

Flood forecasting: Myths and realities

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The recent floods in Kerala were devastating and created a huge loss in terms of property, animal resources and agriculture. The natural balance of earth, soil, forests and water is also severely affected. The social and political debates now focus on the question that whether floods could be forecasted and monitored in a better way.

Developing a flood forecasting and warning system for communities at risk requires good quality data, telemetry system, forecasting tools and dissemination of warning to communities. The system should issue warning at sufficient lead time so that the communities can take necessary action including evacuation.

The main components of a flood forecasting system include (Fig.1):

- Data acquisition
- Telemetry system
- Hydrological modelling
- Weather forecast
- Forecasting floods
- Decision support system
- Dam operation
- Dissemination of forecasts warning

Data acquisition

We need to collect as much as possible historical data. The data required for a forecast system includes rain-

fall, streamflow, soil moisture, land use etc. The data can be integrated to a digital elevation model in GIS (Geographical Information System). Many GIS softwares are now available freely in the web. Remotely sensed soil moisture and land use data is also very useful. The runoff occur from an area depends on the respective soil moisture status. Satellite based meteorological data would also useful where direct measurements are not available. This information is becoming increasingly useful where the river streams are not gauged. The data available with various agencies like Central Water Commission (CWC), IMD, NRSC, KSEB, Irrigation department, etc. may be pooled together for further analysis.

Telemetry System

The collected data should be transmitted to a central station where it can be stored and analysed. The streamflow and rainfall data from remote locations should be transferred instantaneously for up to date forecast. This require a network of raingauges and water level monitoring stations throughout the catchment.

Hydrological modelling

There is a need to select a suitable model based on the need and availability of data. The model should be calibrated and validated using historical data. Once the runoff is estimated for each hydrological response units, suitable routing algorithms are used for the peak flow based on time of concentration.

Weather forecast

The country's weather Department (IMD) forecasts rainfall and temperature at sufficient lead time. The accuracy of these forecasts varies with lead time. A forecaster can use this information to provide some forecasts of flood in the next few days and can update over time using the telemetry data obtained from the catchment.

Forecasting floods

It may take several hours for the rain occurred in a catchment to reach the river and to the lower part of the river basin. Hydraulic models can be used for channel routing and can calculate the travel time of flood

wave to various locations. The forecasters can provide the rate of peak flow at each location in the basin.

Decision Support System

Computer software based decision support system is very useful in making sufficient decisions based on the forecast information. Water level forecast is very important to decide where the water is likely to overflow the banks. This information should be converted into warnings and disseminate to the communities. Converting the forecast information into flood inundation mapping is essential to understand the extent of flooding.

Dam operation

The shutters of the dam have to be operated based on the real-time inputs from the computer software or any other flood routing model. If there are dam storages in the catchment, the forecasters should include the reservoir operating rules in their modelling

and reports of soil survey and conservation department may be made use of the forecasts.

Dissemination of forecasts warning

Once the forecast information is readily available the dissemination of the warnings to public at risk through various media is very much essential. This information should reach the community with sufficient lead time for taking necessary actions.

In fact, the reservoir operations are based on a lot of predictions and approximations. On time rainfall forecasts from the meteorological department coupled with analysed information on previous rainfall pattern is essential for timely management of reservoir water.

Considering the unique topographical and demographic features of Kerala, the Government, local bodies and public should focus on the following points:

- Every Panchayath should undertake a survey and make a repository of various water and natural resources available in their jurisdiction along with the drainage map, land use map and soil map. The available watershed maps,

and reports of soil survey and conservation department may be made use of the forecasts.

- If possible, do a flood plain analysis and mapping. The vulnerable area for flood and landslides may be marked. Apart from scientific tools, the learning of elders in the community may also make use of. Identify all the construction permits and other related licences should be issued based marked information.

- Prepare a land use map with the help of Agriculture department and mark fragile areas for specific uses. Remove hindrances to the natural flow of water. However, watershed development activities like check dams may be taken up at appropriate areas.

- Encourage soil conservation practices in the catchments areas, by providing provisions for adequate drainage.

- Desilt the watercourses at regular intervals. Prevent adding plastics and other wastes to water bodies.

- Protect the bare lands,

especially in steep slopes by promoting afforestation or planting grasses like vetiver.

- Explore traditional water management structures like ponds, tunnels and refine the technology for present day use.

- Encourage rural clubs and schools to take part in the campaign.

- Establish a weather information kiosk in all Panchayath offices or community areas, integrated to IMD or other local weather advisory services. Plan a real time information system/warning centre in those panchayaths/areas near to dam sites or prone to landslides. Modern technologies like GIS or cloud computing can be made use of. A local weather information and disaster prevention App can be developed for vulnerable areas with nodal point at State disaster management centre.

- Make provisions for an immediate rescue and relief centre in identified panchayaths.

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