Transboundary floods: Regional Flood Outlooks and Community Based Early Warning Systems

23rd May 2017

Aditi Mukherji
Theme Leader, Water and Air

International Centre for Integrated Mountain Development

Kathmandu, Nepal

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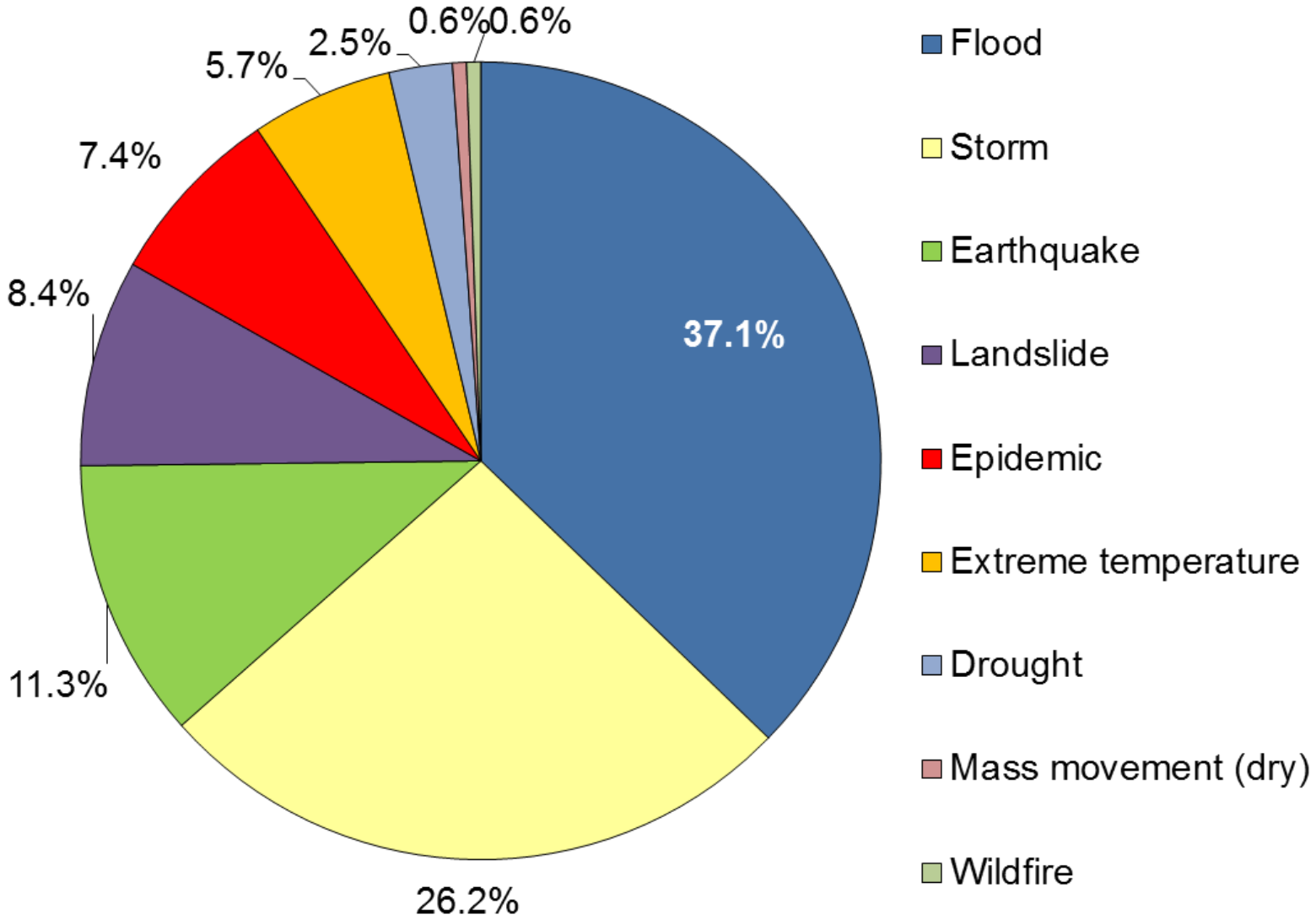
HKH is a multi-hazard environment



(Source: EM-DAT – The OFDA/CRED International Disaster Database)

One-third of disasters are floods

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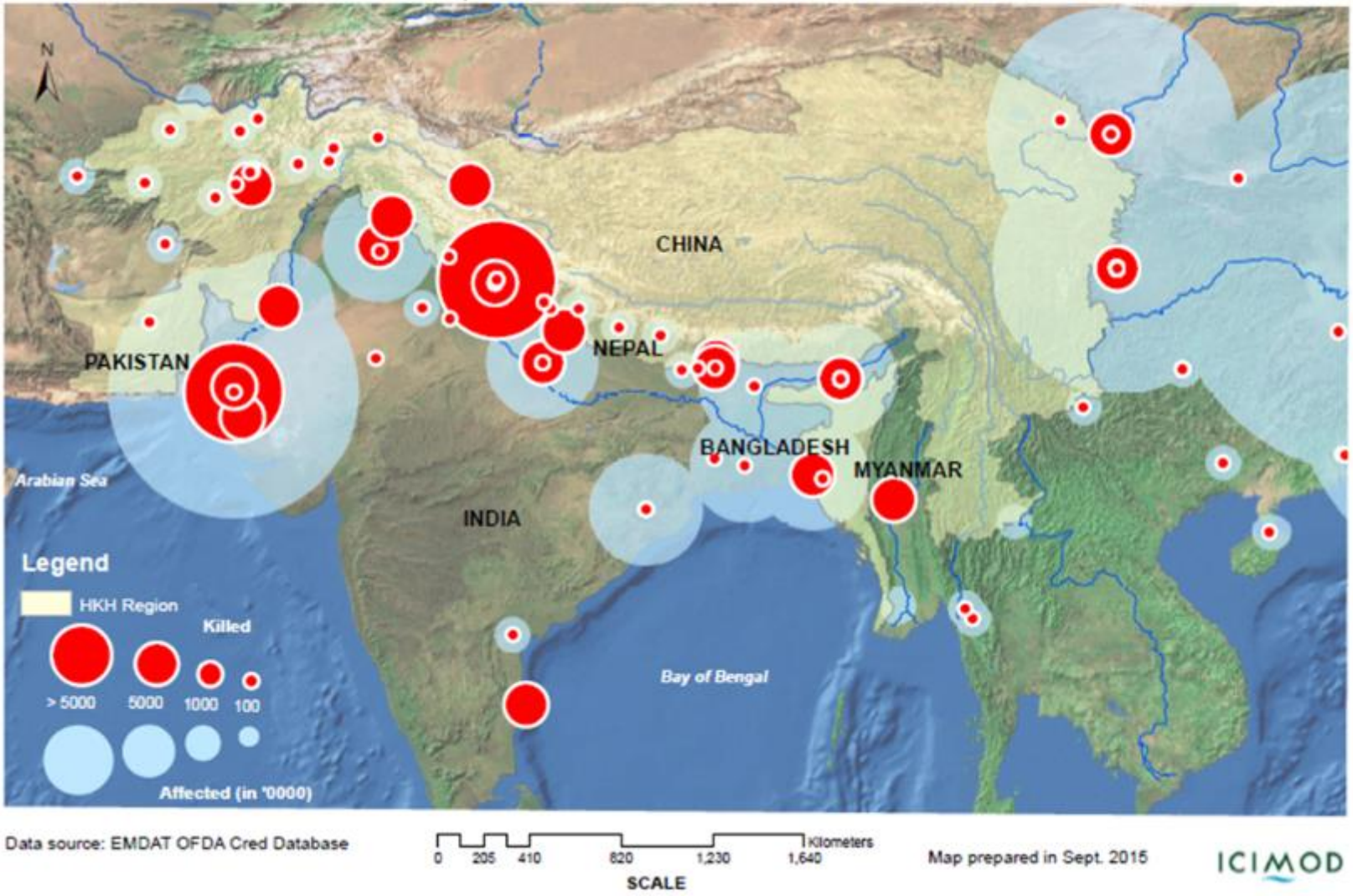
People killed and affected by floods in the Hindu Kush Himalayan region (2010–2014)



