INFORMATION ON DOCTORAL THESIS

1. Full name: Khuong Van Hai

2. Sex: Male

3. Date of birth: 11/10/1984

4. Place of birth: Bac Ninh province

5. Admission decision number 2165/QĐ-ĐHKHTN dated 05/08/2022 by Rector of the University of Science, Vietnam National University

6. Extension decision No. 2893/QD-DHKHTN dated 6 August 2025, issued by the Rector of the University of Science, Vietnam National University, Hanoi, extending the training period from 6 August 2025 to 5 August 2026.

7. Official thesis title: Improving the Quality of Streamflow Simulation of the Da River into Vietnam under Climate Change.

8. Major: Hydrology

9. Code: 9440224

10. Supervisors:

1) Assoc. Prof. Dr. Nguyen Tien Giang

2) Assoc. Prof. Dr. Nguyen Cao Don

11. Summary of the new findings of the thesis:

The dissertation focuses on improving the quality of streamflow simulation of the Da River into Vietnam under climate change, limited observational data, and the impacts of human activities, particularly reservoir operation and water use in the upstream area. Methodologically, the study applies the VIC hydrological model in combination with meteorological-hydrological data, reanalysis data, and multi-source remote sensing data; and employs change-point analysis, trend analysis, and quantitative assessment of the impacts of climate change and human activities on streamflow.

The main results achieved by the thesis include:

(1) Identification of non-stationarity and change points in the hydrological regime: Statistical tests were used to identify change points in meteorological-hydrological time series, thereby identifying changes in streamflow characteristics over time and providing a basis for dividing the study period into periods with different hydrological regimes.

(2) Trend analysis: Based on the identified periods, the dissertation analyzes trends in meteorological variables and streamflow, clarifying changes in streamflow magnitude and temporal distribution, particularly in the context of climate change.

(3) Identification and quantification of influencing factors: The dissertation analyzes, separates, and quantifies the effects of climate change and human activities

on streamflow variation, focusing on reservoir operation, land-cover changes, and water-use demand, thereby clarifying the relative roles of natural and anthropogenic factors.

(4) Integration of influencing factors into the hydrological model: Based on the analysis results, reservoir-operation information inferred from multi-source remote sensing data, together with land-cover changes and water-use demand, was incorporated into the VIC model to more fully represent anthropogenic impacts on streamflow generation and variation.

(5) Assessment of improvement in simulation quality: The dissertation evaluates simulation quality between scenarios with and without consideration of anthropogenic factors. The results show that integrating reservoir-operation information, land-cover changes, and water use improves the simulation of Da River streamflow into Vietnam, confirming the effectiveness of the integrated approach under conditions of limited data and non-stationary streamflow.

New points of the thesis:

(1) The dissertation has inferred the operation curves of annual/seasonal regulation reservoirs in the upstream area, where operational information is unavailable, using multi-source remote sensing data, and has successfully encoded and integrated the reservoir-operation information into the VIC model.

(2) The dissertation has proposed a new methodological framework for quantifying the impacts of climate change and human activities on streamflow variation, with applicability to river basins under similar conditions.

Scientific and practical significance of the thesis:

Scientific significance: The dissertation contributes to clarifying changes in the Da River streamflow regime under the combined impacts of climate change and human activities; and proposes an integrated approach combining the VIC hydrological model with remote sensing data and alternative data sources under conditions of limited observations. In particular, the framework for quantifying the impacts of climate change and anthropogenic activities contributes additional scientific foundations for studying streamflow in transboundary river basins.

Practical significance: The research contributes to improving the quality of Da River streamflow simulation into Vietnam under limited upstream information, providing a basis for streamflow forecasting, reservoir operation, and water resources management. The research methods and procedures can be applied to other transboundary river basins with similar conditions.

12. Further research directions:

Further develop the VIC model using finer time steps (daily and weekly) to improve the simulation of short-term streamflow variability and extreme events; strengthen the integration of information on socio-economic activities and reservoir operating rules, particularly to improve the simulation of low flows. At the same time,

investigate combining the VIC hydrological model with artificial intelligence methods through a hybrid modeling approach to reduce uncertainty and improve simulation reliability in data-scarce transboundary river basins.

13. Thesis-related publications:

International journals:

(1) Hai Van Khuong; Giang Tien Nguyen; Don Cao Nguyen; Bich Thi Ngoc Do; Minh Tran Duc Dang (2025), "A new framework for quantifying the impacts of climate variability and human activities on streamflow variation with an application to the upper Da river basin", Climatic Change, 178, 234. DOI: 10.1007/s10584-025-04072-6.

(2) Vinh Ngoc Tran; Hanh Duc Nguyen; Hai Van Khuong; Huy Ba Dao; Quan Huu Minh Le; Chi Que Nguyen; Giang Tien Nguyen (2025), "Reconstructing Long-Term Daily Streamflow Data at the Discontinuous Monitoring Station in the Ungauged Transboundary Basin Using Machine Learning", Water Resources Management, 39(7), 3327–3348. DOI: 10.1007/S11269-025-04109-6.

Domestic journals:

(1) Khuong Van Hai; Dao Ba Huy; Nguyen Tien Giang (2025), "Developing Operation Rules for Reservoirs in the Upper Da River Basin Using Multi-source Remote Sensing Data", VNU Journal of Science: Earth and Environmental Sciences, 41(1S), 1–14. DOI: 10.25073/2588-1094/VNUEES.5389.

(2) Khuong Van Hai; Giang Nguyen Tien; Do Thi Ngoc Bich (2024), "Applying the variable infiltration capacity (VIC) model to reconstructing streamflow data in the Da River basin at MuongTe hydrological station", Journal of Hydro-Meteorology, 09(20), 52–65. DOI: 10.36335/VNJHM.2024(20).52-65.

Hanoi, August 17th, 2026

On behalf of academic supervisors **PhD. Student**

Assoc. Prof. Dr. Nguyen Tien Giang Khuong Van Hai