ASSESSMENT OF FLOOD SIMULATION ACCURACY: COMPARATIVE ANALYSIS OF HEC-RAS WITH LiDAR AND SENTINEL-1A DATA

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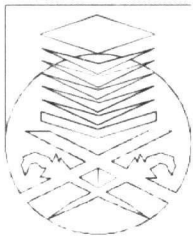

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ABSTRACT

This dissertation presents a comprehensive study of flood simulation using HEC-RAS using LiDAR and Sentinel-1A data. The research also used data from hydrological records, Digital Elevation Models (DEMs), and topographic maps. This study uses HEC-RAS software for flood simulation and it starts by generating a DEM from satellite data using the SNAP software discussed in Chapter 3. The main objective is to analyse the flood simulation for Sungai Buloh using HEC-RAS software. The main findings highlight the exposed low-lying areas near the river especially in places such as Paya Jaras and Kg. Kubu Gajah, where significant flood depths underscore the need for targeted flood management strategies. This research emphasizes the important role of high-resolution DEMs in accurately mapping floodplain boundaries for accurate flood simulations. Methodologically, this study involves steps such as initial DEM generation from satellite data using SNAP software, further refinement in ArcGIS for accurate topographic representation and improvement through LiDAR data analysis at 1m x 1m resolution for better accuracy. The subsequent simulation process includes digitizing the river geometry, creating cross-sections at 100m intervals, and analysing flood simulation results such as water surface profiles, flow velocities and flood maps using HEC-RAS and ArcGIS tools. Detailed flood maps are generated to identify vulnerable areas. Simulation results are carefully verified against observed data, comparing with historical flood records to ensure reliability. The study concludes with an adapted flood management strategy for Sungai Buloh and emphasizes the importance of high-quality input data such as high-resolution DEM and accurate hydrological parameters in improving the accuracy of flood simulations and management effectiveness.

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CHAPTER 1

INTRODUCTION

1.1 Background Study

Floods are the most frequent type of natural disaster occurred in Malaysia. According to history, the event that caused the city of Kuala Kubu to flood because of a dam failing nearby rocked our nation. October 1883, the historic city of Kuala Kubu is inundated because of a damaged dam that reserves water for the city's residents (Daud, 2001). Viewed from a different perspective, Malaysia is geographically protected from earthquakes, volcano eruptions, and other catastrophic natural catastrophes, yet it is unable to avoid flood disasters.

A flood is defined as an unusual event in which water overflows in a place that is not often flooded. The amount of water that overflows from the banks of rivers, lakes, or drainage systems due to heavy rains, melting ice, high tides or obstructions in channels is referred to as a flood (Department of Irrigation and Drainage, 2017)). Floods in Malaysia, which are seen as the only major natural disaster that often hits the country, are caused by water that rises suddenly or stagnates on land due to heavy rain. This flood disaster can also cause great losses to settlements, economy, and environment, and even loss of human life. This requires very serious attention to overcome the flood problem, if we do not want something bigger to happen in the future. In addition, government bodies and Non-Governmental Organization (NGO) are also working to solve this problem by developing sponge town settlements and moving riverside villages that are at risk of flooding to higher ground. Therefore, these areas that are vulnerable to flooding need to be known and analysed.