(Source: EM-DAT – The OFDA/CRED International Disaster Database)

Transboundary floods - shared vulnerability across national borders

Increasing trend of disasters in the HKH threatening sustainable development

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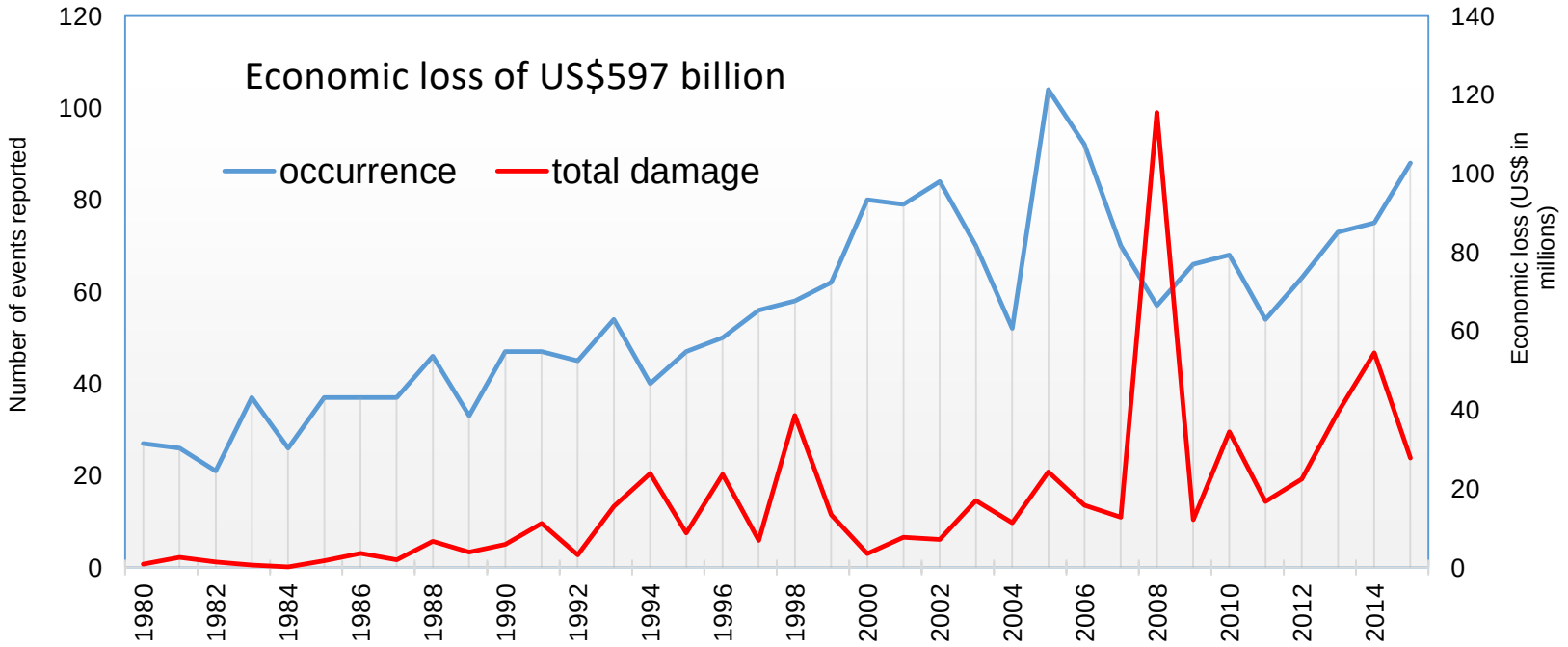

Source: EM-Dat Database

Why: climate change, population increase, haphazard urbanization, inadequate implementation of policies, plans, preparedness, investments, institutional capacities and governance arrangements.

Vulnerability across borders

- 9 April 2000: landslide blocked Yigong River, a tributary of the Yarlung Zangbo (Brahmaputra) River
- The outburst occurred on 10 June 2000 and created a huge flash flood of up to 1.26×10^5 m^3/s
- Extensive damage but no casualties in China
- India: 30 dead, >100 missing, >50,000 homeless, damage of $ 22.9 million US dollars

Upstream / downstream linkage
Need for transboundary cooperation

HKH-HYCOS: Setting up monitoring stations and establishment of real-time flood information systems

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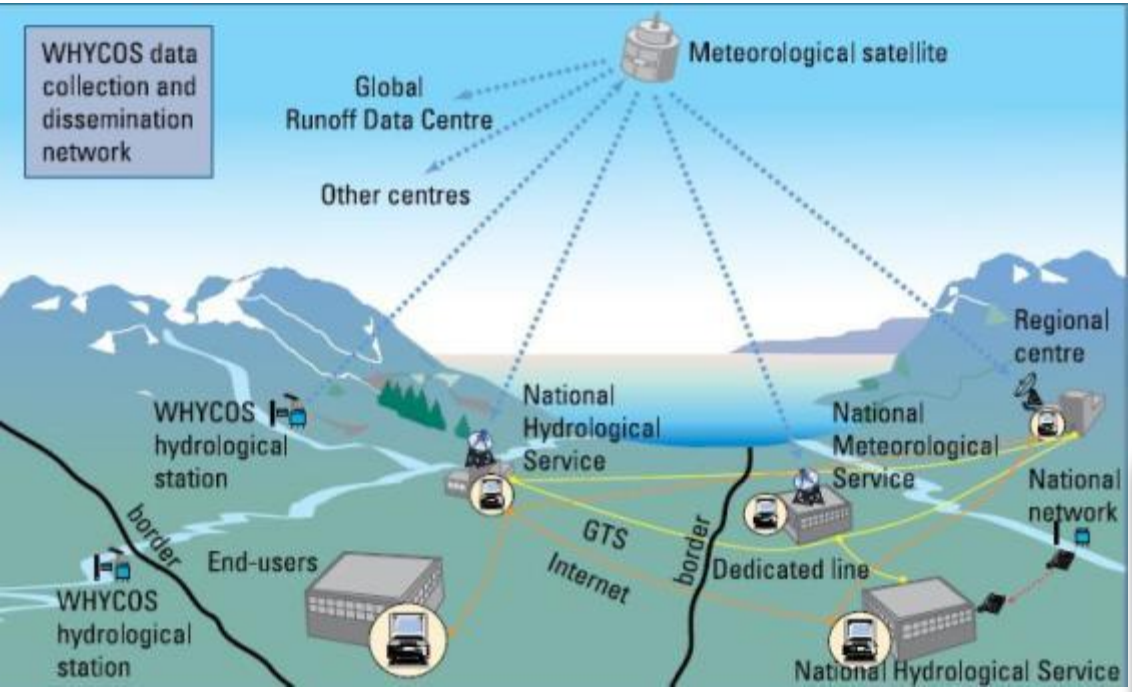
'Making Information Travel Faster Than Flood Waters'



Establishment of a Regional Flood Information System in the HKH-Region - Timely exchange of flood data and information through an accessible and user friendly platform

