



## Rationale

The Hindu Kush Himalayan (HKH) region is extremely vulnerable to various types of water-induced disasters, given the region's fragile geology, rugged terrain, and distinctive monsoon patterns. Consequent disaster impacts are often exacerbated by inefficient risk communication. With climate change-induced extreme rainfall events on the rise, flood risk communication through mediums such as early warning systems (EWSs) needs strengthening.

Existing technical flood EWSs provide hazard-based warning. Countries in the region face two major challenges in flood risk communication: the considerable investment required to gauge flood-prone medium and small rivers and the short lead time provided by in-situ flood EWSs. Technical flood EWSs can also be rendered ineffective by stakeholders' inadequate readiness. Moreover, the warning is limited to major rivers, excluding many flood-prone rivers and rivulets. The need to enhance flood EWSs tailored to countries in the HKH region, therefore, is paramount.

## Objective

The International Centre for Integrated Mountain Development (ICIMOD), Brigham Young University, and

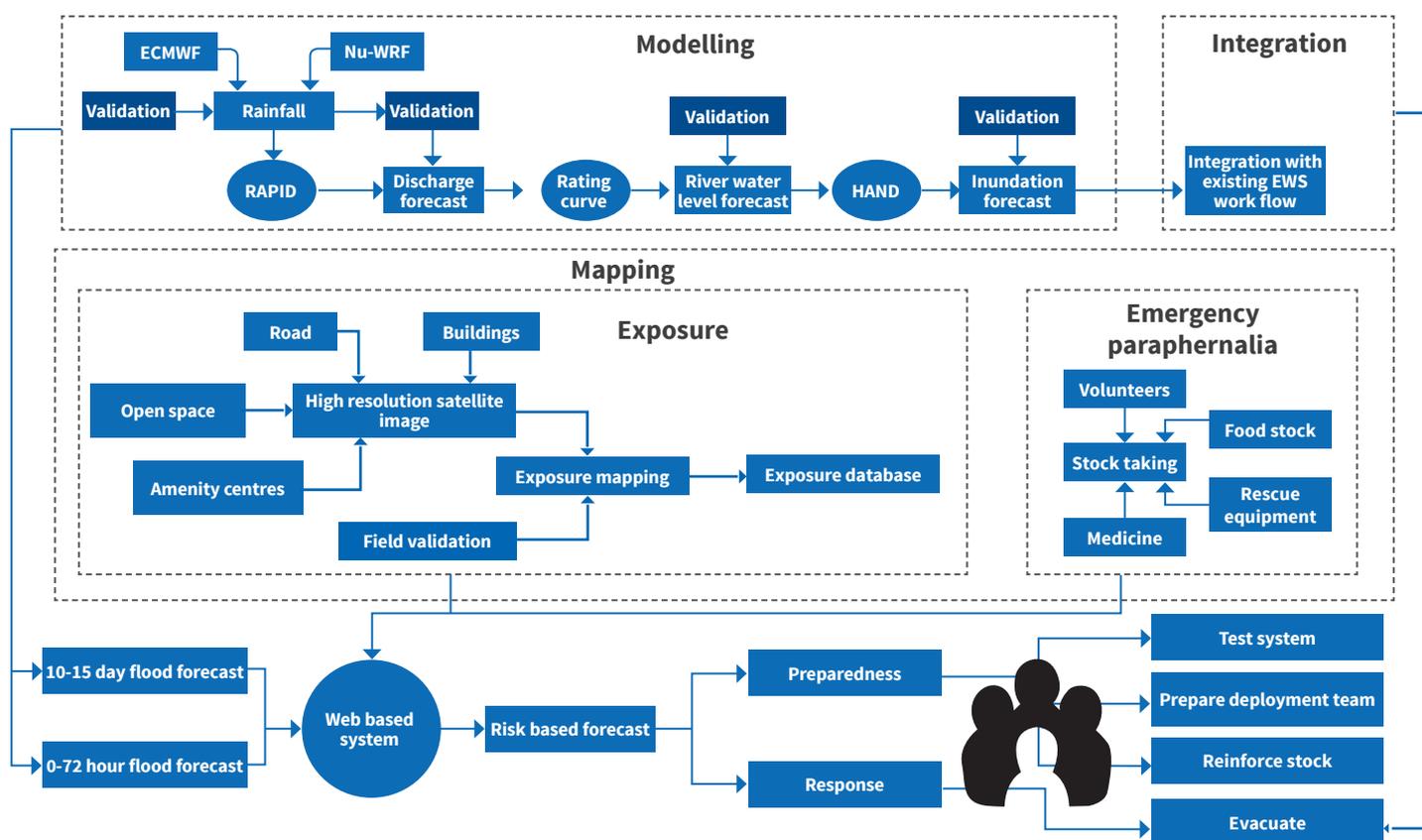
the National Aeronautics and Space Administration's (NASA) Jet Propulsion Laboratory are collaborating to develop a system that provides flood early warning information for rivers by using information generated by the Global Flood Awareness System (GloFAS), a joint initiative of the European Commission and the European Centre for Medium-Range Weather Forecasts (ECMWF).

The system uses downscaled global flood discharge forecasts with routing models to forecast flood water levels in flood-prone river stretches, with 10–15 days of lead time. The goal is to enhance response interventions through effective planning and preparedness and to reduce loss of property and life.

## System design

The GloFAS product is downscaled to tailor it for river stretches in Bangladesh, Bhutan, and Nepal before routing, using a routing application for parallel computation of discharge (RAPID) model. The system incorporates digital elevation models and exposure (gridded population and infrastructure) data. Historical river hydrology data, flood inundation scenarios, and impact information are used to validate and calibrate the model. This system is able to forecast flood water levels at any stretch of a given river for the next 10–15 days.

## DIFFERENT COMPONENTS OF THE FLOOD EARLY WARNING SYSTEM



## Implementation strategy and engagement

The system involves multiple stakeholders with specific roles and responsibilities. Ownership of the system and information and adoption by local governments and community workers are of utmost importance. Thus, continuous engagement with different levels of stakeholders is being pursued.

## Way forward

Small- to medium-sized basins in countries across the HKH region need such downscaled models to forecast floods. It is necessary to scale out EWSs in Bangladesh, Bhutan, and Nepal before adapting them to other regional countries. ICIMOD plans to validate the model output at different basin scales using in-situ data and integrate GLOFAS information into physical hydrodynamic models for improving flood inundation model outputs.



SERVIR connects space to village by helping developing countries use satellite data to address challenges in food security, water resources, weather and climate, land use, and natural disasters. A partnership of National Aeronautics and Space Administration (NASA), United States Agency for International Development (USAID), and leading technical organizations, SERVIR develops innovative solutions to improve livelihoods and foster self-reliance in Asia, Africa, and the Americas.

The International Centre for Integrated Mountain Development (ICIMOD) implements the SERVIR Hindu Kush Himalaya (SERVIR-HKH) Initiative – one of five regional hubs of the SERVIR network – in its regional member countries, prioritizing activities in Afghanistan, Bangladesh, Myanmar, Nepal, and Pakistan

### For further information

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