

# Regional Flood Outlook for Reduced Flood Risk in the Indus, Ganges, and Brahmaputra Basins

## Background

Every year floods ravage large swathes of the Indus, Ganges, and Brahmaputra (IGB) river basins in the Hindu Kush Himalaya (HKH), killing thousands of people and affecting the livelihoods of millions (Figure 1). Flood disasters undermine progress made towards achieving the United Nations Sustainable Development Goals. Monitoring the likelihood of flood occurrences in these river basins using state-of-the-art tools and technologies can improve preparedness and minimize loss of human lives and livelihoods.

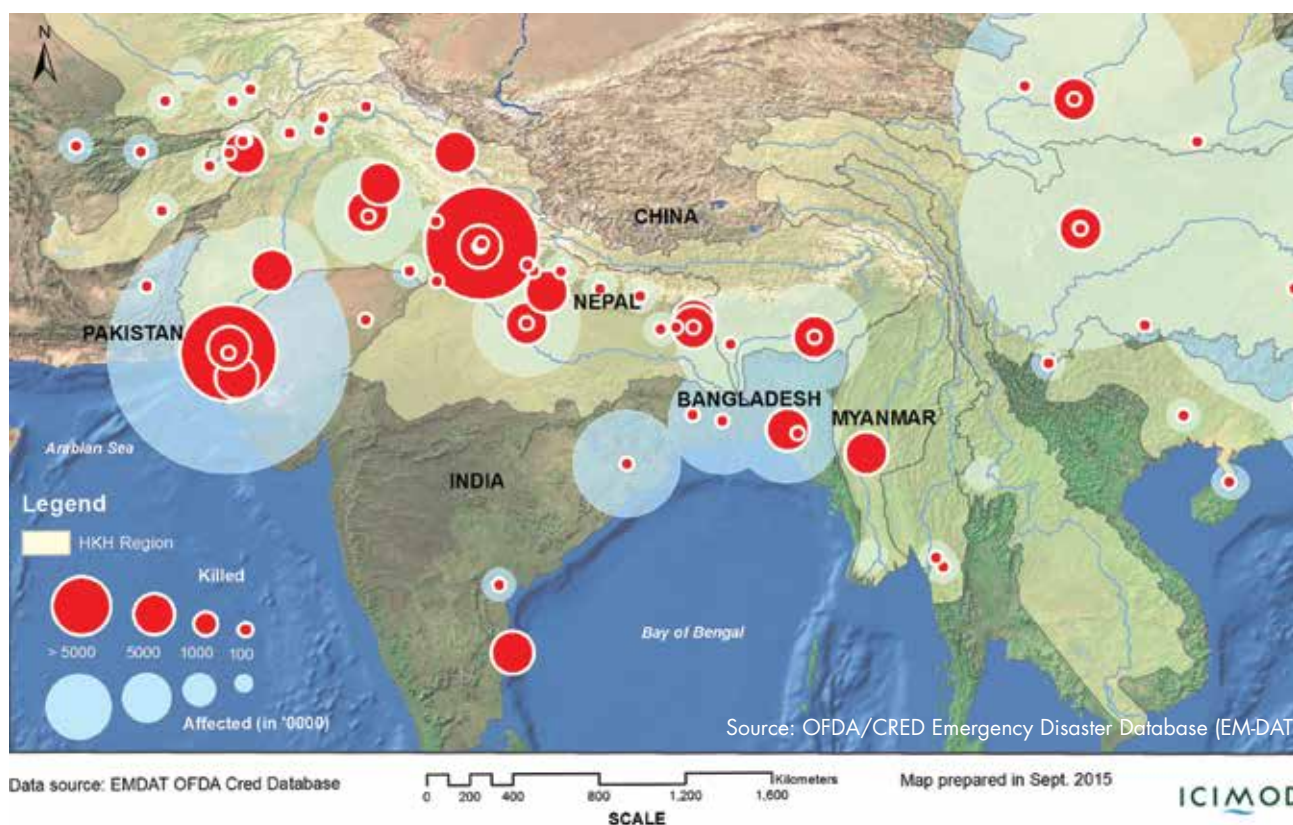
There is growing recognition that regional cooperation among Bangladesh, Bhutan, China, India, Nepal, and Pakistan can help avoid or minimize transboundary scale flood catastrophes in the IGB basins. Regional cooperation in generating and sharing hydro-

meteorological data and information, particularly for flood forecasting, is necessary since the bilateral river treaties and data sharing agreements in place, although necessary, are not sufficient.