HYCOS is a vehicle for technology transfer, training, and capacity building

Modernization of observation network and real-time data transmission

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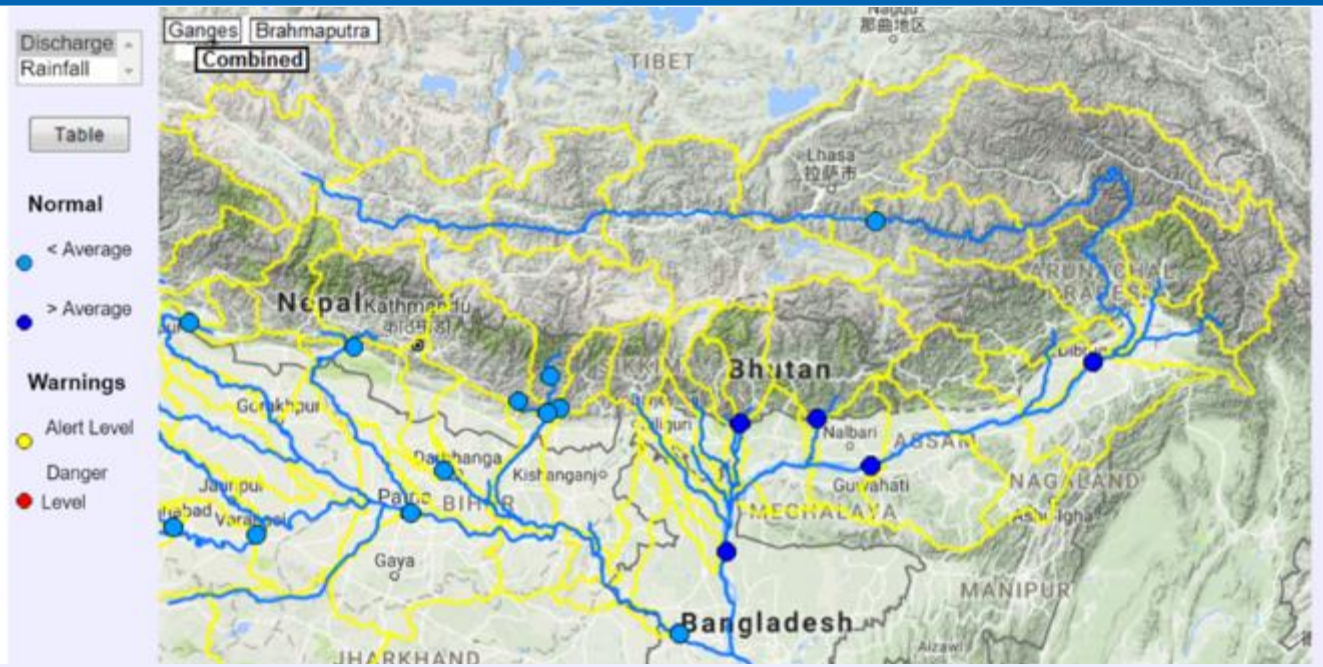
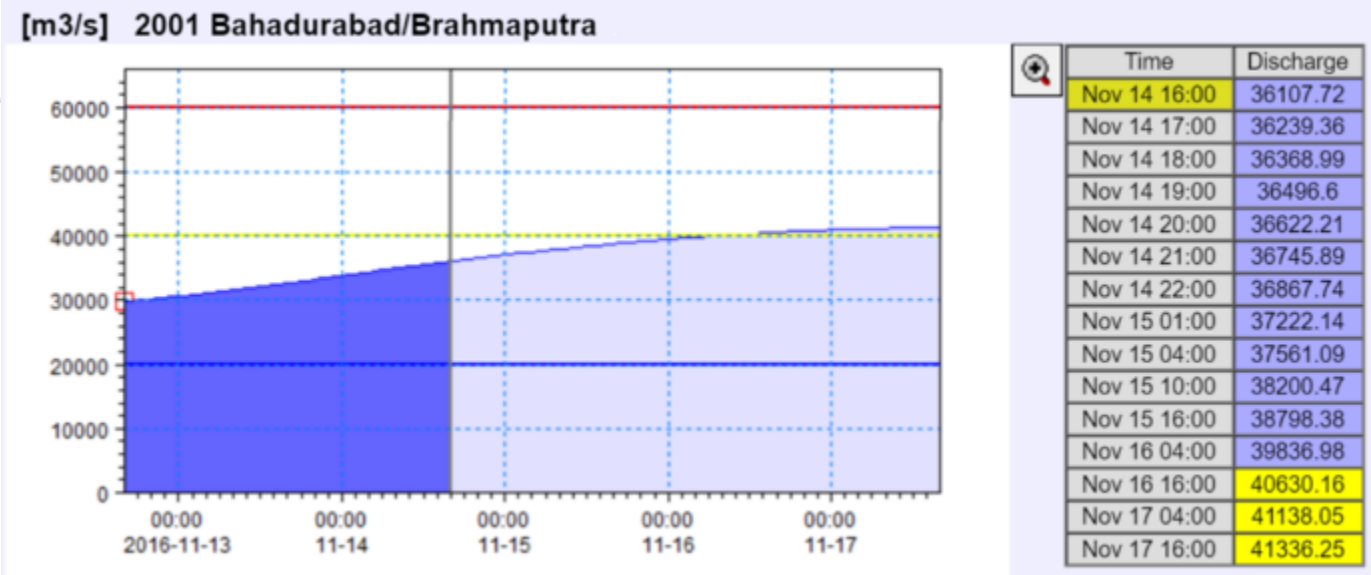
- 38 hydrometeorological stations upgraded in four countries: Real-time transmission of data (Bangladesh, Bhutan, Nepal, Pakistan)
- Access to > 300 Global Telecommunication Stations of WMO
- Use of latest technology for data collection and transmission (GPRS/GSM)

Regional flood outlook





Time	Discharge
Nov 14 16:00	36107.72
Nov 14 17:00	36239.36
Nov 14 18:00	36368.99
Nov 14 19:00	36496.6
Nov 14 20:00	36622.21
Nov 14 21:00	36745.89
Nov 14 22:00	36867.74
Nov 15 01:00	37222.14
Nov 15 04:00	37561.09
Nov 15 10:00	38200.47
Nov 15 16:00	38798.38
Nov 16 04:00	39836.98
Nov 16 16:00	40630.16
Nov 17 04:00	41138.05
Nov 17 16:00	41336.25

Developed a flood outlook system for the Ganges-Brahmaputra basin utilizing freely available data and weather forecasts

Mathematical model describing the **precipitation-runoff process** in the catchments and **hydrodynamic flood routing** along the river system.

Data/ tool used for modeling

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Observed data

- Rainfall (Bangladesh, Bhutan & Nepal)
- Temperature (Nepal)
- Discharge (Bangladesh, Bhutan & Nepal)

Topography

- STRM 90m images
- Cross section (India & Nepal –Koshi only)

Software/ tool

- ARC VIEW, Google earth
- Excel, Visual Basic, Python & R script

Satellite data

- TRMM Rainfall (3B42) & (RT)
- APHRODITE Temperature (V1204)
- Global ET(GDAS)
- MODIS Snow accumulation
- GFS Rainfall/Temp

