Chapter 3
Advances in Geospatial Modeling for Flood Risk Assessment in Changing Climate

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ABSTRACT

The chapter discusses advances in geospatial modeling for flood risk assessment in the context of climate change. It integrates Global Climate Models (GCMs) with geospatial techniques to explore the impact of changing climatic trends on flood frequency and intensity. By compiling historical climate data from 2000 to 2050, the study creates a baseline understanding of regional temperature fluctuations and precipitation changes. GCM results are downscaled to local levels, ensuring compatibility with hydrological models. The research provides a comprehensive framework for addressing the evolving flood landscape, accounting for risks related to GCM estimates and model assumptions. It highlights proactive adaptation strategies such as sustainable land use, flood-resistant infrastructure, and informed policymaking, especially for the Indus River Basin. This interdisciplinary approach offers an advanced analytical framework for understanding and mitigating flood-related vulnerabilities amid climatic uncertainty.

1. INTRODUCTION

Pakistan is especially affected by the negative impact of climate change because of its geography and agricultural sector. Pakistan has suffered significant changes in precipitation and temperature trends in the last few decades. The Meteorological Department of Pakistan PMD (2020) estimates that over the past century, average temperatures have risen by about 0.6°C. Increased and variable rainfall events caused by changes in precipitation patterns have raised the risk of floods. Flooding is a significant natural disaster in Pakistan, causing significant damage to crop and infrastructure. The frequency and severity of flooding have increased due to climate change factors like intense rainfall and glacier melting. In 2020, over 5 million people were affected by flooding. The agricultural sector, which supports a significant portion of the population and contributes to the national economy, suffers greatly from floods. The Food and Agriculture Organization (FAO) reports that floods in

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