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Topic of Research: Damage Assessment of Concrete Dams Under an Ensemble of Climate Change Scenarios

Findings

My Ph. D. thesis has been based on assessing damage to concrete dams under various climate change scenarios considering Global Circulation Models (GCMs) and RCPs for two future time periods, namely 2020 -2039 & 2040 to 2059, and the application of MIKE software to dam-break modelling under crest failure and piping failure conditions.

The complete work of my doctoral thesis is divided into six chapters in which Chapter 1 is the introduction, which gives a brief overview of the present background of the current state of research in the field of climate change impacts and dam break analysis. Chapter 2 provides a comprehensive review of literature related to climate change impact assessment and dam break analysis conducted by different researchers. Chapter 3 describes the geographical and hydrological characteristics of the Satluj River basin– a key mountainous basin in the Himalayan region. Chapter 4 describes the analysis of projections of surface air temperatures under different combinations of Global Circulation Models (GCMs) and RCPs for two future time periods, namely 2020 -2039 and 2040 to 2059. Chapter 5 describes the application of MIKE software to dam break simulation. Two types of failure mechanisms – overtopping failure and piping failure have been considered. Chapter 6 provides the conclusion of the research as under:

A dataset of temperature projections based on RCP scenarios for various locations within the Satluj River basin has been created using the data available at the Climate Change Knowledge Portal of the World Bank. The dataset created in this research allows for a future evaluation of the impacts of climate change in the basin using different combinations of GCMs and RCPs. Methodology for the application of MIKE to dam-break modelling under crest failure and piping failure has been developed. An efficient dam-break model has been developed and applied for the simulation of dam break under overtopping and piping failure conditions. Dam break studies, such as the one undertaken in the present research, are of significant importance in Civil Engineering, hydrology, and disaster management due to their critical implications for public safety and infrastructure protection. The dam break model developed herein can be efficiently utilized to evaluate the potential risks associated with the failure of dams, which is crucial for developing mitigation strategies and emergency response plans. Numerous recommendations regarding the installation of monitoring instruments in dams have been made to ensure the safety and stability of dams. Critical infrastructure such as roads, bridges, utilities, and buildings located downstream of dams can be vulnerable to dam breaks. With the dam break model developed herein, the potential impact on infrastructure and plan for their protection or relocation can be devised.