information is available. This should be updated by a centre that is paid to do it.
- We should choose three pilot rivers: the Ganges, the Indus, and the Brahmaputra.
- Real-time collection should preferably be three-hourly and if not possible at least a daily update.
- Everything cannot change at once. We should let things develop over time.

## Group 3 - Operational Regional Flood-forecasting System: Next Steps

Group 3 discussed the topic at length and made the following suggestions.

### Group 3 Suggestions

- Review the existing system
- Improve information collection
- Encourage real-time data collection
- Encourage screening of data
- Improve processing of data (modelling)
- Improve flood forecasting
- Encourage the transmission/sharing of data
- Strengthen existing implementation systems
- Pass on information to flood-prone areas
- Build capacities of institutions dealing with flood forecasting

### Comments and Suggestions on the Group 3 Presentation

- There are many models on flood-forecasting systems, however they may not be suitable to all regional countries. Therefore various options should be taken into consideration.

- The consultative process between the European countries is working because they have a long history of scientific cooperation.
- Regional forecasting is difficult but at the same time it is necessary. At present, there is a lack of capacity and hence one cannot trust the data.
- The flood forecast and other related flood information would be available on the regional website and the information should be relatively reliable.

### Chairperson's Concluding Remarks

In his concluding remarks, Mr. Khan highlighted that the Group One had presented their work on the conceptual framework to be presented to the respective governments. The group suggested that the document should be developed by WMO and proposed that this should be circulated by November this year. They assumed that after getting feedback the framework would be likely to be adopted. Group Two raised an important point concerning the standardisation of the formats to be used for collecting, storing, and disseminating data in order to ensure uniformity. The chairperson noted that the meeting agreed to address this concern. He pointed out group three's concerns about the quality of information and the necessity of having reliable data transmitted from one country to another. He stated that every sovereign state at the meeting had demonstrated a spirit of mutual cooperation. He therefore believed that all the countries represented at the meeting would make an effort to disseminate quality data to other countries. He suggested that there might be some capacity building required in certain countries where the facilities may not be up to the mark. Mr. Khan reminded the participants of the importance of the discussions noting that the participants had discussed the institutional arrangements within their respective governments. He reminded the participants that a panel of experts would also be constituted to do the initial work towards a legal government framework for the implementation of whatever recommendations that the meeting makes. He also noted that the meeting had agreed that a regional webpage would be developed by March 2002. The focal point for the activities is the WMO and follow-up meetings will be held as and when appropriate. In conclusion, Mr. Khan thanked all the groups for their excellent presentations.

### Summary of Key Issues Raised on Day Three

There was a general acknowledgment regarding the increasing problems caused by floods and the havoc it wreaks on a large number of people in the region by destroying lives and property.

### Key Outcomes from Group Discussions

*Morning Session*

- Information is shared under different bilateral agreements on flood forecasting
- Flood information sharing rather than flood forecasting should be the starting point
- Regional cooperation for flood information is important
- Preparation of a proposal by WMO with pilot sites serving as regional data centres on humanitarian grounds was suggested.
- Preparation and sharing of an inventory of hydro-meteorological data of the HKH Region
- Establishment of a regional centre for data acquisition, processing, and dissemination
- Assessment of the existing network for flood forecasting (real-time data network)

- Capacity building to improve institutional arrangements and the use of the latest equipment will be essential
- Organisational concepts for dissemination and use of products to ensure effective dissemination of flood forecasts
- Information dissemination to the communities to be left to national governments

*Afternoon Session*

An Action Plan was suggested for the establishment of a forum for coordinating regional cooperation on flood information sharing. With HKH-HYCOS as the focal point the following steps were suggested.

- Preparation of a concept paper (justification, proposed working agreement, regional framework, deliverables to be prepared on a consensus basis) – **Draft 11/2001**
- Work on the model for flood data processing using the WHYCOS programme.
- Establishment of an institutional framework for networking by the participating countries (WMO as facilitator) by **5/2002**
- Development and establishment of flood information on a regional web-page by **3/2002**
- Establishment of a consultative panel to assist in the development of a governmental framework by **10/2001**

**Establish Data/Information Exchange Mechanism**

- To identify the national focal points for data exchange
- To exchange standards for data and information
- To exchange real-time data on water levels, flows, extent of snow cover, precipitation, and area of inundation
- To establish one regional website as an information exchange mechanism

**Establish a Priority of Basins: The Indus, the Ganges, and the Brahmaputra basins were identified as priority basins**

Operationalising a Regional Flood-forecasting System

- Review of existing system and improvement in information collection, transmission/sharing of data, and data screening
- Improve processing of data (modelling), flood forecasting, and strengthen existing implementation system
- Pass on information to flood-prone areas and capacity building