Performance of model

Evaluation of flood forecast on Koshi

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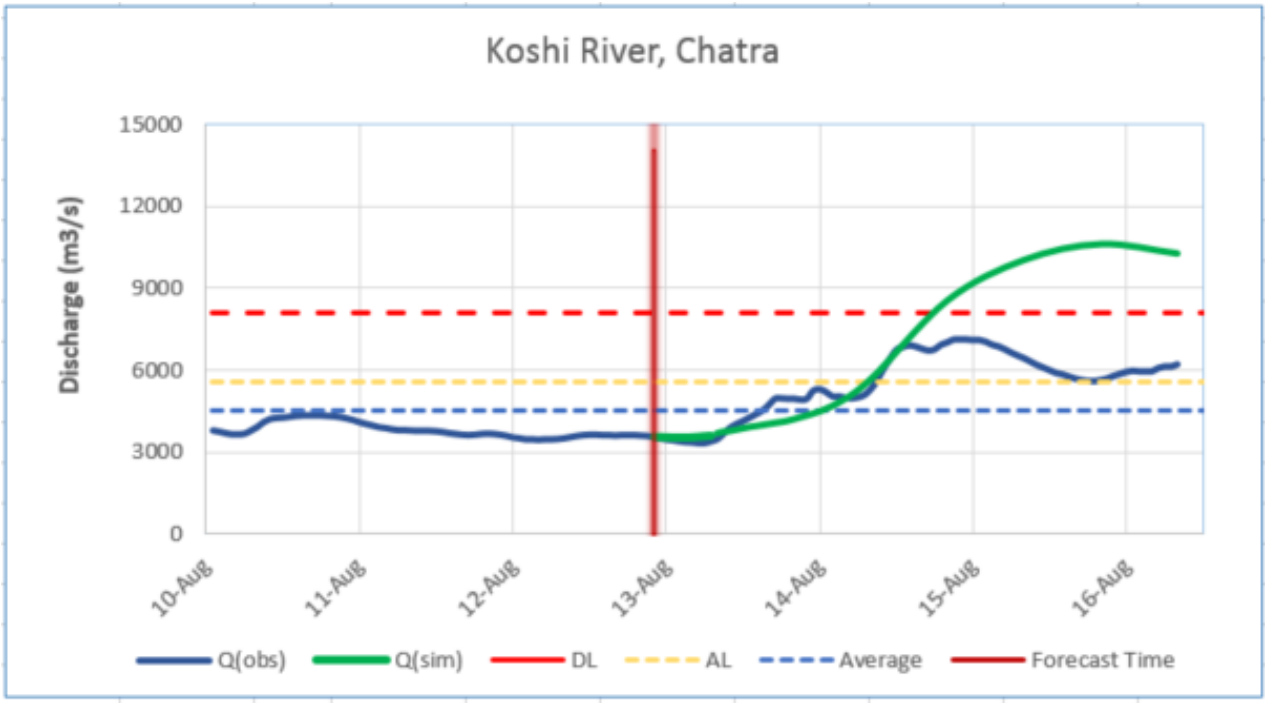

- 24 hour accuracy is very good
- Need to improve accuracy beyond 24 hours

- Flood outlook information is provided to the hydromet services to improve national flood forecasts for timely flood warning

Dissemination of information
Web-based charts and tables

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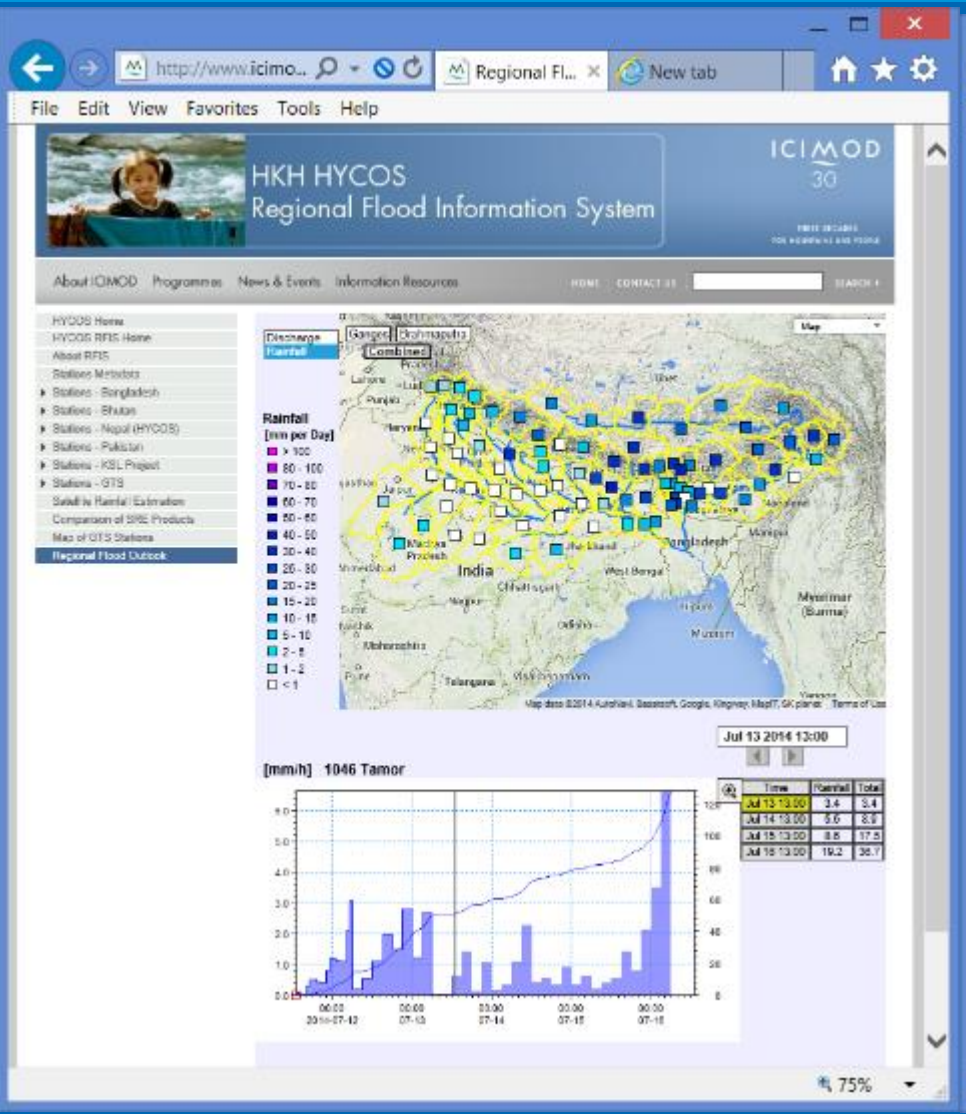

Lessons learnt

- Latest development in the technology has enabled us to develop flood information system at basin scale
- Utility of data and information for developing flood outlook demonstrated the value of real-time data
- Capacity building and training enhanced cooperation and partnerships
- Limited networks in the region – need further strengthening and sharing
- Flood forecasting and warning needs to be integrated with the disaster risk management activities for an effective end to end flood early warning system
- Efforts need to be made for risk communication, awareness and better preparedness
- Institutional mechanisms for provision of flood warning to communities need to be strengthened
- Regional cooperation is a long term process which requires building trust and confidence between and amongst countries

Moving ahead: User phase

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- Strengthening of end user interface as a means for adapting to changing climate
- Utility of data and information
- Education, capacity building and training
- Strengthening national flood forecasting capabilities
  - Flood forecasting models and tools
  - Flood outlooks at national and regional levels
- Observation networks
  - State of the art technologies for expansion
  - Discharge measurements
- Strengthening international and regional cooperation

