



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study : **Ph.D.**

Thesis Title: **Inland water episodic event management using opensource geospatial and numerical modelling**

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Thesis Submitted to the Department/ Center : **Department of Civil Engineering**

Date of completion of Thesis Viva-Voce Exam : **31.08.2023**

Key words for description of Thesis Work : **Automation, Dark Object Subtraction, River ecosystem management, Google Earth Engine, OpenFOAM, Water quality**

SHORT ABSTRACT

Inland water episodic events are rapid and transient changes in the typical conditions of rivers, lakes, or other bodies of freshwater caused by floods, droughts, heatwaves, or other extreme weather conditions, as well as pollution, industrial accidents, and other human activities. The aim of this study is to devise a system for monitoring and managing such events by focusing on natural solutions based on riparian vegetation, which plays an important role in preserving ecological balance and water quality, strengthening riverbanks, providing habitats for numerous species, regulating stream temperature, and cycling nutrients. For efficient analysis and customized data representation, as well as to leave room for future improvements and modifications in the source codes, an opensource approach has been employed. Firstly, an attempt has been made to model episodic events in terms of range of values shown by proxy water quality and riparian vegetation quantity/health indicators. To analyze and process raw satellite data for acquiring this information, a cloud computing Google Earth Engine (GEE) based web- GIS application has been developed. In the absence of atmospherically corrected level 2 surface reflectance products, raw satellite imageries can be used to generate results with the use of a state- of- the- art fully automated Dark Object Subtraction based approximate atmospheric correction technique. When compared to the Level 2 surface reflectance product, it achieved similar results in image classification. In addition, it provided a good estimate of the range of derived water quality parameters for the river Ganga in India, when compared to reported field measurements. Using Level 2 data, this application was further used to examine the temporal patterns of river influence on riparian vegetation. There was a high correlation between NDVI and GNDVI for riparian vegetation zones and non- riparian zones, indicating that the two indices are highly correlated. These indices can be used to estimate the amount of nutrients in a system. In addition, nutrient exchanges as a result of interactions between river and riparian vegetation zones have been observed. These are continuous and cyclic processes that play a significant role in regulating the health and quantity of vegetation, thereby sustaining the river ecosystem. For a detailed understanding of these proxy based nutrient exchanges, a three- dimensional hydrodynamic opensource model (OpenFOAM) has been setup for a riparian vegetation (mangrove root) structure, and compared with the performance of engineered river training structures.