## Regional Flood Information System

The International Centre for Integrated Mountain Development (ICIMOD) has partnered with national hydro-meteorological agencies in Bangladesh, Nepal, Bhutan, and Pakistan and with the World Meteorological Organization (WMO) and provided technical expertise to establish a regional flood information system (RFIS). The RFIS provides a platform for sharing near real-time hydro-meteorological data from over three dozen stations in the IGB basins to improve flood forecasting and enhance resilience to flood disasters.

Figure 1: Spatial extent of flood disasters in the HKH from 2010 to 2014





RFIS is a web-based system that enables multilateral exchange of near real-time hydro-meteorological data and information on parameters such as water level, rainfall, and temperature at selected stations along the rivers of the IGB basins for use in developing products such as flood forecasts, outlooks, and early warnings.

## Regional Flood Outlook

ICIMOD has developed a regional flood outlook system for the Ganges and Brahmaputra basins in the HKH region. It is also prototyping a flood outlook system for the Indus basin, focusing on the Chenab River.

The hydrological-hydrodynamic model based regional flood outlook is powered by Mike 11, a river modelling system, and uses numerical weather prediction data and satellite-based rainfall and snow cover estimates as primary inputs for predicting hydrological flows (Figure 2). Other dynamic and static data such as historical climatological data are used to determine whether such flows will breach flood levels. This outlook has the ability to assimilate the latest flow observations from real-time stations and adjust simulated and observed trends to continuously optimize the accuracy of future forecasts. Three-day flood outlooks produced for 21 nodes in the Ganges Brahmaputra (GB) basins were successfully tested when intense rainfall occurred across the Himalaya through 14–16 August 2014 (Figure 3).

