Abstract (English)

The topic of this PhD thesis is focused on the application of remote sensing data in the monitoring of freshwater bodies, which are critical to sustaining life, ecosystems, and economic growth. We underscore the pressing need for freshwater resource conservation and monitoring, with an accent on sustainable management, given the present economic, social, and environmental challenges.

The thesis has the following objectives: building and in-depth current scientific literature review, developing and comparing machine learning models along application of machine learning models in the estimation of eutrophication drivers (i.e. nutrient concentrations) by leveraging the potential of remote sensing data, and, lastly but no the least, developing a web application for real-time monitoring the eutrophication in the Danube Delta. Underlying the stated objectives, lies the need for monitoring freshwater bodies against eutrophication by different kinds of stakeholders, such as environmental protection agencies, public health authorities, economic sectors, and local communities. Developing and publishing a tool for detecting and monitoring eutrophication at large scale, with high spatiotemporal coverage, in the Danube Delta can provide the stakeholders with the means of using an early warning system in minimizing the economic and health impacts of eutrophication hazards on local communities, in the short term, and on the long term to enhance the decision making of stakeholders process with near real-time data.

Along the thesis we highlight the potential of remote sensing data and machine learning applications compared to traditional in-situ monitoring, but at the same time we show that some intrinsic challenges exist in applying successfully these techniques. In comparison with the traditional methods of in situ monitoring, remote sensing offers broad spatial coverage, timeliness, cost efficiency and accessibility. The original contribution rests, on the one hand, on building large-scale machine learning models and, on the other, on developing and publishing a web application for detecting and monitoring eutrophication within the Danube Delta area. An integrated approach targeted at the need for a timely decision-making process and a contribution in sustainable, cost efficient, environment management and protection of Danube Delta freshwater ecosystems are the ultimate goals of the thesis.

Key words: Danube Delta, remote sensing, machine learning, eutrophication. Google Earth Engine