

ABSTRACT

In many parts of India, dams are located in remote and ungauged catchments where hydrological data is limited or unavailable. This poses a significant challenge for accurate flood risk assessment and emergency planning. This study addresses this gap by employing a hydro-meteorological approach to estimate the design flood, particularly the Probable Maximum Flood (PMF), using spatial and aerial precipitation data from the most severe historical storm events. This conservative method is well-suited for data-scarce regions. It is the basis for a comprehensive dam break analysis (DBA) using two-dimensional unsteady flow modeling in HEC-RAS.

The analysis evaluates the potential consequences of a hypothetical dam breach by generating inundation maps that reflect flood depth, velocity, and wave arrival time. A total of 163 downstream villages are identified as being affected, with 110 located in the Nagaon district and 53 in the West Karbi Anglong district. The flood wave arrival times were categorised into three warning levels: no warning, some warning, and adequate warning, based on Central Water Commission (CWC) guidelines. Notably, two villages were found to have critically short warning times of less than 15 minutes, indicating a need for immediate attention in emergency planning.

Furthermore, hazard classification was performed based on maximum depth and velocity, highlighting high, medium, and low severity areas. A total of 12 villages were identified in high-severity zones, all located in West Karbi Anglong. To support emergency response, evacuation priority was established for 29 villages with arrival times under 12 hours, integrating both hydrodynamic and socio-spatial parameters.

Overall, the study underscores the importance of integrating a hydro-meteorological approach with GIS-based analysis to support disaster preparedness, development of Emergency Action Plans (EAPs), and enhance the resilience of communities living downstream of large dams.