VIETNAM INSTITUTE OF METEOROLOGY, HYDROLOGY AND CLIMATE CHANGE

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DOCTORAL THESIS INFORMATION WITH NEW SCIENTIFIC CONTRIBUTION, THEORETICAL STUDY

1. Dissertation title: *Methane and nitrous emissions from crop cultivation in the Red River Delta*

Code: 9850101

Major: Natural Resource and Environment Management

2. PhD Candidate: Bui Thi Thu Trang

Advisors: Assoc. Prof. Dr Mai Van Trinh, Dr. Dinh Thai Hung

Training Institution: Viet Nam Institute of Meteorology, Hydrology, and Climate Change.

3. Introduction to the Dissertation:

Although the National GHG inventory has been implemented three times from 1994, Vietnam's GHG inventory calculation still mainly uses the emission factors according to Method 1 of the IPCC (IPCC, 1996). These factors do not differ in topography, climate, soil, crops, and crop intensification. However, the precise quantification of GHG emissions from rice and other crops is complex because of spatial variations in climate and soil, crops, and farming practices.

As a result, the application of a mathematical model in quantifying GHG emissions is a possible solution to meet both technical requirements and emissions calculation for space and time with high and stable accuracy due to the monitoring and measuring of GHG emissions in the field is very complicated and requires many resources (equipment, funds, and human resources). The DeNitrification-DeComposition (DNDC) model is a tool widely applied in calculating GHG emissions from agroecosystems in the world and is gradually gaining attention in Vietnam. This model allows to forecast the amount of carbon retained in the soil, the loss of nitrogen, and the emission of greenhouse gases such as CO_2, CH_4, N_2O from agroecosystems by day.

The thesis named *"Study on methane and nitrous emissions from crop cultivation in the Red River Delta"* was selected for implementation, to obtain: (1) Determine the amount of GHG emissions from annual rice and upland crop cultivation in the Red River Delta; (2) Establish GHG emission maps for annual rice and upland crop areas according to the Red River Delta's different climate and soil conditions. The thesis were conducted on on rice, maize, and annual upland crops; main soil types: fluviols, infertile gray soil, solonetz soil, thionic soil in the Red River Delta; greenhouse gases:

methane (CH_4) and nitrous oxide (N_2O) emissions from wet rice soils and nitrous oxide (N_2O) emissions from annual maize and upland crops in the Red River Delta. The main contents of thesis were implemented: (1) Study overviews of research on GHG emissions in crop production in Vietnam and the world; (2) Develop a methodology to calculate the amount of CH_4, N_2O from annual rice and upland crops according to different climate and soil conditions in space; (3) Study the current situation and evolution of CH_4 and N_2O emissions from rice grown at the monitoring areas; (4) Establish a set of input data to serve the calculation of GHG emissions by space: meteorological data, map of current land use, land map, complex map of meteorology, soil, and land use; (5) Study the operating mechanism of the DNDC model, assess the sensitivity of the parameters, adjust and verify the model for GHG emission calculation for researched crops in the Red River Delta; (6) Research on GHG emissions for plant species and research scope.

The thesis consists of the following main parts:

Introduction;

Chapter 1: Overview of greenhouse gas emissions from crop cultivation;

Chapter 2: Methodology of the research;

Chapter 3: Research results on greenhouse gas emissions from annual rice and upland crop cultivation in the Red River Delta;

Conclusion and recommendations; References.

4. New contributions of Dissertation:

Firstly, the thesis clarified that GHG emissions (CH_4 and N_2O) depend on the following objects: type of soil, cultivation method, sub-climate in space and time;

Secondly, modeling and spatial analysis methods were applied to calculate GHG emissions for all points in the study area based on the proven monitoring data on soil, meteorology, crop types, and farming methods from representative points;

Thirdly, the thesis synthesized the calculation results of GHG emissions at the experimental sites and completed quantifying GHG emissions in space based on spatial and temporal data on climate, soil, crops, farming methods, and modeling tools, GIS. From there, GHG emission distribution maps for the whole Red River Delta were established.

Representative of Advisors		PhD Candidate
Assoc. Prof. Dr Mai Van Trinh	Dr. Dinh Thai Hung	Bui Thi Thu Trang