

Chapter 3

A Review on Estimation of Climate and Land Use Change Impacts on Tropical Streamflow Using Remote Sensing and GIS: CC and Land Use Impact on Thailand's Tropical Streamflow

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ABSTRACT

The tropical climate is subjected to extreme hydrological events, exacerbated by climate change (CC) and changes in land use/land cover (LULC). Evaluating CC and LULC impacts on streamflow in tropical regions is vital for understanding the risks to vulnerable ecosystems. This chapter presents a meta-analysis of 30 system-

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atically selected case studies that examine the spatiotemporal effects of CC and LULC on streamflow. The findings highlight the complex interactions among CC, LULC, and hydrological dynamics, underscoring the critical role of hydrological models, meteorological inputs, and scenario-based analyses. Models like SWAT and HEC-HMS, coupled with climate projections from GCMs (CMIP5 and CMIP6), are essential for projecting future streamflow changes. Integrating remote sensing (RS) and geographical information systems (GIS) enhances spatial accuracy and reliability. Incorporating diverse climate and LULC scenarios, including representative concentration pathways (RCPs), provides insights into adaptive water resource management in tropical regions.

1. INTRODUCTION

According to the IPCC-AR6 (2021), Climate Change (CC) is a prominent contemporary challenge in hydrological research. CC is projected to intensify these shifts in rainfall and temperature patterns, which will cause extreme hydrologic events (Ming et al. 2021; Adopted 2014). Addressing the challenges associated with these natural disasters by adapting water management practices is set to become a significant undertaking in the present century (Dlamini et al. 2017). Between 1960 and 2019, about 17% of Earth's terrestrial surface changed, including the loss of 0.8 million km² of forests and the expansion of agricultural land by roughly 1.0 million km², among other transformations (Winkler et al. 2021). The extensive land use/land cover (LULC) changes, predominantly linked to human activities, impact watershed hydrologic systems differently (Koneti, Sunkara, and Roy 2018). Thus, it is critical to quantify and comprehend the spatiotemporal dynamics of LULC changes. This knowledge is crucial for informing and actively contributing to the ongoing discussions on CC (Change 2019).

Nevertheless, despite the significant societal relevance of CC and LULC changes, researchers face challenges in understanding the evolution of global LULC over time and across space. This limitation is primarily attributed to the lack of comprehensive data and substantial uncertainties inherent in existing LULC transformation records (Prestele et al. 2017). However, the advancements in remote sensing (RS) technology, such as satellite imagery and LiDAR, combined with the analytical capabilities of GIS, have significantly enhanced the ability to detect, map, and analyze LULC changes with greater accuracy and detail. Despite these advancements in technology, LULC statistics still face certain constraints. These limitations arise from fragmented material, varying scales, inadequate geographic or temporal detail, and inconsistent time series (Bayer et al. 2021). Advanced RS and Geoinformation Systematic methods are popular and effective technologies

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