Significance of CBFEWS

Reaching the most vulnerable communities

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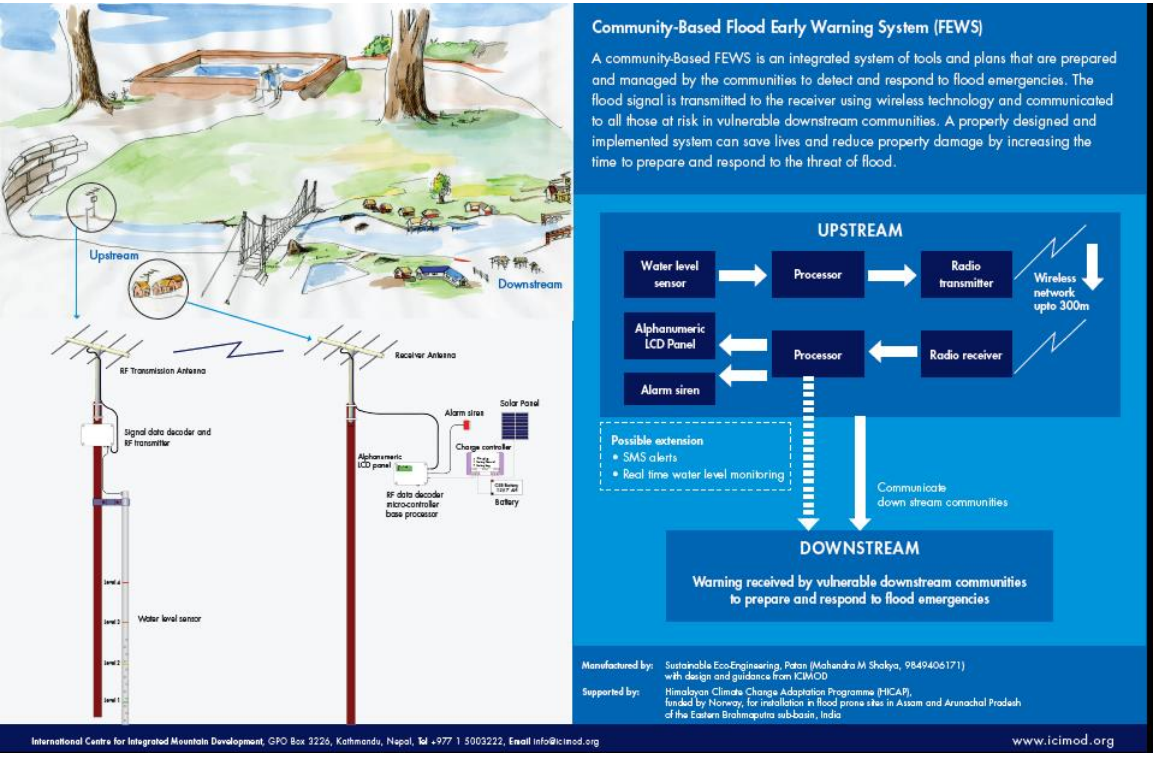

1. People centered
2. Upstream/downstream linkage
3. Almost real time information
4. Provide guidance on how to act on warnings
5. Innovative use of low cost ICT tools

CBFEWS in HKH

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Pakistan

Indus basin

Nepal

Ratu Khola, Koshi

Afghanistan

Baghlan and Badagshan (potential)

India

Jiadhal and Singora rivers, Assam

Four elements of CBFEWS

More than just a prediction…

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1.
RISK KNOWLEDGE AND SCOPING

Systematically collect data and undertake risk assessments and scoping

2.
COMMUNITY BASED MONITORING AND EARLY WARNING

Install early warning instrument and flood monitoring by upstream communities

3.
DISSEMINATION AND COMMUNICATION

Communicate flood information by upstream and provide early warnings to downstream communities

4.
RESPONSE CAPABILITY AND RESILIENCE

Enhance community response capabilities and build resilience

http://www.unisdr.org/2006/ppew/whats-ew/basics-ew.htm

Enhanced technology

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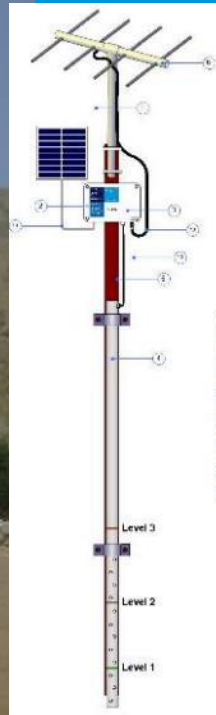
With wire

Wireless technology

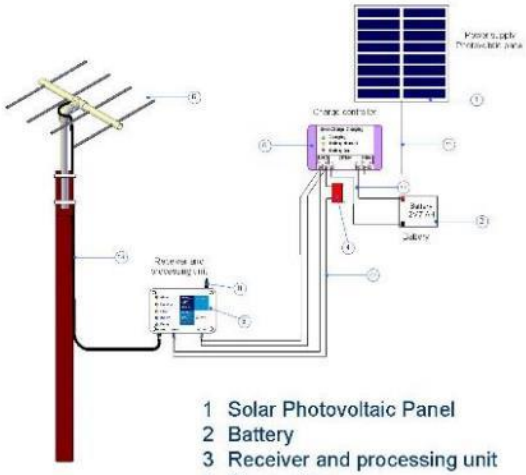
Telemetry based

Community Based Monitoring and Early Warning



1 Solar Photovoltaic Panel
2 Battery
3 Signal Processor and data transmitter
4 Water level sensor
5 RCC column
6 Transmitter Antenna
7 Cables
7.1 Photovoltaic charging Cable
7.2 Sensor cable
7.3 Antenna cable

Transmitter unit



Receiver unit

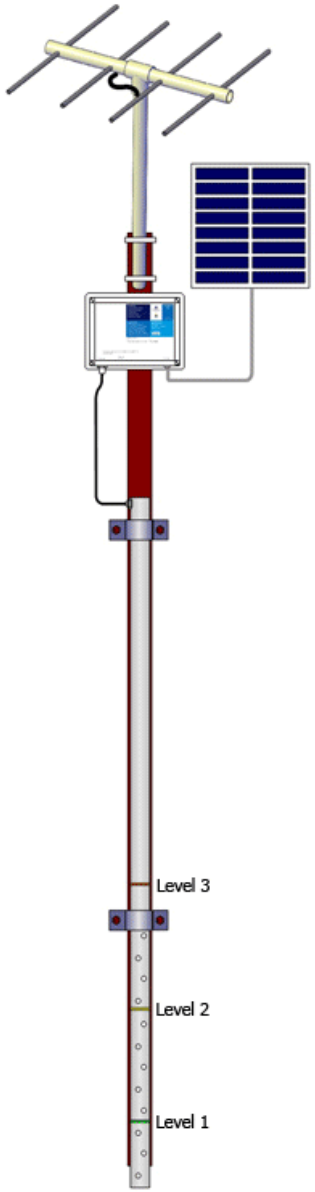
1 Solar Photovoltaic Panel
2 Battery
3 Receiver and processing unit
4 Alarm siren
5 Charge controller
6 Receiver Antenna
7 Cables
7.1 Photovoltaic charging Cable
7.2 Battery Cable
7.3 Alarm siren Cable
7.4 Antenna cable
8 GSM Antenna

