Measures to strengthen flood preparedness

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September alone this year saw flooding across four continents, resulting in the loss of thousands of loss and unprecedented damages. Within Asia, there were floods in India (in Assam, Arunachal Pradesh, Meghalaya, Sikkim, Manipur, Tripura, Uttar Pradesh, Himachal Pradesh, Gujarat and Kerala) which resulted in 719 deaths and displaced more than 350,000 people. In June, in Bangladesh, floods affected thousands, in Pakistan, heavy rains caused flooding, in China, authorities had to evacuate 110,000 people from their homes in Guangdong, as days of heavy rain caused massive floods in China's most populous province. Indonesia witnessed flash floods in Sumatra and West Sumatra, while the Noto earthquake triggered floods in Japan. Heavy rains also caused floods in Sri Lanka. Flooding events across the world have one common factor--that of an atmosphere made warmer by the climate crisis. The climate crisis has a strong effect on the intensity and the frequency of flooding, with rising sea levels and unpredictable weather patterns intensifying floods worldwide.

An aerial view shows partially submerged houses after flood in Feni, Bangladesh on August 24 (AFP)

Flooding causes not just a loss of lives but also severe displacement, along with extensive damage to infrastructure and economies. It also increases health risks due to water-borne diseases, food shortages, and environmental degradation. Groups and communities also often face long-term recovery challenges with impacts on education, health care and mental health. Even though not completely accurate, floods can be

predicted with varying degrees of precision. Advances in technology, meteorology and hydrology enable scientists to forecast floods using satellite imagery, radar and rain gauge data, hydrological models, weather forecasting models and real-time monitoring systems. In statistical modelling, scientists analyse historical data to identify patterns, while in physical modelling, simulations on flood behaviour are created using hydrological and hydraulic models. Ensemble forecasting combines multiple models for improved accuracy. However, countries across the globe need better early warning systems, geographic information systems, remote sensing, Artificial Intelligence and machine learning and the Internet of Things (IoT) sensors.

Some examples of successful flood prediction systems include the national flood forecasting system of the United States (US), the European Flood Awareness System, the Flood Forecasting and Warning System of India and the Bangladesh Flood Forecasting and Warning System. However, all four have experienced flooding of varying degrees culminating in various degrees of losses, exemplifying the need for further investments in technology. Nevertheless, the US flood warning system serves as a model for other countries, showcasing the importance of integrated real-time data, automated alerts, and advanced hydrological forecasting in mitigating flood risks. While floods were reported this year in South Carolina, losses have still been relatively moderate with roughly 122 million people at risk for flooding in their communities. The flood warning system in the US is built on real-time data, rainfall estimates and alert protocols, all of which is integrated into a single software platform. The platform works with different hardware and provides credible data to drive decisive actions.

The key features of the US flood warning system include real-time monitoring, in which the system uses sensors and gauges to track rainfall and flood risks in various locations. When a threshold is reached, an automated alert is sent out to initiate emergency action plans. The system also uses storm modelling and simulation to predict the extent of flooding in different scenarios. Hydrological forecasting is also relied upon, as it provides flood inundation mapping, enabling advanced lead time to indicate which areas could be impacted.

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Thus, as seen from the example of the US floods can be mitigated through a combination of infrastructure, policy and environmental measures. In terms of infrastructure creation, levees and floodwalls, dams and reservoirs, flood-control canals and channels, storm management systems and sea walls and coastal protections are an urgent requirement. In the realm of policy and planning measures, flood plain management and zoning regulation are needed, along with building codes and flood-resilient construction. Emergency preparedness and response plans are also an urgent priority, followed by flood insurance programmes and public education and awareness campaigns. Environmental measures include wetland restoration and preservation, watershed management and reforestation, soil conservation and erosion control, floodplain reconnection and natural flood management, along with climate crisis mitigation and adaptation strategies. For all of this to show results in the mitigation of floods, green infrastructure including green roofs and rain gardens, smart flood sensors and monitoring systems, and community-based flood risk management will also be necessities.

There is also an urgent need for international cooperation in the realms of transboundary flood risk management, international flood forecasting and warning systems, along with collaborative research and development and global flood risk assessment and mapping. A few case studies include the Netherlands' Room for River Project which focuses on floodplain restoration, Tokyo's flood protection system, which focuses on creating underground tunnels and canals, and Australia's National Flood Risk Information Project which focuses on data-driven decision-making. Implementation of these measures will need a coordinated effort from governments, communities and stakeholders to effectively prevent and mitigate floods.

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