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論 文 要 旨

THESIS SUMMARY

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学生氏名： Student's Name	SUIF ZULIZIANA	指導教員（主）： Academic Advisor(main)	吉村 千洋
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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

Sediment transport is a crucial process in many environmental and engineered systems. In particular, suspended sediment play a key role in controlling water quality and it can cause a major reduction in stream capacity for handling flood waves. Basically, sufficient understanding of sediment transport dynamics must be demonstrated before the fate of contaminants can be reliably estimated. Therefore, a modelling is needed for adequate simulation of sediment dynamics for a prospective plan for basin development and management were undertaken or current plans are continued. Once constructed, such models are seen as useful tools for understanding particular catchments and for predicting the impact of land use and climate change on erosion and sediment transport for current plans or for future plans.

Modelling of soil erosion and sediment transport has been regarded as a challenging task as it is a highly dynamic process in spatial and temporal scale. Recently, such modelling work, including erosion, transport and deposition attracts more attention, yet only a few were reported in large river basins (e.g., drainage area > 100 000 km^2). In this study, a distributed model for assessment of sediment transport at large basin scale was proposed. The model has been then tested on one large river basin in Southeast Asia, Mekong River Basin (795,000 km^2).

The overall goal of this research is to develop and apply a sediment transport model for erosion, transport and deposition targeting for large river basin. Specific objectives of this research are:

- Develop a spatially distributed model for soil erosion and suspended sediment transport.
- Application, testing and validation of the spatially distributed model in Mekong River Basin.
- Develop an integrated framework on spatial-temporal patterns of suspended sediment dynamics in the Mekong River Basin.
- Develop a process-based distributed model for soil erosion and sediment transport process.
- Application, testing and validation of the process-based soil erosion and sediment transport model
- Scenario analysis on future suspended sediment transport: Impact of Climate change and future dams on sediment transport in the Mekong River Basin.

In the following chapters, the targets listed above are achieved by incorporating case studies in each of the subjects.

The **1 Chapter** is about general information and overall objectives of the research. The overall goal of this research is to develop and apply a sediment transport model for erosion, transport and deposition targeting for large river basin.

Chapter 2 deals with the literature review of sediment transport and its modelling in large river basins, including an overview of sediment sources and pathways, model types and applications, and describes the role of human activities on sediment processes in large river basins.

Chapter 3 The aim of this chapter is to propose an integrated framework of sediment assessment at basin scale and to estimate the spatio-temporal patterns of suspended sediment dynamics in Mekong River Basin. SSL was assessed over temporal by coupling a Revised Universal Soil Loss Equation (RUSLE) with a sediment accumulation and routing scheme. In this framework, the Revised Universal Soil Loss Equation (RUSLE) model and remote sensing images were utilized to assess soil erosion (SE), suspended sediment load (SSL) and suspended sediment concentration (SSC). The RUSLE model was adopted in a GIS framework to assess SE and coupled with a sediment accumulation and routing scheme to simulate SSL. Moreover, satellite images also were applied for monitoring SSC in Mekong River Basin and for estimating its spatio-temporal profiles over Mekong River Basin. Landsat scenes captured between 1987 and 2000, including 110 Thematic Mapper images and 21 Enhanced Thematic Mapper Plus images, were analyzed in correspondence with ground observations for monitoring SSC. These two methods were applied within one framework because a basin-scale management approach must integrate various environmental factors (e.g., sources of sediment, transport). The presented framework can be used for basins which has a limited observation (e.g., river discharge). For example, in this study, hydrological model is not used for estimation hydrological process in assessment of sediment dynamic process. Thus, the framework allows us to assess the sediment not only in rivers, but with the interactions between its yield, transport and sedimentation.

Chapter 4 In this study, a process-based distributed model was proposed for assessment of sediment transport at large basin scale. A distributed hydrological model was coupled with a process-based distributed sediment transport model describing soil erosion and sedimentary processes at hillslope unit and channels. The model has been then tested on two large river basins in Southeast Asia, Chao Phraya River Basin (drainage area: 160,000 km^2) and Mekong River Basin (795,000 km^2). This study has aimed to develop a process-based distributed model, which can simulate the sediment dynamic process targeting a large basin scale. This model continuously simulates the sedimentary process including erosion and sediment transport for a targeting single particle size, hydrologic, soil type, landuse and topography as input data. The soil loss and its transport process were coupled with existing distributed hydrological model as a comprehensive sediment assessment tool for large catchments in Southeast Asia. Moreover, the sediment model separately simulated the deposition and detachment in rivers, which have not been considered in most of the existing models. This chapter also describes its applications in two large river basins in Southeast Asia; Chao Phraya and Mekong River, which are characterised by different climate and hydrogeology. The model simulated sediment process which can simulate

not only suspended sediment loads, but also can give the spatial variation in suspended sediment concentration and sediment deposition with time.

Chapter 5 The main objective of this chapter is to evaluate the impact of possible future climate and dams change on the suspended sediment dynamics under a near future (2041–2050) and future (2091–2099) scenarios. The magnitude of the change is demonstrated with different scenarios. A distributed process-based suspended sediment dynamics model was simulated hydrological and sediment dynamics processes (Chapter 4). The model was developed to simulate suspended sediment dynamics variables in large river basins. The model used in this study represents the physical processes observed in the real world, such as surface runoff, subsurface flow, ground flow, and evapotranspiration. In addition, our model has both land surface and in-river components in the prediction of sediment. Prediction of sediment generation and transport requires consideration of land surface processes and in-river processes are very important, especially for large river basin scale. The distributed model calculates soil erosion in each grid and we also can identify the severe area to be eroded. In this chapter, the past suspended sediment load and concentration in Mekong River Basin was simulated to the observations from 1991 to 2000. Using the estimated model parameters, the sediment dynamics processes were then projected for the 2040s and 2090s, considering the expected changes in two factors; climate and dams existing, construction and planned.

Chapter 6 gives the conclusions and recommendations for both models of soil erosion and suspended sediment transport modelling and its application. Nevertheless, at basin scales, the outputs results from this model may provide useful information to development planners, decision makers and other stakeholders when planning and implementing appropriate basin-wide sediment management strategies, which can be integrated with water resource management. Moreover, our model could also be used to project the change of sedimentary evolution impacts under different scenarios in large river basins such as Mekong River.