Notification No.: F.NO. COE/ Ph.D./(Notification**)/585/2025**

Date: 28-08-2025

Name of the Scholar: Rehan Khan

Name of Supervisor: Prof. Mohammed Sharif

Name of Co-Supervisor: Prof. Mohammad Shakeel

Name of Department: Department of Civil Engineering, Faculty of Engineering and Technology, Jamia Millia Islamia, New Delhi

Title of Thesis: Flood Risk Management Under Changing Climate

Findings

The research titled *"Flood Risk Management Under Changing Climate" focuses on the Periyar River Basin in Kerala, India — a region of immense ecological significance and biodiversity. The study examines 123 years of rainfall, temperature, and discharge data (1901–2023) to evaluate the impacts of climate change on the basin's hydrological cycle, water resources, and flood risk. It integrates statistical analyses of historical trends with climate projections from multiple models to assess both current conditions and future scenarios.

The main objective of the research is to analyze long-term variations in rainfall and temperature, assess hydrological changes under different climate change scenarios, and evaluate potential flood risks using the Soil Conservation Service Curve Number (SCS-CN) method in conjunction with data from CMIP6 models. Through this, the study aims to provide a scientific foundation for adaptive water management and flood mitigation strategies tailored to the Periyar River Basin.

The findings reveal that rainfall in the basin exhibits substantial variability, both annually and within the monsoon season. There is a notable linear increase in rainfall during August and September, corresponding with the Southwest Monsoon, which serves as the primary water source for the region. In contrast, months such as January, February, June, July, November, and December show a declining trend in rainfall, raising concerns about water availability during the dry months. This uneven distribution of rainfall could lead to excess water and flood situations in late monsoon months while causing water scarcity and agricultural stress in the early phases of crop growth.

Temperature analysis indicates a consistent and long-term warming trend across the basin. Both maximum and minimum temperatures have increased over the study period, with a more pronounced rise during winter and pre-monsoon seasons. This warming has the potential to alter crop growing cycles, reduce agricultural yields, and increase evapotranspiration rates, thereby decreasing surface and groundwater availability. Furthermore, rising temperatures could disrupt the ecological balance of the basin by altering species distribution and affecting biodiversity.

The study also evaluates future discharge projections using the SCS-CN method by integrating land use, soil, and precipitation data with historical records from the Indian Meteorological Department and projections from 13 CMIP6 Global Climate Models (GCMs). These were analyzed under four Shared Socioeconomic Pathway (SSP) scenarios—SSP126, SSP245, SSP370, and SSP585—for both near-end (2024–2061) and far-end (2062–2100) futures. The results show that under low-emission scenarios such as SSP126, there is a general decrease in discharge, indicating reduced water availability, while under high-emission scenarios like SSP585, discharge tends to increase, signifying a higher likelihood of extreme flood events. Overall, SSP585 demonstrates the greatest variability in discharge patterns, reflecting the amplified hydrological extremes expected under intensified climate change conditions.

The research concludes that climate change poses profound challenges to the Periyar River Basin's hydrology, water resources, and ecosystems. The combined effects of rising temperatures, changing rainfall distribution, and fluctuating discharge patterns underscore the urgency for proactive, adaptive water management and flood mitigation strategies. By integrating long-term data with future projections, the study provides a strong scientific basis for decision-making in sustainable water resource planning and climate adaptation. It also contributes significantly to the field of flood risk management by emphasizing the need for scenario-based approaches that incorporate high-resolution climate models, ultimately offering a robust framework for managing vulnerable river basins in a changing climate.