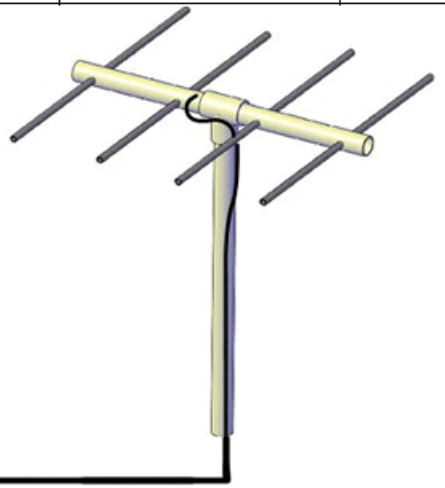
Function

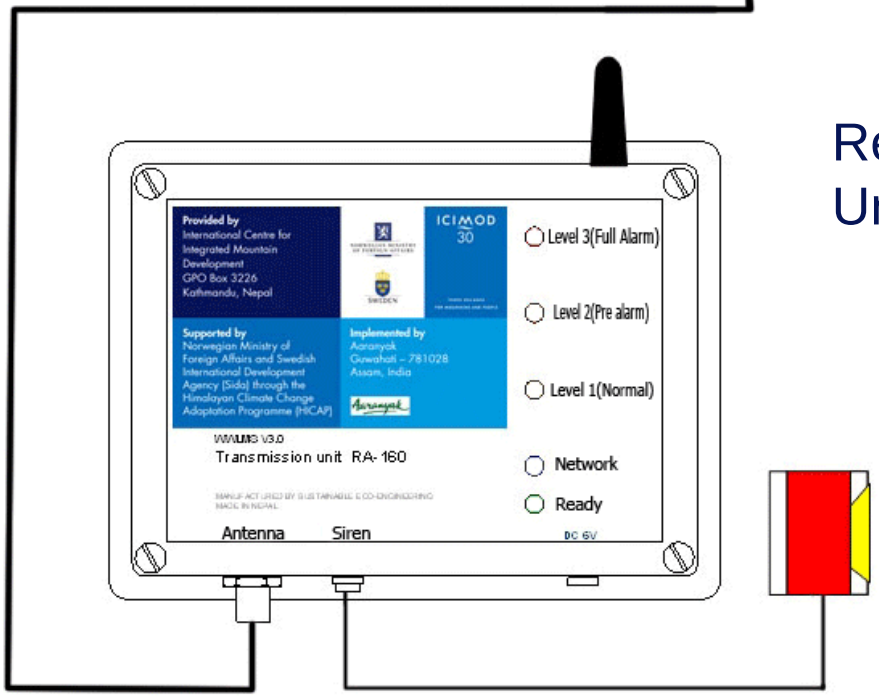
UPSTREAM			DOWNSTREAM	
Warning Level	Color of LED light	Siren signal	Interpretation	Action
Level 1		No siren	High probability of flood	Be Alert and Standby
Level 2		Beeping sound	Flood is inevitable in few hours	Be Prepared
Level 3		Continuous ringing	Flood is coming	Evacuate for safety

PEOPLE

Transmitter Unit







Receiver Unit

CBFEWS with telemetry: Conceptual Diagram

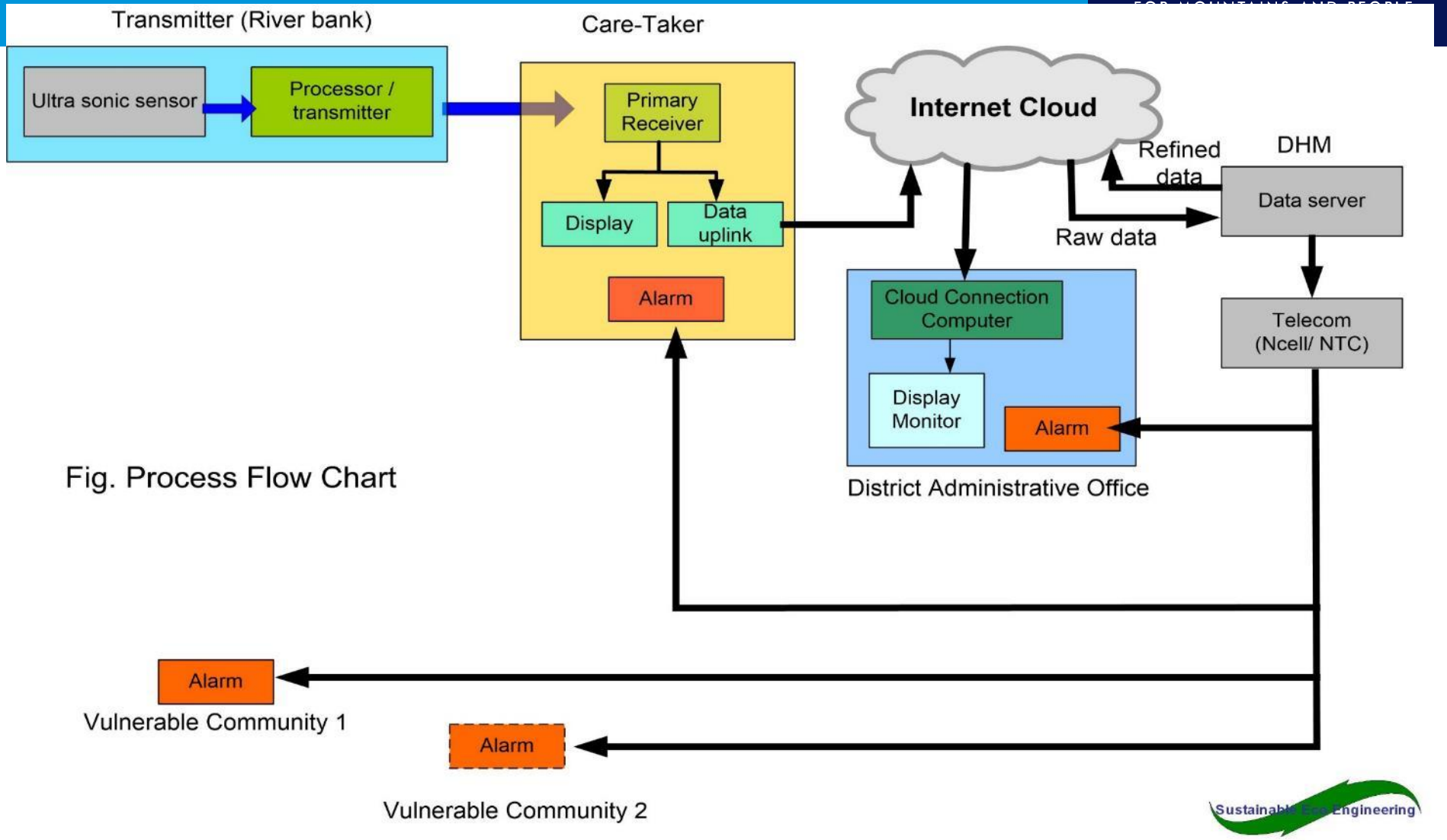
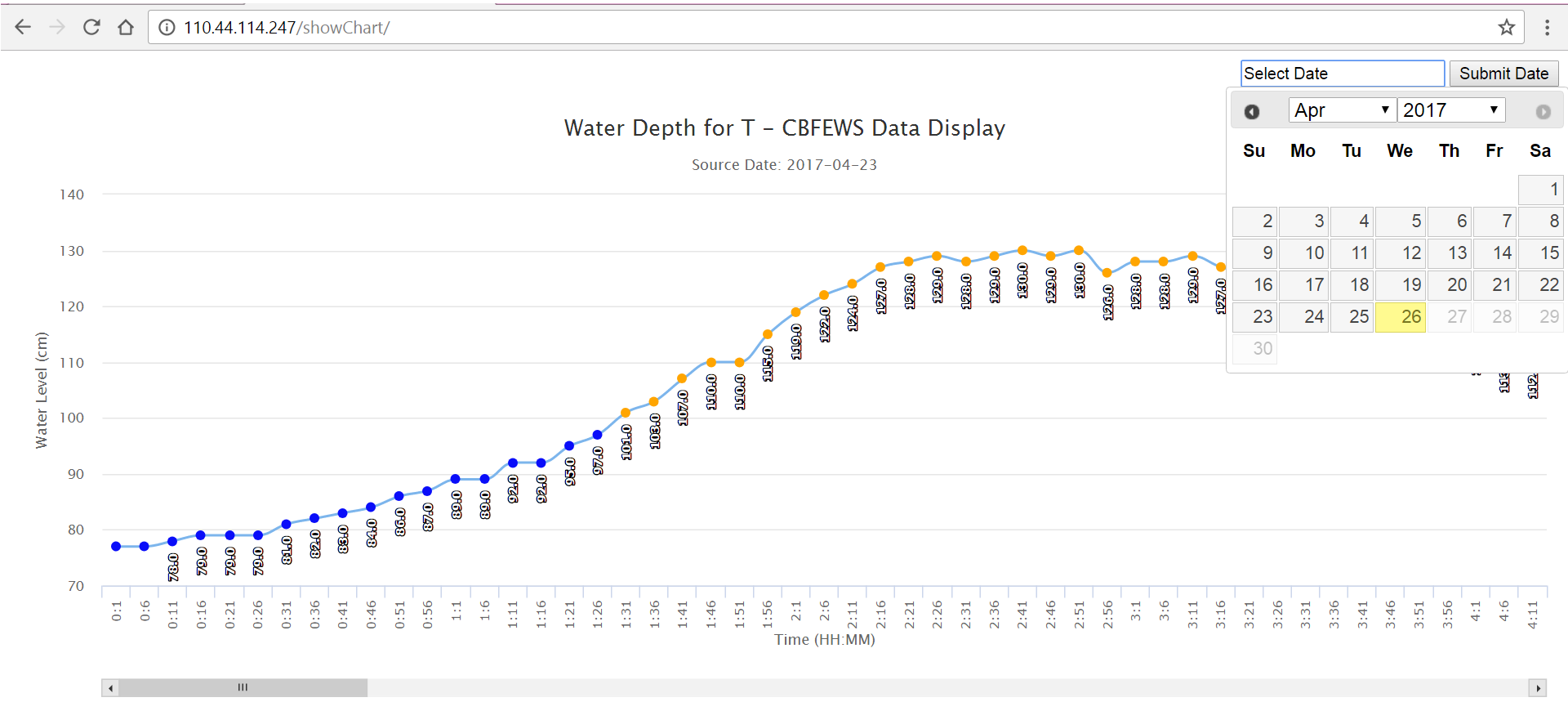