Figure 2: Schematic structure of the flood outlook system

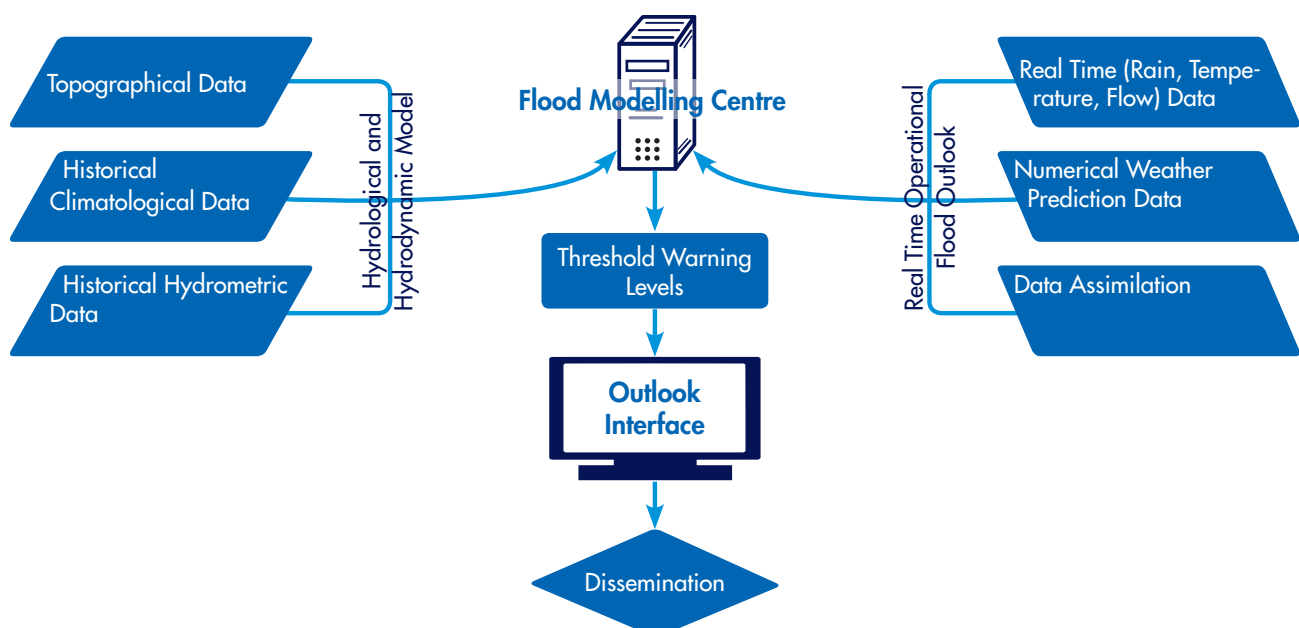
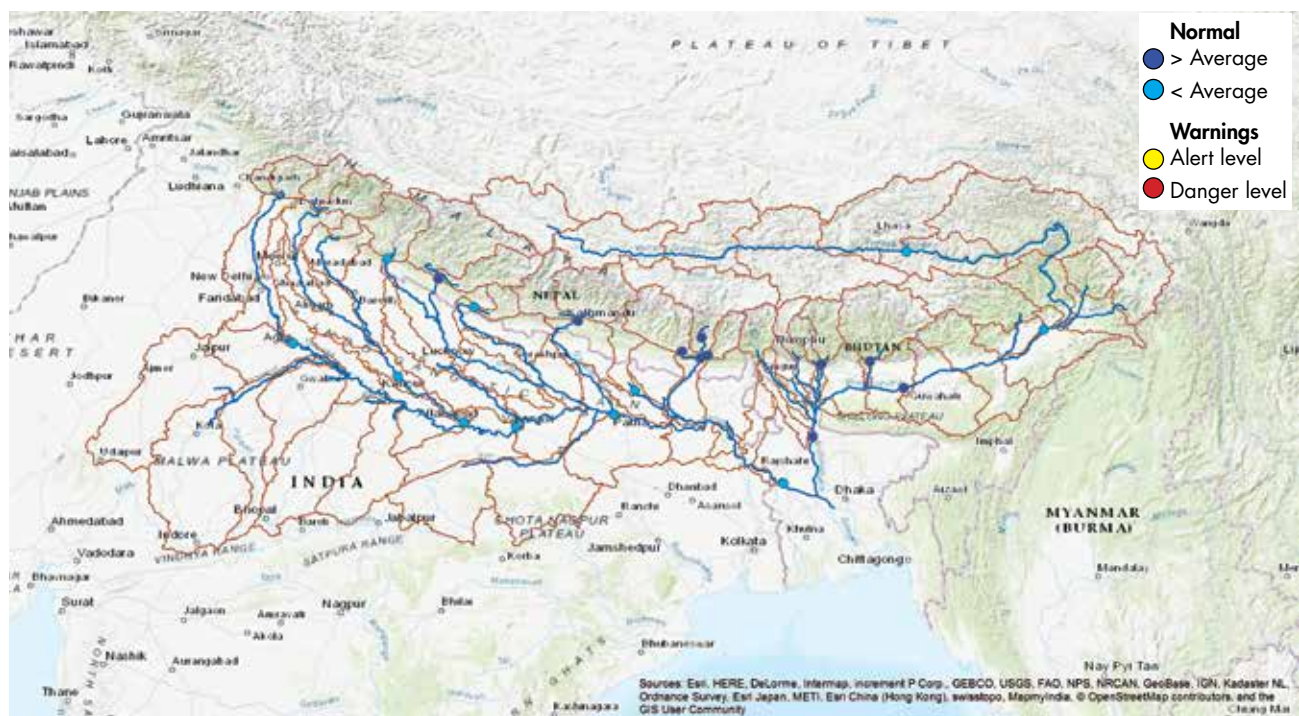




