



APPLICATION OF LANDSAT IMAGERY FOR THE INTERPRETATION OF SURFACE WATER QUALITY – A CASE STUDY OF DE VONG – CO CO RIVER, QUANG NAM

Quynh Nguyen Khanh Cao^{1,2}, Duyen Chau My Nguyen^{1,2}, Long Ta Bui^{1,2*}

¹ *Laboratory of Environmental Modelling, Faculty of Environment and Natural Resources, Ho Chi Minh City University of Technology, 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam*

² *Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc District, Ho Chi Minh City, Vietnam*

* *Corresponding author: nhphong@dcselab.edu.vn and longbt62@hcmut.edu.vn*

Abstract: Co Co River is located in the lower section of Thu Bon River and flows parallel to the shoreline. It flows into Han estuary (Da Nang) toward the North and flows into Cua Dai (Hoi An) toward the South. The river has a total length of 27,5 km and it is divided into 2 branches. The study area is called De Vong, belonging to Hoi An city, Quang Nam province. The objective of the study was to (1) apply images of Landsat 8 satellite for interpreting surface-water quality in the De Vong and Co Co River basin, (2) to analyse the correlation with observed data and (3) to build simulator maps in July and September of 2020.

The study focuses mainly on the parameters: BOD, COD, DO, NH₄⁺-N and TSS, with at-satellite reflectance values of Landsat 8 OLI-TIRS C1 LEVEL-1 spectral bands, in order to calculate the simulations following correlation and regression by the method of combining spectrum bands using different algorithms, serving to increase the accuracy of the results. The research supported by two software: Envi5.2 and ArcGIS 10.4.1. Procedure of analyzing images for the interpretation of surface water quality is presented in **Figure 1**. It shows steps of analyzing satellite images which are also illustrated. This research uses the coefficient of determination (R^2) to analyze and evaluate the accuracy of the results from calculated model with real-time data. The performance of the model is evaluated using R^2 predicts future results on the basis of other associated data.

The results of the analysis show that the water quality parameters had significant relationships with the models. From these correlation models, water quality parameters were extracted from Landsat 8 image. Results for accuracy of the model evaluation using coefficient of determination (R^2) shows that the accuracy of extracted results is relatively good and high for some parameters such as COD, BOD and TSS with $0.6 < R^2 < 0.99$. In July 2020, the correlation between reflectance spectrum of surface water in De Vong – Co Co River and the parameters are all highest than 0.50 and reach an acceptable level. In which, COD and TSS are highly correlated with reflectance spectrum of PCA_B2 and PCA_B7, respectively $R^2 = 0.806$ and 0.8836 . The rest is correlated with the average reflectance spectrum. In September 2020, the correlations of all parameters are higher than 0.50 and in which DO and TSS have high accuracy ($R^2 > 0.9$).

After simulating the distribution of water quality parameters concentration in De Vong and Co Co River, it can be seen that, in July 2020, the concentrations of the upstream for BOD₅, COD and TSS tend to be higher than that in the downstream area, due to the influence of impacts from tourism activities of Da Nang Bay and wastewater from residential areas (Co Co river) and discharge from biological agriculture, residential areas to canals (De Vong river), but still acceptable. In September 2020, it can be seen that there was a recovery in water quality for BOD₅ and COD concentrations of both De Vong and Co Co river with a gradual decrease. Water quality for these parameter is quite good and within the allowable range.

The research has given a regression equation used to validating the accuracy between the real-time data and Landsat 8 OLI image. Analyzing regression with acceptable coefficient of determination ($R^2 > 0.5$), some quality parameters water has a good coefficient ($R^2 > 0.7$). Results show that BOD₅, COD, DO, NH₄⁺-N and TSS concentrations from real-time data are highly correlated with the ratio of spectral bands of Landsat 8 OLI satellite images. The research has evaluated the concentration of determined parameters. Specifically, the concentrations of DO and NH₄⁺-N in river meet the standards on permissible limits, and the load carrying capacity for two parameters is quite high. Thus, it is possible to calculate the concentration from the reflected spectral band of the Landsat 8 image with suitable algorithms. The research has opened a new direction in analyzing surface water quality based on remote sensing images. It is necessary to continue having in-depth researches on the application of remote sensing images in analyzing some surface water parameters with sampling period.

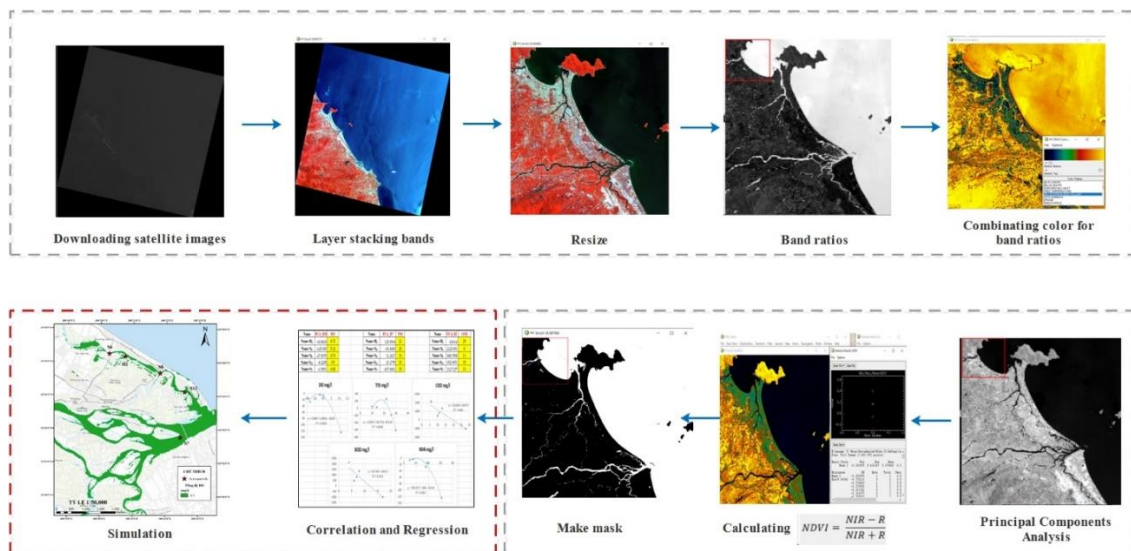


Figure 1 Procedure of analyzing images for the interpretation of surface water quality

Keywords: Landsat 8, De Vong River, Co Co River, water quality, coefficient.