Fig. Process Flow Chart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Select Date
Submit Date
Apr
2017
Su Mo Tu We Th Fr Sa
Water Depth for T – CBFEWS Data Display
Source Date: 2017-04-23
Water Level (cm)
Time (HH:MM)

Hands-on training on CBFEWS

(Conducted as per demand)

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Training methodology:

The Assam Tribune
The Riviera Kharguli
Search Past Week GO
Guwahati, Sunday, July 03, 2011
Home Main Weather Backissues Epaper Dainik Asam Contact Us

Community-based flood early warning project

Staff Reporter

GUWAHATI, July 2 – A community-based flood early warning system in a flood-prone area of Assam could bring relief to scores of people. The project, with an aim to reduce flood risk through training and awareness, is being implemented by a team from the environmental group Aaranyak with support from the International Centre for Integrated Mountain Development (ICIMOD).

The project includes Flood Early Warning Systems that can be operated and maintained by communities in four highly flood prone villages of Dhemaji district. Following their installation, the system has been successful in warning villages on at least three occasions helping save precious lives and property, said PJ Das, who heads the Head of Water, Climate and Hazard Programme of Aaranyak.

Das mentioned that the devices were able to sound warnings about the rise in the river's water level and thus enable the villagers to prepare for the oncoming floods. "Once a flood warning is set off in a village at any risk level, information about the water level rising in the upstream can be disseminated from that village through mobile phones to selected individuals in downstream settlements," he said.

Villagers who have become acquainted with the system have noted that if warnings can be propagated to downstream areas after the sounding of the alarm in an upstream village, a 'lead time' of about 90 minutes can be available for residents in downstream areas.

After successful use of the system last year, the instruments were withdrawn in November 2010, but reinstalled in May this year. The unit at Dihiri has already given flood warning in the morning of June 4 when there was an alarming rise in the river's water level.

Das said that the system has been demonstrated to communities and government officials, and his team wants it to be replicated by the State government and NGOS on a wider scale. It is a tested and proven system, and benefits easily outweigh the cost of equipment and installation, he said.

To consolidate the adaptation and mitigation efforts, Aaranyak has also organised awareness meets in the flood-prone areas and sensitized local communities about dealing with flash floods.

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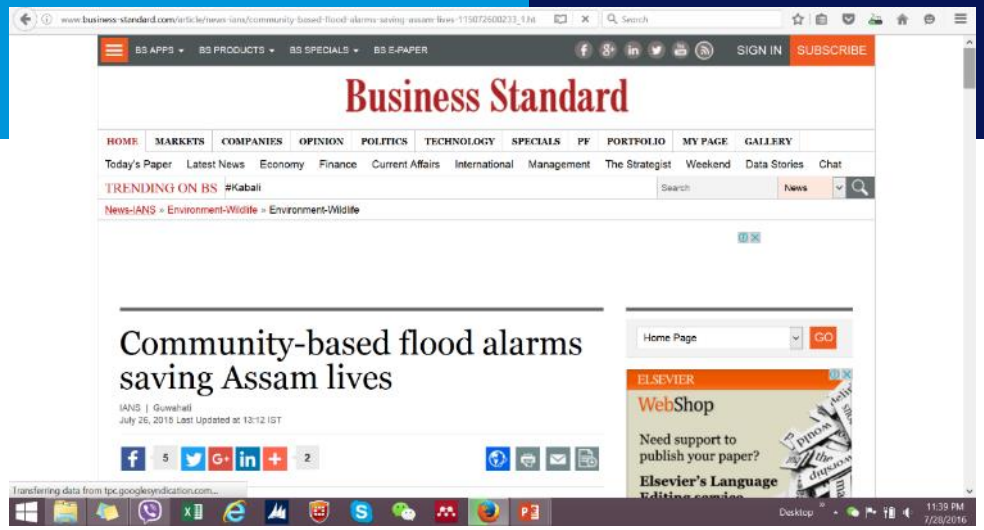


Early warning can minimize the devastation of flash flood

By Monoj Gogoi

DHEMAJI, Oct 3: The frequency and intensity of flash flood is rapidly and noticeably increasing year by year in the eastern parts of Assam and Arunachal Pradesh, particularly in the Lakhimpur and Dhemaji districts of Assam and Lohit, Lower Subansiri and Anjaw districts of Arunachal Pradesh.

Many people believe that the root cause of this rapid increase in flash flood in these regions may be attributed mainly to erratic rainfall in the upper catchment areas due to climate change or climate variability.

The flash flood is different than the normal monsoon flood as it carries huge amount of water loaded with debris and sediment to the plains affecting people, livestock, crops land etc. The energetic flash flood is difficult to deal with and more hazardous than a typical monsoon flood because of its suddenness without giving much indication before. The north bank tributaries of the Brahmaputra are flashier and more prone to the flash flood for high gradients.

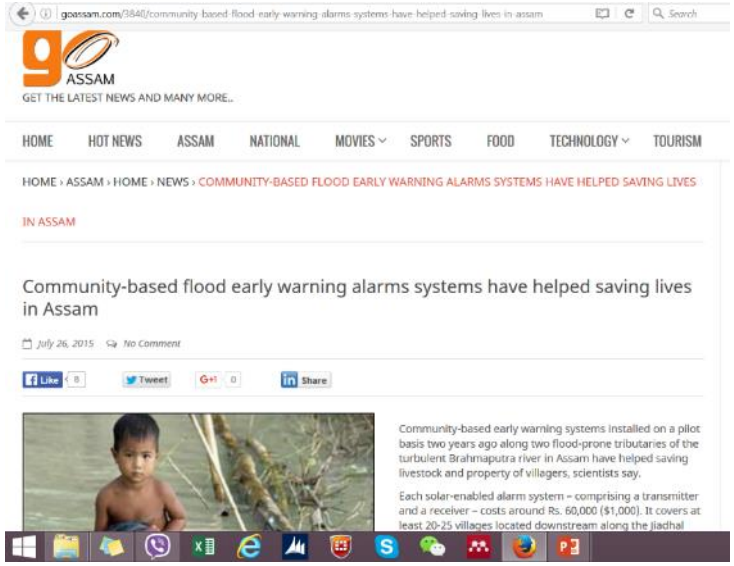
River researchers believe that the devastation of such flood could be minimized by effective flood forecast and early warning system. Dr. Partha J Das, a river researcher and a renowned environmentalist told this correspondent that in this context it was very important to monitor weather system, especially in synoptic situation that cause heavy rainfall in the upper catchment in Arunachal Pradesh hills as well as the geomorphological conditions in upper catchment. Based on such information forecast and warning of flash flood could be provided.