Figure 3: Regional flood outlook for the Ganges and Brahmaputra river basins

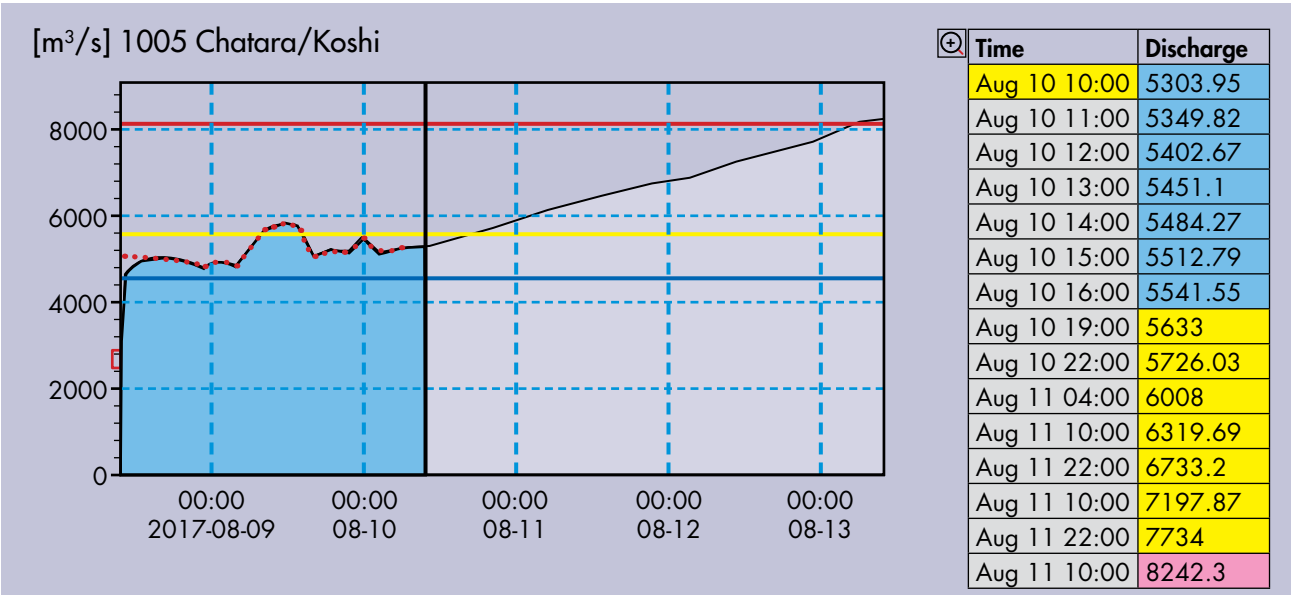


[www.icimod.org/floodoutlook](http://www.icimod.org/floodoutlook)

The flood outlook (Figure 4) provides discharge values specified by hydro-meteorological services corresponding to the alert level (yellow line) and danger level (red line) for each node. It predicts when the alert level and the danger level are most likely to be crossed for up to three days following the date/time of their issue. The outlook results thus serve as an important decision support tool for hydro-meteorological agencies.



Figure 4: Flood outlook for Chatara, Koshi basin, 10–13 August 2017



## Use and benefits of the regional flood outlook

- The national hydro-meteorological agencies of Bangladesh, Bhutan, Nepal, and Pakistan can use the regional flood outlook to improve their flood forecasting and early warning services
- Various other end users including local government bodies and various entities working in flood disaster management at the local or community level can also use the flood outlook for better disaster preparedness and response
- Data from the RFIS are being used to validate various space-based products such as satellite rainfall estimates

## Potential of Flood Outlook

During the 2017 August floods, the Department of Hydrology and Meteorology of Nepal (DHM) used ICIMOD's regional flood outlook along with information provided by other models for various locations in Nepal to prepare its flood bulletin and issue a flood advisory to the National Emergency Operation Centre and targeted end users. This enabled wider dissemination of flood early warning for better preparedness and response whenever water levels in various rivers rose above the alert and danger levels, and widespread flooding occurred. The DHM used this regional flood outlook again in the monsoon of 2018.

## Way Forward

Activities related to the regional outlook system being undertaken during the HYCOS User Phase (2017–2019) include:

- Working with partner agencies to improve flood forecasting and warning services, including evaluating historical data to introduce quality control in observation nodes
- Customizing and promoting the uptake of flood outlook systems by national hydro-meteorological agencies in Bangladesh, Bhutan, Nepal, and Pakistan and relevant local and community level stakeholders for better disaster preparedness and response
- Preparing improved flood outlooks for more flood-prone locations in Bangladesh, Bhutan, Nepal, as well as for the Indus basin in Pakistan
- Strengthening the capacity of national hydro-meteorological agencies operating in IGB basins to conduct hydrological and hydrodynamic modelling to improve the reliability and accuracy of flood outlook using additional data
- Working with regional partners for the development of site-specific flood outlook for impact based forecasting



### For further information, please contact

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