He also suggested that with high resolution digital satellite real time data, it was highly possible to monitor the weather system and rainfall events and catchment condition even in inaccessible hilly terrains.

Criticizing the present approach of the government to flood management he told it was reactive in nature. To deal with, possibilities of such events should be disseminated from upstream to the potentially affected people in the downstream in the form of flood forecast and warning, especially for the north bank tributaries of Assam. While some amount of qualitative flood forecast was provided by the Central Water Commission (CWC) for the Brahmaputra, there was hardly any forecast or warning for its tributaries, he added.

It may be mentioned that a community based flood early warning system has been introduced experimentally in some of these rivers, particularly in the Jiadhal river in Dhemaji by Aaranyak, a Guwahati based biodiversity conservation NGO in collaboration with Kathmandu based ICIMOD over last few years. This system comprises of a simple flood gauge and a related instrument that produces a siren as water level rises in the river. And this flood warning is disseminated from the upstream to downstream through a community network using mobile phone. 'This system of providing flood warning has become popular and useful to the community', Jarman Doley, a flood affected by the Jiadhal told.

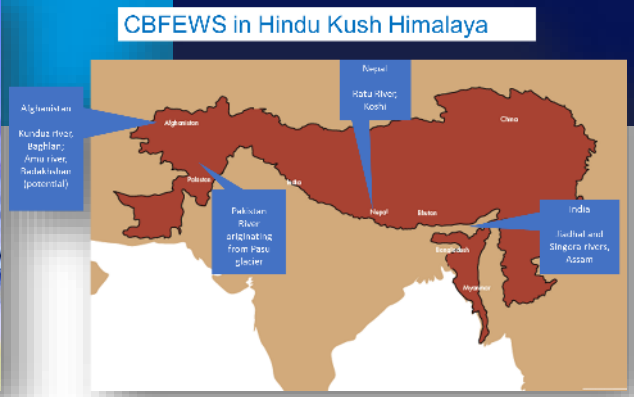
Harish Pegu, a flood control activist from Dhemaji told 'It is very essential that government should promote such efforts and take up such effort on a larger scale in all the rivers of the eastern Himalayan region.'



Major highlights

Saved assets, including livestock, worth USD 3,000 in Sept 2013 flood, Dihiri, Assam, India

Awarded UNFCCC's Momentum for Change 2014 Lighthouse Activity Award in COP 20



Out scaled in the HKH region (Nepal, Afghanistan, and Pakistan)

Engaged with local and state level disaster management authorities for joint implementation and upscaling

Managing transboundary floods

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- Hi-tech approach of regional flood outlook and sharing of real time information across boundaries
- Can be coupled with low-tech community based approaches for reaching out to the most vulnerable communities
- For successfully managing transboundary floods
- Regional co-operation is not only about countries cooperating with each other; but it can also mean communities across the border sharing information and help each other cope

Thank you

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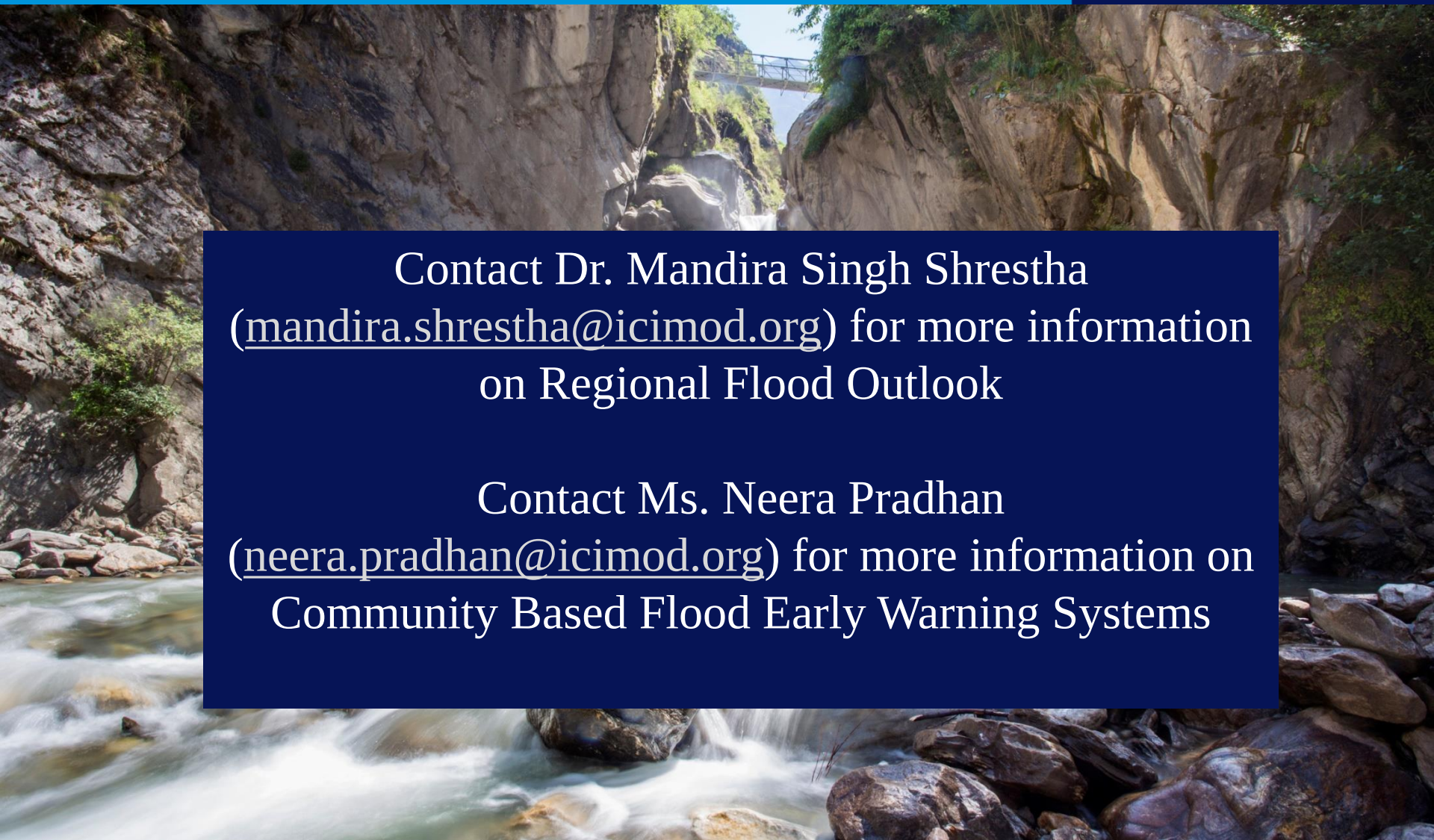

Contact Dr. Mandira Singh Shrestha (mandira.shrestha@icimod.org) for more information on Regional Flood Outlook

Contact Ms. Neera Pradhan (neera.pradhan@icimod.org) for more information on Community Based Flood Early Warning Systems